Use of machine learning models for identification of predictors of survival and tumor recurrence in patients undergoing liver transplantation for hepatocellular carcinoma

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ABSTRACT BOOK

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Rising Star Plenary Session

0-001

Metabolic reprograming of polyunsaturated fatty acids in fatty graft promotes post-transplant HCC recurrence

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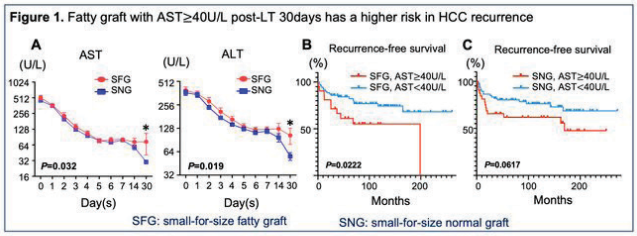
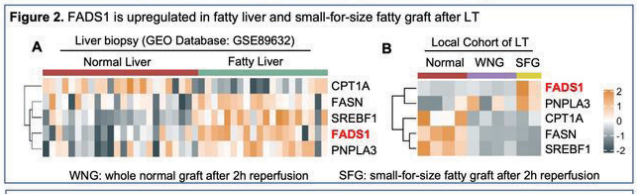
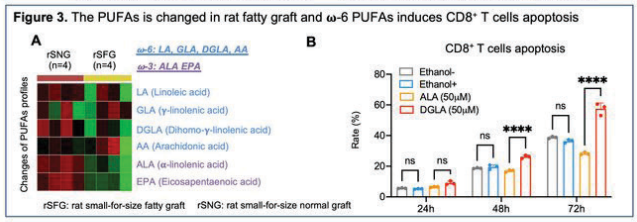
Background: The underlying effects on HCC recurrence after living donor liver transplantation (LDLT) using fatty liver at lipid metabolic level remains largely unknown. The utilization of fatty liver grafts may effectively expand the donor pool to remit the shortage of liver grafts. Recent evidence demonstrates that fatty acids desaturase 1 (FADS1) mediate polyunsaturated fatty acids (PUFAs) desaturation plays a proinflammatory role in the progression of steatosis. In this study, we aim to investigate the biological and metabolic function of FADS1 in the fatty graft microenvironment and its role in HCC formation.

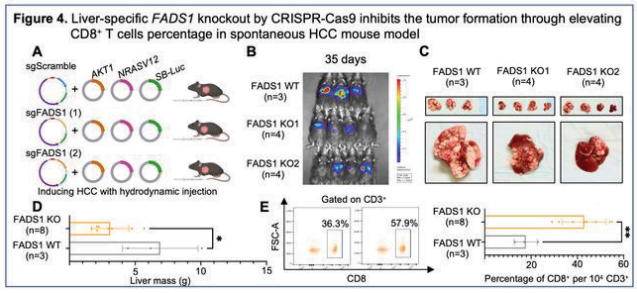
Methods: The comprehensive analysis of FADS1 expression and PUFAs profiles in the fatty graft was performed in clinical samples and rat LT. The role of FADS1 on tumor formation driven by *AKT1* (fatty liver-related oncogene) and *NRASV12* was further investigated in liver-specific *FADS1* knockout mice by CRISPR-Cas9.

Results: Clinically, patients with small-for-size fatty graft (SFG) showed higher AST and ALT levels post-LT 30 days and lower recurrence-free survival (P<0.05, Figure 1A-B); in contrast, there was no significance in the small-for-size normal graft (Figure 1C). The expression of FADS1 was upregulated in steatosis liver (GEO database, Figure 2A) and in SFG (local LT cohort, Figure 2B). The composition of PUFAs was changed in SFG in rat LT (Figure 3A); compared with ALA (ω-3), DGLA (ω-6) induced CD8$^+$ T cells apoptosis (P<0.05, Figure 3B). The liver-specific *FADS1* KO was established in the spontaneous HCC mice model (Figure 4A) and showed that *FADS1* KO delayed the tumor formation (Figure 4B-C). The tumor mass was decreased (P<0.05, Figure 4D), and the percentage of CD8$^+$ T cells was upregulated in the *FADS1* KO group (P<0.05, Figure 4E).









Conclusions: PUFAs metabolic reprogramming mediated by FADS1 is identified in fatty graft and knockout of FADS1 contributes to suppressing HCC formation.

0-002

Risk factors for biliary complication-free survival after living donor liver transplantation in the era of laparoscopic donor hepatectomy

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Background: Biliary complication (BC) remains the most common postoperative complication after liver transplantation (LT) despite the advancement of surgical techniques and management. Biliary reconstruction after living donor liver transplantation (LDLT) is technically more demanding than deceased donor LT due to multiple

duct openings, small and short graft duct. Herein, we analyzed the risk factor of BC-free survival after LDLT including considerable cases of laparoscopic living donor hepatectomy.
Methods: From August 2011 to December 2019, 824 recipients underwent adult LDLT in Seoul National University Hospital. BC was defined as a bile leakage (BL) or a biliary stricture (BS) requiring interventions. Median follow-up period was 63.5 months.
Results: BC was developed in 272 cases (34.3%) at a median time of 4 months (range 1-81); 64 (8.1%) cases of BL and 253 (31.9%) cases of BS. Pure laparoscopic donor hepatectomy (PLDH) was done in 358 cases (43.5%), open hepatectomy (OH) in 435 cases (52.9%), and laparoscopic-assisted hepatectomy in 30 cases (3.6%). BC-free survival rates were significantly lower in PLDH group (59.8%) than in OH group (70.6%) (P<0.001). PLDH and donor warm ischemic time were one of the risk factors for BC after LDLT in univariate analysis (P=0.001 for both), however, none of these factors were associated risk factors on multivariate analysis. Preoperative radiofrequency ablation history, hepaticojejunostomy (HJ), multiple anastomosis of bile duct, postoperative transfusion during hospital stay, and use of inotropics during hospital stay were found to be significant risk factors for biliary complication in multivariate analysis.
Conclusions: PLDH for LT is considered a feasible option, however, there are increased possibility for BC in the recipient. Therefore, maximal effort should be exerted to avoid associated risk factors for BC, i.e. reducing donor warm ischemic time, postoperative transfusion, and use of inotropics postoperatively, and close surveillance for BC is required in this specific group.

0-003

NRP or HOPE – what protects high-risk livers best? A comparative study in a liver transplant model donated after circulatory death

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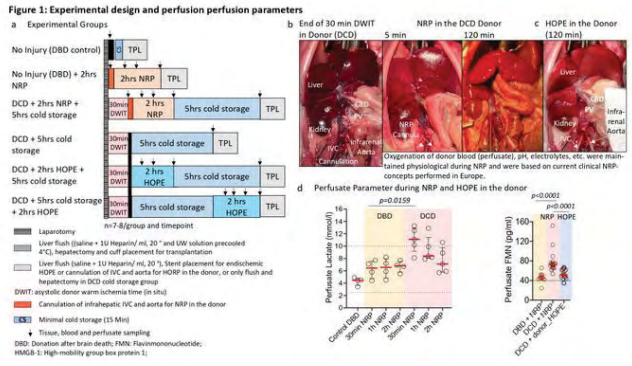
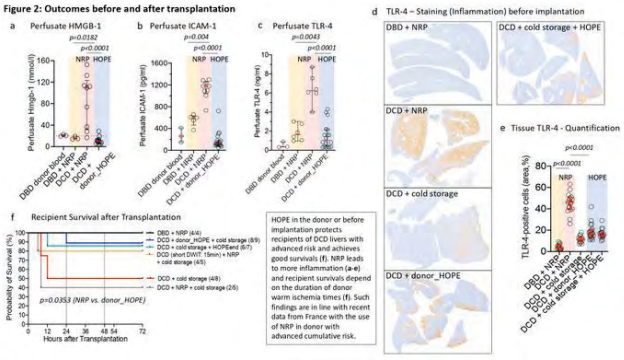
Background: Normothermic regional perfusion (NRP) in donors and hypothermic-oxygenated-perfusion (HOPE) after cold storage, were both shown to improve outcomes after liver transplantation from donors after circulatory death (DCD). Randomized, comparative studies are however lacking, and results of most clinical trials are difficult to compare, because they include donor organs with various risk profiles. The aim of our study was therefore to explore the impact of NRP and HOPE in a standardized transplant model.
Methods: A rodent model of NRP and HOPE, applied in the donor or after cold storage (CS), was developed. Following 30min of asystolic donor-warm-ischemia-time (DWIT), abdominal aorta and cava were cannulated to perfuse the abdominal organs either with donor blood at 37°C (NRP) or with oxygenated Belzer-MPS at 10°C (donor-HOPE) for 2hrs. Livers were then procured and underwent 5hrs CS, followed by transplantation. Un-perfused, cold-stored DCD organs and healthy DBD-livers with implantation after NRP served as controls (Figure1). Endpoints included the entire spectrum of ischemia-reperfusion-injury before and after transplantation.



Results: DBD-livers showed minimal signs of inflammation during 2hrs of NRP and achieved 100% recipient survival after transplantation (Figure 1&2). In contrast, DCD livers with 30min DWIT suffered from mitochondrial injury and inflammation as measured by increased perfusate Lactate, FMN- and Hmgb-1-concentrations and subsequent Toll-like-receptor-4-activation during NRP. The performance of donor-HOPE (instead of NRP) led to significantly lower levels of mitochondrial injury and inflammation. Results after donor-HOPE were comparable to endischemic ex-situ HOPE after CS. Most DCD-liver recipients survived when treated with one HOPE-technique (85% and 89%), compared to only 40% after NRP(p=0.035). Following the reduction of DWIT to 15min, DCD livers procured with NRP achieved a better survival (80%) (Figure2).



Conclusions: High-risk DCD livers benefit from HOPE-treatment, either immediately in the donor (in-situ) or after cold storage. Comparative studies are required to translate our results into clinical practice.

0-004

Ex-vivo normothermic perfusion of human split livers more than 7 days. A unique model to study new therapeutics and increase the number of available organs

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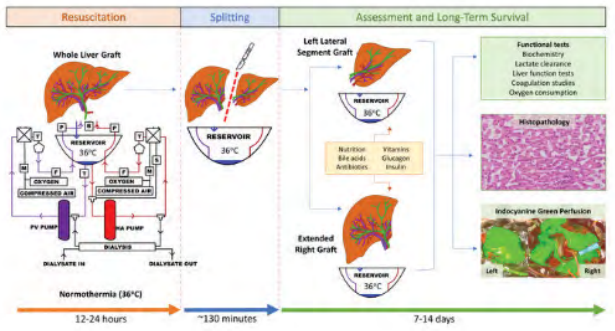
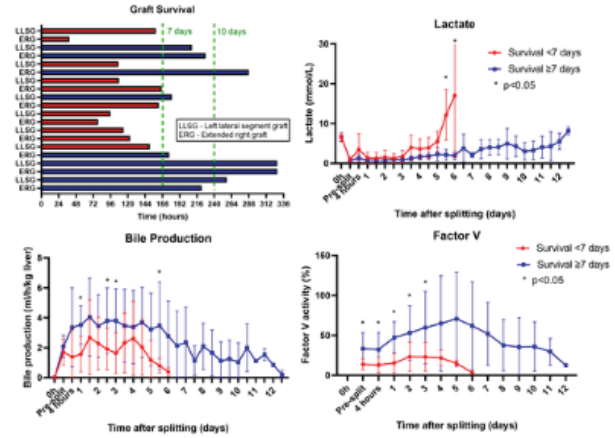
Background: Normothermic machine perfusion facilitates the assessment of organs prior to transplantation but so far has been limited to short-term goals or required a custom-built system. Long-term perfusion for days to weeks provides the opportunity for sophisticated assessment and analysis of the injury, recovery and survival of these organs. In this study, we aimed to use a modified commercial system to develop a reliable long-term perfusion model involving splitting of livers during normothermic perfusion and then continuous perfusion on separate machines.

Methods: We developed a protocol for long-term organ perfusion using a modified commercial system which included long-term oxygenators, a gas-mixer and a dialysis membrane. Discarded human livers were perfused using a red-cell based perfusate under normothermic conditions (36°C) and then surgically split without interruption to perfusion. The resulting left lateral segment grafts and extended right grafts were then perfused on separate machines for the purpose of long-term survival and individual graft assessment with biochemical and histological markers of liver function.



Results: Ten livers underwent a conventional split during continuous normothermic perfusion resulting in 20 partial grafts. The median ex-vivo survival was 163 hours and the longest surviving graft was 328 hours (13 days). Long-term graft survival was demonstrated by continued lactate clearance, bile production and synthesis of coagulation factors. The grafts that survived ≥7 days demonstrated significantly higher bile production and Factor V levels in the first 24 hours after splitting.



Conclusions: We report the longest ever ex-vivo survival of livers under normothermic conditions and demonstrate the possibility to perfuse paediatric-sized grafts using a reproducible protocol. This provides the opportunity for the testing of therapeutics with a matched control, and could increase the number of available organs for both adults and children.

Plenary Abstract Session I

0-005

Evaluating the performance and external validity of machine learning-based prediction models in liver transplantation: an international study

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Background: National liver transplant (LT) registry data are curated in many countries. We compared data from three national registries and developed machine learning algorithm (MLA)-based models to predict post-LT 90-day mortality within and across different countries. Predictive performance and external validity of each model was assessed to contextualize the applicability of MLA in LT.
Methods: We studied adult (≥18-years) primary LTs between Jan-2008 and Dec-2018 from United Network for Organ Sharing (UNOS-US), National Health Service Blood and Transplantation (NHSBT-UK), and the Canadian Organ Replacement Registry (CORR-Canada). MLA models for 90-day post-LT mortality were built firstly on each individual registry (based on variables inherent to the individual database) and then using all 3 registries (based on harmonized variables). The predictive abilities of the models were evaluated across countries using area-under-the-receiver-operator-curve (AUROC) and area-under-the-precision-recall-curve (AUPRC).
Results: Patients included were as follows: Canada n=1,214, UK n=5,287, and US n=59,558. ElasticNet had the best performance across both individual registries and harmonized datasets. Model performance diminished from the individualized registries to the harmonized registry (only using variables in common between the three registries), especially in the UK (individualized ElasticNet:AUROC:0.54;Range 0.52-0.56 to harmonized AUROC:0.48; Range:0.48-0.50) and the US (individualized ElasticNet:AUROC:0.70; Range:0.70-0.71 to harmonized AUROC:0.65;Range:0.64-0.65). Model performance after external validation across countries was overall poor.
Conclusions: MLA-based models can be constructed using international LT registries, with independent ElasticNet models demonstrating optimal predictive performance. While MLA-based models yield fair discriminatory potential when used within individual databases, the external validity is poor when applied to different registries across countries. This is likely due to inherent limitations and variability within each dataset. It is conceivable that these limitations may be overcome by increasing the granularity of datasets (e.g., with linkages to other administrative datasets) and placing an increased emphasis on consensus for variable standardization.

Table 1. Harmonized - Cross Country Test Set Performance, Mean (range) across 5 imputations

Model (Country model was trained on)	Registry (Country predictions made on)	AUROC	AUPRC
CA	CA	0.58 (0.57 to 0.60)	0.16 (0.16 to 0.19)
	UK	0.68 (0.67 to 0.70)	0.25 (0.24 to 0.26)
	US	0.57 (0.55 to 0.58)	0.21 (0.18 to 0.24)
UK	CA	0.49 (0.49 to 0.50)	0.04 (0.04 to 0.04)
	UK	0.63 (0.62 to 0.64)	0.05 (0.05 to 0.05)
	US	0.65 (0.65 to 0.65)	0.08 (0.08 to 0.08)
US	CA	0.57 (0.56 to 0.58)	0.05 (0.05 to 0.05)
	UK	0.60 (0.60 to 0.60)	0.05 (0.05 to 0.05)
	US	0.63 (0.63 to 0.63)	0.06 (0.06 to 0.07)

Abbreviations: AUPRC: Area under precision-recall curve, AUROC: Area under receiver-operator characteristic, CA: Canada, UK: United Kingdom, US: United States

0-006

A population-based analysis of long-term outcomes following pediatric acute liver failure highlights high risk populations in access to transplant

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Background: Pediatric acute liver failure (PALF) is a devastating illness that affects otherwise healthy children. Nearly 70% of children with PALF recover, while ≥25% require emergent liver transplant (LT). PALF has an estimated overall mortality of 15%. Beyond short-term outcomes, the long-term clinical course of PALF has not been established. This study aims to characterize long-term outcomes and identify prognostic factors of PALF using registry data.
Methods: Children (<18 years) admitted with PALF were identified by ICD codes in the California Office of Statewide Health Planning and Development Patient Discharge Dataset (1/2005-12/2018). Multivariable Cox proportional hazards models were used to identify risk factors for liver transplant and death.
Results: Among 2162 inpatients with PALF, the mean age at presentation was 9.7±6.2 years, with a median follow-up of 4.6 (IQR 0.06 -10.4) years. 50.1% were female and 44.2% Hispanic. Most deaths occurred within 4 months of presentation. Children <2 years (18.2% of patients) were more likely to undergo LT (HR 2.74 [95% CI 1.96-3.83], p<0.001) and more likely to die (HR 1.66 [95% CI 1.33-2.07], p<0.001) when compared to children >10 years old (52.3% of patients) (Table 1). Mortality was higher among females (HR 1.47 [95% CI 1.17-1.85], p<0.001). No statistically significant difference was observed based on race/ethnicity.

Covariate	Hazard Ratio[1] for Liver Transplant (95% CI)	p-value	Hazard Ratio[1] for Death (95% CI)	p-value
Age at ALF				
< 2 years	2.74 (1.96-3.83)	<0.001	1.66 (1.33-2.07)	<0.001
2 - < 5 years	2.36 (1.54-3.63)	<0.001	1.15 (0.88-1.51)	0.31
5 - < 10 years	2.21 (1.45-3.35)	<0.001	0.83 (0.62-1.12)	0.23
>= 10 years	referent		referent	
Sex				
Male	referent		referent	
Female	0.88 (0.66-1.17)	0.38	1.47 (1.17-1.85)	<0.001
Race/Ethnicity				
White	referent		referent	
Black	0.75 (0.40-1.40)	0.37	0.87 (0.59-1.29)	0.49
Hispanic	0.72 (0.50-1.02)	0.07	0.96 (0.77-1.19)	0.70
Asian/Pacific Islander	0.98 (0.55-1.76)	0.95	1.00 (0.69-1.46)	0.99
Native American/ Alaska Native	0.51 (0.02-14.86)	0.70	0.06 (0.01-36.63)	0.39
Other/Unknown	1.26 (0.69-2.31)	0.45	1.11 (0.70-1.76)	0.64

[1] Sub-distribution hazard ratio

Table 1: Cox proportional hazards models for liver transplant and death.

Conclusions: This large, highly diverse population-based study of long-term outcomes following PALF demonstrates that children who present <2 years of age are more likely to die or require emergent LT, highlighting the importance of early referral to a transplant center. Further, this analysis demonstrates higher mortality in females, for unclear reasons. Strategies to improve referral patterns and explore potential sex disparities for patients with PALF are needed.

0-007

Cost-effective and time-saving 3-D printing protocol of intra-abdominal cavity of liver transplantation recipient to prevent large-for-size syndrome

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Background: A protocol for a cost-effective and time-saving 3-D printing model of intra-abdominal cavity was utilized to prevent large-for-size syndrome during liver transplantation.
Methods: 3-D printings were performed on potential recipients with small cavity. During deceased donor organ procurement, size of the graft was compared to the model while 3-D printed graft was physically placed into the 3-D model in living donor transplantation.
Results: Nine adults and five pediatric patients were included. Median time for model production was 584 minutes (IQR 502.3–643.8) and estimated median cost for the filament used was 1.59 dollars. (IQR 1.06–1.68) With the guidance of 3-D printed model, transplantation of reduction graft from deceased donor (n=1), whole liver transplantation after giving up the previous donor match (n=2), whole liver transplantation from the first matched donor (n=4), right hemiliver transplantation from living donor (n=1) and extended left liver transplantation rather than right liver from living donor after giving up the previously matched deceased donor (n=1) were resulted using 3-D printed model in adults. Among pediatric patients, two cases were resulted in reduction graft as planned and three cases resulted in extended left lateral graft transplantation. All the cases with 3-D printed abdominal cavity showed appropriate fitting of the donor's liver graft to both the 3-D printed model and actual recipient's abdominal cavity with no large-for-size syndrome.
Conclusions: Our cost-effective and time-saving 3-D printed model of intra-abdominal cavity was feasible and proved to be useful for preventing large-for-size syndrome in small adult recipients and pediatric patients.

0-008

Regulatory T-cells infusion during normothermic ex vivo liver perfusion reduces graft immunorecognition after transplantation

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Background: Liver transplantation (LT) without the need for immunosuppression would significantly reduce the burden on patients. Normothermic ex vivo liver perfusion (NEVLP) offers the optimal platform to modify liver grafts before transplantation. Regulatory T cells (Treg) have emerged as multipotent immunoregulators with many suppressive functions on a variety of immune cells, and the potential of Treg therapy to facilitate tolerance has been suggested in a small clinical trial in liver transplantation.
Methods: $CD4^+CD25^+$cells were isolated as Treg from 15mL peripheral blood of pigs using cell sorter. They were expanded ex vivo with anti-CD3/CD28-antibody bound beads and porcine IL-2 stimulation for 4 weeks. For suppression assay, $CD4^+CD25^+$cells as Tregs and $CD4^+CD25^-$cells as T effector cells were co-incubated for 7 days. Expanded Tegs were stained with CMTMR just before being injected into NEVLP, and biopsy samples were taken from each lobe after 5-hour NEVLP. Perfusate samples were collected hourly during NEVLP.
Results: A total of 2.46×10^5 $CD4^+CD25^+$cells (Tregs) were isolated and expanded to 2.76×10^7 (113.3-fold). Over 95% of them expressed Foxp3 with the ability to suppress proliferation of T effector cells in a cell-number-dependent manner (Figure.1). Tregs evenly distributed throughout the perfused liver at the end of NEVLP (Figure.2). Several parameters obtained from perfusate for the assessment of liver damage (AST) and function (Lactate, bile production and pH) showed injected Tregs did not have any negative effects on NEVLP when compared to those without Tregs.

Figure. 1

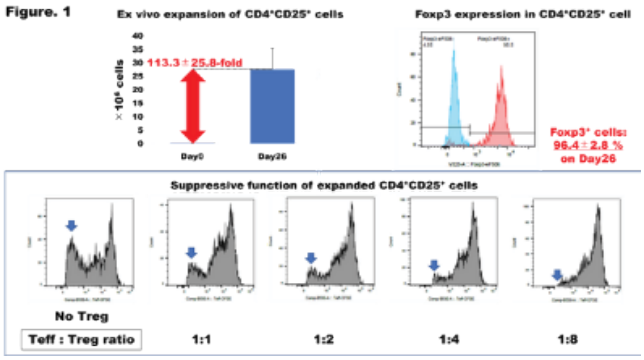
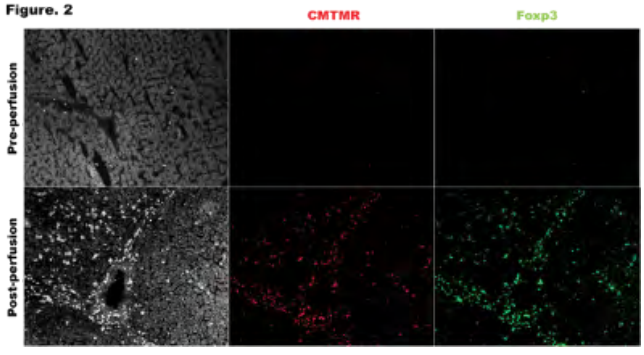


Figure. 2



Conclusions: Tregs can be isolated from peripheral blood and expanded with great suppressive function against T effector cells. Injection of these cells during NELVP allows distribution and uptake throughout the liver without any negative effects. These results support further investigation of Treg cells to induce tolerance prior to LT.

0-009

Risk factors associated with development of new onset heart failure post-transplant: single center, retrospective study

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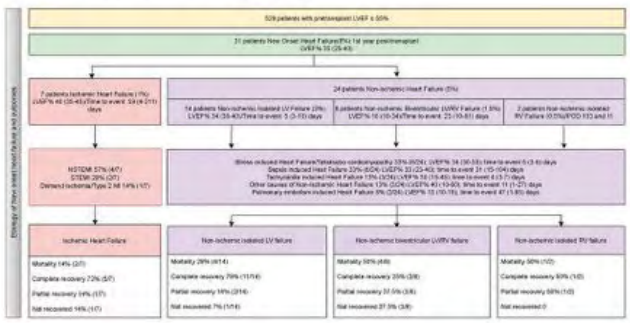
Background: The purpose of our study is to identify the incidence, potential risk factors, characteristics, and outcome of new onset heart failure (HF) after liver transplantation in patients with preserved left ventricular ejection fraction (LVEF ≥ 55%) pre-transplant.

Methods: After excluding two patients who died intraoperatively and seven patients with preexisting cardiomyopathy (EF<55%), 528 patients were included in the study. The primary outcome was the development of new onset systolic HF post-transplant defined by echocardiographic evidence of falling left and/or right ventricular function within 1st year. We grouped post-transplant HF into ischemic and non-ischemic groups.

Results: Within 1st year of transplant, new onset HF occurred in 6% (31/528) of the patients. Ischemic HF accounted for 1% (7/528) while non-ischemic HF accounted for 5% (24/528) of the cases. Ischemic HF comprised 23% (7/31) and non-ischemic HF comprised 77% (24/31) of post-transplant HF cases, see Figure 1. Three pre-transplant risk factors were statistically associated with post-transplant new onset HF: a prolong QTc ≥490 ms, presence of diastolic dysfunction and a body mass index < 24 kg/m^2. Two intraoperative risk factors were statistically associated with post-transplant: a lower baseline hemoglobin at the time of transplant and intraoperative administration of vasopressors such as epi/nor-epinephrine. Under logistic regression the whole model was statistically significant (2=33, P<0.0001). A C-index of 0.79 was calculated for these risk factors. Non-ischemic HF and ischemic HF had significantly lower 1-year survival than patients without HF, 63% and 71% versus 94%, respectively (Log-Rank P<0.0001). Biventricular LV/RV and isolated RV failure had lower survival of 50% than isolated LV failure 71% when compared with the group without HF of 94% (Log-Rank P<0.0001).

Figure 1: New onset heart failure flowchart: etiology and postoperative outcomes



Legend: LVEF: Left Ventricular ejection fraction; NSTEMI: non-ST segment elevation myocardial infarction; STEMI: ST segment elevation myocardial infarction; Type 2 MI: type 2 myocardial infarction; RV failure: right ventricle failure; Biventricular LV/RV failure: biventricular left and right ventricle failure; POD: postoperative day)

Conclusions: Patients undergoing liver transplantation are at risk for postoperative cardiovascular events such as new onset heart failure despite thorough preoperative cardiac evaluation.

0-010

Perioperative outcomes after controlled donation after circulatory death: a comparative study of cold storage, normothermic regional perfusion and normothermic machine perfusion

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Background: In controlled donation after circulatory death (DCD) for liver transplantation, ischemia-reperfusion injury is linked to early graft dysfunction, post-reperfusion syndrome and renal injury in the recipient. Cold storage (CS) of the liver is standard of care, but normothermic regional perfusion (NRP) preceding CS and normothermic machine perfusion (NMP) after CS are novel techniques that appear to mitigate ischemic injury and associated complications[1,2]

Methods: We reviewed recipients of controlled DCD transplants in our center from January 2015 to December 2020. We identified preservation technique, post-reperfusion syndrome (PRS), plasma potassium increase at reperfusion (Δ K), intraoperative transfusion requirement, perioperative acute kidney injury (AKI) and early graft dysfunction.

Results: One hundred sixty-two DCD graft recipients were evaluated, comprising 60 treated with CS, 57 with NRP, and 45 with NMP. Donor and recipient risk factors were similar between groups, except that NRP recipients had significantly higher baseline creatinine, lower MELD and longer asystolic warm ischemia time (median minutes, [IQR]: CS=12[10-14]; NRP=15[13-18]; NMP=12[10-14.5]) The CS group had a higher incidence of PRS (CS 38.3%, NRP 12.3% and NMP 15.6%, p=0.0014) and higher post-reperfusion plasma potassium increase (ΔK, mean+/-SEM: CS=1.36+/-0.10, NRP=1.23+/-0.14, NMP=0.83+/-0.10, p<0.01). Red cell transfusion requirements were similar. The CS group had higher Model for Early Allograft Function (MEAF) scores (median, [IQR]: CS=5.77[4.7-7.1]; NRP=4.22[2.7-5.5]; NMP=3.34[2.3-5.2], P<0.0001), higher peak ALT (median, [IQR]: CS=722[455-1309]; NRP=492[318-755]; NMP=296[220-539], p<0.0001) and an increased incidence of renal injury (AKIN stage ≥ 2, CS 51.7%; NRP 33.3%; NMP 35.1%; p=0.09).

Conclusions: Compared to CS alone, use of either NRP or NMP significantly reduced the incidence of post-reperfusion syndrome and early graft dysfunction after controlled DCD liver transplantation. A strong trend to reduced renal injury was also observed.

References:

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O-011

Overcoming the disparity in donor liver access due to body size

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Background: There are different disparities in allocation of deceased donor livers including racial, gender, and socioeconomic. Our goal was to determine the disparity due to body size differences between the donor and recipient and then explore allocation models to overcome the size disparity.

Methods: Data was collected on adults (≥ 18 yrs) waiting for a liver transplant only and all donors available for single liver transplants from the Organ Procurement and Transplantation Network (OPTN) data from June 2013 to March 2020. Markov microsimulation created an allocation match-run for each donor. Matching donor by size to a recipient was by body surface area (BSA). Donor to recipient BSA ratios (D_R BSA) of <0.69 and >1.25 were not allowed. Other allocation rules followed the OPTN rules for MELD score, blood type, and 500-mile circles.

Results: A total of 84201 adults were on the wait-list and 24842 donors were available. Candidates were divided into quartiles by BSA. After the match-runs, the smallest quartile had a disparity of 15.5% fewer donors and the largest quartile had a disparity of 12.2% fewer donors. Quartiles 2 and 3 had a surplus of organs from 1.2% to 2.9%, respectively. Female sex disparity was 6.4% fewer organs. New allocation rules were added to the prior rules and simulated. A split-liver allocation rule to split all donors in the 25% to the 90% quartile of BSA when allocated to a recipient in the 0-25% quartile, if the D_R BSA was >1.25, would eliminate the disparity by body size and gender. Of the total donors, 2639 (6.7%) would require being split.

Conclusions: From our simulation analysis, there is a body size disparity for small statured and female candidates. This disparity can be overcome by splitting few donor organs. In the US, more programs should be encouraged to participate in split liver transplants.

Plenary Abstract Session II

0-012

Tumor-derived iron loaded-exosomes impair CD8⁺ T anti-tumor ability via ferroptosis in hepatocellular carcinoma

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Background: Ferroptosis is a form of regulated cell death caused by an iron-dependent accumulation of lipid peroxides. Tumor-infiltrating CD8⁺T cells are associated with progressive loss of effector function due to a suppressive tumor microenvironment (TME). In the TME, tumors cells may cause CD8⁺T cells dysfunction by secreting various bioactive substances, including exosomes. Yet, the role of tumor-derived exosomes (TDEs) in regulating ferroptosis of CD8⁺T cells is still unexplored and remains enigmatic.
Methods: The gene and protein expressions of ferritin heavy chain 1(FTH1) in hepatocellular carcinoma (HCC) tissues were investigated in our clinical cohort as well as in HCC cell lines. Flow cytometry and immunostaining were used to characterize ferroptosis of CD8⁺T cells. T cells were isolated and cultured with TDEs *in vitro* for functional experiments. Mouse liver tumor models were applied to assess the role of ferroptosis inhibition on improvement of anti-tumor immunity *in vivo*.
Results: Clinically, we demonstrated that FTH1 expression was upregulated in HCC tissues and negatively correlated with the overall survival and clinicopathological scores. Specifically, high expression of FTH1 is positively associated with the cluster of ferroptosis CD8⁺T cells abundant within HCC tissues. In *in vitro* experiments, FTH1 was found highly expressed in exosomes of HCC cell lines. TDEs mediated uptake of FTH1 by CD8⁺T cells induced lipid peroxidation and ferroptosis which can be reversed by ferroptosis inhibitor, subsequently impaired the cytotoxic functions of CD8⁺T cells and aggravated CD8⁺T cell exhaustion status. Mechanistically, NCOA4-mediated ferritinophagy was initiated during ferritin degradation, promoting labile iron accumulation on CD8⁺T cells. In animal models, using deferoxamine and FTH1 knockdown inhibited ferroptosis on CD8⁺T cells and effectively restored their anti-tumor activity in the mice model.

Figure 1: TfR+CD8+T cells within FTH1 expression tumor tissues indicate poor prognosis of HCC

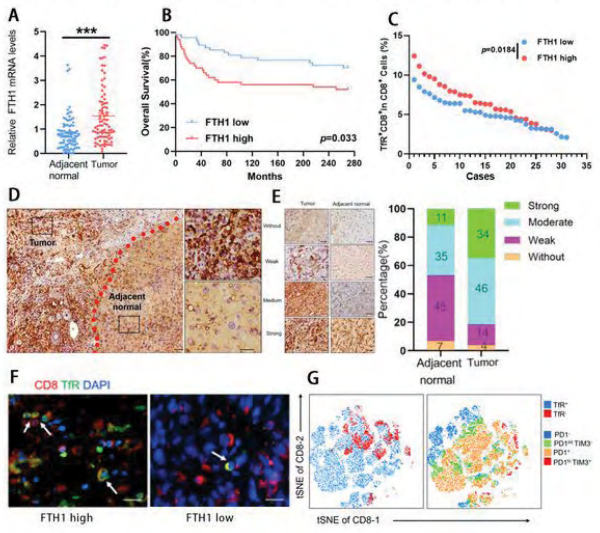
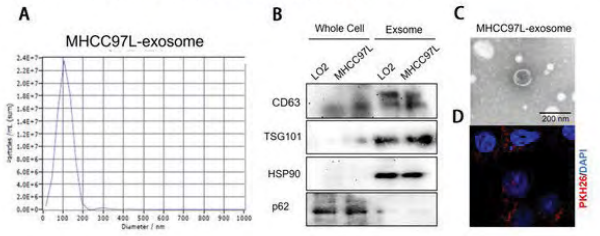


Figure 2: Tumor derived exosomes can be taking up by CD8+T cells



Conclusions: Tumor-derived exosomal FTH1 promoted CD8⁺ T cell ferroptosis in HCC through NCOA4-mediated ferritinophagy, highlighting a promising strategy for cancer immunotherapy.

0-013

Development and validation of a deep learning model for the prediction of hepatocellular cancer recurrence after transplantation: an international study

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Background: Identifying patients at high risk for hepatocellular carcinoma (HCC) recurrence after liver transplantation (LT) represents a challenging issue. The present study aims at developing an accurate post-LT recurrence prediction calculator using the machine learning method (Time_Radiological-response_Alpha-fetoproteIN_Artificial-Intelligence, TRAIN-AI).
Methods: 3,381 patients with HCC listed for LT from 2000 to 2018 and coming from 17 centers from North America, Europe, and Asia were included in the study. The original dataset was split to generate the two main data sets used for the research. The Training Set was composed of 70% of the records of the original dataset, and the Test Set was composed of the remaining 30%. Using the Training Set data, a prognostic model for HCC recurrence was developed with a Deep Surv model, and a Cox proportional hazards deep neural network was constructed. Validation of the model was done using the Test Set. The TRAIN-AI was compared using the DeLong test with Metroticket 2.0 Score, AFP-French Model, Milan Criteria, San Francisco Criteria, Up-to-Seven Criteria, TRAIN Score, NYCA Score, and HALT-HCC Score.
Results: The developed TRAIN-AI model showed excellent c-statistics, with an AUC=0.78 (95%CI=0.73-0.82). The TRAIN-AI always outperformed the other scores: Metroticket 2.0 Score AUC=0.66, P<0.0001; AFP-French Model AUC=0.65, P<0.0001; Milan Criteria AUC=0.63, P<0.0001; San Francisco Criteria AUC=0.61, P<0.0001; Up-to-Seven Criteria AUC=0.60, P<0.0001; TRAIN Score AUC=0.59, P<0.0001; NYCA Score AUC=0.58, P<0.0001; HALT-HCC Score AUC=0.57, P<0.0001.
Conclusions: The proposed TRAIN-AI score showed higher accuracy than other available risk scores in terms of post-LT recurrence risk. Further validation is required. A web-calculator has been developed for improving the user-friendly availability of the model.

0-014

New criteria in liver transplantation for hepatocellular carcinoma: a combined molecular and clinical predictor of survival

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Background: Worldwide, liver cancer is one of the most frequent cancers and causes of cancer-related mortality. Liver transplantation is the best treatment for cirrhotic patients with hepatocellular carcinoma. Transplant eligibility is currently ascertained through clinical criteria. We propose a new decision algorithm combining tumour biopsy biomarkers with clinical variables to predict overall survival after transplantation.
Methods: We performed a systematic review of the literature to identify candidate biomarkers. Candidate RNA levels were assessed by quantitative reverse transcriptase PCR in formalin-fixed, paraffin-embedded tumour tissue, resulting in a four gene signature. Together with clinical variables we developed a decision algorithm using machine learning approaches. Algorithm validation was based on a retrospective cohort with >5years follow up with ~30% patients transplanted beyond Milan criteria.
Results: HepatoPredict algorithm identifies 95% of the patients with >5years DFS (Disease Free Survival). Even outside Milan criteria >40% transplanted patients were alive and disease-free at 5years. For a similar number of liver transplants, the proposed algorithm can increase DFS and OS (Overall Survival) by 25% and 28%, respectively, while reducing the false negatives by at least 65%. HepatoPredict method predicts at three confidence levels, with decreasing precision and increasing sensitivity. The highest confidence level (DFS precision of 93%) contains 60% of predictions and can further stratify patients within Milan criteria by identifying the patients that experience a recurrence after transplantation (false positives <5%).
Conclusions: The method proposed outperforms conventional clinical-pathologic risk factors (Milan and San Francisco criteria), providing superior prognostic information. It can increase the sensitivity of patient selection, without loss of specificity, thus increasing the number of patients that can benefit from successful transplantation without demanding more organs. Finally it can further identify the subset of patients most likely to benefit from a transplantation, enabling an objective stratification of waiting lists or allocation of optimal vs. sub-optimal organs.

0-015

Transplantation for intrahepatic cholangiocarcinoma and the role of genetic profiling

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Background: Most intrahepatic cholangiocarcinoma (iCCA) patients present with advanced, unresectable disease and survival is poor. Selected patients with liver-limited disease may benefit from liver transplantation (LT). However, randomized, prospective clinical trial data are lacking. Genetic aberrations (GAs) in advanced iCCA have

great prognostic potential: FGFR2 and DNA repair mutations are associated with a favorable prognosis, while TP53, CDKN2A/B and KRAS mutations may reflect poor survival.
Methods: We reviewed the prospectively-maintained institutional databases at MD Anderson Cancer Center (7/20/2006 to 9/12/2019) with stage I/II iCCA (non-LT group) and Houston Methodist Hospital (11/2010 to 1/2021) for iCCA patients referred for LT (LT group), who were required to have at least 6 months of disease stability on systemic therapy.
Results: We identified 95 and 65 patients in the non-LT and LT groups, respectively; 37 underwent LT evaluation and 18 received LT. Median overall survival (OS) in the non-LT group was 25 months (range: 1.4 to >144 months) and 5-year OS 15%. Patients receiving LT had 1-, 3-, and 5-year OS of 100%, 77%, and 62%. The most frequent GAs observed were TP53 (27%), CDKN2A/B (27%), KRAS (22%), ARID1A (18%), IDH1 (16%) and FGFR2 fusion (10%). In LT group, 26 had actionable mutations, with a high proportion of the favorable FGFR alterations (7/26, 27%) and low frequency of the unfavorable KRAS (2/26, 8%), CDKN2A deletion (2/26, 8%) and TP53 (5/26, 19%) mutations. Of the 18 LT cases, 7 (39%) had recurrence. There was no correlation between specific mutations and post-LT recurrence risk.
Conclusions: Patients with early stage (I-II) iCCA have very low 5-year OS irrespective of GAs and may benefit from LT. Patients with favorable genetic prognostic biomarkers may experience improved survival post LT. Larger, prospective clinical trials that select for clinical and genetic prognostic markers and incorporate living donor transplantation to reduce time on waitlist are indicated.

0-016

Pediatric aboi living donor liver transplantation: a single center propensity score match study

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Background: Living donor liver transplantation (LDLT) is an important treatment option for pediatric patients with end-stage liver disease. Meanwhile, using ABO-incompatible (ABOi) liver grafts from living donors remains controversial. And, according to some studies, could increase the complication rate and decrease long-term survival. Our study aimed to compare outcomes of ABO compatible (ABOc) and incompatible LDLT in pediatric patients.
Methods: Between June 2010 and September 2021, 767 children underwent LDLT. From these patients, ABOi LT were performed in 139 cases. A specific titer-based management protocol was used. To avoid a data bias the propensity score match [1:1] was applied. Two groups (139 children in each group) were balanced with PSM based on age, weight, PELD score, operation date, graft type, and living donor age.
Results: There was no significant difference in survival among the groups (p = 0.53). The overall 3, 5 and 10-year survival rates in the ABOc group were 79.7, 79.0, and 78.3% respectively. The overall 3, 5 and 10-year survival rates in the ABOi group were 83.9, 81.3, and 81.3% respectively.
Furthermore, there was no statistically significant difference between the rate of biliary and vascular complications in the two groups (p = 0.9 and 0.31, respectively). However, the occurrence of rejection episodes was significantly higher in the ABOi group (p < 0.05).
Conclusions: The largest single-center experience has been shown in the study. In conditions of organs shortage, ABOi LT demonstrates appropriate long-term outcomes in pediatric patients.

0-018

Gender and racial discrimination among liver transplantation professionals: report of a global survey

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Background: In medicine, equality, diversity and inclusion (EDI) are fundamental principles. Little is known about the pattern of practice and perceptions of EDI among liver transplant (LT) providers.
Methods: In 2020, the International Liver Transplant Society (ILTS) EDI Committee conducted a survey among its members around

topics related to discrimination, mentorship and gender. Answers were collected and analyzed anonymously. Female leadership around the world was also searched via the committee members' network.
Results: The survey was e-mailed to 1312 ILTS members, 199 responses were collected from 38 countries (15.2% response rate). Of these, 40.7% were female. Almost half were surgeon (45.7%), 27.6% hepatologist, 26.6% anesthesia/intensive care (26.6%) specialists. Only 22% of the division chiefs were female when all specialties were included. Sixty-eight (34.7%) reported some form of discrimination during training or at their current position. Presumed basis of discrimination was related to gender/sexual orientation (20.6%), race/country of origin (25.2%) and others (7.1%). Less than half (43.7%) received mentorship when any potential discrimination occurred. An association between female responses and discrimination, differences in compensation and job promotion was observed (all p<0.05). Among 856 LT programs around the world, there was only 8,2% female leadership.
Conclusions: This survey represents 38 countries from 7 continents around the world and reveals alarmingly high rate of experience with racial and gender discrimination, lack of mentorship, and very low rates of female leadership in the LT field and calls to action to equity and inclusion.

LB-0-01

Long-term outcome of liver transplantation for unresectable liver metastases from neuroendocrine neoplasms: a Belgian retrospective multi-centre study

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Background: Liver transplantation (LT) is the only curative treatment for unresectable liver metastases from neuroendocrine neoplasms (NEN-Liver-Mets). While recurrence is frequent after LT, there is limited data available in the literature on the outcome of recurrent patients.

Methods: We retrospectively reviewed the medical records of all patients who underwent LT by NEN-Mets at the six LT centres in Belgium from 1986 to 2020. Patient and tumour characteristics, indication for transplantation, overall survival (OS), disease-free survival (DFS), and tumour recurrence and outcomes were analysed.
Results: Forty patients underwent a LT for NEN-Liver-Mets in Belgium. Twenty-nine patients were male (74.2%) with a mean age of 41.9 and 47.1 years at the time of NEN diagnosis and LT, respectively. WHO classification was available for 32 patients and changed over time (see table below). OS post-LT at 1-, 5-, and 10-years are: 84,3%, 65,0% and 54,6% respectively, while the overall DFS are: 76.3%, 44.5% and 38.2% in the same intervals. Patients transplanted after 2010 showed better OS at 5-and 10-years (74.8% and 74.8%) when compared with patients transplanted before (60,0% and 49.5%). Twenty patients (50%) presented a NEN recurrence, of this, 14 (70%) were transplanted before 2010 and only 6 (30%) were transplanted afterwards (p=0.03). The median time for recurrence diagnosis was 12.3 months (range: 5.1 to 69.2). The most frequent recurrence treatments were surgical resection, somatostatin analogs, chemotherapy, and sunitinib therapy (8, 6, 6, and 4 patients, respectively). Survival rates were 89.5% and 56.1% at 1- and 5-years after recurrence diagnosis.

Table 1: Patients and tumour characteristics

	Patients	LT before 2010	LT after 2010	*p*
Population	40 (100%)	20 (50%)	20 (50%)	NS
Mean Age at NEN diagnosis (years)	41.9±	40.0±10.6	43.6±11.3	NS
Mean Age at LT (years)	47.1±	45.0±10.4	49.6±12.4	NS
Primary tumour site				
Pancreas	23 (57%)	11 (55%)	12 (60%)	NS
Small bowel	10 (25%)	5 (25%)	5 (25%)	NS
Duodenum	1 (2.5%)	1 (5%)	0	NS
Stomach	2 (5%)	0	2 (10%)	NS
Biliary tree	1 (2.5%)	0	1 (5%)	NS
Unknown	1 (2.5%)	1 (5%)	0	NS
Bronchial tree	2 (5%)	2 (10%)	0	NS
WHO classification				0.01
Grade 1	10 (25%)	5	5	
Grade 2	17 (42.5%)	6	11	
Grade 3	5 (12.5%)	2	3	
Not defined	8 (20%)	8	0	
Endocrine Syndrome	16 (40%)	7 (44%)	9 (56%)	NS
Primary tumour resection prior LT	34 (85%)	17 (50%)	17 (50%)	NS
Post-LT NEN recurrence	20 (50%)	14(70%)	6 (30%)	0.03

Conclusions: Patients transplanted for unresectable NEN-Liver metastases had good long-term survival. Although the total recurrence rate is high, it decreased dramatically after 2010, probably due to better patient selection. Furthermore, recurrence treatment should be recommended as it may prolong patient survival.

Concurrent Oral Abstract Session: Anesthesia / Critical Care Medicine / Acute Liver Failure

0-024

Increased plasminogen activator inhibitor-1 is associated with less severe clinical bleeding after reperfusion during liver transplantation

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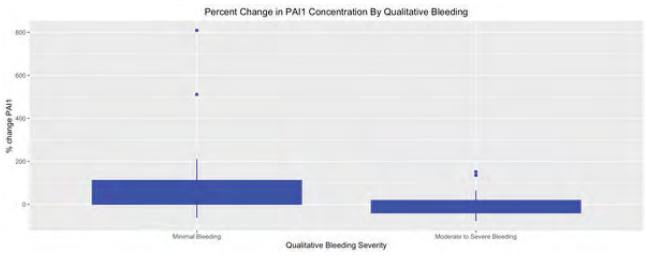
Background: Severe bleeding following reperfusion in liver transplantation (LT) is often discrepant with available objective laboratory and thromboelastography data. This bleeding may be due to ischemia reperfusion injury (IRI), however IRI severity is graded by peak AST levels within 48 hours and therefore provides little intraoperative utility. "Cold IRI" is initiated by damage to endothelial cells within the liver during cold storage. This investigation examined biomarkers associated with coagulation and endothelial cells to determine whether any circulating factors might contribute to severe bleeding following reperfusion.

Methods: We analyzed data obtained from the Mild Hypothermia and Acute Kidney Injury in Liver Transplantation trial (MHALT) which randomized patients to mild hypothermia or normothermia during the implantation phase of LT. Pre-, peri-, and post-operative clinical variables were obtained. Peripheral blood was obtained prior to incision, and two hours following portal reperfusion. The attending surgeon assessed bleeding severity 30 minutes following arterial reperfusion. Concentrations of thrombomodulin (TM), tissue factor (TF), and plasminogen activator inhibitor 1 (PAI-1) were quantified. The cohort was analyzed according to bleeding severity; continuous variables via Mann-Whitney U and categorical via Fisher exact tests, with significance of $p<0.05$.

	Minimal Bleeding (N=29)	Moderate to Severe Bleeding (N=24)	Overall (N=53)	P-Value
Age at transplant (y)				0.33
Median [Min, Max]	60.0 [29.0, 74.0]	55.5 [27.0, 70.0]	58.0 [27.0, 74.0]	
Sex				0.77
Male	20 (69.0%)	15 (62.5%)	35 (66.0%)	
Race				0.89
Black	1 (3.4%)	1 (4.2%)	2 (3.8%)	
White	18 (62.1%)	13 (54.2%)	31 (58.5%)	
Other	10 (34.5%)	10 (41.7%)	20 (37.7%)	
Body Mass Index (kg/m^2)				0.41
Median [Min, Max]	28.9 [20.1, 39.7]	30.0 [22.8, 47.1]	29.7 [20.1, 47.1]	
Etiology of liver disease				0.23
Hepatitis C	10 (34.5%)	2 (8.3%)	12 (22.6%)	
Hepatitis B	2 (6.9%)	2 (8.3%)	4 (7.5%)	
Alcoholic	6 (20.7%)	9 (37.5%)	15 (28.3%)	
NASH	6 (20.7%)	5 (20.8%)	11 (20.8%)	
Cryptogenic	1 (3.4%)	3 (12.5%)	4 (7.5%)	
Other	4 (13.8%)	3 (12.5%)	7 (13.2%)	
Hepatocellular carcinoma				0.15
Yes	20 (69.0%)	10 (41.7%)	30 (56.6%)	
Estimated Blood Loss (mL)				<0.001
Median [Min, Max]	1300 [500, 5600]	5350 [1000, 23200]	2400 [500, 23200]	
%Change Platelets				0.94
Median [Min, Max]	-10.7 [-73.4, 68.8]	-13.3 [-68.7, 179]	-11.6 [-73.4, 179]	
%Change Tissue Factor				0.20
Median [Min, Max]	-22.4 [-80.1, 38.5]	-39.0 [-74.4, 48.2]	-25.1 [-80.1, 48.2]	
%Change Thrombodulin				0.28
Median [Min, Max]	37.6 [-34.8, 309]	43.3 [-68.6, 206]	40.0 [-68.6, 309]	
%Change PAI				0.005
Median [Min, Max]	47.1 [-61.7, 809]	-8.63 [-77.6, 151]	13.2 [-77.6, 809]	
Ischemia Reperfusion				0.52
Minimal	24 (82.8%)	18 (75.0%)	42 (79.2%)	
Mod/Severe	5 (17.2%)	6 (25.0%)	11 (20.8%)	

Results: 65 patients were enrolled; 53 had qualitative bleeding assessments. Pre- and intra-operative demographic data by bleeding severity is shown in Figure 1. There were no differences in percent change of TM or TF before/after reperfusion, however those with minimal bleeding had a significantly greater percent increase in PAI-1 concentration following reperfusion compared to those with moderate/severe bleeding ($p=0.005$, Figure 2).



Conclusions: Increased PAI-1 concentration is associated with less severe bleeding following reperfusion during LT. This suggests that the clinically significant bleeding not explained by traditional laboratory tests may be the result of dysregulation of fibrinolysis homeostasis.

0-025

Effect of norepinephrine on blood volume, cardiac output, and systemic filling pressure in patients undergoing liver transplantation

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Background: Patients with liver cirrhosis present symptoms that are similar to those of patients with sepsis who have increased total vascular compliance that may cause pooling of blood in the venous pool. No previous studies have evaluated the effect of using norepinephrine (NE) on intravascular blood volume. We investigated the effect of NE infusion on mean systemic filling pressure (MSFP), venous return, and cardiac preload in patients undergoing liver transplantation.

Methods: A total of 33 patients who underwent living donor liver transplantation were enrolled in this study. Cardiac output (CO) was measured using PiCCO device (Pulsion Medical Systems, Munich, Germany). MSFP was calculated using the inspiratory hold maneuver at four time intervals, viz., at baseline, 10 min after NE infusion, 5 min after NE discontinuation, and after infusion of 500 cc of 5% albumin. Other hemodynamic parameters, including mean arterial pressure (MAP), pulse pressure variation, stroke volume variation, global end-diastolic volume (GEDV), and mitral inflow velocity (E wave), were evaluated.

Results: NE infusion increased the MAP and systemic vascular resistance in all patients. However, it did increase CO, MSFP, and GEDV in 20 patients (60%), and 13 patients (40%) showed no changes in these variables. In all patients, discontinuation of NE infusion led to a significant decrease in MAP, CO, resistance to venous return, and MSFP. Infusion of 500 cc colloid increased CO, but interestingly, this was associated with a significant decrease in systemic vascular resistance, and thus MAP and MSFP showed no changes

Conclusions: NE infusion at 0.1 μg^{-1} kg^{-1} min^{-1} is associated with increase in CO in patients with liver cirrhosis undergoing liver transplantation. The effect of NE on CO was primarily because of increase in venous return due to the increase in MSFP.

0-026

Diagnosis and monitoring of intracardiac thromboemboli during liver transplantation with transesophageal echocardiography: a case series

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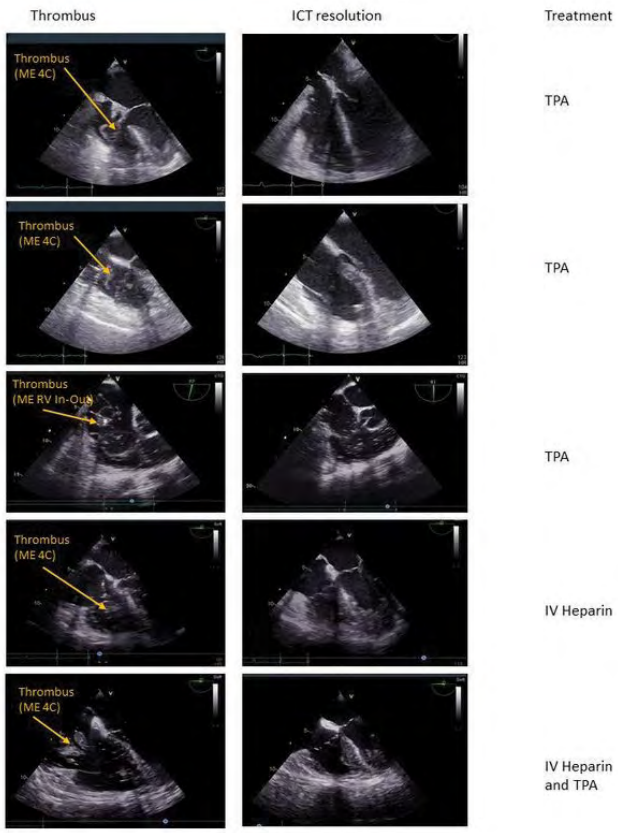
Background: Intra-cardiac thrombosis (ICT) is a rare but catastrophic event during liver transplant (LT) and is associated with high rates of morbidity and mortality. While there is no consensus treatment, systemic thrombolytics and/or anticoagulants may be administered for hemodynamically significant ICT. Intraoperative TEE is currently the gold standard for ICT diagnosis and may be used to monitor thrombus resolution after treatment.

Methods: We present a retrospective series of 17 cases of TEE confirmed ICT during LT over five years (2016-2020) at a single institution.

Results: Our study population was critically ill: median MELD was 40 and 59% were in the ICU pre-operatively. Median age was 61 years and 53% were male. All organs were from brain death donors. Out of 17 cases, four were aborted prior to graft implantation. Every ICT was diagnosed by TEE imaging. 15/17 were associated with hemodynamic instability. ICTs occurred during all phases of LT: 4 during dissection, 7 while anhepatic and 6 post-reperfusion. Nearly all patients (84%) received emergent treatment (IV Heparin, TPA or both) with 13/17 (77%) receiving TPA. Intraoperative images from five cases demonstrating both ICT and resolution of thrombus after treatment were captured (Table 1). Patients in our series had a high prevalence of morbidity and mortality regardless of treatment: 53% had an intraoperative cardiac arrest and 24% had a hemorrhagic stroke. The mortality rate was 47%.



Conclusions: Routine use of TEE during LT enables rapid detection of ICT, allowing for early treatment. TEE is also crucial for monitoring ICT resolution and cardiac function. In our series, administration of thrombolytics led to resolution of thrombus burden and improved hemodynamics in many cases. However, despite early detection and treatment, ICT was associated with high rates of serious complications including bleeding and a high rate of mortality.

0-027

Efficacy of renal resistive index & conventional methods versus renal resistive index & diltiazem in preventing post operative acute kidney injury in adult liver transplantation

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Background: Prevention of AKI can significantly improve outcomes in liver transplantation. Recent studies have demonstrated the utility of Doppler derived Renal Resistive Index (RRI) in predicting AKI in patients undergoing liver transplantation. Intra renal vasoconstriction precedes development of AKI. Calcium antagonists cause vasodilation of afferent arterioles. Based on the above evidence we postulated that use of diltiazem in patients with high post operative RRI may be helpful in preventing the occurrence & reducing the intensity of AKI.
Methods: We performed a single center, prospective, pilot study, including 28 adult liver recipients. RRI was measured 1 day prior to surgery and every day during the first post operative week. Patients who demonstrated a RI > 0.69 during any of the 7 days were assumed to be at risk for AKI. These patients were randomly allocated into 2 groups. Those in group A received reno protective strategies in the form of hydration and N-acetyl cysteine, while group D received oral diltiazem 60 mg BD in addition to the Reno protective strategies. Both group of patients were followed up till the 7th post – operative day.
Results: 28 patients were included in the study, 14 in each group, with similar baseline characteristics. All the patients had RI >0.69 during the 2nd and 3rd post operative day. Among the patients who developed AKI, majority developed on day 3 (62.5 % in group A & 60% in group D). However, incidence of AKI was lower in group D as compared to group A (46.4% versus 57.1%, p-.256).
Conclusions: Initial evidence from our study suggests that use of RRI along with diltiazem would be helpful in predicting as well as preventing the occurrence of early post-operative AKI in liver transplant patients. RRI and diltiazem have the advantage of been easily available and cost effective interventions for the prevention of AKI.

0-028

Evaluation of acute post-operative pain after open, laparoscopic and robotic approaches for living donor hepatectomy

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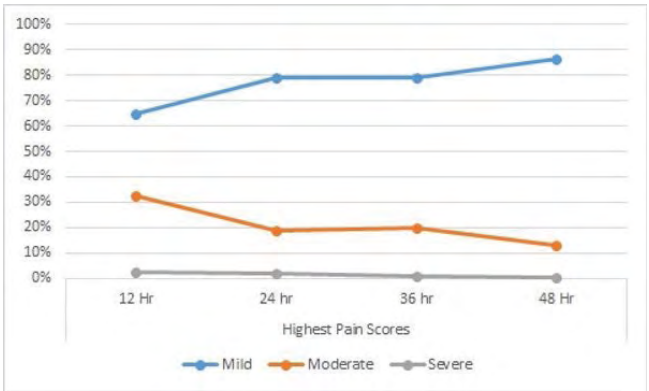
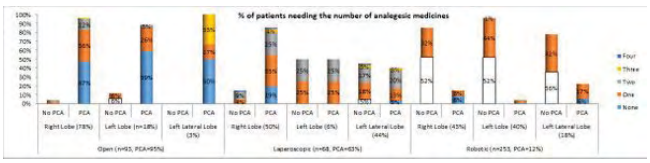
Background: The correlations between the surgical approach (open, laparoscopic, or robotic) for Living Donor Hepatectomy (LDH), or the extent of resection (right, left, or left lateral lobe), and the severity of acute post-operative pain, have not been investigated. We studied the impact of LDH surgery on the post-operative pain and analgesic requirements during the transition at our instituition from open access to minimally invasive approaches between 2018 and 2020.
Methods: The electronic records of all LDH cases (n=414) done during the aforementioned period were studied retrospectively after obtaining the ethics approval; basic patient demographics, length of surgery, types of surgical approach, resection, analgesia provided, and pain scores (at 12, 24, 36, and 48 hours post-operatively) were noted.
Results: Right (n=215, 52%), left (n=121, 29%), and left lateral (n=78, 19%) lobectomies were performed via open (n=93, 22%), Laparoscopic (n=68, 16%), and robotic (n=253, 61%) approach. Pain scores are in Figure1. Opioid Patient Controlled Analgesia (PCA) was taken up by 161 (39%) patients, mostly in the Open group (95%); 67% patients needed additional analgesics (Tramadol 32%, Paracetamol 19%, Fentanyl 9%, Codeine 2%, Ketorolac 2%, Diclofenac 1%). The laparoscopic group needed 1-3 additional pain killers, regardless of PCA, in almost half the patients. The robotic group was mostly treated (88%) without PCA, and single analgesic medicine on demand. No correlation was found between the age, BMI, or duration of surgery, and the pain scores / analgesic requirements. Laparoscopic surgery and left lateral lobectomy were separately found to be associated with statistically significant higher pain scores and analgesic requirements.





Conclusions: Robotic surgery was associated with the lowest post-operative pain, whereas laparoscopic resection had the highest analgesic demand. Left Lateral lobectomy was associated with more pain than other resections.

0-029

Effect of pre-transplant metabolic syndrome on liver transplant outcomes in young adult patients with nonalcoholic steatohepatitis

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Background: Liver transplantations (LT) due to non-alcoholic steatohepatitis (NASH)/cryptogenic cirrhosis (CC) is increasing. NASH and CC are usually associated with metabolic syndrome (MS). There is a concern that LT in these patients have worse outcomes in comparison to patients being transplanted for other causes. In this retrospective evaluation, we analyzed the effect of MS on outcome in young patients with NASH/CC undergoing LT.

Methods: The United Network for Organ Sharing database was used to compare postoperative outcomes in 2 patient populations with NASH/CC:

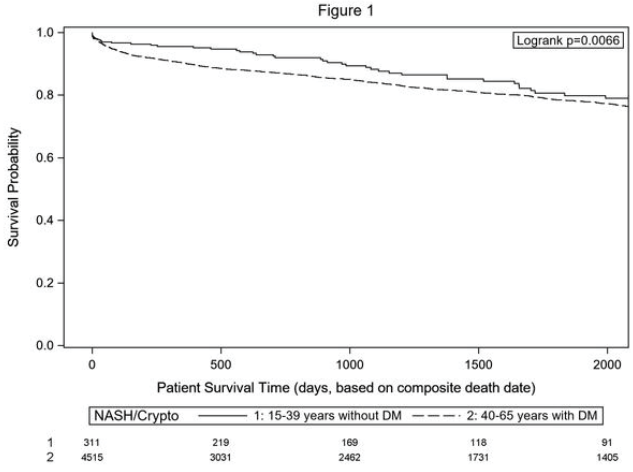
1. Obese patients 15-39 years old *without* diabetes mellitus (DM) (Group I) vs. obese patients 40-65 years old *with* DM (Group II).

2. All patients 15-39 years old with NASH/CC (Group III) vs. patients 15-39 years old with metabolic diseases other than NASH/CC (Group IV). A regression analysis was performed to identify independent predictive factors for mortality.

Results: Results: Between January 1, 2003, and March 5, 2021, 119,880 patients underwent LT. After all exclusions, 85,970 LT recipients participated in the study.

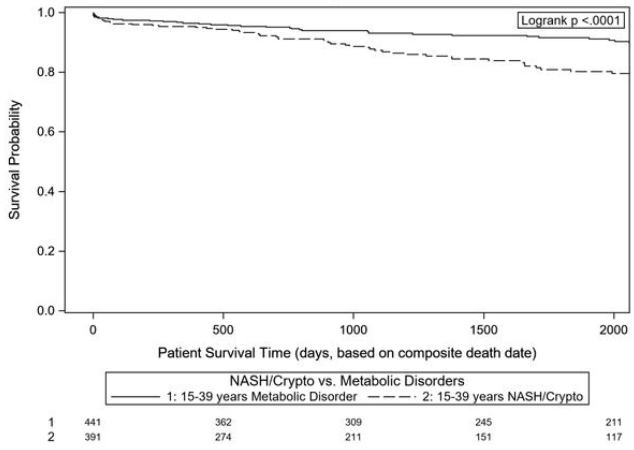
Group I patients had significantly better postoperative survival (p=0.0066) in comparison to Group II despite significantly higher MELD scores at time of listing and at transplant (p<0.0001) (Figure 1).

Figure 1



Group VI patients (with metabolic causes of ESLD) had significantly better survival than patients in Group III (with NASH/CC) (Figure 2).

Figure 2



Regression analysis confirmed that Group I (patients lacking MS) was associated with superior survival (HR=0.6, p=0.007). Re-transplantation was identified as an independent risk factor for worse survival.
Conclusions: Younger patients with NASH/CC have superior postoperative survival if ESLD is not associated with MS. Overall long-term survival of patients with NASH/CC is worse in comparison to other metabolic conditions.

0-030

The role of extracorporeal membrane oxygenation as salvage therapy in adult liver transplant recipients: a high-volume transplantation center experience

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Background: Extracorporeal membrane oxygenation (ECMO) has been used sporadically in adult orthotopic liver transplantation (OLT) recipients to treat acute cardiopulmonary failure. This retrospective study aimed to identify OLT patients benefiting from ECMO support.
Methods: We reviewed 109 OLT patients who received ECMO support for more than 24 hours from January 2007 to December 2020.
Results: Twelve recipients (11.01%) experienced reapplication of ECMO after weaning during the same hospitalization period. A total of 57 recipients (52.29%) were successfully weaned from ECMO, but only 47 (43.1%) survived until hospital discharge. The 109 enrolled OLT recipients who received ECMO support during the perioperative period had a 1-year survival rate of 42.6%. Of the 109 recipients, 15 recipients (13.76%) experienced 18 ECMO related complications, and cerebrovascular accident was the most common complication (6.42%). Multivariate analyses identified ECMO treatment prior to 2011 (p=0.045), septic shock as the indication for ECMO treatment (p=0.001), and a total bilirubin level ≥5mg/dl (p=0.024) as significant and independent risk factors associated with in-hospital mortality.
Conclusions: The outcomes of adult OLT recipients treated with ECMO were acceptable in terms of weaning success and survival until hospital discharge. This study confirmed that ECMO treatment for recipients with septic shock and elevated bilirubin levels may be associated with higher in-hospital mortality and demonstrated the importance of a multidisciplinary ECMO team approach.

Concurrent Oral Abstract Session: Basic Science / Translational Research I

0-031

Long-term ex-vivo normothermic machine perfusion allows the repeated assessment and salvage of unusable human grafts with cholangiopathy

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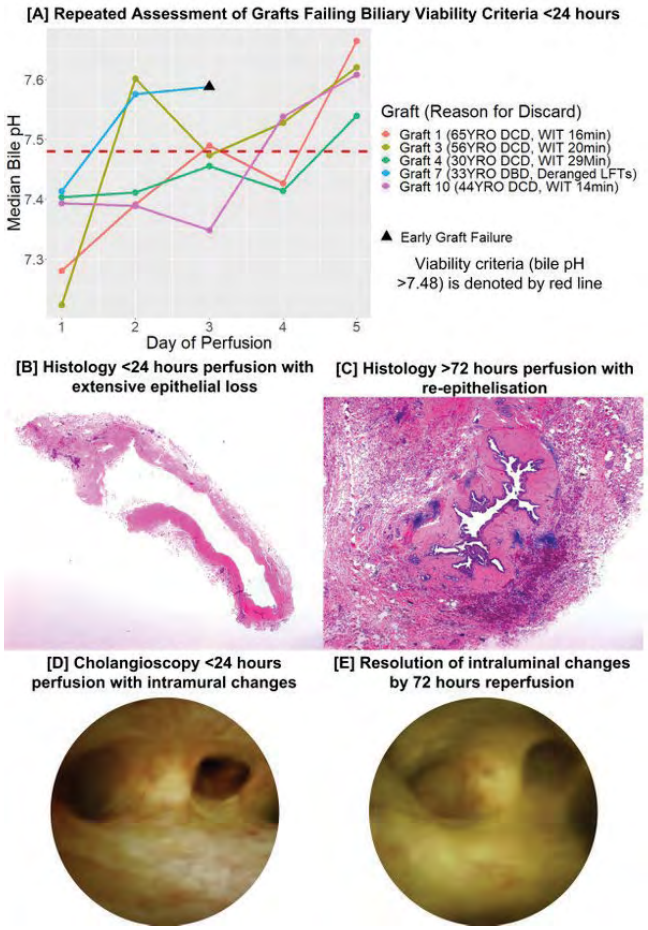
Background: With increasing clinical experience in normothermic machine perfusion (NMP), viability criteria have emerged to assess biliary injury before transplantation. However, existing definitions of biliary viability are based on short-term perfusion protocols less than 24 hours. Longer durations of perfusion enable repeated assessment of viability and may facilitate recovery of the biliary tree. This has the potential to salvage grafts that would otherwise be considered unusable. This study aimed to investigate injury and recovery of the biliary tree during long-term NMP up to 7 days. Innovative real-time tools to assess bile ducts were also evaluated.
Methods: We developed a protocol for long-term organ perfusion using a liver perfusion system which included long-term oxygenators, gas mixer and dialysis filter. Human livers that were unsuitable for transplantation were perfused using a red-cell based perfusate under normothermic conditions (36°C). Bile pH and glucose were used as markers of cholangiocyte function. Histology and immunohistochemistry were used to assess bile duct injury and regeneration. Direct visualization of the bile duct was performed at the time of biopsies using cholangioscopy.
Results: Eleven grafts were included in the study. Five of eleven grafts (45%) did not meet biliary viability criteria within 24 hours from reperfusion. All of these grafts eventually fulfilled biliary viability criteria by 5 days of perfusion (Fig.1A). Histology demonstrated almost extensive biliary epithelial loss after 24 hours reperfusion, while bile duct re-epithelisation was observed after 72 hours of perfusion (Fig.1B-C). Cholangioscopy allowed real-time assessment of biliary tree that correlated with markers of biliary injury and function (Fig.1D-E).



Conclusions: Long-term NMP up to 7 days offers an innovative platform for assessing and potentially recovering bile ducts, and could increase the number of organs available for transplantation.

0-032

Pivotal blinded randomized trial of a novel pro-regenerative drug in post-resection liver failure

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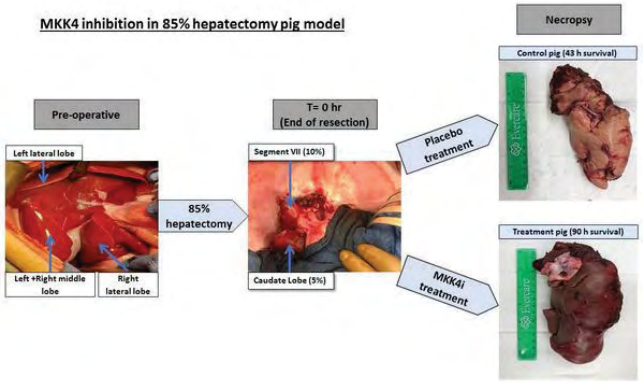
Background: Acute liver failure (ALF) following major liver resection is a devastating complication associated with impaired regeneration and death. We aimed to investigate the hepato-regenerative and survival benefits of a novel Mitogen-activated protein Kinase Kinase 4 (MKK4) inhibitor in 85% hepatectomy pig model of ALF.
Methods: Pharmacokinetic studies of MKK4 inhibitor were initially performed in normal pigs and after subtotal hepatectomy. Large white pigs (29-34 kg) were then blindly randomized into MKK4 inhibitor treatment group (n=6) and placebo control group (n=6). All pigs underwent placement of a central venous catheter and intracranial pressure (ICP) probe, 85% hepatectomy, and standard medical therapy. Treatment with 5 mg/kg MKK4 inhibitor was initiated 24 hours before hepatectomy and continued every 12 hours. ICP and liver function were measured every 12 hours. Volumetric CT scans were performed pre and post resection to measure the extent of resection and at 43-hr and 90-hr to evaluate regeneration of the remnant liver. Regeneration Index = regenerated volume/remnant volume. Primary endpoint was survival to 90 hours following hepatectomy. Death equivalence was defined as unresponsive grade 4 hepatic encephalopathy or ICP >20 mmHg of 1-hour duration.
Results: Four of six (66%) treatment animals survived to 90 hours in contrast to two of six (33%) animals in the control group (p=0.02). MKK4 inhibitor increased regeneration index at 43h (2.70 +/- 0.24 vs 2.38 +/- 0.22; p= 0.038) and 90 h (3.26 +/- 0.54 vs 2.56 +/- 0.44; p = 0.034) following resection compared to the placebo. ICP, INR, and bilirubin were improved significantly in the treatment group.
Conclusions: Prophylactic MKK4 inhibitor treatment accelerated liver regeneration and improved survival in 85% hepatectomy pig model. These favorable results in a large animal model warrant further investigation of MKK4 inhibitor in the clinical setting of post-resection liver failure.



0-033

Pretransplant alterations in serum protein glycosylation are associated to risk of hcc recurrence after liver transplantation and provide a potential prognostic biomarker: a proof-of-concept study

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Background: Hepatocellular carcinoma (HCC) recurrence after liver transplantation (LT) occurs in 10% of patients. Specific changes have been observed in protein glycosylation in HCC, involved in cancerogenesis. The goal was to assess the risk of HCC recurrence after LT, according to changes in serum protein glycosylation before LT.
Methods: A prospective study was performed in LT recipients between 2011 and 2018. A whole serum protein N-glycan profile was assessed using DNA sequencer assisted fluorophore assisted capillary electrophoresis. For every sample, 13 glycans were quantified. Specific changes in serum protein glycosylation profiles were compared between patients with HCC recurrence and patients without.
Results: Amongst 225 consecutive liver transplant patients, 76 patients suffered from HCC. Eight patients developed HCC recurrence after a median follow up time of 9.5 months. Seventy-four patients fulfilled Milan criteria. Significant differences in the abundance of 5 serum glycans were present in patients with HCC recurrence. Based on these changes, a composite biomarker was developed. It integrates an increased presence of triantennary and fucosylated glycans and a decreased presence of undergalactosylated glycans in patients with HCC recurrence. This panel shows an AUC of 0.855 (p=0.001; 95% CI 0.731-0.979) for association with HCC recurrence. Using an optimized cut-off, sensitivity was 87.5% and specificity 67.6%. Only 2.1% of patients with a value below this cut-off showed HCC recurrence, compared to 24.1% of patients with values above (p=0.011) (figure 1). PPV was 72.98% and NPV 84.39%. In multivariate analysis, the biomarker panel showed an independent relation with HCC recurrence (HR 1.931; p=0.008:1.184-3.149).
Conclusions: A glycomics based serum panel is strongly associated with tumor recurrence in liver transplant patients with HCC adhering to Milan criteria. In multivariate analysis, this biomarker was the only pretransplant discriminative parameter of HCC recurrence in this cohort. The biomarker panel could potentially improve allocation strategies in transplant candidates with HCC.

0-034

Modeling ischemic cholangiopathy in human cholangiocyte organoid for screening of novel cholangio-protective agents

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Background: Ischemic cholangiopathy (IC) refers to biliary damage caused by disruption of blood supply in the peribiliary plexus. Detailed knowledge of ischemic cholangiopathy pathogenesis remains scarce due to the lack of appropriate *in vitro* models. We aimed to recapitulate ischemia-evoked biliary damage using human intrahepatic cholangiocyte organoids(ICOs) in vitro for the study IC and preclinical drug discovery.
Methods: Human ICOs(n=5) were initiated from liver biopsies. Cultures were exposed to hypoxia (1% O_2) for 72 hours and reoxygenated for 6(H/R6h) or 24 hours(H/R24h), which was tracked by hypoxia-inducible factor 1alpha(HIF-1α) reporter.Transcriptional changes were profiled by RNA sequencing.The effect of hypoxia/reoxygenation on cell proliferation, apoptosis, and necroptosis was determined by immunostaining with Ki67, active caspase 3, cleaved caspase 8, and phosphorylated mixed lineage kinase domain-like protein respectively,and ATP content.
Results: Extensive activation of the HIF-1α reporter was observed in ICOs at 72h of hypoxia. Hypoxia- and H/R6h-exposed ICOs displayed significantly declined organoid size (p<0.001),disintegration of the cytoskeleton, and disrupted epithelial integrity. Microscopic analysis indicated a clear decrease of Ki67 expression after hypoxia or H/R6h, which recovered obviously after H/R24h. Transcriptional analysis reveals that progenitor and cholangiocytes markers were downregulated in hypoxia-exposed ICOs and partially restored after H/R6h. Besides, immunostaining revealed that intrinsic apoptosis, but not necroptosis, was triggered by hypoxia, while extrinsic apoptosis and sporadic necroptosis were induced by H/R6h. Supplement of Emricasan, a caspase inhibitor, during H/R6h failed to attenuate apoptosis but switched it into necroptosis.
Drug screening identified clinical-grade alpha-1 antitrypsin (AAT) as a potent inhibitor of hypoxia- and H/R6h-induced apoptosis without necroptotic switch. Treatment of AAT in both hypoxia- and H/R6h-exposed ICOs increased the cell viability (p<0.05) and partially restored the Ki67 activity.
Conclusions: ICOs recapitulate IC *in vitro* featured by distinct types of programmed cell death and reduced proliferation. AAT is identified as a novel cholangio-protective agent by restoring proliferation and preventing apoptosis and necroptosis.

0-035

Hepatocyte subpopulations and exacerbated ischemia-reperfusion injury in fatty livers

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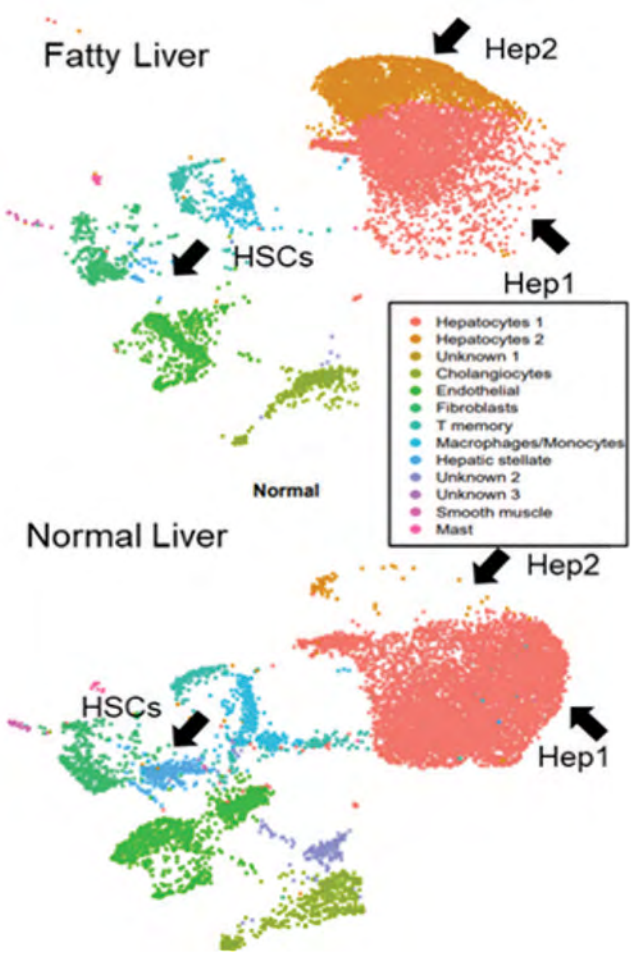
Background: Ischemia reperfusion injury (IRI), an inherent component of transplantation, significantly impacts liver transplant (LT) outcomes. Clinical studies have found that steatotic livers are particularly susceptible to IRI. We aimed to discern the cellular landscape of fatty livers at single-cell resolution in order to identify the main cells and pathways that associate with IRI exacerbation.
Methods: Nuclei were isolated from normal (NL) and fatty livers (FL) (n=4). 30,200 nuclei in Gel-Bead V3 were captured by using 10X Genomic Chromium Platform. Data was analyzed in CellRanger 4.1.0. Cell clustering was performed using PCA followed by uniform manifold approximation and projection. Gene expression patterns among clusters were evaluated to find cluster-specific marker genes. Cell subset and cell number differences between NL *vs.* FL were analyzed and compared.
Results: 18 cell clusters were identified based on gene markers (parenchymal and non-parenchymal cells) (**Fig. 1**). Two hepatocyte cell subsets were discovered: Hep1 and Hep2. Hep2 were over represented in FL (Hep 2, NL= 87 *vs.* FL= 2390). In FL, Hep1 had decreased complement and coagulation gene expression *(CD46, CD55, C8, SERPINA1, fibrin, PLG, KNG1, KLKB1, KNG1)*. Hep2 cells had increased expression of acute phase response signaling, oxidation of lipids, FGF21 signaling, angiogenesis and development of vasculature genes. FL had a significantly decreased number of hepatic stellate cells (HSCs) and endothelial cells (ECs). HSCs in FL presented an activated phenotype. Also, ECs showed an activated response to IL6, PRAR signaling pathway, acute inflammatory response, and platelet degranulation in FL.



Conclusions: Single cell transcriptomics serves as a critical tool to identify specific cells/pathways that may represent targets for IRI therapeutic intervention. Decreased coagulation factors, increased proinflammatory profiles and activated peroxidation in FL hepatocytes may explain the exacerbated IRI in FLs. Decreased HSCs in FL may further limit regenerative capacity post-IRI.

0-036

Post-operative day 1 galectin-3 is predictive of early allograft dysfunction in liver transplantation

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Background: Early allograft dysfunction (EAD) is an important outcome measure in liver transplantation that is predictive of graft failure, but the mechanism behind it remains elusive. Galectin-3 (Gal3) is a beta-galactoside binding lectin that plays a key role in inflammation and ischemia-reperfusion injury. The aim of this study was to investigate the association between post-operative day (POD) 1 circulating Gal3 levels and EAD and other early outcome measures post-liver transplant.

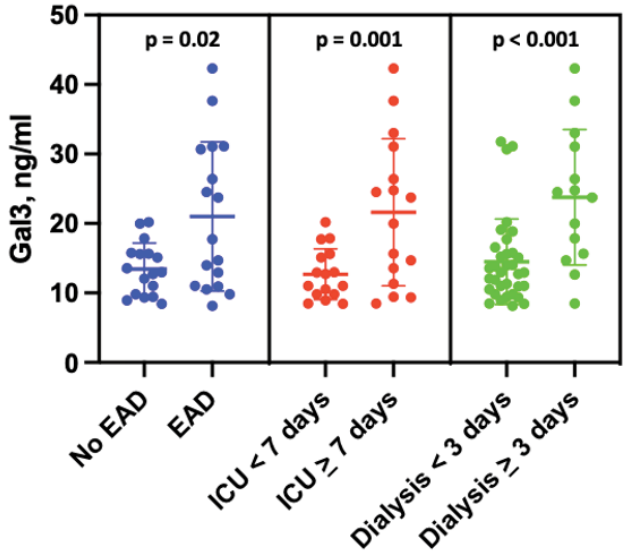
Methods: Citrated plasma was collected from recipients on POD1. Gal3 was measured using standard ELISA. The primary outcomes of interest were EAD, intensive care unit (ICU) length of stay, and post-transplant dialysis. EAD was defined based on post-operative INR, bilirubin, and AST/ALT within 7 days of transplant, as previously described. Continuous data is presented as mean (standard deviation) and compared using two-tailed t-test. Logistic regression was used to assess the predictive power of Gal-3 for EAD.

Results: 17 of 48 (35%) recipients in the study developed EAD. Recipients with EAD were less commonly non-Hispanic Caucasian and more commonly had alcohol cirrhosis (Table 1). Significantly elevated Gal3 levels were seen among recipients with EAD and those with prolonged ICU length of stay and dialysis requirement (Figure 1). After adjusting for alcohol cirrhosis and race, POD1 Gal3 > 20.17 ng/ml was associated with EAD (OR 14.59, 95% CI 2.03 – 104.56, p = 0.008) and the multivariable model was highly predictive of EAD (AUC = 0.85).

Table 1. Recipient Demographics

Characteristic at Transplant	No EAD (n = 31)	EAD (n = 17)	P-value
Age, years	54.65 (13.20)	49.35 (10.07)	0.2
Weight, kg	81.18 (17.71)	83.84 (19.69)	0.6
Female	10 (32%)	9 (53%)	0.2
Non-Hispanic Caucasian	29 (94%)	12 (71%)	0.03
O blood group	19 (61%)	8 (47%)	0.3
Alcohol cirrhosis	9 (29%)	12 (71%)	0.006
Hepatocellular carcinoma	7 (23%)	3 (18%)	0.6
Na-MELD	25.94 (10.55)	26.21 (8.42)	0.9
Living donor	0	2 (12%)	0.05
Cold ischemia time, minutes	322.19 (67.15)	286.71 (121.50)	0.2
Warm ischemia time, minutes	29.74 (8.50)	34.47 (10.65)	0.1
Donor age, years	35.90 (13.01)	36.27 (18.05)	0.9
Female donor	12 (39%)	11 (65%)	0.09

Figure 1. POD1 Gal3 Levels by Early Post-Liver Transplant Outcomes. *Bars represent mean and standard deviation. EAD = early allograft dysfunction, ICU = intensive care unit.*



Conclusions: Gal3 is elevated in liver transplant recipients with longer ICU duration and dialysis requirement, and in combination with diagnosis and race, is highly predictive of EAD. Gal3 may represent a novel therapeutic target to improve early allograft function and recipient outcomes.

0-037

A metabolic immune-modulatory strategy to mitigate hepatic ischemia/reperfusion injury in a murine model

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Background: Hepatic ischemia/reperfusion injury (IRI) is the leading cause of early graft dysfunction and contributes to the shortage of donor liver grafts. However, despite its obvious clinical importance, effective therapies to prevent or treat this condition remain elusive. Indoleamine 2,3-dioxygenase (IDO) catalyzes the catabolism of the essential amino acid tryptophan to the product kynurenine and is well known for inducing a powerful immunosuppressive metabolic programming and restoring homeostasis. In this study we focus on evaluating the efficacy of systemic IDO therapy to control the local hepatic inflammatory response of mouse IRI by administering PEGylated IDO as a means of reducing its immunogenicity and extending its circulation time.
Methods: Male 8-12 week old Balb/c mice were separated into 3 intravenous treatment cohorts; PEGylated-IDO (PEG-IDO), IDO, and phosphate buffered saline (PBS). 48 hours after administration mice were either subject to a sham operation or a well-established model of partial hepatic IRI with 90 minutes of ischemia and 6 hours of IRI.
Results: PEGylated-IDO significantly improves hepatic IRI. Plasma AST and ALT levels at 6 hours after reperfusion were significantly lower in the PEG-IDO group, when compared with those in PBS and IDO treatment groups. Histological analysis of PEG-IDO treated livers showed significantly less congestion, necrosis, and vacuolization as assessed by Suzuki score. Systemic PEG-IDO therapy also decreased the local infiltration of the inflammatory cells such as CD3+ T cells, Ly-6G+ neutrophils, and CD68+ macrophages, and it reduced the expression of proinflammatory IL-6, TNF- , IL-1 and IFN- . Furthermore, as measured by the number of TUNEL+ hepatocytes, apoptosis was also suppressed in PEG-IDO treated mice.
Conclusions: The results in this study show that redirecting tryptophan immunometabolism via PEG-IDO therapy protects livers from hepatic IR induced damage. This metabolic immune-modulatory strategy represents a new class of anti-inflammatory/immunosuppressive biologic drug for the treatment of liver inflammatory disorders.

Concurrent Oral Abstract Session: Basic Science / Translational Research II

0-038

Decrease of mitochondrial damage and attenuation of hepatic ischemia/reperfusion injury (IRI) by a new generation of histone deacetylase (HDAC) inhibitors

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Background: Hepatic IRI leads to primary liver graft non-function and promotes rejection after transplantation. Some HDAC isoforms contribute to IRI. Here, we examined whether LP342 and LP411, the lead candidates of a new generation of hydrazide-based HDACis we discovered, decrease hepatic IRI.
Methods: I/R was induced by clamping blood vessels to 70% of liver tissue in mice for 1 h. LP-342 (1 mg/kg) and LP-411 (3 mg/kg) were injected once at 20 h (-20 h) or 1 h (-1 h) before ischemia.
Results: At 6 h after reperfusion, ALT increased to ~19,000 U/L and panlobular necrosis (69% of liver tissue) occurred with infiltration of leukocytes. Cleaved caspase-3 increased by ~150%. LP342 given once at -20 h or -1 h decreased ALT to ~3,700 U/L and ~8,700 U/L and necrotic areas to 9% and 31%, respectively. Apoptosis increased only 31 - 32% with LP342 pretreatment. Meyloperoxidase (neutrophil infiltration) increased by ~450% after I/R but only increased by 63% and 89% with LP342 treatment at -20 h and -1 h. Nitro-oxidative stress, c-Jun-*N*-terminal kinase (JNK) activation and mitochondrial dysfunction contribute to IRI. 4-Hydorxynonenal, 3-nitrotyrosine and inducible nitric oxide synthase expression, JNK activation and Sab binding increased markedly after I/R, which LP342 blunted. LP342 also induced thioredoxin-1 expression before and after I/R. LP411 exhibits similar protections. Both LP342 and LP411 decreased the mitochondrial depolarization as detected by intravital microscopy 2 h after I/R. LP342 increased both histone-3 and NFκ-B p65 acetylation before and after I/R, but did not alter tubulin acetylation, demonstrating that LP342 inhibits Class I but not Class II HDACs *in vivo* and modifies acetylation status of both histone and non-histone proteins.
Conclusions: These novel HDACis protect against IRI most likely by epigenetic regulation of antioxidant and iNOS expression and suppression of NFκ-B activation through lysine post-translational modifications. They are likely promising therapy for IRI.

0-039

Extracellular microvesicle micrornas in liver perfusate associate with early allograft dysfunction

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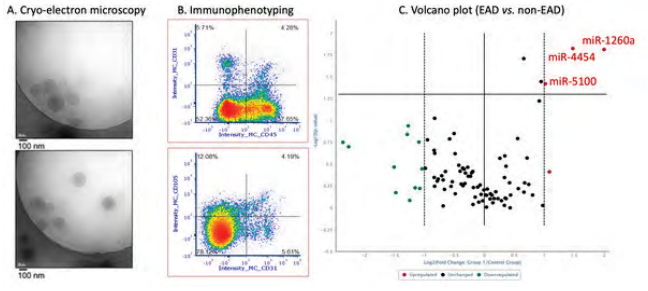
Background: Early allograft dysfunction (EAD) in liver transplantation (LT) is associated with poor long-term graft survival. Prior to LT, while organs are stored or reperfused, they release uniquely packed extracellular vesicles (EVs) in response to ischemic conditions. Decoding EV cell origin and bioactive cargo will allow for a better understanding of the early stress signals that culminate in EAD.
Methods: Perfusate was collected from 24 LT patients. EVs were quantified using TRPS and Imaging Flow Cytometry. Total RNA was isolated using the miRNeasy Micro Kit (Cat # 74004). MiRNA expression was evaluated using Human miRNA PCR arrays (MIHS-116Z). Global normalization of each plate was performed. In silico prediction of miRNA targets was done by analyzing the top miRDB genes in Metascape. EAD was defined by the presence of one or more of the following 1) total bilirubin ≥10 mg/dL or INR ≥1.6 on day 7, and/or 2) ALT or AST >2,000 IU/L within the first 7 days.
Results: Using 600µl of perfusate, we were able to recover an average of 1.5x108 EVs (images in Fig 1A). Flow Cytometry allowed for the identification of endothelial cell markers (CD31, CD105) on perfusate EVs. (Fig 1B) Three miRNAs (miR-1260a, miR-4454, miR-5100) that are involved in metabolic processes and DNA repair were over-expressed ($p<0.05$, FC≥2; Fig 1C) in the perfusate of EAD patients (n=4) compared to patients with normal function (n=20). No donor/recipient characteristics were statistically significant between groups (including age, race, and ischemia time).



Conclusions: EVs are released from injured endothelial markers and are responsible for shuttling bioactive molecules to the periphery. Perfusate miRNAs derived from EVs can function as specific, noninvasive measures assessing risk of EAD. Such findings can elucidate the pretransplant tissue responses that influence graft outcomes, and may ultimately guide posttransplant management.

0-040

Liver metabolism during normothermic machine perfusion: a metabolomic evaluation based on ex-vivo high field ^{1}H-NMR spectroscopy

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Background: Normothermic machine perfusion (NMP) allows ex-situ maintenance of hepatocyte metabolism, but the metabolic events occurring during the procedure are poorly described even if they could affect post-transplantation results. We aimed at investigating the metabolite changes induced by NMP in a rat model. To discriminate between beneficial and deleterious metabolite changes, experiments were performed using different strategies for oxygen delivery (DO2).
Methods: Livers were procured, subjected to 30 min-static cold storage (SCS), and perfused for 150min with three different perfusion fluids (n=5 rats/group): (i)Dulbecco-modified-Eagle's-Medium (DMEM, hypoxic group); (ii)DMEM added with human red-blood-cells (RBC); (iii)DMEM added with Oxyglobin, a non-cellular hemoglobin (OXY). Perfusate samples were collected hourly, while biopsies were taken at the end of perfusion. Specimens procured from healthy livers (native) and from grafts exposed to 30 min-SCS (SCS) were used as controls. Metabolic profiles were investigated in tissue extracts by means of high-field (14.1 Tesla) proton (1H) nuclear magnetic resonance (NMR) spectroscopy
Results: Compared to RBC and OXY groups, grafts perfused with DMEM alone showed a decrease in DO2, oxygen consumption (VO2), lactate clearance, glucose consumption, bile production, and ATP content. Of note, all these markers were similar between RBC and OXY groups.

Analysis of NMR metabolomics data revealed distinct metabolite profiles across the experimental groups (Figure 1A and 1B). Differentially expressed metabolites are involved in the biosynthesis of primary bile acid, pantothenate, and CoA, and in the metabolism of valine, taurine, and hypotaurine. Livers from the DMEM group had increased succinate, lactate, and alanine content relative to controls (Figure1C).

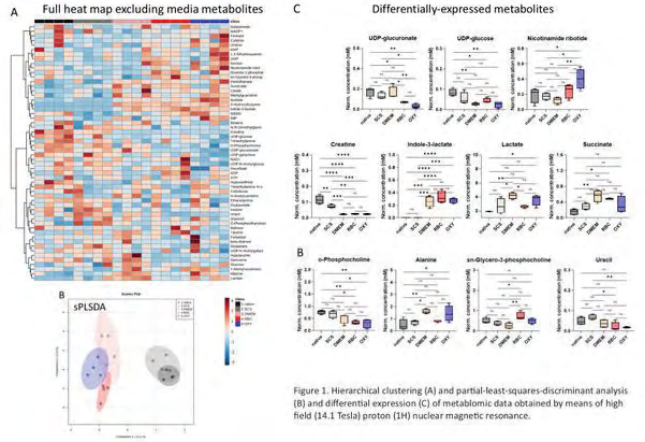

Figure 1. Hierarchical clustering (A) and partial-least-squares-discriminant analysis (B) and differential expression (C) of metablomic data obtained by means of high field (14.1 Tesla) proton (1H) nuclear magnetic resonance.

Conclusions: This study provides valuable information to depict the impact of NMP on liver metabolic activation and the associated changes in energy, growth, lipid, and redox metabolisms. Cellular and non-cellular hemoglobin showed comparable results in terms of oxygen delivery and metabolism recovery.

0-041

Tertiary lymphoid structures promote HCC immunotherapy response

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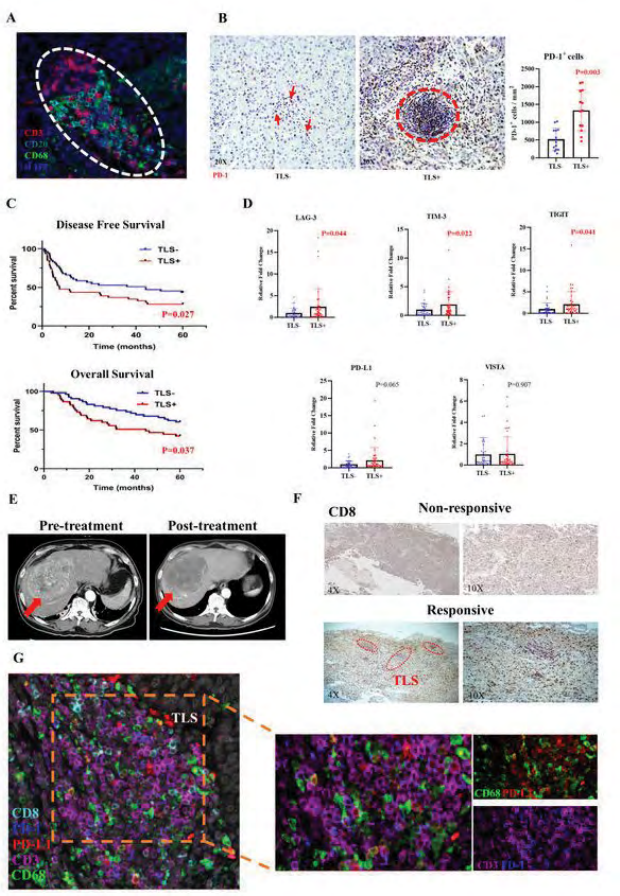
Background: Tertiary Lymphoid Structures (TLSs) develop in non-lymphoid tissues at sites of chronic inflammation and cancer, including hepatocellular carcinoma (HCC) and chronically rejected allografts. A favorable impact of TLSs on preventing tumor invasion and metastasis has been observed in various tumors. In addition, the presence of intra-tumoral TLSs is associated with better survival and immunotherapy response. However, the roles of TLSs in HCC are still controversial.
Methods: The expression of TLSs in HCC tumor were detected by H&E staining and multiplex immunohistochemistry (mIHC). Expression levels of various immune checkpoints were evaluated by qRT-PCR. After nivolumab treatment, 13 patients were divided into the responsive group and non-responsive group according to the percentage of necrotic tumor areas in tumor sections.



Results:
The representative mIHC image of TLS in the HCC tumor was showed in **Fig 1A**. IHC analysis indicated that PD1 expression was higher in TLS$^+$ tumors than in TLS$^-$ tumors (**Fig 1B**). HCC patients with intra-tumoral TLS$^+$ had a higher 5-year recurrence rate and shorter overall survival than patients without TLSs (**Fig 1C**). In addition, PCR results showed that TLS$^+$ HCC tissues were with higher expression of LAG-3, Tim-3 and TIGIT. However, for the expression of PDL1 and VISTA, there was no difference between these two groups (**Fig 1D**). Patients achieving pathological complete response after anti-PD1 treatment had a certain degree of necrosis on contrast enhancement CT scan (**Fig 1E**). Compared with non-responders, more CD8$^+$ T cells infiltrated in tumors of responders and tended to gather around TLSs (**Fig 1F**). The interactions of various immune cells can be found in the TLS of the response case (**Fig 1G**).
Conclusions: Intra-tumoral TLSs predicted a poor prognosis in HCC patients underwent hepatectomy. Anti-PD1 treatment could educate TLS to develop antitumor activity and potentially reverse unfavorable clinical outcomes.

0-042

Ferroptosis contributes to hepatic ischemia/reperfusion injury in a murine model

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Background: Hepatic ischemia-reperfusion injury (IRI) sustained during liver transplantation is associated with worse graft function and clinical outcomes, especially in fatty livers. We hypothesized that ferroptosis, a novel form of cell death characterized by iron accumulation and uncontrolled lipid peroxidation, was an essential contributor to increased IRI in the lipid rich environment of fatty liver.
Methods: 10-week-old C57BL6 male mice were split into two cohorts; one was fed a high fat, high sucrose diet (HFD, n = 8) for 12 weeks, while the other was maintained on normal chow (ND, n = 8). At 22 weeks age, 4 animals from each group had hepatic IRI induced via 70% portal pedicle clamping for 1 hour. Remaining mice underwent sham operations as controls. Following 24 hours of reperfusion mice were sacrificed. Serum was analyzed for AST and ALT. H&E and immunohistochemistry for 4-hydroxynonenal (4HNE) and Acyl-CoA synthetase long chain family member 4 (ACSL4) were performed on liver sections. ACSL4 ELISA was performed on homogenized liver.
Results: Serum AST and ALT were significantly higher in HFD mice as compared to ND following IRI (Figure 1-A). H&E staining demonstrated confluent necrosis within ND liver, however this was not clearly observed in HFD liver (Figure 1-B). 4HNE immunofluorescent staining exhibited increased abundance in HFD liver sections, consistent with increased lipid peroxidation in fatty livers as compared to ND (Figure 1-C). ACSL4 immunohistochemistry demonstrated increased abundance in HFD liver as compared to ND. This finding was confirmed with ACSL4 ELISA (Figure 1-D).

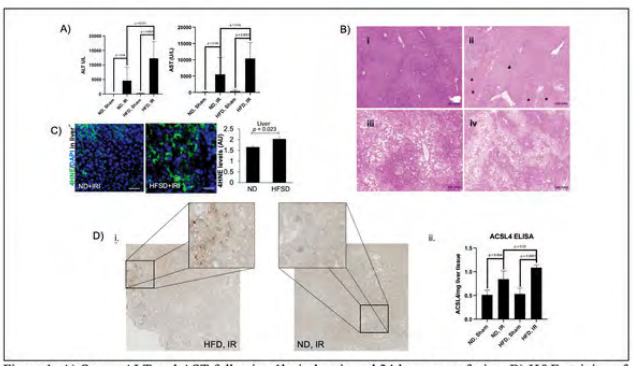

Figure 1: A) Serum ALT and AST following 1hr ischemia and 24 hours reperfusion. B) H&E staining of liver sections from i) ND, Sham; ii) ND, IR; iii) HFD, Sham; iv) HFD, IR. Arrowheads represent regions of confluent necrosis. C) 4HNE immunofluorescent staining of ischemic liver sections. D) Representative images of ACSL4 immunohistochemistry demonstrates increased abundance in HFD liver sections (i). This was confirmed on ACSL4 ELISA (ii).

Conclusions: Our study suggests ferroptosis is an important mechanism for liver injury in a murine model of hepatic IRI, and its contribution is more pronounced in fatty liver.

0-043

Xenogeneic cross-circulation supports ex vivo human livers for 24 hours

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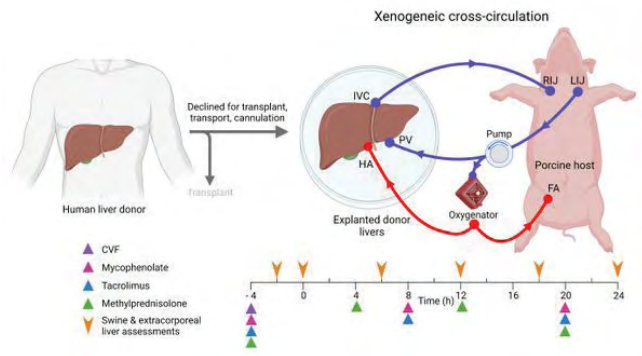
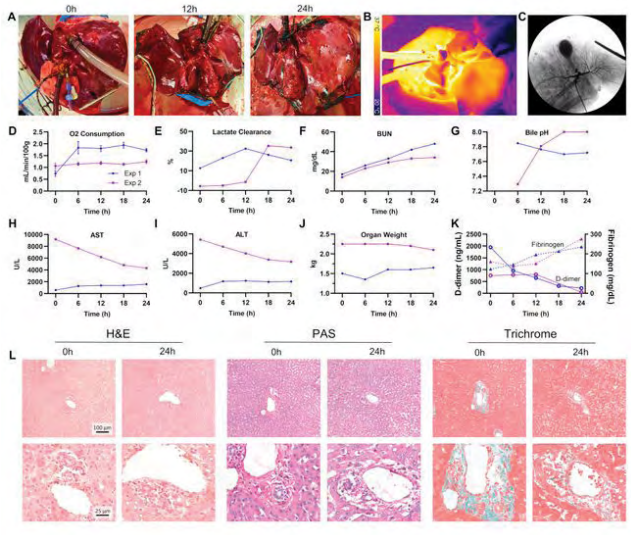
Background: Despite increasing use of machine perfusion as an organ preservation and rescue technique in liver transplantation, significant organ shortages and waitlist mortality highlight a continuing need for improved organ recovery methods. We have previously described a platform for *ex vivo* support of explanted porcine livers using cross-circulation. Here, we describe the use of xenogeneic cross-circulation (XCC) for the support of explanted human livers for 24 hours.

Methods: Human donor livers (n = 2) declined for clinical transplantation were procured and placed on normothermic, veno-arteriovenous XCC with anesthetized, immunosuppressed, complement depleted porcine hosts (**Fig. 1**). Longitudinal analyses of extracorporeal livers and porcine hosts were performed over 24 hours of XCC.



Results: Throughout 24 hours of support, extracorporeal livers maintained gross architecture, normothermic perfusion, and biliary integrity (**Fig. 2A-C**). Functionally, the liver demonstrated stable or improved oxygen consumption, lactate clearance, protein metabolism, and alkaline bile composition (**Fig. 2D-G**). Liver enzymes increased upon reperfusion, but decreased or remained stable throughout cross-circulation

(**Fig. 2H, I**). Organ weight remained stable and fibrinolytic markers improved over the course of support (**Fig. 2J-K**). There was no major histologic evidence of hepatocellular injury (**Fig. 2L**). Circuit parameters remained physiologic during XCC (hepatic artery flow 233 ± 55 mL/min; hepatic artery pressure 89 ± 45 mmHg; portal venous flow 510 ± 120 mL/min; portal venous pressure 10 ± 3 mmHg; portal venous O_2 saturation 64 ± 15%).



Conclusions: We demonstrate that XCC enables the physiologic support of explanted human livers for 24 hours. XCC has potential application as a translational research platform and clinical biotechnology for organ salvage and recovery.

0-044

MIF inhibitor ISO-1 alleviates ischemia/reperfusion injury in a rat model of donation after circulatory death liver transplantation

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Background: As a pivotal mediator in inflammatory response, macrophage migration inhibitory factor (MIF), plays an important role in ischemia/reperfusion injury (IRI) following orthotopic liver transplantation (OLT). Our study aimed to investigate the effects of pharmacological MIF inhibition in IRI using a rat model of donation after circulatory death (DCD) OLT.

Methods: Male Lewis rats were used as donors and recipients. Animals were randomly allocated into three experimental groups: Control, Vehicle-DCD and ISO-1-DCD. The grafts were retrieved after the induction of cardiac arrest via phrenotomy in the DCD groups. Liver grafts in the Control group were retrieved without warm ischemia. Animals were sacrificed after 1, 3, 24, 168 h post-reperfusion (n=6/group/time-point). Animals in the treatment groups received either 20mg/kg MIF antagonist ISO-1 intraperitoneally, resolved in 5% DMSO before laparotomy (ISO-1-DCD), or DMSO alone (Vehicle-DCD). Liver microcirculation and hepatocellular damage were analysed. Messenger ribonucleic acid (mRNA) expression, protein levels of MIF, together with additional markers of IRI, were evaluated.

Results: The ISO-1-DCD group showed significantly ($p<0.05$) reduced hepatocellular and histopathological injury which was comparable to the level of injury observed in the Control animals without warm ischemia (AST: 294±142 IU/L ISO-1-DCD vs. 867±472 Vehicle-DCD vs. 224±44 IU/L Control). Portal venous perfusion was improved in the ISO-1-DCD group compared to vehicle. Serum level of HMGB1 in the ISO-1-DCD group were reduced in the early reperfusion phase (HMGB1: 11±7 pg/mL ISO-1-DCD vs. 29±19 Vehicle-DCD). Supporting findings were obtained from the assessment of further tissue and serum inflammatory markers.

Conclusions: These results suggest that the pharmacological inhibition of MIF using ISO-1 might confer potent protection against the detrimental effects of IRI in DCD liver transplantation.

Concurrent Oral Abstract Session: Comorbidities and Liver Transplantation Outcomes

0-045

The utility of new versus old diagnostic criteria for cirrhotic cardiomyopathy in predicting major adverse cardiovascular events after liver transplantation

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[1]Vanderbilt University, Nashville, United States, [2]University of California Los Angeles, Los Angeles, United States, [3]Baylor College of Medicine, Houston, United States, [4]University of Virginia, Charlottesville, United States

Background: The diagnostic criteria for cirrhotic cardiomyopathy (CCM), first described in 2005, were revised in 2020 to reflect advancements in echocardiographic technology. This study aims to assess the utility of new CCM criteria compared to the old CCM criteria in predicting post-transplant major cardiovascular events (MACE).
Methods: This retrospective review included adult liver transplantation (LT) recipients at a North American center between 1/2009 and 1/2019. MACE were defined using administrative data and manual review for arrhythmia, heart failure, cardiac arrest or cardiovascular death. Those with MACE prior to LT were excluded. Echocardiograms obtained within 1 year prior to LT were reviewed for the diagnostic criteria for CCM by World Congress of Gastroenterology in 2005 (WCG) and those by CCM Consortium (CCMC) in 2020. Utilizing both definitions, incidence of MACE after LT was compared between those with and without CCM.
Results: A total of 212 patients met study inclusion criteria. CCM was present in 164 patients by the WCG criteria (77%), but the revised criteria applied only to 64 patients (30%). A total of 45 MACE and 31 deaths occurred within a median follow up of 3.2 years. Most deaths (38.7%) occurred secondary to cardiovascular disease. After controlling for age, gender, and comorbidities CCM defined by the original criteria was not associated with MACE after LT ($p = 0.194$), but with the revised criteria applied there was a significantly increased risk of MACE (HR 1.88, 95% CI 1.03-3.44, $p = 0.041$). Additional analysis of echocardiographic variables demonstrated low septal e' as the most predictive variable for MACE after LT (HR 3.11, $p = 0.001$).
Conclusions: This study validates the recent revision of the diagnostic criteria for cirrhotic cardiomyopathy. The prior criteria failed to predict MACE post LT while the new definition predicts MACE. These findings can guide decision-making regarding surveillance of CCM patients post LT.

0-046

Cirrhosis-related sarcopenia may never resolve after liver transplant

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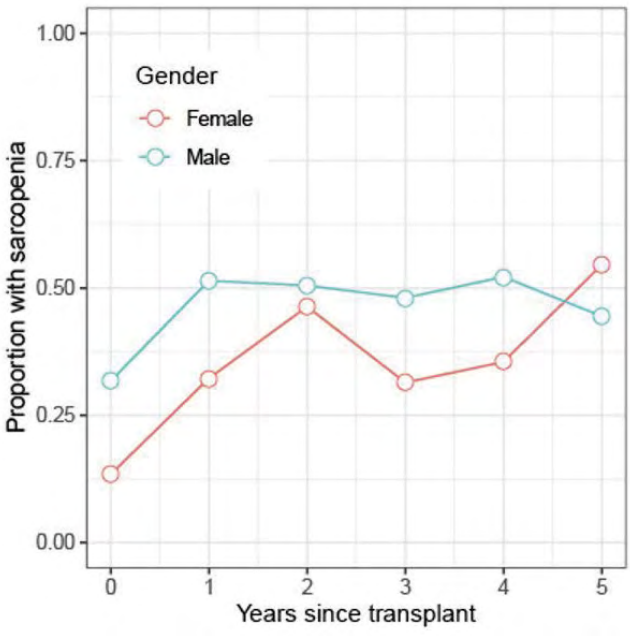
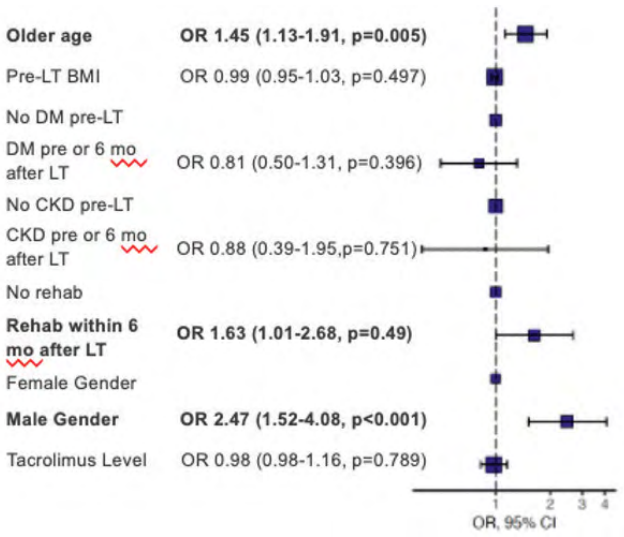
Background: Sarcopenia has significant burden in cirrhosis and is associated with impaired survival pre- and early post-liver transplantation (LT). This study aims to evaluate the long-term changes in sarcopenia post LT.
Methods: A retrospective study of adult patients who underwent LT at our center 1/2009-10/2019. Data were collected for pre and post LT course. Skeletal muscle index (SMI) was calculated using standard of care CT scans pre-transplant and up to 10 years post LT. Automated segmentation software measured total abdominal muscle mass at L3 then using height, we calculated SMI pre- and each year post-LT. Sarcopenia was defined as SMI <43 cm^2/m^2 for males if BMI<25, <53 cm^2/m^2 for males if BMI $\geq$ 25 and <41 cm^2/m^2 for females. Patients were excluded if they had no CT within 6 months pre LT or no scan post LT.
Results: 401 patients met inclusion criteria with 1205 CT scans analyzed. Average age at transplant was 57, 63% were male. Average BMI and MELD at transplant was 29 and 22, respectively. 13% of women and 25% of men were sarcopenic pre LT. SMI decreased most within the 1st year post LT (mean decline 4.7 cm^2/m^2) and continued to decline significantly over year two for women. 77 patients had follow up at 4 years post LT with 45% of women and 35% of men being sarcopenic. Older age, male gender and lower BMI were associated with baseline sarcopenia. Baseline sarcopenia and SMI changes were not associated with post LT outcomes.





Conclusions: Sarcopenia does not appear to resolve long-term and likely worsens leading to nearly doubling its prevalence 3-5 years post LT. Female gender may be protective at baseline but women experience more significant decline in SMI over time.

0-047

Recent outcome of liver transplantation for Budd Chiari syndrome - analysis of the european liver transplant registry (ELTR) and affiliated centres

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Background: Maintenance anticoagulation and Transjugular Intrahepatic Portosystemic Shunt (TIPS) have improved management of Budd-Chiari Syndrome (BCS) over the last decades. Most published studies on outcomes of liver transplantation (LT) for BCS in Europe date before these changes.
Methods: Data were obtained from the European Liver Transplantation Registry (ELTR). Age <16, secondary BCS and hepatocellular carcinoma were excluded. Patient (PS) and graft survival (GS) before and after 2000 was compared. Multivariate Cox regression analysis (with re-transplantation as time-dependent covariate) identified predictors of PS and GS after 2000. Supplementary data was requested from all ELTR affiliated centres and received from 39.
Results: 811 patients were transplanted for primary BCS between 2000 and 2020. Median age was 37.2y, 60% were female, median MELD was 17 and 29% had high urgency (HU) listing. One-, five- and ten-year PS rates between 2000-2020 were 83%, 76% and 69%, compared to 71%, 66% and 61% for the 293 patients transplanted before 2000 (p<0.001), while GS was 78%, 69%, 62% vs. 63%, 58% and 52%, respectively (p<0.001). Since 2000, BCS recurred in 3% and 12% received a re-transplant. Older recipient age (HR 1.02; 95%CI 1.01-1.04) and higher MELD (HR 1.03; 95%CI 1.01-1.06) were associated with worse PS while HU listing was associated with improved PS (HR 0.57; 95%CI 0.35-0.92). Older donor age was the only independent predictor of worse GS (HR 1.01; 95%CI 1.00-1.02). In n=236 (29%) with additional centre-data, 38% had myeloproliferative disease, 25% received TIPS pre-LT and 82% used anticoagulation post-LT. In these, anticoagulation was the only independent factor associated with PS (HR 0.38; 95%CI 0.15-0.98).
Conclusions: LT for BCS results in excellent patient and graft survival. Outcomes have improved since 2000. Older recipient age and higher MELD result in poorer survival. HU listing appears to select patients with most favourable outcome. Long-term anticoagulation seems beneficial. Further validation is needed.

0-048

Evaluation of cardiovascular and bleeding outcomes post percutaneous coronary intervention in patients undergoing liver transplant evaluation

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Background: Coronary artery disease (CAD) contributes to significant morbidity and mortality in liver transplant recipients. As non-alcoholic steatohepatitis (NASH) prevelance increases, cardiac complications are expected to rise. Preoperative cardiac risk stratification for ischemic disease prior to liver transplantation often results in the need for percutaneous coronary intervention (PCI). Patients with end stage liver disease (ESLD) have a high bleeding risk, and this risk is compounded when they are placed on a course of dual antiplatelet therapy (DAPT). While there is evidence for shortened DAPT with second generation drug eluting stents (DES) in the general population, this does not exist for patients with ESLD undergoing evaluation for liver transplantation. We aimed to evaluate the DAPT usage and outcomes at our institution.
Methods: Patients with ESLD who underwent coronary angiography at the University of Cincinnati Medical Center between January 2015 and December 2020 were included for this IRB approved study. We performed retrospective analysis of the patients receiving second generation DES. The primary outcome studied was death and a composite outcome of major adverse cardiovascular events (MACE) which include stroke, myocardial infarction, heart failure, or repeat revascularization.
Results: A total of 800 patients were identified of which 43 met inclusion criteria. The bleeding incidence post PCI was 23.3%. 79.1% of PCI patients had DAPT >3 months and 20.9% received ≤3 months of DAPT. 67% of the shortened DAPT cohort were optimized with intracoronary imaging and there was 11.1% incidence of MACE in this group vs 11.7% incidence of MACE in the longer duration DAPT group.
Conclusions: In our study, shortened DAPT patients remained at a similar incidence of MACE periopereatively. Additionally, the bleeding event rate remained low post PCI in the overall group. This data is hypothesis generating about shortened DAPT therapy in selected patients to improve the time to a life-saving transplant.

0-049

Liver transplantation outcomes for Budd-Chiari syndrome in the MELD era

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Background: Recent data on the characteristics and outcomes of Budd-Chiari syndrome (BCS) patients with liver transplantation (LT) and predictors of survival are limited. Our aim was to determine trends and long-term outcomes in recipients of LT for BCS.
Methods: We extracted data from the UNOS database on all adult (≥ 18 years old) waitlisted candidates and recipients of LT with BCS and restricted analysis to the MELD era (2002-2019). Multivariable-adjusted Cox regression was used to estimate hazard ratios. Cox proportional hazards were used to determine predictors of mortality.
Results: 647 BCS were waitlisted between 2002 and 2019. In total, 378 (58.4%) BCS patients received LT. The median calculated MELD in LT recipients was 24 (SD=9) and 48 (13%) recipients were listed as status 1. Of BCS patients who received LT, over three-fourths (78.8%) were alive after LT after an up to 15-year follow-up. After 10-year follow-up, survival was highest among BCS patients with trans-jugular intrahepatic portosystemic shunt (TIPS) and without LT (82%) followed by those with TIPS and LT (76%). Factors associated with adjusted increased hazards of death after LT were longer length of hospital stay following LT [HR 1.32, 95% CI (1.19-1.47)], Black ethnicity [HR = 2.24, 95% CI (1.38 – 3.64)], diabetes mellitus [HR = 3.17, 95% CI (1.62 – 6.21)] and higher donor recipient index (DRI) [HR = 1.44, 95% CI (1.05 – 1.99)]. Albumin at the time of transplant was negatively associated with up to 15-year survival after LT [HR = 0.66, 95% CI (0.50 – 0.88)]. Interestingly, neither MELD nor prior TIPS showed a significant association with long-term survival after LT.
Conclusions: This data strongly suggests that LT should not be delayed when conservative measures or shunt procedures fail in patients with BCS, as LT can lead to excellent long-term survival.

0-050

Non-alcoholic steatohepatitis as liver transplant indication: similarities and differences between a high and a low prevalence countries

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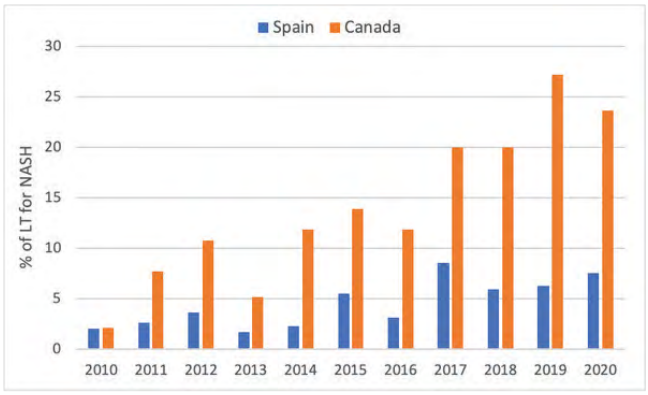
Background: Non-alcoholic steatohepatitis (NASH) is the second most common indication for liver transplantation (LT) in North America. In Spain, while NASH is becoming the most common chronic liver disease, its impact in LT waiting list was negligible until recently. Our aim was to compare the prevalence and phenotype of NASH as LT indication between Spain and a Canadian center, an area where prevalence of obesity began earlier.
Methods: Multicenter retrospective cohort study including adult patients transplanted for NASH-related cirrhosis from 2010 to 2020 in 6 reference LT centers, 5 in Spain and 1 in Canada. The percentage of LT for NASH and the most important risk factors associated with this indication were determined.
Results: 418 patients (118 in Spain and 300 in Canada) were transplanted for NASH-related cirrhosis between 2010-2020. Despite similar percentage of LT for NASH in 2010 in both countries (around 2%), the number of transplants due to this indication has increased faster in Canada (x12 in 2020) than in Spain (x3) (Figure). In fact, Spain has only reached the 7.5% transplant rate for NASH in 2020, a rate that was observed a decade earlier in Canada. Similar rate of obesity was observed between transplant recipients for NASH in both countries (89.7% in Canada and 77.1% in Spain, p=0.002). Actuarial survival at 1-, 3- and 5-year post-LT in Spain was 0.92, 0.87 and 0.8, and in Canada was 0.93, 0.87 and 0.82, respectively (p=0.572).



Conclusions: Our results suggest an upward trend for NASH-related LT both in Spain and Canada, possibly related to the increasing prevalence of metabolic syndrome. Risk factors and posttransplant outcomes are similar in both countries. Spain prevalence for NASH-related transplant is slower than in Canada but raises concern regarding the rise of NASH in a country with low prevalence.

0-051

Fontan versus non-fontan combined heart-liver transplantation: proceed but cautiously

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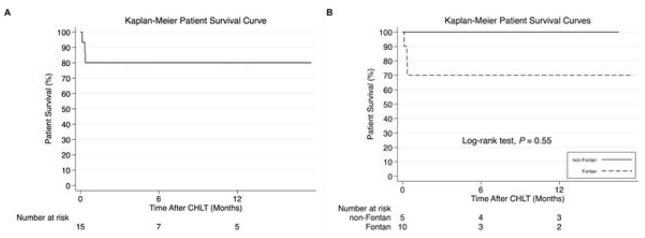
Background: Combined heart-liver transplantation (CHLT) is increasing, corresponding with a growing prevalence of Fontan-associated end-organ damage. We aimed to describe our contemporary institutional experience with CHLT and compare our Fontan and non-Fontan CHLT recipients.

Methods: All consecutive CHLTs performed at a high-volume transplant center between 04/2017-11/2021 were included. Patient characteristics were described with summary statistics and survival analysis was performed using the Kaplan-Meier method and log-rank test.

Results: 15 consecutive adult recipients underwent sequential CHLT. Cardiac indication was Fontan failure (10), Shone syndrome (1), ischemic cardiomyopathy (1), non-ischemic cardiomyopathy (1), Adriamycin cardiomyopathy (1), and hemochromatosis (1). Liver indication was Fontan-associated liver disease (10), cardiac cirrhosis (2), HCV cirrhosis (2), and hemochromatosis (1). Median age at CHLT was 38 years (interquartile range [IQR]: 34-51), 73.3% were men, and median waitlist time was 27 days (IQR: 15-104). Median MELD-XI score was 12.6 (IQR: 9.4-15.4) and median VAST (varices, ascites, splenomegaly, thrombocytopenia) score was 2 (IQR: 2-3). Compared to non-Fontan recipients, Fontan recipients were younger (median 36 vs 50 years, p=0.051) but had longer cardiopulmonary bypass (median 199 vs 126 minutes, p=0.01) and operative times (median 817.5 vs 599 minutes, p=0.01), and larger yet not statistically significant transfusion requirements (median 12.8L vs 6.3L, p=0.25). Five of 15 patients required perioperative extracorporeal membrane oxygenation (ECMO). Of the five, 3 were Fontan patients who subsequently died. Six (40%) underwent unplanned re-operation. The 1-year overall patient survival was 80% (Fontan: 70% vs non-Fontan: 100%, p=0.55; Figure A-B).



Conclusions: Although feasible, CHLT for the treatment of Fontan-associated end-organ disease is particularly challenging and associated with higher recipient morbidity compared to non-Fontan-related CHLT. Advances in cardioprotective strategies during the liver transplant portion of CHLT in Fontan recipients may improve outcomes in this growing high-risk population.

Concurrent Oral Abstract Session: Donation After Circulatory Death and Machine Perfusion

0-052

Ease score outperforms classic olthoff early allograft dysfunction (EAD) score as a predictor of 90-days graft survival after donation after circulatory death (DCD) liver transplantation

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Background: The use of Donation after Circulatory Death (DCD) liver grafts has significantly increased. Classic Early Allograft Dysfunction (EAD) is most often defined by Olthoff criteria, mainly dictated by postoperative levels of transaminases. However, in DCD, these are significantly higher, without necessarily affecting outcome. Additionally, EAD was validated in cohorts with at most 10% DCD recipients. This study aims to compare the Olthoff EAD score with the newer EASE-score for prediction of 90-days graft survival after DCD liver transplantation (LT).
Methods: Between 2001 and 2021, all DCD LT recipients in the Erasmus MC were retrospectively analyzed. Re-transplantation or death before post-operative day 3, and machine-perfused grafts were excluded.
Results: Two-hundred patients received a DCD graft. Median donor age was 46 (IQR 34-53) and recipient age was 56 (IQR 49-63). Donor DRI was 2.12 (IQR 1.76-2.35). Total donor WIT, hepatectomy time and CIT were 31 (IQR 25-36), 60 (IQR 43-74) and 372 (IQR 330-417).
According to the Olthoff criteria, EAD occurred in 116/200 (58%) patients. Olthoff-EAD yes/no separated 90-days graft survival in 78% vs 87% (p=0.040). The AUROC to predict 90-days graft survival was 0.60 for the Olthoff score. The EASE-score stratified patients in 3 distinct categories, as compared to the 5 categories described in the initial publication. The 90-days graft survival was 89% in stratum 1 (score <-3.5), 81% in 2 (score -3.5 to -1,5) and 37% for stratum 3-5 combined (score >-1.5) (p<0.001). The AUROC to predict 90-days graft survival was 0.86 for the EASE score.
Conclusions: This study shows that the EASE-score is superior in a pure DCD cohort to define EAD and to predict 90-days graft survival. The EASE-score outperforms the Olthoff score and would be preferable to describe EAD as surrogate marker for graft survival in future studies addressing DCD LT. EASE scores > -1.5 could guide clinical decision-making on relisting for re-transplantation.

0-053

Outcome of livers from donation after circulatory death with prolonged warm ischemia time treated with normothermic regional perfusion and hypothermic oxygenated machine perfusion

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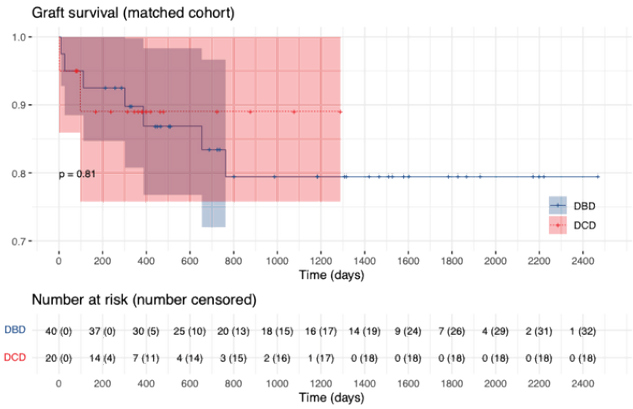
Background: In liver transplantation (LT) with grafts obtained after circulatory death (DCD), prolonged warm ischemia time (WIT) is associated with poorer outcomes. In Italy, where 20-minutes stand-off is prescribed, use of normothermic regional perfusion (NRP) with post-mortem cannulation is mandatory and it is usually associated with ex-situ machine perfusion. Our aim was comparing outcome of DCD livers treated with NRP + hypothermic oxygenated machine perfusion (HOPE) with that of grafts from neurological determination of death (DBD).
Methods: Prospectively collected data on primary LT recipients of Maastricht 3 DCD livers graft treated with NRP + HOPE between 1/2016 and 5/2021 were analyzed. End-ischemic dual HOPE (D-HOPE) was performed for ≥ 90 minutes during recipient hepatectomy. 1:2 propensity score matching was used to overcome selection bias.
Results: 20 DCD LTs were included. Median (IQR) functional WIT, NRP and D-HOPE time was 44 (35-47), 248 (221-269) and 205 (146-276) minutes, respectively. Recipients of DCD grafts were older (60.7 vs 57.2 years, p = 0.01) and more frequently had hepatocellular carcinoma (80% vs 54%, p = 0.04), with lower D-MELD (541 vs 791, p = 0.05) and donor risk index (1.4 vs 1.6, p < 0.01). Two DCD grafts were lost due to hepatic artery thrombosis and late biliary fistula. Both recipients were successfully retransplanted. After matching, outcome was comparable between groups, with no difference in terms of Clavien-Dindo grade ≥ 3 complications (25% vs 18%, p = 0.73), comprehensive complication index (16.5 vs 20.9, p = 0.28) or early graft loss (5% vs 5%, p = 1). Notably, ischemic cholangiopathy was not observed in either group. 1-year graft survival was 89% (75.7-100%) and 89.7% (80.7-99.8%) in DCD and DBD group, respectively (p = 0.81).



Conclusions: NRP + D-HOPE combination allows safe utilization of DCD grafts with prolonged fWIT.

O-054

One hundred normothermic machine perfused DBD livers grafts with intention to transplant: donor risk scores do not predict transplantable grafts

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Background: Composite donor risk scoring systems such as the Donor Risk Index (DRI) and Donor Liver Index (DLI) have been shown to predict post-operative graft survival, however their ability to distinguish between grafts that are viable following NMP-L is poorly described. Our aim was to determine if composite donor risk scoring systems differentiate between viable and non-viable grafts.

Methods: Single centre retrospective study of all donor livers that underwent NMP-L between 11/2018 and 11/2021. The donor characteristics, including DRI and DLI, of all livers that were assessed as viable and non-viable were compared. The institutional viability criteria utilised included a reduction in perfusate lactate to ≤2.5mmol/l and two of the following: Glucose metabolism, homogenous perfusion, bile production, stable portal venous flow >500ml/min and arterial flow >200ml/min.

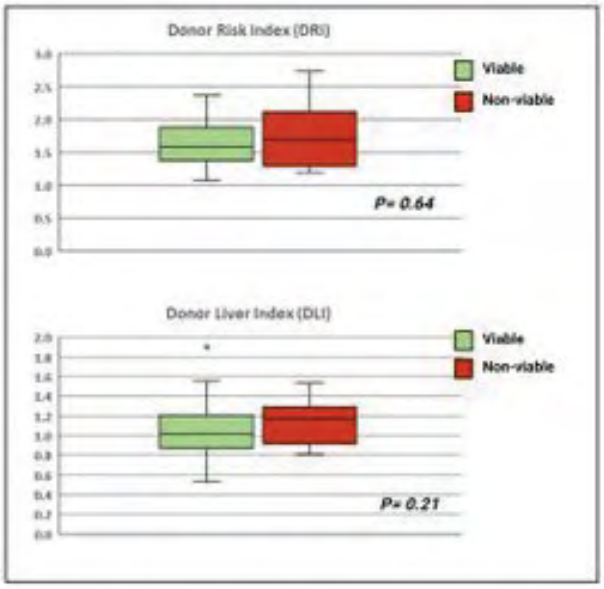
Results: During the study period, 100 donor livers underwent NMP-L with the intention to be transplanted, with 85/100 proving viable and proceeding to transplant. An additional two grafts were assessed as viable but did not proceed to transplant for logistical reasons. Twelve grafts were assessed as non-viable (Table 1) and discarded. All grafts were from deceased brain death (DBD) donors. The proportion of moderate or severe steatosis was significantly higher in the discarded group (Table 1). The donor bilirubin was higher in the group that failed viability assessment (Table 1). The median DRI [1.59 (1.38- 1.87) vs 1.70 (1.28-2.12), *P*=0.64] and DLI [1.02 (0.87-1.21) *vs* 1.16 (0.92-1.29), *P*=0.21] did not differ between groups (Table 1 and Figure 1).

TABLE 1:

	Viable† N=87	Non-viable‡ N=12	P value
Age (yrs)	51 (40-63)	53 (37-66)	0.85
Female (%)	57 (65%)	7 (47%)	0.21
ICU stay (days)	3 (2-4)	2 (2-3)	0.30
Body mass index	26.0 (22.1-30.6)	27.6 (26.8-31.0)	0.14
Peak ALT	104 (38-374)	101 (38-594)	0.65
Final ALT	61 (30-153)	83 (25-561)	0.65
Peak bilirubin	12 (8-18)	20 (13-32)	**0.01**
Final bilirubin	9 (6-15)	14 (9-25)	**0.03**
Fast track	63/87 (72%)	10/12 (83%)	0.45
Steatosis			**0.01**
Nil	38/87 (44%)	2/12 (17%)	
Mild	21/87 (24%)	4/12 (33%)	
Moderate	28/87 (32%)	4/12 (33%)	
Severe	0/85 (0%)	2/12 (17%)	
Donor Risk Index	1.59 (1.38-1.874)	1.70 (1.28-2.12)	0.64
Donor Liver Index	1.02 (0.87-1.21)	1.16 (0.92-1.29)	0.21

Legend: Characteristics of both the group of grafts that proceeded to transplant, and those deemed unsuitable and discarded. ICU= Intensive care unit, ALT=Alanine aminotransferase. † Two of these grafts not transplanted due to logistical reasons. ‡ One graft discarded due to equipment failure, not included in analysis.

FIGURE 1



Legend: Box and whisker plots comparing both Donor Risk Index (DRI) and Donor Liver index (DLI).

Conclusions: The composite scoring systems of the DRI and DLI, do not accurately distinguish between grafts that will or will not be deemed viable with NMP-L. Graft features, such as steatosis, likely have a larger impact on graft viability.

0-055

Damage associated molecular pattern (DAMP) removal during liver normothermic machine perfusion facilitates organ rescue and reconditioning during preservation

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Background: Extended criteria donor (ECD) livers constitute an increasing proportion of the organ donor pool and are highly susceptible to reperfusion injury following transplantation despite NMP. Circulating DAMPs play a crucial role in propagating an inflammatory insult occurring during NMP of ECD livers. We aimed to assess the impact of DAMP removal during NMP to rescue or recondition ECD liversExtended criteria donor (ECD) livers constitute an increasing proportion of the organ donor pool and are highly susceptible to reperfusion injury following transplantation despite NMP. Circulating DAMPs play a crucial role in propagating an inflammatory insult occurring during NMP of ECD livers. We aimed to assess the impact of DAMP removal during NMP to rescue or recondition ECD livers
Methods: A large animal (porcine) DCD liver model was employed, where following a period of preservation, livers underwent allogeneic whole blood reperfusion simulating transplantation. Using a Nucleocapture® column connected to the OrganOx metra to remove DAMPs from the circulating perfusate during NMP. N=12 livers were perfused in 4 groups. We measured haemodynamic parameters, perfusate biochemistry, Bile production, pH and cell-free DNA, mitochondrial cell-free DNA and histones.
Results: All livers produced Bile and had stable haemodynamic parameters during NMP and subsequent allogeneic whole blood reperfusion. Warm ischaemic times were similar, median 15 mins (range 13-20mins) as was cold ischaemia, median 4hr 26mins, (range 4hr27-5hr27 mins). NMP with Nucleocapture® significantly improved liver function on the device in terms of lactate clearance. After 6 hours of NMP, lactate fell from an average of 8.49mmol/L without Nucleocapture® to 2.6 mmol/L when DAMP removal was employed.
Conclusions: ECD livers preserved with NMP can be significantly improved or reconditioned when DAMPs are removed from the circulating perfusate. Nucleocapture® technology and other immunomodulatory columns may play a crucial role in increasing the number of usable ECD livers and reducing reperfusion related complications post-transplant.

0-056

Benchmarking liver transplantation outcomes of normothermic regional perfusion: our experience

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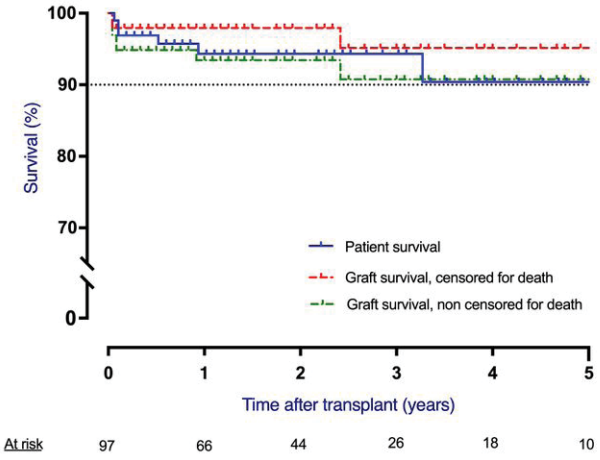
Background: Donation after circulatory death (DCD) livers are held in disrepute due to prohibitively high rates of primary non-function (PNF), early allograft dysfunction (EAD) and biliary complications. In this study, we share our experience in normothermic regional perfusion (NRP) and compare the outcomes against the established benchmarks of liver transplantation.
Methods: Retrospective analysis of DCD-NRP livers between January 2011 and October 2021. Endpoints measured were EAD (Olthoff), Model for early allograft function (MEAF), acute kidney injury (AKI; peak creatinine ≥2 times baseline), biliary complications, Clavien-Dindo complication grade, graft, and patient survival. These were compared against established liver transplantation outcomes as outlined by Muller et al, Ann Surg. 2018.
Results: 111 NRP liver transplantations were performed over the study period. Eighty-four (76%) NRP were abdominal only, 20 (18%) thoraco-abdominal and 7 (6%) with cardiothoracic direct procurement. 97 liver transplants were included in the analysis after excluding 14 with sequential normothermic machine perfusion (NMP). The median donor risk index (Feng) was 2.2 (IQR 1.7 – 2.5) and recipient UKELD of 54 (IQR 51 – 58). There were 45 (46%) transplants in either high risk (30%) or futile (17%) category by UK-DCD risk score, 13 with previous liver transplants and four super urgent. None of the liver had primary non function with 12% EAD and median MEAF sore of 4.1 (2.7 – 5.6). Postoperative AKI was seen in 35%. Overall biliary complication (leaks and strictures) was 18% with 8% anastomotic and 6% non-anastomotic stricture rate. No liver graft was lost to cholangiopathy. Table 1 summarises the comparison with the benchmark parameters.

Table 1: Comparison of outcomes (n=97)

Parameter	Findings	Benchmark*	Criteria met
Intraoperative blood transfusion	4 (2 – 6)	≤ 3U RBC	no
Renal replacement therapy	9%	≤ 8%	no
ITU stay (days)	2 (1 – 4)	≤ 4 days	yes
Hospital stay (days)	17 (13 – 24)	≤ 18 days	yes
≥ Grade III complication#	36%	≤ 42%	yes
Biliary complication	18%	≤ 28%	yes
Hepatic artery thrombosis (HAT)	1%	≤ 4.4%	yes
Graft loss, 1 year	2%	≤ 11%	yes
Mortality, 1 year	5%	≤ 9%	yes
Retransplantation, 1 year	3%	≤ 4%	yes

Values are percentage or median (interquartile range)
* Muller et al, Ann Surg. 2018 Mar;267(3):419-425
# Dindo et al. Ann Surg. 2004;240:205–213.



Conclusions: NRP is associated with superior outcomes and compares better against the established benchmarks of liver transplantation. This allows its use in high-risk transplantation like super urgent and retransplants.

0-057

Vascular and functional assessment with indocyanine green fluorescence imaging and efficacy of thrombolytic therapy in livers from donor after circulatory death during normothermic perfusion

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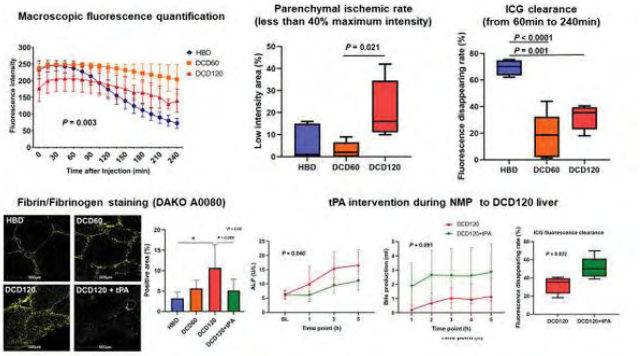
Background: Current graft evaluation during Normothermic Machine Perfusion (NMP) cannot completely exclude damaged grafts which induce graft dysfunction and ischemic cholangiopathy in Donation after Circulatory Death (DCD). To reveal the hepatic vascularity and function, Indocyanine Green (ICG) fluorescence imaging was applied to porcine NMP by the characteristics of hepatic excretion and detectability by near-infrared light, and the utility of thrombolytic therapy during NMP was investigated.

Methods: Pig Livers from Heart beating donor (HBD), DCD 60 minutes, DCD 120 minutes, and DCD 120 minutes + tPA (tissue plasminogen activator) were evaluated with ICG-NMP (N=5). Following induction of warm ischemia with heparinization and procurement, livers were perfused for 5 hours. In the thrombolytic group, tPA was administrated twice from the hepatic artery on the back table and at the start of NMP. ICG enhancement and clearance were measured with SPY Elite® (Stryker).



Results:
Macroscopic fluorescence quantification clearly classified each liver pattern (P = 0.003). Parenchymal ischemic rate (less than 40 % of maximum intensity at the first 20 seconds) showed significantly higher rate in DCD120 compared with HBD and DCD60 (21.4% vs 6.2% vs 3.0%, P = 0.018). ICG clearance revealed significantly higher rate in HBD than DCD60 and DCD120 (69.3% vs 17.5% vs 32.1%, P < 0.0001). The parenchymal fibrin/fibrinogen deposition increased as longer warm ischemia time (HBD 3.2% vs DCD60 5.6% vs DCD120 10.7%, P = 0.020). The tPA reconditioning in DCD120 livers reduced fibrin rate similar to the DCD60 (5.1% vs 5.6%), and showed lower ALP (P = 0.040), increased bile production (P = 0.091), and higher ICG clearance (51.0% vs 32.1%, P = 0.022).
Conclusions: ICG fluorescence imaging during NMP enables classification by hepatic vascularity and metabolism, and thrombolytic therapy reduces parenchymal fibrin deposition and shows bile protection in DCD livers.

0-058

Evaluation of the efficacy of end-ischemic hypothermic oxygenated machine perfusion preservation using an originally developed machine perfusion device for split-liver transplantation in a porcine model

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Background: With the increasing number of patients waiting for liver transplantation, donor shortage has become a serious problem. Split-liver transplantation can help increase the available donor pool but can create two extended-criteria grafts and increase the risk of transplant failure. Hence, split-liver grafts may be considered marginal because of their small size and the degree of incurred injury due to liver splitting.

Methods: This study examined the efficacy of end-ischemic hypothermic oxygenated machine perfusion preservation (HOPE) using an originally developed machine perfusion system for split-liver transplantation. Porcine split-liver grafts were created via 75% liver resection after 10 min of warm ischemia. In Group 1, grafts were preserved by simple cold storage (CS) for 8 h (CS group; n=4). In Group 2, grafts were preserved by simple CS for 6 h and end-ischemic HOPE for 2 h (HOPE group; n=5). All grafts were evaluated using an isolated ex vivo reperfusion model with autologous blood for 2 h.
Results: Biochemical markers (aspartate aminotransferase and lactate dehydrogenase levels) were significantly better immediately after reperfusion in the HOPE group than in the CS group. Furthermore, the HOPE group had a better histological score. The levels of inflammatory cytokines (tumor necrosis factor-α, interferon-γ, interleukin-1β, and interleukin-10) were significantly lower after reperfusion in the HOPE group.
Conclusions: We concluded that end-ischemic HOPE for split-liver transplantation can aid in recovering the graft function and reducing ischemia-reperfusion injury. HOPE, using our originally developed machine perfusion system, is safe and can improve graft function while attenuating liver injury due to preservation.

Concurrent Oral Abstract Session: Donor Selection Criteria / Patient Selection / Organ Allocation

0-059

Donor simvastatin treatment is safe and might improve outcomes after liver transplantation: a randomized double-blind clinical trial

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Background: Liver transplantation (LT) is currently the only curative therapy for end stage liver disease (ESLD). We present the SIMVAstatin donor treatment before Liver Transplants (SIMVALT) study.
Methods: SIMVALT is a monocentric, double-blind, randomized, prospective trial comparing the safety and efficacy of preoperative deceased brain donors' treatment with the intra-gastric administration of 80 mg of simvastatin on liver transplant recipient outcomes in a real-life setting between June 30, 2018, and April 30, 2020, with special focus on the graft loss at 90 and 180 days post-transplant.
Results: The trial enrolled 58 adult patients (18-65 years-old). The minimum follow-up was 6-month (last follow-up, November 30, 2020). Intention-to-treat-based population (ITT) and per-protocol population (PPP) analyses were done. In the ITT population, the overall graft and patient survival were 94.3% at 90-day, and 93.1% at 180-day. In the PPP, no patient and graft rates at 90-day and 180-day were experienced in the Experimental Group (n=27), and they were 89.66% (p=0.0804) and 86.21% (p=0.0415), and 93.1% (p=0.1572) and 86.21% (p=0.0415) in the Control Group (n=29). The percentage of patients with severe Clavien-Dindo complications (≥IIIb) was higher in the Control Group 55.2% Vs 25.0% in the Experimental Group (p=0.0307). There only significant changes in the Examining liver function tests, there was a significant increase in gamma-glutamyl transferase (POD15 p=0.0174 and POD30 p=0.0375) and alkaline phosphatase levels (POD15 p=0.0152), in the simvastatin group versus the placebo group.
Conclusions: Donor simvastatin treatment is safe, and might significantly improve early graft and patient survival after LT supporting further research of the drug in phase III trials in this population.
Trial Registry number: ISRCTN27083228.
This clinical trial has been reviewed and accepted for financial support by the Italian National Health Ministry (Programme of "Ricerca Finalizzata 2013" - Clinical health care research - GR-2013-02357764).

0-060

Availability of living donor optimizes timing of liver transplant in high-risk waitlisted cirrhosis patients

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Background: Liver transplant (LT) candidates have become older and frailer, with growing Non-alcoholic steatohepatitis (NASH) and comorbid disease burden in recent years. We aimed to evaluate the impact of access to living donor liver transplantation (LDLT) in waitlisted patients at highest risk of dropout with prolonged waiting time.
Methods: We retrospectively reviewed all adult patients with decompensated cirrhosis listed for LT from November 2012 to December 2018. Patients with a potential living donor (pLD) available were identified. Patients with hepatoma, MELD exception points, fulminant liver failure, multi-organ transplant or re-transplantation were excluded. Survival analyses with Cox PH models and time to LT with Competing risk models were performed followed by prediction model development.
Results: Out of 1,290 listed patients, 860 met inclusion criteria. Mean age was 54.6 years. 41.3% were females. 360 (41.8%) patients had a pLD identified. 496 (57.6%) patients underwent LT, 170 (34.2%) were LDLT. Lower instantaneous rate of transplant was seen in patients with age >60 years (p=0.019), MELD-Na <20 (p<0.0001), moderate to severe frailty (p=0.05) and height <160cm (p=0.08). The benefit of pLD was evident for all, but patients with moderate to severe frailty at listing (interaction p=0.03), height <160cm (interaction p = 0.03), and MELD-Na <20 (interaction p <0.0001) especially benefited. Our prediction model identified high-risk patients most benefiting of pLD (who would otherwise wait longer for deceased donor and would be dropped out from waiting list) with time-dependent AUC of 0.81.

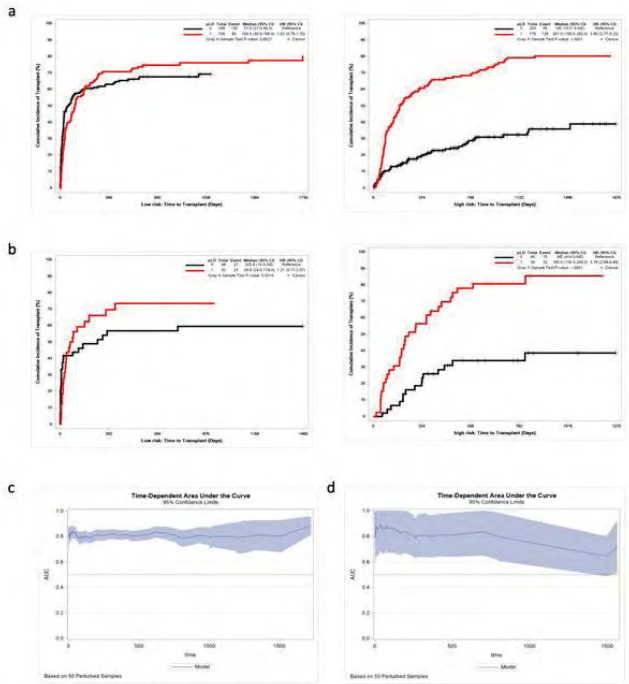

Figure: Prediction model performance *a) Competing risk analysis for time to transplant stratified by availability of potential living donor for patients with Prediction score low vs high on derivation set;* interaction p<0.001, *b) Competing risk analysis for time to transplant stratified by availability of potential living donor for patients with Prediction score low vs high on validation set;* interaction p<0.0047. *c) Prediction Model area under curve on training set (0.810). d) Prediction Model area under curve on validation set (0.816).*

Conclusions: Access to LDLT in a transplant program can optimize the timing of transplant for the increasingly older, frail patient population with comorbidities who are at the highest risk of dropout. Our model could be used to guide the referral of such high-risk subgroup patients to LDLT centres earlier in their course and save more lives.

0-061

Safe use of hepatitis B surface antigen positive (HBSAG (+)) grafts in liver transplantation (LT): a nationwide study based on KOTRY (Korean Organ Transplantation Registry) data

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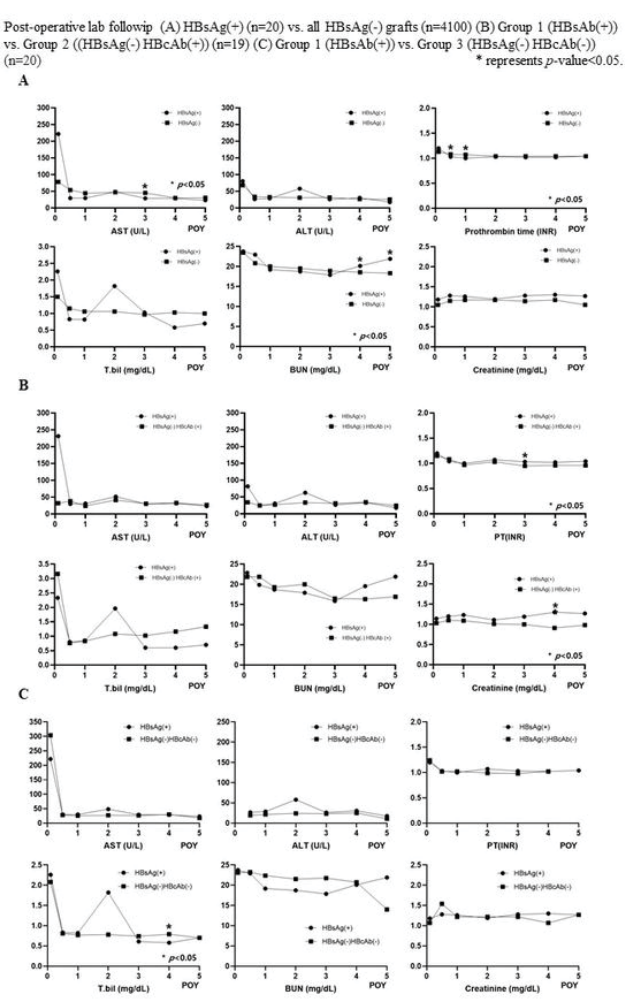
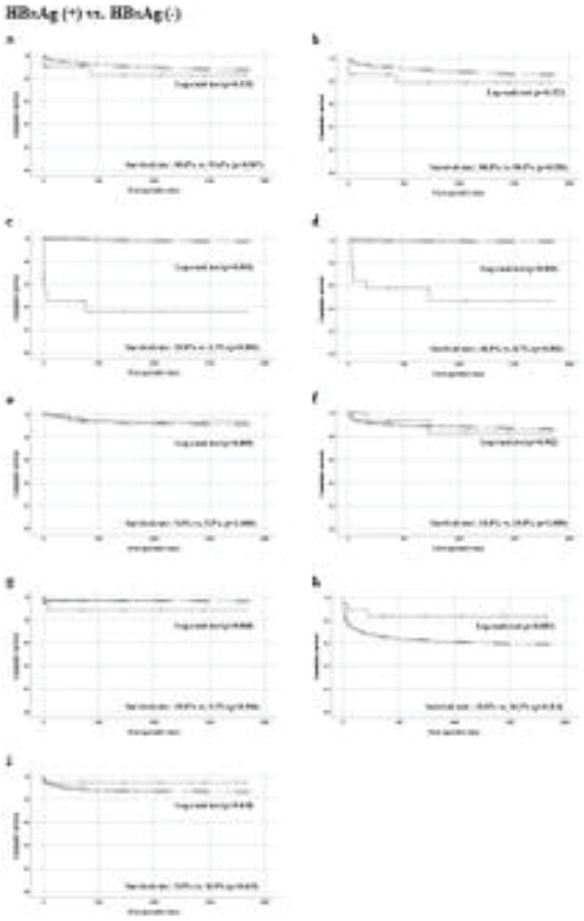
Background: In the era of nucleos(t)ide analogues (ANs), we investigate the outcomes of liver transplantation (LT) using HBsAg (+) grafts using Korean national registry database.
Methods: Among 4265 LTs which were registered in KOTRY database between April 2014 and January 2020, 20 (0.5%) LTs using HBsAg (+) grafts were identified. We investigated the overall outcomes of LT using HBsAg (+) liver grafts (n=4100, S (+) group) compared to those of HBsAg (-) liver grafts. S (+) group were compared to those for LT using HBsAg (-) & HBcAb (+) (n=882, C (+) group) and HBsAg (-) & HBcAb (-) (n=3132, SC (-) group) after propensity-score matching (1:1).
Results: Twenty HBsAg (+) grafts from deceased donors were transplanted to HBsAg (+) recipients. HBIG was maintained in 16 patients (80%). Most common NA was tenofovir. S (+) group showed comparable patient survival (26.5±21.8 vs 22.8±18.2 months, p=0.332) and graft survival (26.5±21.8 vs 21.3±18.2 months, p=0.152) compared to those of HBsAg (-) group. Age (HR=1.03, p=0.016), HCC (HR=4.61, p<0.001), MELD score (HR=2.82, p=0.001), ascites (HR=2.14, p=0.002) and encephalopathy (HR=2.53, p<0.001) were the risk factors affecting patient survival. For graft survival, HCC (HR=4.01, p=0.001), pre-operative treatment to HCC (HR=0.54, p=0.006), MELD score (HR=2.14, p=0.012), ascites (HR=2.52, p<0.001), and encephalopathy (HR=1.99, p<0.001) were significant factors.After PSM matching between S (+) and C (+), and S (+) and SC (-), there was no significant difference in patient survival (24.3±20.7 vs 38.2±23.0 months, p=0.863, 24.3±2.7 vs 38.2±23.0 months p=0.547), and graft survival (26.5±21.8 vs 36.3±17.4 months, p=0.576, 26.5±21.8 vs 36.3±18.4 months, p=0.327, respectively).





Kaplan-Meier curve for (A) patient survival, (B) graft survival, (C) HBV positive seroconversion, (D) HBV recurrence, (E) HCC recurrence, (F) rejection free survival, (G) HCV recurrence, (H) complication free survival, and (I) high-risk complication free survival. Comparison between HBsAg(+) (n=20) and HBsAg(-) group (n=4100) was done. Patients were divided into groups by donor serology. (Black line: HBsAg (+) group; Gray dots: HBsAg (-) group)

Conclusions: HBsAg (+) liver grafts can expand the donor pool without compromising the outcomes in the era of NA in the HBV endemic area.

0-062

Long-term outcomes of liver transplantation (LT) using grafts from donors with active and chronic hepatitis B virus (HBV) infection: multi-center cohort study

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Background: We report the long-term outcome of liver transplantation (LT) using grafts from donors with active and chronic hepatitis B virus infection using Hepatitis B immunoglobulin (HBIG) and Nucleos(t)ide analogues (NA).

Methods: Among 2260 LTs performed in Seoul National University Hospital, SNU Bundang Hospital, and SNU Boramae Hospital between January 2000 and April 2019, 26 (1.2%) grafts from donors with HBsAg (+), HBeAb (+) or HBV DNA (+) were referred as active and chronic HBV hepatitis grafts and reviewed retrospectively. HBV reactivation redefined as the increase of viral DNA for HBsAg (+) grafts and HBsAg positive seroconversion for chronic hepatitis grafts. Also, we adopted the stage of chronic HBV infection to evaluate and manage of recipients transplanted HBV infected grafts.
Results: Sixteen deceased donor LT were performed with active HBsAg (+) grafts. Ten living donor LT were performed with inactive HBV infected grafts; 8 patients in inactive hepatitis; HBsAg (-), HBcAb (+) & HBV DNA (+), and 2 patients in chronic HBV hepatitis with seroconversion; HBsAg (-), HBsAb (+) and HBeAg (+). Average follow-up period was 82.6±60.1 months. NA and HBIG were administered during perioperative period depending on donor and recipient's serology. Deaths (n=8) were occurred 2.0-47.3 months after transplantation. Comparing LT using non-hepatitis virus-infected grafts, there was no difference in patient survival (30.8% vs. 18.6%, p=0.247). Most common causes of death were infection (n=4) and HCC recurrence (n=3). HBV reactivation (n=1) resolved without additional management. All 10 LDLT recipients survived and were in good condition. Survivors were in inactive or resolved status for HBV infection under the HBIG and NA. Fourteen patients followed-up more than 5 years were stable and no increase in HCC recurrence was observed 5 years after transplantation.
Conclusions: Considering long-term outcome, liver grafts with active and chronic HBV infection can be safely used in HBV endemic area.

0-063

Waitlist outcomes of patients with graft cirrhosis listed for liver retransplantation

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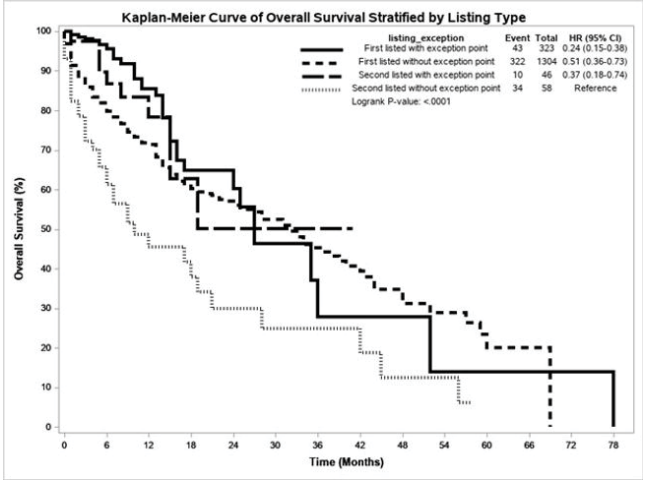
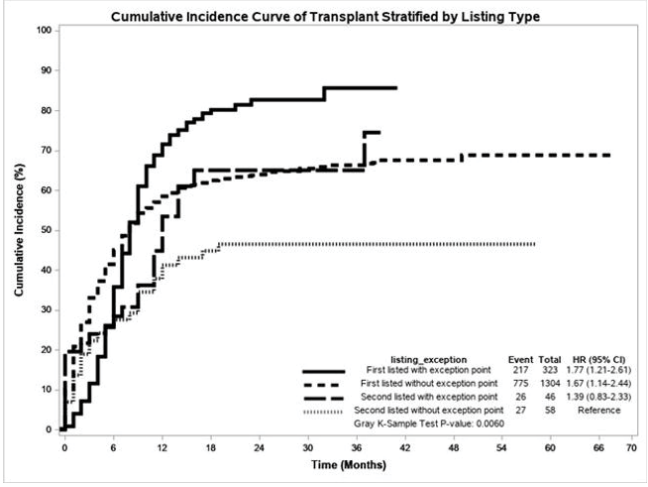
Background: Recurrent fibrosis complicates 40% of liver transplants (LT) and can lead to consideration for re-transplantation. However, patients relisted for graft cirrhosis may have worse outcomes than indicated by their MELD-Na score. Therefore, we aimed to evaluate the trajectories of relisted versus primary listed patients on the waitlist using a competing risk framework.
Methods: We retrospectively examined 1,912 patients listed at our centre between November 12th, 2012, and December 31st, 2020. Patients were divided into four groups: 1) primary listing with exception points, 2) primary listing without exception points, 3) 2nd listing with exception points and 4) 2nd listing without exception points. We excluded patients listed for multi-organ transplant, 3rd liver transplant, urgent retransplant, and those delisted due to clinical improvement. Competing risk analysis and Fine-Gray models were used to assess cumulative incidence of transplant by listing type.
Results: 1,731 patients were included, of whom 104 were relisted. Patients listed for re-transplant were younger (mean age 49.9 vs 56.6 years) and had higher median bilirubin (36 vs 19 umol/L) and creatinine (139.6 vs 112.5 umol/L) by end of list. 44.2% of re-transplant patients received exception points (ischemic cholangiopathy/ biliary issues) vs 19.8% of primary listed patients (p<0.001). Relisted patients without exceptions, representing those with graft cirrhosis, had the worst OS (Figure 1) and lowest instantaneous rate of transplant (Figure 2). Multivariate analysis suggested that listing type, height and INR were significantly associated with cumulative incidence of transplant.





Conclusions: Patients relisted for graft cirrhosis are carefully curated and comprise a minority of waitlist population. Despite young age, they have worse liver/kidney functions, poor waitlist survival, and decrease incidence of transplant, suggesting the need for early relisting, while considering living donor LT or standardized exception points.

0-064

The effect of adoption of acuity circles on HCC transplantation rates at a single high acuity center

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Background: Transplantation for selected patient with HCC has been prioritized with a MELD exception since 2002. Further changes have decreased the maximum exception for HCC. Most recently, UNOS adopted Acuity Circles (AC) to better allocate organs rather than using Donor Service Areas. The effect of these AC on HCC patients transplant rates especially at higher acuity centers like ours is unclear.

Methods: Retrospective review for patients transplanted with HCC between January 1 2018 and November 1 2021 was completed. Patients were divided in to 2 groups pre- and post- implementation of AC on February 4, 2020. Patient demographics, laboratory values, and outcomes were compared.

Results: 83 patients were transplanted pre-AC and only 54 post-AC ($p<0.001$). One-year survivals were not different between the two groups with pre-AC 91.2% vs 82.2% ($p=0.3$). Age, Race, and BMI were similar in both groups. The median meld at transplant was different with 30 pre- and 26 post-AC ($p<0.001$). The biologic meld rose with median pre-AC of 13 and post-AC of 23 ($p=0.01$). The percentage of patients with exception at transplant also decreased from 80.7% to 53.7% ($p<0.001$). There was a significant decrease in MELD-delta or the difference from biologic to exception meld from 18.5 pre-AC to 7 post-AC ($p<0.01$). The median wait list time was similar. The median distance traveled for the organ procurement was 166 nautical miles vs 40 ($p=0.53$).

Conclusions: The adoption of AC has changed the number and type of HCC patients getting transplanted at our center. Less HCC patients were transplanted after implementation of AC. Though there was no significant change in the survival and distance travelled for organ procurement, there is a growing concern over HCC patients having to wait for transplants and hence newer strategies including consideration of living donor evaluation may need to be considered to improve HCC transplant rates.

Concurrent Oral Abstract Session: Immunosuppression and Infection (COVID-19)

0-066

Efficacy and safety of SARS-COV-2 vaccination in liver transplant recipients

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Background: Liver transplant recipients have a poorer vaccine response than the general population. Real-life data on SARS-CoV-2 vaccination in liver transplant recipients are limited. The objective of this study was to evaluate the efficacy and safety of the vaccine and identify factors associated with vaccine response.
Methods: This was a retrospective observational study of consecutive liver transplant recipients attending CHU de Montpellier. Data on the transplantation indication, immunosuppression, vaccine type, and serology 28 days after the last vaccine dose were collected. Serology below 30 BAU/ml (WHO units) defined non-responders, 30-260 BAU/ml low responders, and >260 BAU/ml responders.
Results: 494 patients were included between 1 January and 15 March 2021. 366 (74%) patients were vaccinated: 280 with 3 doses, 63 with 2 doses, and 23 with 1 dose. Complete data were available for 234 patients. 164 (70.1%) patients were male, with a mean age of 59±12 years with a mean time to transplantation of 4.9±5.9 years. No serious adverse events were reported. Of 201 (85.9%) patients with complete vaccination and post-vaccination serology, 104 (51.7%) were responders, 45 (22.4%) poor responders, and 52 (25.9%) non-responders. In multivariate analysis, factors associated with no or low response were vaccination with Vaxzevria alone (HR 6.8 [1.46-31.67], p=0.046), mycophenolate mofetil (MMF) therapy (HR 2.1 [1.1-3.9], p=0.025), no previous SARS-CoV-2 infection prior to vaccination (HR 3.6 [1.025-12.89], p=0.046), and female gender (HR 2.4 [1.15-4.99], p=0.02).
Conclusions: Only half of our patients were vaccine responders after three injections. MMF, female gender, and Vaxzevria vaccination were associated with a poorer response, while previous SARS-CoV-2 exposure was associated with a better response.

0-067

Post-COVID cholangiopathy: a delayed life threatening complication!

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Introduction: COVID-19 related Liver injury may occur during the illness with no sequalae. Here we describe four patients with severe cholestatic jaundice following initial recovery from COVID-19 illness.
Cases: All were men aged 50 to 67 years, developed COVID-19 varying from mild to severe disease. Liver function tests at the time of their illness did not show significant elevation. None of them had underlying known chronic liver disease. Clinical recovery from COVID-19 was complete and were discharged between 7 and 21 days. All these patients developed fatigue and jaundice four to six weeks from their initial illness and couple of them had pruritus. Symptoms progressed with worsening hyperbilirubinemia. Peak enzymes were AST x 4-8 upper limit normal (ULN), ALT x 3-10 ULN, ALP x 4-6 ULN and GGT x >5-15 ULN. Peak bilirubin varied between 15 to 42 mg/dl. Interestingly, none of them developed coagulopathy, ascites or hepatic encephalopathy. Abdominal imaging showed no features of chronic liver disease and no biliary dilatation. A liver biopsy showed loss of interlobular bile ducts, degenerative features in residual ducts, hepatocanalicular bilirubinostasis and fibrin thrombi in some vessels. Out of these four patients, one died of worsening symptoms and sepsis. The second patient remained symptomatic and underwent evaluation for liver transplantation. He was found to have double vessel coronary artery disease requiring stenting. Following stent placement, he was commenced on aspirin and clopidogrel. Interestingly, there was a significant improvement in LFT within six weeks, deferring liver transplantation. His clinical improvement was attributed to anti-platelet drugs. The third patient developed progressive jaundice and exhaustion. He underwent Auxiliary partial orthotopic liver transplantation (APOLT) providing provision for recovery of his native liver. Fourth patient showed a remarkable improvement with anti-platelet drugs.
Conclusion: Post-COVID Cholangiopathy is a poorly understood serious complication following COVID-19 with unclear treatment.

0-068

COVID vaccination among liver transplant recipients: an EASL-ESOT/ELITA-ILTS multi-society international survey

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Background: Vaccination against COVID-19 is a major preventive strategy, though antibody response post-vaccination in transplant recipients has been described to be less robust as compared to the general population. The goal of this survey was to describe different vaccination policies around the world, regarding prioritization, safety and efficacy assessment, in liver transplant centers.
Methods: A prospective web-based survey was proposed to EASL-ESOT/ELITA-ILTS active members across the world. The survey focused on prioritization, type of vaccine administered, and safety and efficacy assessment policies.
Results: As of December 2021, over 130 centres have responded to the survey. Preliminar results will be shared at the meeting in May 2022.
Conclusions: COVID vaccination in liver transplant recipients is a general practice around the world. Vaccine safety is comparable to that of the general population, as given by real-life results extracted from this survey.

0-069

Biopsy proven rejection in patients converted to everolimus (EVL) after liver transplantation (LT): longterm histological data from the everoliver multicenter observational French Registry

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Background: The aim of this multicenter observational study is to analyze incidence, histological features and treatment of rejection under EVL regimen.
Methods: From 2006 till 2020, LT patients who were converted to EVL were recruited in the study. Data from last liver biopsy performed prior to conversion and from all biopsies performed after conversion were collected. Indications of transplantation were mainly alcoholic cirrhosis (56.2%) and HCV cirrhosis (19.0%). HCC was present in 44.6% of the recipients.
Results: 1210 adult recipients (75.5% male) had a mean age of 54.5±10.3 years. EVL was introduced in 46.8% of the patients during the 1rst year post-transplant. Main reasons of introduction of EVL were chronic renal failure (34.9%) treatment of recurrent cancer (8.3%) or de novo cancer (16.7%) and prevention of cancer recurrence (34.5%). Mean through EVL levels were respectively 5.5±3.7, 6.4±3.3 ng/mL at M1 and M12. CNI were withdrawn in 49.8% at M12. Under CNI regimen, 604/1210 (50%) patients had at least 1 liver biopsy prior to conversion to EVL. Biopsy-proven acute rejection (BPAR) treated BPAR, and BP chronic rejection (BPCR) were respectively 9.7%, 6.9% and 2.0%. Under EVL regimen, 715/1210 (59.1%) patients had at least 1 liver biopsy after conversion to EVL with a median delay of 15.0 (0.1-180) months. BPAR, treated BPAR and BPCR were respectively 8.7%, 5.5% and 3.1%. In the 416 patients who had at least paired biopsies prior and after conversion, 17 patients (4.1%) without BPAR prior to conversion developed BPAR after conversion.
Conclusions: Data from 1300 liver biopsies from patients converted to EVL, showed a low risk of BPAR under EVL regimen (≤ 5%) and mostly were mild. Conversion from CNI to EVL allowed a weaning of CNI in 50% of the patients at 1 year and a minimization of CNI in the others without increasing chronic rejection (3%).

0-070

The role of immunosuppression level in liver allograft fibrosis after pediatric liver transplantation

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Background: Liver allograft fibrosis (LAF) is prevalent among patients with long-term survival after liver transplantation (LT). We aimed to identify clinical risk factors associated with LAF in pediatric LT recipients, with a focus on the impact of immunosuppression level on LAF and its evolution.
Methods: A retrospective study on pediatric LT recipients with at least one-year follow up who underwent liver biopsy was conducted. Cox regression models were used to analyze risk factors associated with LAF, and landmark analysis was used to evaluate the impact of tacrolimus (TAC) level on LAF. Longitudinal analysis was also conducted in patients undergoing repeat liver biopsies.
Results: A total of 139 patients involving 174 liver biopsies were included. With a 2.3-year follow-up period, LAF was detected in 91.4% of patients (9.4% had severe LAF). Episodes of acute rejection, biliary complications, positive cytomegalovirus DNA after LT, and prolonged cold ischemia time were independent risk factors for LAF. The risk in the low TAC level group at 1-3, 3-6, 6-12 and 12-36 months after LT was higher than the counterparts. Especially, in patients with high TAC level (≥ 5.1 ng/mL) during postoperative 1-3 years, the risk of LAF

was 67% lower in the short-term (P = 0.006). Twenty-six patients underwent repeat biopsies. Patients with increasing TAC level after the first biopsy were more likely to achieve fibrosis reduction (HR = 7.53, P = 0.025).
Conclusions: LAF is common among pediatric LT recipients with more than one-year of follow-up, but was mostly mild or moderate. Under-immunosuppression may contribute to the development of fibrosis; and the degree of LAF may be improved by administering adequate levels of immunosuppression.

0-071

Early switch to mTOR inhibitors preserves renal function as compared to CNIs in liver transplant recipients with HCC: a real life experience

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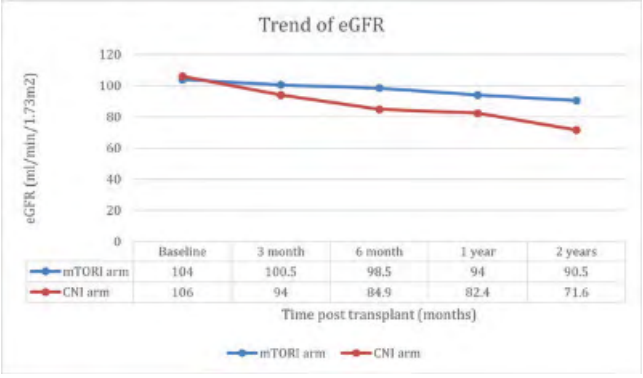
Background: Renal dysfunction is a common long-term issue in liver transplant recipients. Calcineurin inhibitor (CNI) use, especially with respect to high trough levels is deemed to be a cause in this setting and switching to mammalian target of rapamycin inhibitors (mTORI) has been proposed as a renal function preserving strategy.
Methods: Out of total 3503 Living Donor Liver Transplantation (LDLT) performed, retrospective analysis of 2043 adult patients who underwent LT from Jun-2010 to Oct-2019 was performed to screen cohort of patients who underwent LDLT for HCC as per Institutional criteria. Of 104 recipients, 58 who received mTORIs within 3 months for prevention of HCC recurrence were compared with 46 patients who received CNIs. At 1-3 months, after ruling out significant proteinuria (<0.8g/day), mTORIs were added, CNI slowly tapered and mycophenolate mofetil was continued at usual doses. Renal function was monitored for >2 years.
Results: Mean age 54.3 ± 9 versus 55.6 ± 5.8 years in mTORI versus CNI group. Baseline creatinine, and MDRD4 eGFR, were similar (0.87 ± 0.3 versus 0.83 ± 0.5, 104 ± 39 versus 106 ± 37.2 respectively) in both groups. Median time for addition of mTORI was 8 (IQR 6-9) weeks; Sirolimus used in 52 (89.7%) and Everolimus in 6 (10.3%). After 2 years of LT, there was significant difference in creatinine and eGFR between the two groups (0.93 ± 0.2 versus 1.2 ± 0.6, p=0.042; 90.5 ± 24.4 versus 71.6 ± 25.3, p=0.005 respectively) as shown in Figure 1. There was no difference in incidence of biopsy proven rejection [13 (22.4%) versus 9 (19.6%), p=1.000] between the two groups. mTORI had to be discontinued in 8 patients because of significant proteinuria.



Conclusions: Early switch to mTORIs in LDLT recipients with HCC results in better initial and long-term renal function without any difference in the incidence of biopsy proven rejection.

0-072

Correlation of genetic & biochemical predictors of tacrolimus metabolism in living donor liver transplantation: towards personalised immunosuppression

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Background: The art of immunosuppression consists of achieving a fine balance between rejection, infection and drug related adverse effects. Pharmacokinetics of Tacrolimus (expressed as blood concentration/dose ratio(C/D ratio)) & intra-patient variability (IPV) of the drug are known to play an important role in its efficacy. In addition, expression of hepatic cytochrome P450(CYP)CYP3A5 has shown to play a role in tacrolimus metabolism in Living Donor Liver Transplantation (LDLT) recipients, and hence its effects and complications.
Methods: The effect of donor's CYP3A5 genotype, C/D ratio and IPV (using the coefficient of variability measured during the first 6 months post-LDLT) were correlated with the short and long-term outcomes in 150 recipients over a median follow-up of 2 years. The patients were divided into three groups of expressors (CYP3A5*1/*1,*1/*3 and *3/*3 genotypes), three C/D groups (fast, intermediate and slow metabolisers) and two IPV groups (fast and slow metabolisers).
Results: CYP3A5 *1/*3 allele (72%) was the commonest genotype in our cohort and constituted the genotypically intermediate metabolisers sub-group. In the IPV group the fast metabolisers showed a significantly lower estimated glomerular filtration rate

values at the 6-month time point. On multivariate analysis, a high C/D ratio was predictive of nephrotoxicity (odds ratio: 1.91, p=0.003) at 1 year post-LDLT. Despite a significant difference in the tacrolimus dosage requirements among each of the sub-categories of the genotypic variants, C/D groups and IPV groups to achieve target blood levels, it did not always correlate with toxicity or rejection.
Conclusions: In a first-of-its-kind study, we correlate the genotypic and biochemical predictors of immunosuppression with short- and long-term outcomes of LDLT and show that genotypic, IPV and C/D ratio analyses helps personalise optimum immunosuppression. We also propose that these easily calculable parameters should be taken into account early in patient's risk management strategies.

Concurrent Oral Abstract Session: Living Donor Liver Transplantation

0-073

Classification of intrahepatic biliary strictures and assessment of outcome in living donor liver transplantation

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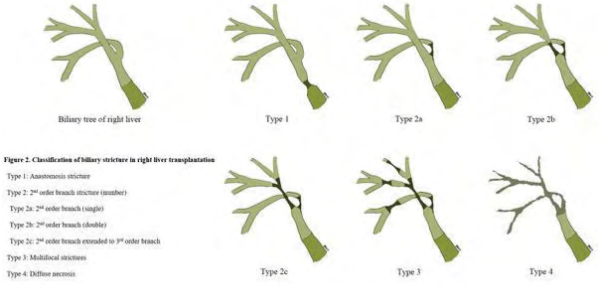
Background: Although intrahepatic biliary stricture (IHBS) after living donor liver transplantation (LDLT) is uncommon, IHBS requires intensive care. The purpose of this study is to classify types of IHBS and to evaluate the prognosis of IHBS after right liver LDLT.
Methods: According to cholangiography, biliary strictures requiring interventions were classified into 4 types based on level and number of involved ducts (Figure); IHBS was defined as non-anastomotic stricture (type 2, 3 and 4). We evaluated incidence of IHBS, intervention frequency per year, biliary intervention free period more than one year (IFY) after last intervention, clinical relapse after IFY and graft survival outcome according to types of biliary stricture. The mean follow-up period was 62.0 months.



Results: Among 719 adult LDLT recipients, the rates of anastomosis stricture and IHBS were 17.0% (n=122) and 10.5% (n=76). The most common type of IHBS was type 2 (86.8%; 2a (10.5%), 2b (19.7%), 2c (56.6%)), followed by 3 (7.9%) and 4 (5.3%). Intervention frequency per year was significantly higher in type 4 (9.5) than other types; 1 (2.3), 2a (2.3), 2b (2.8), 2c (4.3), and 3 (5.7), respectively (P=0.001). IFY was different according to types; type 1 (84.4%), 2a (87.5%), 2b (86.7%), 2c (72.1%), 3 (66.7%), and 4 (25.0%), respectively (P=0.032). Among IHBS group, clinical relapse after IFY was more common in type 3 (66.7%) and 4 (50.0%) than type 2 (31.8%) (P=0.026). The graft survival rate of type 3 and 4 IHBS (80.0%) was significantly lower than others (P=0.001).
Conclusions: The incidence of IHBS was not rare in right liver LDLT. Although type 3 and 4 IHBS were uncommon, they required more intensive care with poorer graft survival rates.

0-074

Classification of left hepatic vein anatomy and customised outflow reconstruction techniques for left lateral segment grafts in paediatric liver transplantation

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Background: Anatomical variations of left hepatic vein (LHV) are commonly encountered in pediatric liver transplantation. Meticulous reconstruction is required to prevent hepatic venous outflow obstruction (HVOO). We share our experience of classifying LHV anatomy and customizing outflow reconstruction in left lateral segment (LLS) grafts with complex anatomy.
Methods: We retrospectively studied 296 pediatric LLS transplants done over a 10 year period. Donor Computed Tomographic images of segment 2 (V2) and 3 (V3) venous drainage, reconstruction techniques used in grafts obtained and surgical outcomes were thoroughly analyzed.
Results: Three unique variations of LHV were described as in table 1 and ROC curve analysis (AUC 0.98, p 0.0001) was done to subdivide type 1 LHV. The venous outflow in the LLS graft was classified as graft A with single orifice and graft B with 2 orifices. LHV types 1b, 2 and 3 gave rise to graft B necessitating customized reconstruction techniques as described in table 1. We formulated a bespoke algorithm for selecting appropriate reconstruction techniques depending upon donor LHV anatomy (picture 1). On follow up for a minimum of 1 year, none of the patients developed early or late HVOO. The incidence of early graft dysfunction (p 0.64), acute cellular rejection (p 0.93), intractable ascites (p 0.97), major complications with Clavien Dindo score ≥3b (p 0.35) and overall survival (p 0.62) were similar between graft A and graft B.
Picture 1:

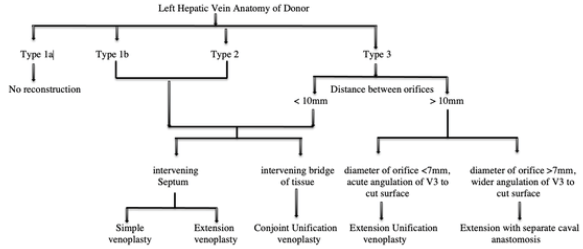

Table 1:

Type Of LHV	n (%)	Reconstruction done
Type 1a: V2 and V3 join to form a common trunk of length >9mm which joins middle hepatic vein (MHV)	254 (85.8%)	None
Type 1b: V2 and V3 join to form a common trunk of length <9mm which joins middle hepatic vein (MHV)	16 (5.4%)	Simple / extension venoplasty (10), Conjoint Unification venoplasty (6)
Type 2: V2 and V3 open separately into IVC	6 (2%)	Simple / extension venoplasty (2), Conjoint Unification venoplasty (4)
Type 3: V2 joins IVC, V3 joins MHV	20 (6.8%)	Simple / extension venoplasty (2), Conjoint Unification venoplasty (12), Extension unification venoplasty (3), Extension with separate caval anastomosis (3)

Conclusions: Identifying anatomical variations of LHV and tailoring outflow reconstruction, helps to increase the donor pool without compromising surgical outcomes.

0-075

To err is robot – a single center experience of complications following donor hepatectomy by robotic approach

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Background: Robotic live donor hepatectomy (RDH) has been reported to have low morbidity compared to its open counterparts. Donor safety, however, remains the primary concern precluding its wide adaption. Our aim was to evaluate the donor complications following RDH and identify their predictive factors.
Methods: Out of 348 live donor liver transplants performed since June 2018, 202 were performed robotically. We conducted an analysis of prospectively maintained data to assess complications in donors, according to modified Clavien-Dindo grading. Multivariate analysis of donor age, sex, body mass index (BMI), liver attenuation index, operative duration, blood loss, type of portal and biliary anatomies were performed to detect predictive factors. We compared the complications between the first and second halves to evaluate the effect of learning curve.
Results: Out of 202 RDH [mean age:37.5 (±10.4);f:m-133:69;mean BMI:25.2±3.84], 196 (97%) were modified right lobe grafts. Conversion to open was required in 7 (3.4%), 5 due to bleeding, 1- hepatic duct injury & 1-portal vein kink. Post-operative complications occurred in 33 (16.3%). Grade IVa complications were seen in 2(1biliary peritonitis and 1pulmonary embolism). Grade IIIb complications occurred in 7 (biliary fistula requiring ERCP-stenting-5; portal vein thrombus requiring thrombectomy-1; inferior vena caval narrowing requiring repair-1). Grade IIIa complications occurred in 7 (6 bilioma and 1 pleural effusion requiring percutaneous drainage). Grade I&II complications were seen in 7 and 10 cases respectively and included grade I surgical site infection(n=2), haematomas(n=8), seroma(n=1), delirium(n=1), urinary tract infection(n=2), stress cardiomyopathy(n=1), PHLF(n=1) and bladder injury(n=1). Diaphragmatic and incisional hernia requiring surgery occurred in 2 donors, 3 and 6 months after surgery respectively. Re-admission rate was 9.4% (n=19). The number of complications came down significantly in the second half (21.7% vs 9.9%;p=0.020;OR 2.53). There were no other predictive factors for donor complications.
Conclusions: Robotic surgery does come with its share of complications. Safety lies in flattening the learning curve.

0-076

Robotic donor right hepatectomy: "thou shalt not do Pringle's maneuver" – are we being heretic?

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Background: The Pringle's maneuver to reduce bleeding is rarely practiced in donor hepatectomy for fear of donor and recipient complications. The aim of our study was to compare the safety and efficacy of Pringle maneuver in robotic donor right hepatectomy.
Methods: Following the first 100 robotic donor right hepatectomies, we performed a pilot study to asses the effect of Pringle's maneuver in donor and recipient outcomes. Prospectively collected data of 32 (M: F=15:17, Age-34.11+/-11.6) donors who had Pringle's vascular control during robotic donor right hepatectomy were compared with 131 (M: F=41:90, Age-38.11+/-9.74) robotic donors without Pringle's maneuver.
Results: In the Pringle group, the vascular occlusion was used for a median duration of 49 (11-117) minutes. Donor BMI, graft weight, biliary anatomy, and recipient MELD, graft to recipient weight ratio (GRWR) were comparable between the Pringle and non Pringle groups. The Pringle group had significantly lower operative duration (427.38+/-59.83 vs. 462.66+/-81.78 min, P-.009), blood loss (386.55+/-259.34 vs. 605.34+/-464.72 ml, P-0.001), peak postoperative INR (2.07+/-.37 vs. 2.28+/-0.52 sec, P-0.029) and shorter hospital stay (8.06+/-2.71 vs. 9.52 +/-4.27days. P=0.005) compared to non Pringle group. Donor complications (Clavien –Dindo Grading) and peak transaminases were similar between the two groups. There was no donor mortality. Among recipients, the peak transaminases, early allograft dysfunction, small for size syndrome, bile leak , hepatic artery thrombosis and mortality were comparable in both the groups.
Conclusions: Pringles maneuver significantly reduces the blood loss and operative duration in Robotic donor right hepatectomy without affecting the donor safety, graft quality and the recipient outcomes. The Pringle maneuver may help surgeons exploring minimally invasive donor right hepatectomy in shortening the learning curve.

0-077

Weight reduction of liver donors with hepatic steatosis as a tool to expand the donor pool for living donor liver transplantation

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Background: The prevalence of liver steatosis in living liver donor candidates has increased due to the worldwide obesity epidemic. Herein, we review our experiences with right lobe (RL) adult living donor liver transplantation in donors who donated liver after confirming improvement of fatty liver through weight reduction (WR) and to investigate the feasibility and safety of using such donors on the donor, graft, and recipient outcomes.
Methods: From January 2015 to December 2020, 150 living donors (LDs) donated RL after an improvement in hepatic steatosis through WR more than 10% of body weight at a single center. We compared the outcomes of the donors and recipients of this group with those of the LDs without WR with matching.
Results: In the WR group, 150 patients lost body weigh (BW) through diet and exercise for 113 (range, 78-184) median days to improve hepatic steatosis. The median (IQR) difference in the BW from their first visit to the operation in the WR group were -13.22 (range, -16.58 - -11.49) kg; BMI were significantly reduced (27.8±3.9 kg/m^2 vs. 23.8±3.1 kg/m^2, P=0<0.0001) A notable difference in the graft volume (GV) between the estimated GV and real GV (WR group vs without WR group; -18.5±93.3 vs. 124.9±148.9, P=0<.0001) was observed. Post-operative complications in the WR group were significantly different from those observed in the group without WR (P=0.0102) before matching but were not statistically different after matching (P=0.3185). There was no differences in the patient and graft survival rates between two groups.
Conclusions: WR in potential living liver donors is an effective tool to expand donor pool, converting marginal donors to low-risk donors and ineligible donors to eligible donors. However, since a decrease in liver volume due to BW reduction can affect graft-to-recipient weight ratio (GRWR), preoperative reevaluation is necessary in patients with expected marginal GRWR.

0-078

Prognostic factors of living-donor liver transplantation for recipients with hepatorenal syndrome

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Background: Although liver transplantation (LT) is considered the only definitive therapy for hepatorenal syndrome (HRS), the probability of renal function recovery is known to be inversely proportional to the time waiting for LT. We aimed to compare outcomes between recipients with and without HRS after living-donor liver transplantation (LDLT) and to evaluate the factors associated with survival and renal recovery among recipients with HRS.
Methods: This single-center, retrospective study included 2,185 LDLT recipients: HRS group (n = 126, 5.8%) and non-HRS group (n = 2,059, 94.2%). The study outcomes were survival and post-LT renal recovery.
Results: The HRS group had a higher death rate than the non-HRS group (17.5% versus 8.6%, P<0.001). In the HRS group, post-LT renal recovery occurred in 69.0% of recipients, and the death rate was significantly higher among recipients who did not recover from HRS than among those who recovered (43.6% versus 5.7%, P<0.001). Multivariable analysis indicated that post-LT sepsis (P<0.001) and non-recovery of HRS (P<0.001) were independent negative prognostic factors for survival. Diabetes mellitus (P=0.007), pre-LT peak serum creatinine ≥ 3.2 mg/dL (P=0.002), time interval from HRS diagnosis to LDLT ≥38 days (P=0.013), and post-LT sepsis (P=0.031) were important negative prognostic factors for renal recovery after LDLT.
Conclusions: If infection, especially pneumonia, can be effectively prevented and treated, it could be helpful in patient's survival and renal recovery after ALDLT, although HRS group had been poor prognosis compared to non-HRS group. Post-LT renal recovery was important for survival, and the interval from HRS to LDLT was significantly associated with post-LT renal recovery. Therefore, when timely access to deceased-donor livers is not feasible, LDLT may permit better renal recovery and improve survival in recipients with HRS.

0-079

Hepatobiliary scintigraphy in living donor liver transplantation: pre operative prediction of post hepatectomy liver failure in donors and early allograft dysfunction in recipients

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Background: In living donor liver transplantation (LDLT), post hepatectomy liver failure (PHLF) in donors, early graft dysfunction (EGD) in recipients is determined by CT volumetry based Future Liver Remnant (FLR) volume and Graft-Recipient Weight Ratio (GRWR). However, they donot assess functional capacity of liver. 99mTc-Mebrofenin Hepatobiliary scintigraphy (HBS) can benefit in this regard.

Methods: Total liver function (TLF) on HBS calculated as mebrofenin uptake rate (MUR) performed initially in healthy volunteers (Group A,n=30), patients with liver steatosis, fibrosis, cholestasis (Group B,n=38) and cirrhosis (Group C,n=17). Later, HBS and CT performed in Liver Donors (n=48) to calculate TLF and FLR function. End points: PHLF in right lobe donors and EGD in all recipients after LDLT.

Results: TLF-MUR (%/min) and TLF-cMUR (%/min/sqmt) of Groups A,B,C are (Mean±SD) 15.7±2.4, 12.1±2.1, 7.6±2.9 and 9.4±1.7, 7.2±1.5, 4.4±1.9 respectively (p-0.000). 4 out of 30 right lobe donors developed grade I PHLF. Predictors of PHLF vs No PHLF are FLR% on CT 39.3±3.6 vs 38.1±4.8 (p-0.654), Age(years) 34.0 ± 16.0 vs 36.1 ± 10.5 (p-0.725), TLF-cMUR (%/min/sqmt) 6.8±0.8 vs 9.36±1.0 (p-0.000), FLR-cMUR (%/min/sqmt) 2.65 ± 0.21 vs 3.40±0.63 (p-0.029). On Receiver-operating characteristic curves (ROC), with cutoff value TLF-cMUR 7.53%/min/sqmt, PHLF was 100% and 0% when below and above cutoff value. 6 out of 48 recipients developed EGD after LDLT. Predictors of EGD vs No EGD are GRWR 1.02±0.5 vs 0.95±0.2 (p-0.685), Na MELD 20.1±10.1 vs 22.3±9.3 (p-0.595), TLF-MUR (%/min) 11.4±0.4 vs 15.6±2.1 (p-0.00). On ROC, with cutoff value TLF-MUR 12.4%/min, EGD was 85.7% and 0% when below and above cutoff value.

Conclusions: HBS cutoff values precisely predict PHLF and EGD. Including non-invasive HBS to donor evaluation protocol improve donor safety and recipient outcomes fulfilling unmet needs as liver functional capacity pivotal compared to anatomical volumes alone.

Concurrent Oral Abstract Session: Minimally Invasive Liver Surgery

0-019

Robotic vs open associating liver partition and portal vein ligation for staged hepatectomy (ALPPS)

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Background: Associating Liver Partition and Portal vein ligation for Staged hepatectomy (ALPPS) is a relatively novel surgical strategy that has implemented the opportunity to obtain a faster growth of FLR. It has been proposed that a minimally invasive ALPPS approach for the first stage, or full minimally invasive ALPPS, may improve outcomes reducing interstage morbidity.
Methods: We report our series of 9 ALPPS with robotic approach completed between August 2019 and July 2021. In detail, 6 were full robotic ALPPS, performed for colorectal liver metastasis (CLRM) in 2 cases, intrahepatic cholangiocarcinoma (ICC) in 3 cases and one for hepatocellular carcinoma, while in 3 cases of perihilar cholangiocarcinoma (PHCC) only the first stage was performed with robotic approach. We compared those cases with our series of open ALPPS, which is made up of 9 cases: 4 CRLM, 1 HCC, 1 ICC, 2 PHCC, and 1 gallbladder carcinoma.
Results: The two populations were comparable without statistically significant differences in terms of age, gender, BMI, ASA score and max tumor size. The robotic group showed a higher rate of patients discharged in the interstage interval (88.8% vs. 44.4%), and shorter median overall in-hospital stay (13 vs. 18 days). Perioperative morbidity resulted comparable, with an incidence of Clavien >3 complications after stage 1 of 11.1% in the open group and 12.5% in the robotic group. All patients completed the ALPPS, and only one case of 90-days mortality occurred in the open group.
Conclusions: Besides the already demonstrated advantages in terms of reduced interstage morbidity, robotic ALPPS represents a promising strategy to expand surgical indication in patients with primary and metastatic liver tumors. It may increase the opportunities to perform radical resections in selected patients that need a faster growth of the FLR, expanding the armamentarium of the modern HPB surgeons.

0-020

Laparoscopic assisted liver transplantation

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Background: Laparoscopic approach is a challenging issue in liver transplantation (LT). In 2019 we implemented a program of laparoscopic-assisted LT (LA-LT) in patients with unresectable liver metastases of neuroendocrine tumors. The aim of this study was to explore feasibility and safety of LA-LT in selected patients.
Methods: Total hepatectomy was performed by laparoscopic approach with implantation through an upper midline incision. All liver grafts were obtained from brain death donors and reduction by left lateral sectionectomy was performed when needed.
Results: From July 2019-July 2021, six patients (4 women, 2 men) were eligible and were operated without conversion. Median age and BMI were 46 (29-54) and 24 (19-35) kg/m^2, respectively. The median implanted graft weight was 995 g (629-1556 g), including a reduced (n=3), full (n=2) and a right split liver (n=1). Median surgical time was 405 min (390-450) and median blood loss was 425 ml (250-600). Median cold and warm ischemia times were 438 min (360-575) and 35 min (30-40), respectively. Median anhepatic phase was 51min (40-67) min and midline incision was 14 cm (13-20) long. On POD 5 median prothrombin index and serum bilirubin levels were 95 % (70-117) and 11 (10-37) µmol/L, respectively. Postoperative course was uneventful, with a median hospital stay of 12 days (10-14), and functional recovery was achieved by POD 5 (4-7). After a median follow-up of 5 (4-26) months, all patients were alive without tumor recurrence or adverse event.
Conclusions: This preliminary series suggests that in selected patients, laparoscopic-assisted liver transplantation is a safe and effective option, with a potential to reduce post-operative morbidity.

0-021

Robotic donor hepatectomies – is it the way forward to enhanced recovery?

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Background: Donor safety has always been the top priority in all living donor liver transplant programs. With the advent of robotic donor hepatectomies (RDH), this can become even safer

with regards to blood loss, pain experience, early mobilisation and recovery. Use of RDH was initiated in July 2020 at our centre and we present our experience with robotic left lateral segment hepatectomies (LLSH).

Methods: After obtaining institutional ethical committee approval, we did a retrospective database analysis of LLSH performed in our institute between October 2018 – October 2021. We then compared the 2 groups - Open LLSH (OLLSH) and RLLSH with regards to demographic profile, duration of surgery, intraoperative blood loss, blood transfusion, postoperative pain as the dose of morphine consumed in the first 48 hours, postoperative liver function tests, duration of ICU and hospital stay. Data is expressed as mean ± SD and median.

Results: A total of 118 LLSH were performed during the study period and 40 were RLLSH. Demographic profile was comparable between the groups. The duration of surgery was significantly longer in RLLSH (434.55 ± 83.69 vs 363.12 ± 65.02minutes; p <0.0001). Intraoperative blood loss was significantly lesser in RLLSH group (257.5 ± 110.43 vs 409.62 ±111.53 ml; p <0.0001). Despite comparable postoperative pain scores, morphine consumption (in milligrams)on postoperative day (POD) 1 (22.35±10.82 vs 30.21±10.27 mgs p<0.0002) and POD2 (13.7±8.69 vs 18.83±8.62 p<0.0028) was significantly lower in the RLLSH group. Serum transaminase levels were lower in RLSSH group on POD1&2 although not statistically significant. There was no difference in the duration of hospital or ICU stay.

Conclusions: Robotic donor hepatectomies increase the safety profile and a better pain experience. It can therefore can have a positive impact on health related quality of life(HRQOL) of donors in the long term. A study evaluating HRQOL in robotic donors is planned.

0-022

Laparoscopic approach in the management of early and late post-liver transplant complications: feasibility and results. A single centre experience

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Background: Laparoscopy is rarely considered an option managing complications in liver transplant (OLT) recipients. We herein describe our experience with the laparoscopic management of early and late post-OLT complications.

Methods: Since 2009 we have considered laparoscopy the preferred approach when dealing with early or late post-OLT complications requiring reoperation.

The exclusion criteria are: compartment syndrome, need for vascular reconstruction, severe acute bleeding causing hemodynamic instability and unavailability of HPB surgeon experienced in both OLT and laparoscopic approach.

From April 2009, we have reoperated 22 patients as consequence of post-OLT complications. Ten patients underwent open surgery based on the above-exposed criteria: 2 compartment syndrome, 2 needing vascular reconstruction, 1 severe bleeding and 5 unavailability of experienced surgeon.

The other 12 patients underwent laparoscopic approach. Seven were early complications (<30 days post-OLT): 6 post-OLT hemoperitoneum and a anastomotic biliary leakage. Other five were late: two intestinal obstructions, two diaphragmatic herniation of the liver causing outflow compromise/ascites and one duodenal perforation (due to ERCP-placed endoprosthesis).

Results: All except one case (91,6%) were successfully solved laparoscopically: One case of bleeding required conversion to open due to difficulty in liver mobilization (bleeding from inferior aspect of cavo-caval anastomosis). Other 5 cases of bleeding (early) were solved: 1 falciform ligament, 1 intercostal artery, 1 diaphragmatic surface, 2 in which source was not found. A kehr was placed in the biliary fistula (early); the obstructions (late) were solved with adhesiolysis; the herniations (late) were reduced and diaphragm sutured and the duodenal perforation repaired.

Conclusions: The use of the laparoscopic approach in managing post-OLT complications is feasible and safe in various settings with high success rates. It provides the patients the benefits of shorter recovery period, decreased postoperative pain, and rapid functional recovery, thereby avoiding risks of a relaparotomy. Additionally, it causes less tissue injury and consequently evokes a minor immune response.

0-023

Pure laparoscopic living donor hepatectomy for the right posterior segment graft

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Background: Laparoscopic donor hepatectomy has been cautiously introduced with wide application of laparoscopic liver resection (LLR). In Kyungpook National University Hospital, pure laparoscopic donor hepatectomy has been performed since 2016. Of them, the right lobe grafts were most used. The right posterior section graft (RPS) was introduced as an alternative to expand donor pool. But, the RPS graft has not been widely used in LDLT because of the lack of donors with suitable anatomical variation, the technical challenge for donor hepatectomy and implantation. We present three cases of pure laparoscopic donor hepatectomy for RPS.

Methods: Graft selection was determined based on volumetric analysis and anatomical variations. In 3 cases of RPS graft, right lobe grafts were not chosen because the ratio of the remnant liver volume/whole liver volume was less than 0.3 and left lobe graft was very small for metabolic demand of recipients. For the optimal bile duct division, we used real time indocyanine green fluorescence

imaging system.

Results: All 3 donors had type 3 portal vein variation. Graft Recipient Weight Ratio (GRWR) was 0.72, 0.81 and 1.34, individually. The operation time was median 380 minutes. Cut surface bile leakage occurred in one case, but resolved without procedure or intervention, and the donor was discharged at postoperative day 9. All recipients were also recovered uneventfully. And, we have never experienced open conversion and blood transfusion in all cases.

Conclusions: To meet the donor's safety and recipient's metabolic demand, graft selection is one of the important factors in LDLT, the RPS may be an alternative to expand donor pool. And, pure laparoscopic donor hepatectomy for RPS can be cautiously applied with the accumulation of experience for pure laparoscopic donor right hepatectomy and strict donor selection criteria.

Concurrent Oral Abstract Session: Pediatrics

0-080

Liver transplantation for paediatric metabolic diseases: a national cohort study

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Background: Liver transplantation (LT) is an established approach for several inborn errors of metabolism (IEM), despite the high-risk of short-term mortality due to significant long-term metabolic benefits. This national cohort study analyses outcomes of LT for IEM in the UK.
Methods: Data of all paediatric LTs done for IEM between 2000 and 2019 were obtained from NHSBT database.
Results: 270 LTs were performed for IEM at the three units. The commonest indications were alpha-1-antitrpsin deficiency (24%), Wilson's disease (18%), cystic fibrosis (14%) and primary hyperoxaluria (10%). Median age at transplant was 8 years, with 40% <5 years of age, and majority were male (59%). 17% of transplants were super-urgent, 83% of them for acute Wilson's. Median wait-time for all elective transplants was 84 days (1-1834 days). 11% were on dialysis pre-transplant and ten of them (0.4%) underwent simultaneous liver-kidney transplant. Only 11% of these transplants were from living donors (median wait-list time 62 days), whereas 85% DBD and 4% DCD grafts (median wait-list time 91 days). Eleven grafts were lost in the first 90-days – PNF (4), hepatic artery thrombosis (6), non-thrombotic infarction (1). Ten children died in the first 90-days-PNF (3), sepsis (6), renal failure (1). The 1-, 5- and 10-year patient and graft survival for the whole cohort was 96%, 90% and 84%, and 95%, 90% and 84% respectively. There was no difference in graft and patient survival between the DDLT/LDLT groups, transplant waiting time <1 vs. >1 year, PELD (<15 vs. >15), recipient age (<5 vs. >5 years), super-urgent status or era of transplant (before/after 2010).
Conclusions: It is reassuring that despite the lack of a formal allocation system for children in UK and longer waiting times, they achieve excellent long-term graft and patient survival. There is potential to reduce waiting times by an increasing adoption of living donation.

0-081

Therapeutic potential of living donor liver transplantation from heterozygous carrier donors in children with propionic acidemia

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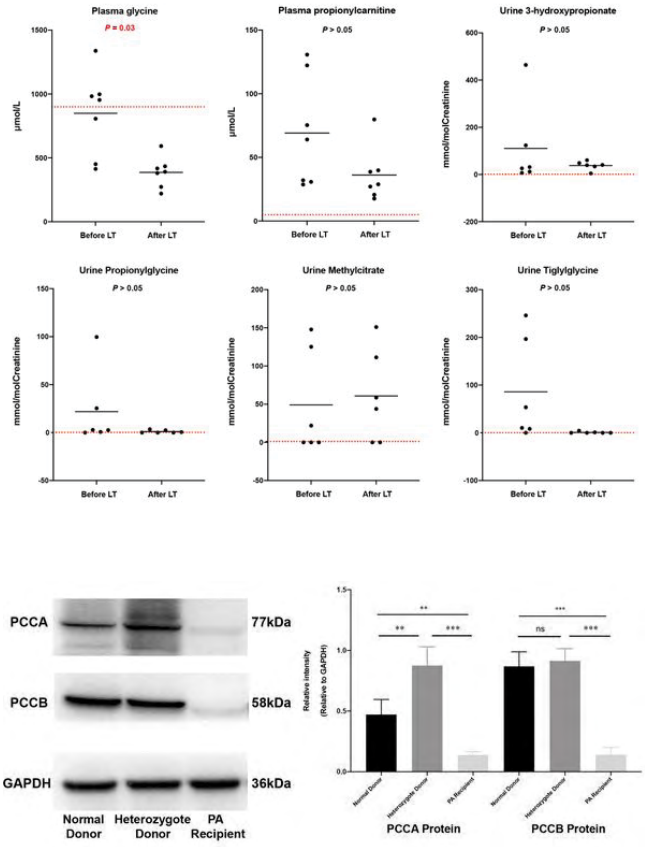
Background: Current world experience regarding living donor liver transplantation (LDLT) in the treatment of propionic acidemia (PA) is limited, especially in terms of using obligate heterozygous carriers as donors. This study aimed to evaluate the clinical outcomes of LDLT in children with PA.
Methods: From November 2017 to January 2020, 7 of the 192 children who underwent LDLT at our institution had been diagnosed with PA (median age, 2.1 years; range, 1.1–5.8 years). The primary indication for transplantation was frequent metabolic decompensations in 6 patients and preventative treatment in 1 patient. Of the seven parental living donors, six were genetically proven obligate heterozygous carriers.
Results: During a median follow-up of 23.9 months (range, 13.9–40.2 months), all patients were alive with 100% allograft survival, and no severe transplant-related complications occurred. In the case of liberalized protein intake, they did not suffer metabolic decompensation or disease-related complications and made progress in neurodevelopmental delay and body growth, as well as plasma and urinary metabolite levels. In one patient with pre-existing mild dilated cardiomyopathy, her echocardiogram results completely normalized 13.8 months post-transplant. All living donors recovered well after surgery, with no metabolic decompensations or procedure-related complications. Western blotting revealed that the hepatic expressions of PCCA and PCCB in one of the heterozygous donors were comparable to those of the normal healthy control at the protein level.



Conclusions: LDLT using partial liver grafts from asymptomatic obligate heterozygous carrier donors is a viable therapeutic option for selected PA patients, with no negative impact on donors' and recipients' clinical courses.

0-082

Pediatric acute liver failure: patient factors associated with higher mortality

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Background: Pediatric acute liver failure (PALF) is characterized by sudden onset deteriorating liver function, progressive coagulopathy, and hepatic encephalopathy in previously healthy children. The clinical trajectory of PALF is highly unpredictable. Herein, clinical variables associated with PALF outcomes in a large, highly diverse single-center experience were examined.

Methods: A retrospective cohort of children (<18 years) admitted with PALF at our center between 2001-2021 were identified by ICD codes. Clinical variables were stratified by outcome (spontaneous recovery, liver transplant (LT), death) for analysis.

Results: Overall, 116 patients were identified. The median age at presentation was 5.2 years [1.8, 13.8] (IQR), with 49% female and 39.7% Hispanic. Most patients recovered (51.7%), while 37% underwent LT and 11.2% died. Children <1 year accounted for most deaths (53.8%, p<0.01), while children >12 years more often recovered (40%, p<0.01) and children ages 4-12 were most likely to receive LT (44%, p<0.01). Indeterminate PALF was the most common etiology (28.4%, p<0.01). When compared to patients who recovered or received LT, patients who died without LT had higher admission INR (p=0.01), peak INR (p<0.005), and average INR (p<0.001); peak total bilirubin (TB, p<0.001), higher average AST (p=0.005), lower average platelet counts (p<0.001), and higher peak GGT (p=0.036) (Figure 1). Ammonia, a marker of encephalopathy, was higher on average (p<0.001) and peaked at a higher level (p<0.001) in patients who died without LT.

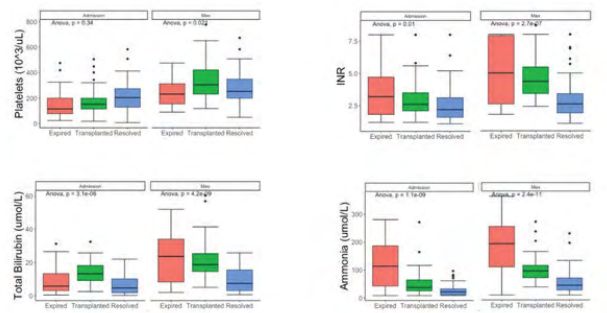

Figure 1. Lab data stratified by clinical outcome.

Conclusions: This single center review of PALF demonstrates that children <1 year old experience greater mortality and that children >12 years are most likely to recover without LT. Patients who die without LT are more likely to have significant elevations in INR, GGT, AST, TB, and ammonia, with worse thrombocytopenia. Further investigation of lab value trajectory in PALF is being explored to develop a predictive model for PALF outcomes.

0-083

Long-term outcomes of a new novel technique for portal vein reconstruction in pediatric liver transplantation using left grafts: ellipsoid oblique technique

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Background: The size discrepancy of the portal vein (PV) between donors and recipients in pediatric liver transplantation (LT) often led to PV complications. The purpose of this study is to evaluate the outcomes of a new technique (ellipsoid oblique technique; EOT) for anastomosis of the PV in pediatric LT.
Methods: 167 pediatric patients aged younger than 10 years were enrolled who underwent living or deceased donor LT from 1999 to 2016 using left or left lateral grafts including reduced grafts. We compared the outcomes between the conventional PV anastomosis (CPA) group (n=132) and EOT group (n=35). The median duration of follow-up was 149.4 months (0-266.2 months).

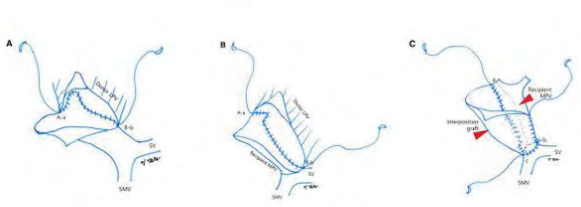

Figure 1. Portal vein reconstruction methods.
(A) Modified ellipsoid oblique technique
(B) Original ellipsoid oblique technique
(C) Oblique interposition patch graft technique

Results: The 5-year survival rates of CAP group and EOT group were comparable (88.6% vs 88.6%, p = 0.99). And the 5-year graft survival rates of both groups were not different (89.4% vs 88.6%, p=0.83). The PV intervention-free survival rates were lower in CAP group but not statistically (88.6% vs 97.1%, p = 0.18). Only one patient in EOT group had PV stenosis 7 days after deceased donor LT using reduced left lateral graft. During operation, there was bleeding at PV anastomosis site and we sutured. The portal vein was narrowed due to the suturing and we performed PV intervention for stent insertion.
Conclusions: EOT for PV reconstruction in pediatric LT appears to be feasible for pediatric patients. The portal vein complications in pediatric LT could be overcome by EOT.

0-084

Outcome of pediatric liver transplantation for progressive familial intrahepatic cholestasis and biliary atresia: a comparative study

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Background: Progressive familial intrahepatic cholestasis (PFIC) is a group of genetic disorders characterized by cholestasis, failure to thrive and cirrhosis and might require liver transplantation (LT). The outcomes of LT for this diverse group remains largely undefined. We present our data of LT for PFIC and compare their early, intermediate and long-term outcomes with a control population (primary LT for biliary atresia (BA)).
Methods: A retrospectively collected database of over a decade (2010-2021) of children with PFIC who underwent LT and BA (primary transplantation) were analyzed. PFIC diagnosis was based on biochemistry, histology, immunohistochemistry and genetic analysis. Patients were grouped into group-1 (PFIC1), group 2 (PFIC2/3/4) and group 3 (primary LT for BA). The groups were compared with regards to early, intermediate and long-term outcomes including post-LT complications, patient/graft survival, rejection, attainment of catch-up growth etc.
Results: Out of the 480 Pediatric LT in our center, 50(10.4%) were PFIC and 10,10, 26 & 4 were of PFIC I, II, III & IV respectively. 26 LT recipients underwent primary LT for BA. There were no significant differences in the rates of postoperative complications or rejection between the groups. The 1-year survival rate in group I, II & III were 70%, 88.8% and 92.6% (p=0.13) respectively. Catch-up growth at the end of 1 year was 30% for group 1, 67.5 % in group 2 and 74.1% in group 3 (p=0.03). 20% of PFIC-I recipients developed graft steatosis post-LT and required biliary diversion (BD), and 2 other patients had pre-emptive BD.
Conclusions: Even though the outcomes of LT for PFIC-I was relatively inferior as reflected by one-year survival rate, catch up growth, graft steatosis and post-LT diarrhea this can be optimized by a combination of LT and BD. Furthermore, the outcomes of PFIC2/3/4 and BA were comparable.

0-085

3D-reconstruction and heterotopic implantation of reduced monosegment, LLS and left lobe grafts in pediatric recipients: a new technique in pediatric LDLT to overcome LFSS

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Background: To overcome the problems of LFS grafts in pediatric LDLT,we introduced a new method of reduced size monosegment or LLS or left lobe grsfts transplanted in the right diaphragmatic fossa (RDF) heterotopically in small infants and children.
Methods: There were 12 pediatric recipients (10infants and 2children) who underwent LDLT with heterotopically implanted grafts. 2D measurements for graft reduction and 3D reconstruction of the right diaphragmatic fossa (RDF) for the graft volume estimation was done by 3D-reconstruction software (Livervision). In recipient the graft is implanted to the right side of IVC after 180 degrees rotating and placing the graft in the RDF. The right hepatic vein orifice is enlarged to obtain a wide HV anastomosis. HV anastomosis is done similar to the right lobe implantation. If the BD of the graft is positioned posterior to the portal vein (PV) because of 180-degree rotation,

bile duct (BD) anastomosis is performed before PV anastomosis. If the BD and the PV exhibit segregation in their alignment, the BD reconstruction is done after PV and HA reconstruction.
Results: The mean recipient age was 25.9±16 months and body weight was 10.2±2.5kg (range:4.2kg-31kg). Primary diagnoses of the recipients were biliary atresia (n:7) and PFIC (n:4), Fulminant liver failure (n:1). Mean GRWR was 2.9±0.27. Reduced and hyperreduced LLS grafts were used in 8 cases, reduced monosegment grafts were used in 2 patients, and left lobe grafts were used in twor children. Bile duct (BD) reconstruction was done by Roux-Y-hepaticojejunostomy in 10 patients and duct to duct anastomosis in 2 patients. All patients are doing well with a mean follow-up of 13.3 months.
Conclusions: The advantages of this technique are to assure stable inflow and outflow of venous anastomoses similar to right lobe LDLT and implantation of larger grafts in sicker patients with higher PELD scores. LDLT with heterotropically implanted reduced monosegmental or LLS or left lobe grafts seems feasible for the treatment of neonates and small infants and children.

0-086

Algorithmic approach to hepatic manifestations of langerhans cell histiocytosis: when and whom to transplant?

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Background: Langerhans cell histiocytosis (LCH) is rare but important cause of cirrhosis with or without decompensation (DCLD) in children. Patients with LCH and DCLD may not tolerate conventional chemotherapy and may rapidly progress to liver failure. Therefore there is a need for equally efficacious non-hepatotoxic chemotherapeutic regimen. The literature is also sparse with regards to the outcomes post-Liver transplant (LT) in these patients.
Methods: Analysis of patients who had hepatic presentation of LCH referred to our centre was performed. The demographics, clinical profile, chemotherapy protocols, details of LT and survival in the follow-up period were looked into.
Results: Of the 8 patients referred with LCH, the median age of diagnosis was 25 (9-48) months and 4 (50%) patients each had compensated cirrhosis and DCLD. 6 (75%) patients underwent LT of which 2 had acute decompensation and 4 had sclerosing cholangitis with portal hypertension (Table 1). Of the two remaining patients, 1 did not tolerate chemotherapy and succumbed, whereas 1 patient after the first cycle of chemotherapy was lost to follow up. As their liver disease was worsening during chemotherapy (after 8 & 20 weeks of chemotherapy), two patients underwent urgent LT followed by continuation of chemotherapy. Among those who underwent LT, conventional vinblastine-based chemotherapy in patients with compensated cirrhosis (n=4) was used and modified chemotherapeutic regimen based on cytarabine was administered for those having DCLD(n=2) (Figure 1). After a median follow-up of 30.5 (10.5-50) months, all patients were alive with stable graft function and no disease recurrence.
Conclusions: We report one of the largest series of LCH patients treated with LT, highlighting their long-term outcomes. We also present our management algorithm of LCH patients with hepatic manifestations, emphasizing the importance of remission before and a modified chemotherapy which these children with liver disease would tolerate (Figure 1).

Concurrent Oral Abstract Session: Transplant Oncology

0-087

Outcomes of hepatocellular carcinoma beyond the UCSF criteria after upfront living donor liver transplant and down-staging

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Background: The role of liver transplant for hepatocellular carcinoma HCC) beyond the University of California San Francisco (UCSF) remains controversial. Upfront living donor liver transplant (LDLT) and down-staging have been adopted.

This study aims:
1) to compare the intention-to-treat ITT and post-transplant survival of HCC beyond the UCSF criteria after upfront LDLT and down-staging,
2) to propose for selection criteria between the 2 treatment options.
Methods: This was a retrospective study from the University of Hong Kong and UCSF. All data were retrieved from prospectively maintained datasets. All HCC beyond the UCSF criteria who underwent upfront LDLT and down-staging from 2004-2018 were analyzed. The primary outcome was ITT-survival, defined as patient survival from the time of listing. Secondary outcomes included post-transplant patient, recurrence-free survival and predictors of dropout from down-staging.
Results: 259 patients were included (upfront LDLT n=87, down-staging n=172). The transplant rate was higher in the upfront LDLT group (66.7% vs. 29.1%, P<0.001). (Figure1) Clinical characteristics of all patients were listed in Table 1. The ITT-survival was better in the upfront LDLT group (Figure 2). Post-transplant survival rates were similar whereas there was trend for a higher risk of recurrence in the upfront LDLT group. (Figure 3 & 4).
In multivariable analysis, Child's B/C grade [HR=1.533 (1.026-2.289), P=0.037] and the largest tumor size + tumor number≥8 at listing [HR=1.683 (1.127-2.515), P=0.011] predicted dropout in down-staging. Patients in the upfront LDLT were stratified into 3 groups according to the number of risk factors. There was no difference in recurrence-free survival when these risk factors were applied to the upfront LDLT group. (Figure 5).

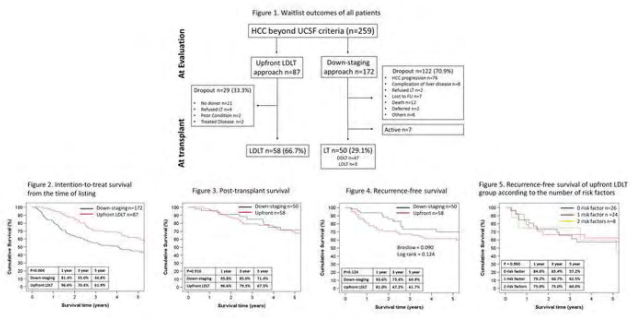

Table 1. Patient characteristics at time of listing and transplant

At listing	Upfront LDLT N=87	Down-staging N=172	P value
Age (years)	55.7 (33-73)	60.1 (39-76)	<0.001
N, % gender male	78 (89.7)	143 (83.1)	0.162
MELD	10 (6-26)	10 (6-27)	0.280
Radiological size of the largest tumor (cm)	4.0 (1.0-9.0)	5.0 (1.5-18.3)	<0.001
Radiological no of tumor (n,%)			0.678
• 1	24 (27.6)	32 (18.6)	
• 2	12 (13.8)	47 (27.3)	
• ≥ 3	51 (58.6)	93 (54.1)	
AFP (ng/ml)	27.0 (2-144400)	24.4 (2-99604)	0.810
At transplant	Upfront LDLT N=58	Down-staging N=50	P value
Waiting time (days)	18.5 (1-537)	316.5 (27-2331)	<0.001
Radiological size of the largest tumor (cm)	3.9 (1.0-9.0)	0 (0-5.0)	<0.001
Radiological no of tumor (n,%)			<0.001
• 0	0 (0)	27 (54.0)	
• 1	16 (27.6)	13 (26.0)	
• 2	9 (15.5)	7 (14.0)	
• ≥ 3	33 (56.9)	3 (6.0)	
Pathological tumor stage within Milan (n,%)	0 (0)	33 (66.0)	<0.001
Vascular invasion (n,%)			<0.001
• No	20 (34.5)	44 (88.0)	
• Micro	37 (63.8)	6 (12.0)	
• Macro	1 (1.7)	0 (0)	

Conclusions: For HCC beyond the UCSF criteria, upfront LDLT offered better ITT-survival but had a higher risk of post-transplant recurrence. Patients who had a high risk of dropout from down-staging, upfront LDLT should be considered.

0-088

Hepatocellular carcinoma (HCC) recurrence following liver transplant correlates with the severity of pre-transplant recipient immune dysfunction

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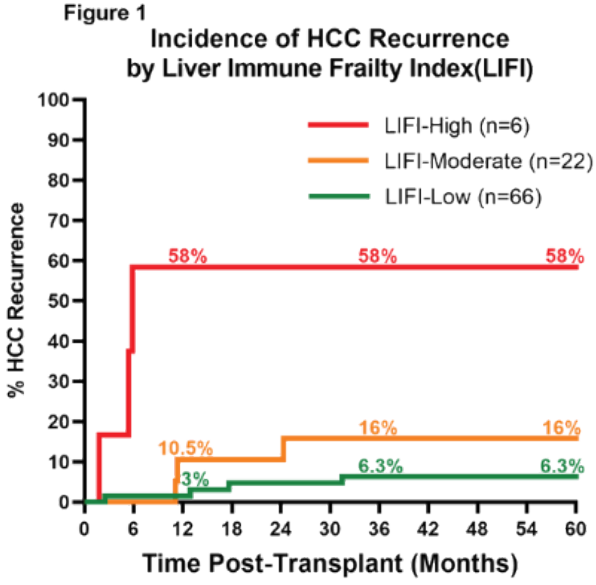
Background: Liver transplant (LT) for HCC in the setting of cirrhosis achieves 5-yr survival as high as 80%, however, 8-20% of recipients recur. Biologic tumor characteristic do not entirely predict recurrence risk, and pre-transplant recipient factors may

also play a role in recurrence. We have previously identified a pre-LT biomarker panel, the Liver Immune Frailty Index (LIFI), which accurately identifies patients with immune dysfunction at risk for early mortality (<1-yr post-LT). As immune surveillance is critical for tumor control, this study sought to determine whether pre-LT immune dysfunction and LIFI score correlate with a recipient's risk of HCC recurrence.

Methods: Patients with pre-LT or explant diagnosis of HCC were included. Multiplex cytokine/chemokine analysis of pre-LT plasma identified three biomarkers significantly correlated with post-LT mortality. LIFI score was calculated based on serum HCV IgG, Eotaxin and Fractalkine levels, stratifying patients into LIFI low, moderate, or high. HCC recurrence was correlated with cytokine/chemokine levels and overall LIFI score.

Results: Plasma from 94 patients was analyzed with median follow up of 48-mo. Analysis revealed pre-LT MMP-2, BAFF, Eotaxin, MMP-3, IP-10, CTAK13 and Fractalkine correlate with increased risk of cancer recurrence post-LT. Patients with LIFI-high were at highest risk vs. LIFI-Low (HR 19.9, p<0.001). Mean time to recurrence was 8 months for LIFI-High vs. 22.16 months for LIFI-low (Figure 1). Detectable HCV viral load at transplant also presented an independent risk for recurrence (HR 7.1, p<0.05).

Figure 1



Conclusions: Pre-LT immune dysfunction significantly increases risk of early post-LT HCC recurrence. This preliminary analysis suggests the LIFI score, a pre-transplant calculated laboratory biomarker, correlates with early HCC recurrence, and could serves as an adjunct to help identify and treat patients at highest risk for HCC recurrence after transplant.

0-089

Use of machine learning models for identification of predictors of survival and tumor recurrence in patients undergoing liver transplantation for hepatocellular carcinoma

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Background: Hepatocellular carcinoma (HCC) is one of the leading indications for liver transplantation, however, selection criteria remain controversial. We aimed to identify survival factors and predictors for tumor recurrence using machine learning methods. We also compared a machine learning model to Cox regression model.

Methods: 32 donor and recipient general and tumor specific parameters were analyzed from 170 patients who underwent liver transplantation for HCC between March 2013 and December 2018 at the University Hospital Merkur. Survival rates were calculated using the Kaplan-Meier method, and multivariate analysis was performed using the Cox proportional hazards regression model. Data was also processed through machine learning Random Forest (RF) method, which included preprocessing, variable selection, Random Forest variable significance, resampling, training and cross-validation of the RF model. Accuracy and concordance index were used for evaluation metrics.

Results: Two year recipient and graft survival was 78% and 75%, respectively. The best predictive accuracy of our RF model was 0.75 while the best concordance index was 0.80. RF analysis yielded several relevant predictors of survival: donor CRP, bilirubin and sodium levels, recipient MELD and recipient age. Most significant predictors of HCC recurrence were recipient AFP level and donor CRP and sodium levels. Some of the analyzed parameters were shown to be detrimental for survival both in Cox multivariate analysis and in the RF models. In contrast to the RF model, Cox analysis showed an association between donor age and recipient and graft survival, while donor BMI and donor male sex were identified as risk factors for HCC recurrence.

Conclusions: The purpose of a machine learning model for prediction of post transplant HCC recurrence is to identify the patients that would benefit from liver transplantation. Further research including prospectively collected data and additional parameters is needed to confirm our results and improve the existing model.

0-090

Phase I study of adjuvant immunotherapy using donor liver derived NK cells for preventing HCC recurrence after liver transplantation

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Background: Development of an effective adjuvant therapy to prevent hepatocellular carcinoma (HCC) recurrence after liver transplantation (LT) is an important medical requirement. Natural killer (NK) cells play a central role in innate immunity against neoplastic cells; therefore, their augmentation is a promising immunotherapeutic approach against HCC recurrence after LT.
Methods: We propose that adoptive transfer of IL-2-stimulated TRAIL$^+$ NK cells extracted from donor liver graft perfusate can mount an anti-tumor response without causing toxicity to intact recipient tissues.
Results: We have successfully performed NK-cell immunotherapy in 45 living donor LT (LDLT) recipients with HCC in Japan. In the series of LDLT with HCC, 38 patients (37%) had HCC exceeding MC on postoperative pathology. Of these 38 patients, the recurrent free survival (RFS) rates were significantly improved in the NK group (n=16) as compared to those in the control group (n=22). Their 5 year-RFS were 75% and 48%, respectively (p=0.042). After infusion of NK cells, the NK cytotoxicity and the proportion of TRAIL$^+$ NK cells in the peripheral blood of patients increased significantly (p<0.05). We also applied the proposed approach to the deceased donor LT (DDLT) recipients in Univ. Miami. This phase I study included 17 subjects with a median follow-up of 96 months. No study-related adverse events were noted in either of the studies. Regarding overall survival, the high-dose group had significantly better survival than the low-dose group (p = 0.0064). In the series of DDLT with HCC, among the 17 patients who met MC on preoperative imaging, 9 patients (53%) had HCC exceeding MC on postoperative pathology. None of the patients have shown any symptom of HCC recurrence.
Conclusions: In conclusions, the administration of IL-2-stimulated NK cells derived from both living and deceased donor liver allografts was safely applied and is, therefore, a potential novel adjuvant immune treatment after LT in HCC patients.

0-091

Circulating tumour cells and their impact on the management of the liver transplant patient with hepatocellular carcinoma

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Background:
For hepatocellular carcinoma (HCC), liver transplantation (LT) is considered a curative treatment, however, more than 10% of transplant recipients have recurrences within the first year. This suggests the existence of circulating-tumor-cells (CTC) that spread from a primary tumor and travel to peripheral blood and distant organs. Their detection and monitoring could be of great clinical value to an early prediction of recurrence as a real-time liquid biopsy. The aim of this study is to determine the relationship between CTC and clinicopathological variables and to compare the CTC-levels in patients with HCC before transplantation and at one and two years after surgery.
Methods: Peripheral blood was obtained from 34 patients with HCC included in the LT list. Immunomagnetic isolation of CTC was performed by the IsoFlux® System. Cell enrichment was stained with anti-CK, Hoechst-33342 and antiCD45, performing cell counting under a fluorescence microscope. The clinicopathological variables (number of tumors, vascular invasion, tumor necrosis and recurrence) were collected. Spearman's rho, Mann-Whitney and Wilcoxon test were used.
Results:
We found statistically significant differences in the CTC-levels between patients with vascular invasion and those without (U=0; p=0.005) such that patients with vascular invasion had median levels of 539 CTC/10 mL (IR: 448-1768) and those without vascular invasion had median levels of 3 CTC/10 mL (IR:0-31.25). Also we found a statistically significant decrease in post-transplant CTC-values at one year (Z= -2.672/ p=0.008) and two years (Z= -2.218/ p=0.027).
Conclusions:
The median CTC-levels of the patients included in the study showed a downward trend after liver transplantation. Also, a significant difference was found in the levels of pre-transplant-CTC between patients with and without vascular invasion, these levels being significantly higher in patients with vascular invasion compared to those without vascular invasion. Detection of CTC may have a useful clinical implication in predicting the evolution of HCC after LT.

0-092

Living donor liver transplantation after downstaging with targeted radiotherapy enables long-term survival in selected patients with cirrhosis, HCC and portal vein tumor thrombosis

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Background: Median survival in patients with hepatocellular carcinoma (HCC) and portal vein tumor thrombosis (PVTT) is 2–6

months; conventionally liver transplantation is contraindicated in them. We present our updated series of patients with cirrhosis, HCC and PVTT who were successfully downstaged (DS) and underwent living donor liver transplantation (LDLT).
Methods: We accept patients with cirrhosis and HCC for LDLT irrespective of tumour size/number provided there is no extrahepatic disease or macrovascular invasion. We studied outcomes in 36 patients who underwent LDLT after successful PVTT-DS (disappearance of PVTT enhancement on contrast CT and loss of (^{18}F) FDG PET avidity) with stereotactic body radiotherapy (SBRT), and tumor ablation with transarterial chemo- or radio-embolisation.
Results: Thirty three HCC patients with Vp1/2/3 and 3 with Vp4 PVTT underwent LDLT after successful DS . Median AFP at diagnosis, and pre-LDLT were 73 ng/mL (3-58 200), and 35 ng/mL (2-7320), respectively. Mean DS to LDLT duration was 12 weeks. Excluding 4 postoperative deaths, 1- and 5-year overall survival (OS) and recurrence-free survival (RFS) were 81%, 57%, and 79%, 61%, respectively. There were 12 long-term survivors (over 3 years, including 5 over 5 years) among the DS group. On univariate analysis, OS was better in patients with Vp1/Vp2 PVTT vs. those with Vp3/Vp4 PVTT and in those with pre-DS AFP <1500 ng/mL. Similarly, RFS was better in patients with pre-DS AFP <1500 ng/mL. On multivariate analysis, pre-DS AFP <1500 ng/mL predicted better OS and RFS. In patients with Vp3/Vp4 PVTT, tumour (^{18}F) FDG PET avidity was an adverse prognostic factor for OS (p=0.04).
Conclusions: HCC patients with PVTT can achieve acceptable long-term survival with LDLT after successful DS. High initial AFP and tumour (^{18}F) FDG PET avidity adversely affect survival in these patients, thus emphasising the pivotal role of tumour biology in predicting outcomes in patients with locally advanced HCC.

0-093

Liver transplantation for combined hepatocellular-cholangiocarcinoma: an analysis of the European Liver Transplant Registry

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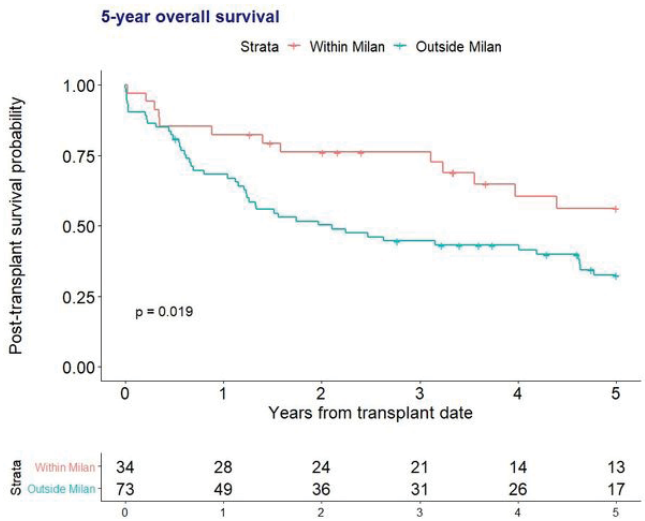
Background: Data on combined hepatocellular-cholangiocarcinoma (cHCC-CCA) demographics and their outcomes after liver transplantation (LT) are limited. We sought to map these by analyzing data from the European Liver Transplant Registry (ELTR).
Methods: ELTR-centers with cHCC-CCA patients transplanted before Jul-2021 were identified and contacted for study participation. Patients without diagnosis confirmation or follow-up data were excluded. The outcomes evaluated were overall survival (OS), recurrence-free survival (RFS), and cumulative incidence of recurrence. For the latter, death without recurrence was considered a competitive event.
Results: A total of 115 patients with cHCC-CCA were transplanted in 22 centers, most (97%) within the last 20 years. The majority were male (83%). Seventy-nine (69%) patients were listed as HCC, while only four patients were diagnosed with cHCC-CCA pre-operatively (3%). Most common underlying liver diseases were alcoholic liver disease (35%), hepatitis C (25%) and hepatitis B virus (17%). Median tumor number at listing was two (IQR:2-2), with a median maximum size of 28mm (IQR:20-41mm). Tumor markers pre-LT were (median): AFP 15 (IQR:5-67), CA19.9 26 (IQR:13-58), CEA 3.3 (IQR:2.0-5.3). Explant pathology showed a median tumor number of two (IQR:1-4), maximum size of 32mm (IQR:23-50mm), with vascular invasion present in 40%. Overall outcomes at 1,3,5-years were: OS 70%, 51%, 37%; RFS 60%, 40%, 32%; cumulative incidence of recurrence 22%, 39%, 42%. Within vs. outside Milan (explant pathology) showed an OS of 82%, 76%, 56% vs. 68%, 45%, 32% (p=0.02), RFS of 82%, 62%, 54% vs. 53%, 33%, 25% (p<0.01), and cumulative incidence of recurrence of 8%, 23%, 23% vs. 29%, 46%, 51% (p<0.01) at 1,3,5-years.



Conclusions: Most cHCC-CCA patients were diagnosed post-LT after being listed for HCC. Alcoholic liver disease was the most common underlying liver disease. Patients within Milan criteria demonstrated acceptable 5-years OS and recurrence rates, superior to those outside Milan.

Concurrent Oral Abstract Session: Surgical Videos for Technical Innovation

V-001

Ex-vivo liver splitting during normothermic machine perfusion

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Description of the video: Normothermic machine perfusion has given us the ability to keep organs alive ex-vivo and assess these grafts prior to transplant. Liver splitting can be performed in an ice-bath using the traditional ex-vivo technique, or during the procurement operation using the in-situ technique. Normothermic machine perfusion could allow these livers to be split ex-vivo while continuously perfused and combines the advantages of both the ex-vivo (convenience) and in-situ techniques (shorter cold ischaemic time).
Using 10 discarded human livers, we developed a 6-step technique to split human livers during continuous normothermic perfusion into left lateral segment grafts and extended right grafts. The steps are as follows. 1: Back-table dissection, 2: Hanging manoeuvre, 3: Vascular dissection, 4: Parenchymal transection, 5: Division of left hepatic duct and 6: Graft transfer.
Back-table dissection involves isolation and looping of the left hepatic vein, left portal vein and left hepatic artery. The liver is then reperfused using a red cell-based perfusate and suspended using a hanging manoeuvre. Selective perfusion using indocyanine green assists in visualising the ideal line for splitting. We then perform the parenchymal transection using a harmonic scalpel and the vessels are sequentially ligated and divided. The anatomy of the biliary tree is directly visualised using choledochoscopy and the left hepatic duct is divided. Finally, the split is completed by dividing the right hepatic artery and the left portal vein. The extended right graft can then be transferred to a second perfusion machine and reperfused. This results in two partial grafts, a left lateral segment graft and an extended right graft perfused on two separate perfusion machines. Our novel method of liver splitting reliably achieves 2 viable grafts from a single donor liver. This raises the potential for semi-elective day time liver transplantation, ex-vivo perfusion for paediatric grafts and sophisticated graft assessment prior to implant.

V-002

Development process of minimally invasive living donor liver transplantation: from pure laparoscopic explant hepatectomy to robotic graft implantation

K.-S. Suh[1], S.K. Hong[1], S. Lee[1], S. Suh[1], S.y. Hong[1], E.S. Han[1], Y. Choi[1], N.-J. Yi[1], K.-W. Lee[1]
[1]Seoul National University College of Medicine, Surgery, Seoul, Korea, Republic of

Description of the video:

Background: With the accumulation of experience in pure laparoscopic hepatectomy, including donor hepatectomy, our center initiated a minimally invasive living donor liver transplantation (LDLT) program since March 2020. The aim of this study is to share our development process of minimally invasive LDLT.
Methods: Medical records and videos of patients who underwent more than pure laparoscopic explant hepatectomy were retrospectively reviewed. Recipients, donors, and their families were informed of the innovative nature of the procedure and its potential advantages and disadvantages. Written informed consent was obtained from all the participants.
Results: Three patients successfully underwent pure laparoscopic explant hepatectomy and graft implantation using upper midline incision. Next step was pure laparoscopic explant hepatectomy followed by pure laparoscopic graft implantation, which was inserted through a suprapubic incision. Finally, pure laparoscopic explant hepatectomy and hybrid laparoscopic/robotic graft implantation was successfully performed.
Conclusion: Minimally invasive LDLT can be performed in the era of minimally invasive surgery when performed by a highly experienced surgeon and transplantation team. Of course, further studies with larger sample sizes are needed to confirm its safety and feasibility.

V-003

Living donor liver transplantation using right anterior graft in donors with expected small remnant volume and anatomic variations

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Description of the video: 49-year old female patient had liver cirrhosis with hepatitis B virus infection and history of several times of variceal ligation and BRTO. But, there was only few chance to be allocated liver for deceased donor liver transplantation, because of relatively low MELD score and blood type (O+). We decided to proceed living donor liver transplantation. Her son is the only one candidate of donor. He was 22-year old and had same blood type (O+), no fatty

liver. However, he don't have enough remnant volume(Lt remnant volume: 22.7%) and also he had anatomic variation on hepatic vein, portal vein, hepatic artery and bile ducts. Rt. anterior graft volume is enough for donation (GRWR: 0.97, remnant volume : 64.8%). And anatomical variation is suitable for donor hepatectomy. We performed Rt. anterior sectionectomy for living donor liver transplantation.
Living donor liver transplantation was done. Operative time of recipient was 6hr 40minute and estimated blood loss was 2000cc. We did venoplasty in the bench surgery for making common orifice of RHV and MHV. Common orifice of RHV and MHV was anastomosed with 4-0 Prolene to RHV of recipient. Rt. anterior portal vein was anastomosed with 6-0 Prolene to Main portal vein of recipients. Arterial anastomosis was done with 8-0 nylon (RAHA of graft to LHA of recipient). Bile duct anastomosis was done with 6-0 Maxon (RABD of graft to CBD of recipient). There was no intraoperative event and no immediate postoperative acute complication. Patients transferred to general ward at postoperative 4 days then discharged postoperative 16 days. Peak total bilirubin was 5.9 mg/dL and this decreased to 2.5 mg/dL at the point of discharge. Peak AST/ALT were 50/94 IU/L, it also decreased to 31/55 IU/L before discharge.

V-004

Robot-assisted living donor liver transplantation

K.-W. Lee[1], Y. Choi[1], S. Lee[1], S.y. Hong[1], S. Suh[1], E.S. Han[1], S.K. Hong[1], S.M. Yang[1], N.-J. Yi[1], K.-S. Suh[1]
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Description of the video: Minimally invasive surgery has been introduced for living donor hepatectomy in the last decade. It has enabled living donors to experience less pain, shorter hospital stay and improved cosmetic outcomes. Recent developments along with accumulation of our team's experience of laparoscopic explant hepatectomy followed by hybrid laparoscopic/robotic engraftment, we present a case of successful total robot-assisted explant hepatectomy followed by robotic engraftment.
Video description
A 57-year old male patient with alcoholic liver cirrhosis with hepatocellular carcinoma underwent robotic living donor liver transplantation (LT). Recipient's Child-Pugh score was 7. Preoperative imaging showed paraesophageal varices, umbilical recanalization, and large amount of ascites. We used modified right graft with graft-to-recipient weight ratio of 0.93%. The patient was placed in lithotomy with reverse Trendelenburg position. Four robotic ports and two 12-mm umbilical and epigastric assistant ports were used. After cholecystectomy, we clamped the common hepatic artery and portal vein with the robotic vascular clamp. High hilar dissection was done and back bleeding from native liver was controlled with sutures. Left and middle haptic venous trunk and right hepatic vein was resected with robotic staples. Suprahepatic IVC was clamped with the Chitwood clmaps and infrahepatic IVC with the robotic vascular clamp. Hepatic vein and portal vein were anastomosed in continuous fashion wpith prolene 4-0 and 6-0, respectively. After reperfusion, hepatic artery was anastomosed with intermittent suture with nylon 8-0. Bile duct anastomosis was carried with prolene 6-0 and two internal stents. The total operation time was 850 minutes. The warm and cold ischemia times were 55 and 229 minutes, respectively. [AI] The estimated blood loss was 6,300 ml. Fifteen units of red cell concentrates and ten units of fresh frozen plasma were transfused. The patient stayed in the intensive-care unit for four days and discharged on postoperative day 13 without significant complication.

V-005

Successful utilisation of robotic platform in all variants of left lateral donor hepatectomies

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Description of the video: Pediatric liver transplantation constitutes 20% of our liver transplant population and over 60 pediatric LDLT/ year, our institution is one of the largest pediatric liver transplant centers in the world. With current success in minimally invasive hepatectomies, we strongly felt the need of minimally invasive approach for liver donors even though our results with open donor hepatectomies were quite satisfactory. Minimally invasive donor left lateral sectionectomy(LLS) has been established to be feasible and comparable to open approach and growing steadily as the standard of care. However this is still a relative contraindication of variant left lateral donor hepatectomies by laparoscopic approach.
We encounter 15-20% of our LLS donor to be technically challenging with vascular anatomical variations and /or large for size graft, requiring graft reduction. With gaining experience over standard anatomy, we extended the robotic platform to these technically challenging cases and found that, it is not only feasible but advantageous in regards to the magnification, instrumentation and firefly technology especially for monosegment graft. We also found the robotic platform to have quicker learning curve with ability to push boundaries to have a near replica of open donor hepatectomies.
This video constitutes five surgical clippings illustrating the successful utilization of Robotic approach in various scenarios– 1. Dissection of replaced left hepatic artery from left gastric artery, 2. Dissection of segment 3 hepatic vein draining into MHV variant, 3. Monosegment II, in situ reduction, 4. Control of bleed from left hepatic vein and 5. Mobilisation of left phrenic vein.

V-006

Laparoscopic extended left lateral sectionectomy after left hepatic artery thrombosis in the early postoperative period following a liver transplant

V. Lopez-Lopez[1], P. Gomez-Valles[1], P. Cascales-Campos[1], F. Alconchel[1], F. Sanchez-Bueno[1], R. Robles-Campos[1], P. Ramirez[1]
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Description of the video: Early hepatic artery thrombosis (HAT) after liver transplantation (LT) is a serious complication associated with a 3-7% rate of postoperative morbidity and risk of graft loss. Sometimes, thrombosis is exclusive to one of the branches of the hepatic artery and produces necrosis limited to one lobe or several segments.We present the first case, to the best of our knowledge, of a laparoscopic extended left lateral sectionectomy in the early postoperative period of a LT.
A 69-year-old man underwent a liver retransplant for ischemic cholangiopathy. On the 2nd postoperative (PO) day, in the control ultrasound, he presented an absence of flow from the left hepatic artery, confirmed by computed tomography (CT) angiography, without clinical or analytical relevant repercussions, for which an expectant attitude was decided. After the development of fever, another CT was performed that reported ischemia of the left hepatic lobe that was more marked in segments 2-3 with signs of hepatic necrosis, and extension into part of segment 4. Before these findings, a 12th PO laparoscopic hepatectomy was planned. We used the low lithotomy position and the surgeon was situated between the legs. The Pringle maneuver was not used to prevent damage to the liver pedicle from recent transplantation. We placed four trocars: one supraumbilical (11 mm), two in the upper right and left quadrants (11 mm), respectively, and another in the epigastric area (5 mm). When introducing the camera, there was an abscess in the left subhepatic space that was drained. We performed an extended left lateral sectionectomy on demand of the ischemic area of 4a-b to a depth with viable and well perfused tissue. The patient was discharged on the 5th PO day.
In conclusion, laparoscopic liver resection in the early postoperative period of transplantation could be an appropriate indication, especially in favorable liver segments.

V-007

Mixed reality enhanced laparoscopic living donor liver transplant

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Description of the video: We describe a case of laparoscopic left lateral living donor liver transplant with the use of mixed reality (MR) technology for pre-operative planning, surgical education, and intra-operative image guidance. The donor is a 21-year-old female, who is an altruistic donor for a 1-year-old child with previous Kasai's Procedure, complicated by recurrent cholangitis and acute liver decompensation secondary to sepsis. Donor workup showed that she had normal variant arterial, portal vein, hepatic vein, and biliary anatomy. The CT and MRI scans were then segmented using LiverVision®, with a simulated cutline for a left lateral section graft. The calculated graft volume was 176mls, giving a graft-recipient-weight-ratio (GRWR) of 1.78. The future liver remnant (FLR) was 76%. The segmented files were then exported as 3D STL files and uploaded to the Microsoft HoloLens2 MR device via Virtual Surgery Intelligence (VSI Holomedicine®) and rendered into 3D holograms. The 3D hologram is used for pre-operative planning, where the 3D holographic images of the inflow and outflow structures, as well as the simulated cutline allowed the us to plan the approach and anticipate important structures we will encounter during the surgery. This shift of cognitive load for the surgeons, where we can optimize time otherwise spent on visualizing a 2D scan into a 3D mental model, allowed us focus on planning for the surgery itself. Shared-experience allowed multiple HoloLens2 devices to be linked to share the same holographic image, where the chief surgeon was able to conduct a virtual walkthrough of the surgery with the residents. During the operation, we were able to superimpose the 3D holographic images onto the patient and the laparoscopic monitor (including a holographic virtual monitor) to provide real-time image guidance and reference, which is a capability never before available to transplant surgeons.

Concurrent Oral Abstract Session: Late Breaking Abstracts I

LB-O-02

Lactate AUC of 0-6h during normothermic machine perfusion has strong predictive value towards the outcome after liver transplantation: results from a multicenter study

J. Hofmann[1], A.T Meszaros[1], A. Butler[2], A. Hann[3], H. Hartog[3], F. Kneifel[4], S. Iype[5], B. Cardini[1], B. Fiore[6], M. Attia[6], J.-M. Pollok[5], J. Brockmann[4], T. Perera[3], C.JE Watson[2], S. Schneeberger[1]

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Background: Biomarkers for livers undergoing normothermic machine perfusion (NMP) with predictive capacity towards the clinical outcome are needed. We investigated lactate clearing capacity as a basic function of liver viability during the first 6h of NMP in a multicenter trial.
Methods: 300 livers underwent ≥6h of NMP before transplantation in 6 centres in UK, Germany, and Austria. The donor age was 49.54±16.73y (mean±SD), DRI was 1.92±0.58, 26.33% of livers stemmed from DCD and cold storage time was 405±123min. All centers applied a back-to-base approach and used the OrganOx metra system for NMP. The perfusate lactate levels at start (5-15min), at 1h, 2h, and 6h of NMP were assessed individually and as AUC and correlated with MEAF and L-GrAFT. Statistical tests were performed using R and GraphPad Prism.
Results: The total NMP time was 774±311min. EAD occurred in 29.67%, MEAF was 5.10±1.89 and L-GrAFT at 7 and 10 day was 0.66±1.27 and -0.23±1.34. The 1-year patient and graft survival were 88.56% and 87.06%. Lactate at 1h, 2h and 6h correlated significantly with MEAF. The correlation increased in robustness over time. Rather than a binary assessment with a cut-off value <2.5mmol/L at 2h, the actual 2h lactate level correlated with the MEAF (p=0.0164 *vs* p=0.0021, Pearson r=0.1385 *vs* r=0.1781). Further to the absolute lactate concentration at 6h, the AUC of 0-6h (p<0.0001, r=0.2705, Figure1.) has strong predictive value towards MEAF after transplantation. We did not find any correlation between perfusate lactate and L-GrAFT.
Conclusions: Lactate AUC of 0-6h but also lactate levels at 6h correlate strongly with risk of liver allograft dysfunction upon transplantation. The value of lactate as a biomarker towards MEAF increases with duration of perfusion. The time frame of monitoring lactate levels should be extended to at least 6h of NMP to retrieve meaningful data.

LB-O-03

A novel approach for immunosuppression optimization using ast guided phenotypic personalized medicine model

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Background: A novel approach for individualization of immunosuppression (IS) is required due to considerable variability in susceptibility to CNI toxicity, infection, and rejection among transplant recipients, particularly across different patient populations. The current standard of care aims to address Inter- and intra-individual variability in dosing requirements, using empirical physician-titrated immunosuppressant administration. However, this strategy frequently results in over- or under-immunosuppression. Both outcomes are problematic given that lower incidences of acute rejection achieved through aggressive IS regimes often are counterbalanced by negative effects leading to worse graft survival from infections or cancers.
Methods: We developed a method to systematize multi-drug IS using an artificial intelligence-based complex systems approach called phenotypic personalized medicine (PPM). PPM applies nonlinear regression to a patient's clinical data to generate a mathematical representation of their response to immunosuppressive agents. This allows the identification of a combination of doses likely to produce a desired clinical outcome. For this project, our outcome was allograft status, informed by aspartate aminotransferase (AST) level. We applied the PPM model to a retrospective cohort of 15 liver transplant (LT) patients to generate 48 dosing recommendations. Of the 48 total recommendations, 17 were predictive (dosing recommendations before rejection/infection events), and 31 were treatment recommendations (dosing recommendations during or after the onset of rejection/infection events).
Results: PPM was able to distinguish between rejection and infection events (p = 0.0058) to effectively modulate IS, recommending increased IS before and during rejection events and decreased IS before and during infection events. In stable patients, PPM, on average, recommended modest reductions in IS. No significant difference in model error or reduction in AST was observed among groups, suggesting comparable efficacy regardless of patient status.
Conclusions: PPM represents a potential actionable strategy to systematize multidrug-immunosuppression and improve LT outcomes. PPM-based IS modulation may aid in the prevention of rejection.

LB-0-04

Clinical impact of spontaneous porto-systemic shunts on postoperative outcomes following liver transplantation: a novel radiological perspective through total shunt area measurement

L. Centonze[1], G. Gorga[2], R. De Carlis[1], D. Bernasconi[3], A. Lauterio[1], C. Sgrazzutti[2], I. Vella[1], L. Carbonaro[2], N. Incarbone[1], F. Rizzetto[2], M.G. Valsecchi[3], A. Vanzulli[2,4], L. De Carlis[1,5]

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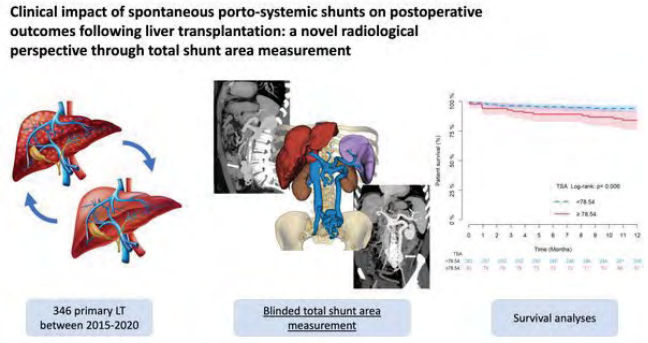
Background: The management of spontaneous porto-systemic shunts (SPSS) in liver transplantation (LT) is still debated. Some evidence supports intra-/peri-operative ligation or embolisation in order to enhance the portal flow to the liver allograft, while other researches have failed to show a detrimental effect on postoperative outcomes of LT when SPSS are left untouched.
The impact of SPSS on the natural history of cirrhotic patients has been recently evaluated through the measurement of total shunt area (TSA), a novel tool that allows for a comprehensive assessment of the extension of SPSS, identifying a direct correlation of higher TSA with lower patient survival.
Our study aimed to assess the impact of TSA on the development of early allograft dysfunction (EAD), acute kidney injury (AKI), graft and patient survival following LT.
Methods: Preoperative imaging of 346 cirrhotic patients undergoing primary LT between 2015 and 2020 were retrospectively revised, recording the size and anatomy of each SPSS in order to calculate TSA.
None of the SPSS was peri-operatively treated, allowing for direct assessment of their effect on perioperative LT outcomes.
The impact of TSA and selected patient and donor characteristics on the development of EAD and AKI was evaluated through uni- and multivariate logistic regression, while their effect on graft and patient survival was investigated through Cox-regression analysis.
Results: A TSA exceeding 78,54 mm^3 was identified as an independent risk factor for the development of EAD (OR: 2.332; p=0.004) and grade 3 AKI (OR: 2.197; p=0.033).
Moreover, higher TSA was significantly related to early graft and patient survivals, emerging as an independent risk factor for 12-months graft loss (HR: 3.436; p=0.010) and patient death (HR: 2.792; p=0.009).



Conclusions: Higher TSA significantly affected postoperative outcomes following LT, supporting the need for careful management of patients presenting multiple/larger shunts.

LB-0-05

Effect of ursodeoxycholic acid on liver regeneration capacity after living donor hepatectomy: a prospective, randomized, double-blind clinical trial

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Background: Ursodeoxycholic acid (UDCA) has multiple hepatoprotective activities: it modifies the bile acid pool, decreases levels of endogenous, hydrophobic bile acids while increasing the proportion of nontoxic hydrophilic bile acids. It also has a cytoprotective, antiapoptotic, and immunomodulatory properties. The aim of this study was to analyse the effect of postoperative administration of UDCA on liver regeneration capacity.
Methods: This is a single centre, prospective, randomised, double-blind study that was carried out in our Liver transplant Institute. Sixty living liver donors (LLDs) were divided into two groups using the simple randomization technique: One group received oral UDCA 500mg 12 hourly for 7 days (study group) from first postoperative day and the other didn't received any additional treatment (control group). Both group were compared in terms of the following parameters: clinical and demographic parameters, liver enzymes (ALT, AST, ALP, GGT, Total bilirubin, Direct Bilirubin) and INR.
Results: A total of 60 patients were recruited in to the study and grouped into two. Thirty received UDCA and 30 didn't receive any additional therapy. The median age in study group is 31 years with a range of 18-50 years. The median age of control group is 24 years with a range of 19-47 years. Liver enzymes and INR showed significant differences at various times within the first 7 post operative days. International normalised ratio was lower in study group on 3 and 4 post operative days. However, GGT was significantly lower at days 6 and 7 for study group. Total bilirubin

was also significantly lower at day 3 for the study group patients but ALP was lower all through day 1 to day 7. Significant difference was also observed in AST at days 3,5 and 6.
Conclusions: Postoperative administration of oral UDCA significantly improves liver enzymes and INR among LLDs.

LB-0-06

130 totally robotic donor hepatectomy: reproducibility of a standardized technique across 2 specialized centers

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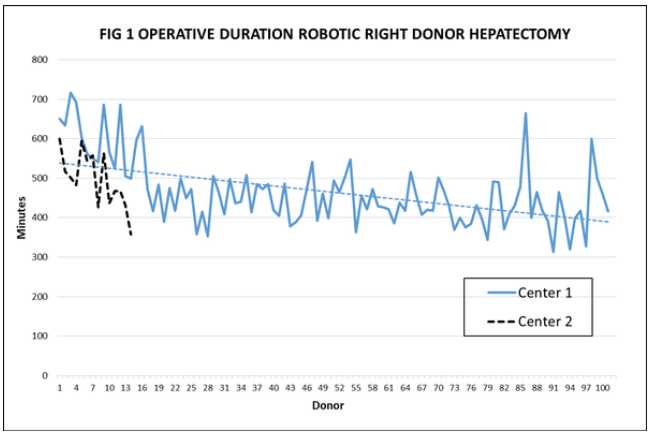
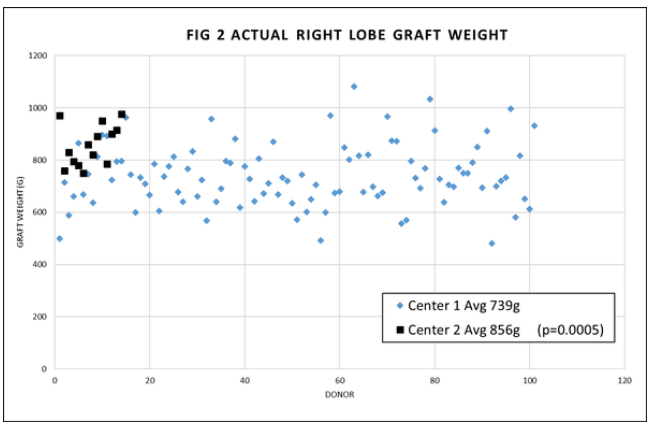
Background: Robotic surgery is emerging as a feasible though complex technique to enable minimally-invasive donor hepatectomy
Methods: First multicenter prospective study on 130 consecutive totally robotic donor hepatectomies using a standardized technique in 2 liver transplantation centers from 2016-2020. Donor demographic, operative and outcome data were collected. Standardization of surgical technique were ensured with initial in-person training and proctoring followed by regular video analysis.
Results: We performed 115 right (RH), 7 left and 8 left lateral segment robotic donor hepatectomy procedures. Average donor age 33, and weight 64.8kg. Majority of RH grafts had a single artery (99.1%), portal vein (89.6%) and bile duct (69.6%) for anastomoses. Most common arterial and bile duct anatomies were standard (88.7%) and Type 1 (74.8%; Korean classification). Average RH operative duration was 468mins; both centers showed improvement in this metric with experience (Fig1). Average RH EBL was 127mls; 3 donors were transfused. No cases were converted to open or laparoscopic approach. There was significant difference in RH graft weights between the 2 centers (Fig2). Donors were started on solid diet on POD#1.3. Average highest recorded post-RH total bilirubin and INR were 2.6mg/dL and 1.4 respectively. Most common RH complications were bile leak (4.3%) and bleeding requiring transfusion (2.6%). Rate of serious complications (Clavien ≥3) was 7.0% with zero mortality. There were no difference in overall or serious complication rates between the 2 centers.





Conclusions: Our standardized technique for totally robotic donor hepatectomy, though complex and relatively novel, can be reproduced in another center with appropriate training, regular evaluation of surgical technique and prospective monitoring of outcomes.

LB-0-07

Excellent contemporary outcomes following pediatric liver retransplantation: an experience from a high-volume liver transplant centre in the United Kingdom

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Background: Pediatric liver transplantation has excellent long-term results. However, there have been relatively few reports on retransplantation in children. Previous reports suggest inferior graft

and patient survival to primary retransplantation. We report a single centre experience over 30 years.

Methods: Retrospective cohort analysis of all pediatric liver retransplantations (<17 years of age) between 1990-2019 in a single centre in United Kingdom were done and 1-, 5-, and 10-year outcomes were studied over three different eras (Era 1= 1990-1999, Era 2= 2000-2009, Era 3= 2010-2019). Univariate and multivariate analysis of risk factors were performed.

Results: Between January 1990 and December 2019, 1324 pediatric liver transplantations were performed. Among them, 143 were liver retransplantations performed in122 children (10.8%). Survival following pediatric retransplantation improved in the third era, with patient survival at 88.8% in 1 year, 85.8% in 5 years and 75.1% in 10 years (p=0.038), and graft survival of 88.6% at 1 year, 85.4% at 5 years, and 73.2% at 10 years (p=0.0088). Transplantation in Era 1 and 2, two or more retransplants, preoperative serum creatinine, serum bilirubin, and ICU stay going into retransplantation led to worse outcomes on univariate analysis. Higher preoperative creatinine was the only influencer on multivariate analysis. No donor/graft variables demonstrated association with outcomes.

	Patient survival (%)			Graft survival (%)		
	1-y	5-y	10-y	1-y	5-y	10-y
Era 1	64.8	55.5	55.5	56.6	47.1	45.2
Era 2	77.1	67.4	67.4	75.2	61.7	57.7
Era 3	88.8	85.8	75.1	88.6	85.4	73.2

Conclusions: The study shows excellent contemporary survival following pediatric liver retransplantation. Access to retransplantation makes an important contribution to overall survival in children. Subsequent transplants may be considered in carefully selected patients.

LB-0-08

Hepatic venous pressure gradient (HVPG) measurement to predict intraoperative bleeding in liver transplantation

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Background: Liver transplantation (LT) is associated with a high risk of bleeding, of transfusion and of vasopressors requirement. Currently, MELD, reflecting liver function, and platelet count, reflecting portal hypertension are used to predict intraoperative course, but their accuracy is limited.The aim of this study was to analyze the ability of hepatic venous pressure gradient (HVPG, reflecting portal hypertension) and of cardiopulmonary pressures measurements to predict of intraoperative bleeding risk and norepinephrine requirements.

Methods: Retrospective observational study, including all patients with cirrhosis who underwent, between 2010 and 2020, liver and right heart catheterization as part of their pre-transplantation assessment. Statistical analysis used appropriate nonparametric tests and logistic regression.

Results: 468 patients were included (median: 57 years, MELD 16; 56% alcoholic cirrhosis). Variables associated with blood loss, red blood cell transfusion, and/or norepinephrine requirements by univariate were included into a multivariate regression analysis shown in table 1. The risk of blood loss > 1L, of transfusion > 2U and norepinephrine > 3 mg/h was markedly increased in patients with HVPG≥16 mmHg and even more in those with HVPG≥20 mmHg (Fig. 1).

Table 1	**Blood loss >1 liter** RR [CI 95%] (p value)	**Red blood cell transfusion >2U** RR [CI 95%] (p value)	**Maximum norepinephrine dose >1 µg.kg-1.min-1** RR [CI 95%] (p value)
Hepatic venous pressure gradient	1.04 [1.01-1.07] **(p=0.02)**	1.05 [1.01-1.08] **(p<0.01)**	1.04 [1.02-1.07] **(p<0.01)**
Systemic vascular resistance	1.00 [0.99-1.00] (p=0.53)	1.00 [0.99-1.00] (p=0.38)	1.00 [0.99-1.00] (p=0.55)
MELD score	1.05 [1.03-1.08] **(p<0.01)**	1.10 [1.07-1.13] **(p<0.01)**	1.03 [1.00-1.05] **(p=0.03)**
Preoperative platelet count	1.00 [0.99-1.01] (p=0.80)	1.01 [1.00-1.01] **(p=0.02)**	1.00 [0.99-1.00] (p=0.86)
Intraoperative temporary portocaval shunt	0.52 [0.30-0.91] **(p=0.02)**	0.71 [0.40-1.27] (p=0.25)	0.73 [0.42-1.25] (p=0.25)
Intraoperative infusion of tranexanic acid	0.72 [0.43-1.20] (p=0.21)	0.65 [0.39-1.10] (p=0.11)	0.62 [0.38-1.00] (p=0.05)

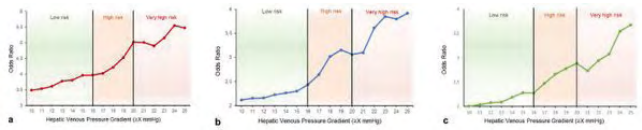

Fig. 1 Effect of different HVPG values on risk of a. RBCs transfusion>2U; b. Blood loss>1 liter; c. Maximum norepinephrine dose>1 µg.kg^{-1}.min^{-1}. HVPG Hepatic Venous Gradient Pressure

Conclusions: These results suggest that systematic measurement of HVPG during the preoperative evaluation of patients with cirrhotic allows a better identification of patients at risk of bleeding and of hemodynamic instability. It may help the clinician to anticipate intraoperative management.

Concurrent Oral Abstract Session: Late Breaking Abstracts II

LB-0-09

Predicting future trajectories of the waitlisted NASH patient using deep learning

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Background: Non-alcoholic steatohepatitis (NASH) cirrhosis candidates waitlisted for liver transplantation (LT) are older and have a higher risk of dropout while listed. Using DeepHit, a Machine Learning model, we conducted a competing risk analysis to predict the probability of a NASH LT candidate receiving an LT versus their probability of death over time using data at waitlisting.
Methods: Using data from 17,971 NASH patients listed for LT from 2002-2021 based on MELD score (excluding exception indications such as hepatocellular carcinoma), a DeepHit model was trained with death on waitlist as the primary event and LT as the competing risk. Stratified five-fold cross-validation was used to split data and account for imbalanced labels. Within each training set, 20% was reserved as validation sets for model training and hyperparameter tuning. The best-performing model and hyperparameters were chosen based on average concordance index (C-index) during validation. The model was tested using the test set where the event-specific C-index and Brier score were evaluated at the 25th percentile (1 month), median (5 months), and at 1 year on the waitlist.
Results: The model achieved a C-index for events of death and transplant by one month after listing of 0.892 (sd=0.015) and 0.852 (sd=0.008), respectively. The Brier score for the two events were 0.240 (sd=.002) and 0.214 (sd.004). The C-index decreased marginally at 5 months and 1 year (Table 1). Prediction of waitlist death and LT probability within 1 year of being waitlisted were achieved for patients in the test set (Figure 1).

		1 month	5 months	1 year
C-index	Event 1	0.8920000 (0.015)	0.799 (0.024)	0.760 (0.027)
	Event 2	0.852 (0.008)	0.814 (0.005)	0.778 (0.011)
Brier score	Event 1	0.240 (0.002)	0.472 (0.007)	0.600 (0.014)
	Event 2	0.214 (0.004)	0.371 (0.034)	0.428 (0.073)

Table 1. Cause-specific C index, Brier score and their standard deviations evaluated at 1 month, 5 months and 1 year. Event 1 is death on waitlist. Event 2 is receiving a liver transplant.

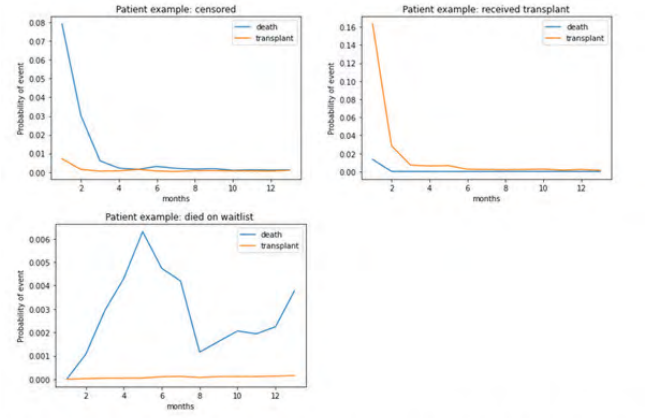

Figure 1. Prediction plots of probability of death on waitlist and probability of receiving liver transplant for NASH patients using the DeepHit model trained with patient waitlist data. Predictions for one patient from each of the event categories which include censored, received transplant, and died on waitlist, were demonstrated.

Conclusions: Our model can be used to predict NASH patient trajectories following listing for LT. Specific modifiable predictors of such risk can be elucidated for each patient to reduce risk of dropout/death on the waitlist.

LB-0-10

Decision-making tool for early liver retransplantation: the Early Liver Retransplantation Score (ELRS)

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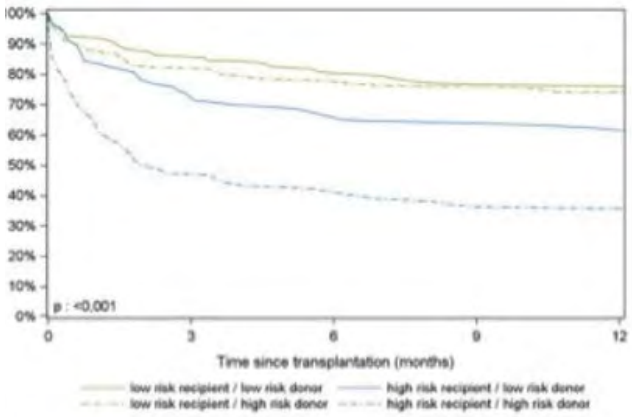
Background: Retransplantation of the liver (ReLT) is the only therapeutic option to treat early liver graft failure. Compared with first LT, patient and graft survival is worse after ReLT. Selecting the best graft/recipient combination is essential in order to optimize patient survival despite graft scarcity. The aim of this multicentric study was to establish a donor and a recipient ERLS to predict the risk of graft loss after early ReLT.
Methods: Using the Frenchnational transplantation database (CRISTAL), we analyzed all adult recipients who underwent a first or a second ReLT between 2007 and 2019 within the first 90 days post-LT (N=447). Patients were randomly divided in a 2:1 ratio into derivation (DC) and validation cohorts (VC), respectively. A global transplant risk score was first derived from the DC using variables from donors and recipients using a Cox model. and then tested in the VC. Two separate recipient and donor-risk scores have been built from this global score and were used to assess donor-recipient matching.
Results: The factors at retransplantation associated with 1-year graft loss were: For the donor: age>70, hypertension, BMI>25; for the recipient: MELD >35, mechanical ventilation, glomerular filtration rate

<60 ml/min, Re-LT after day 8 post-LT and the presence of at least 1 complication at ReLT*. The C-index of the final model was 0.66 in the DC. Correlation between observed and predicted graft-loss rate was close for the VC (r=0.80). Four risk levels ranging from 36% to 76% 1-year graft survival were identified from the matching of donor and recipient scores (Fig.1).



Score ELRS	N	1 month survival	3 month survival	1 year survival
low risk recipient / low risk donor	110	92.7% [86.0% - 96.3%]	86.4% [78.4% - 91.5%]	76.2% [67.0% - 83.1%]
Number of patients at risk		102	95	82
low risk recipient / high risk donor	136	88.2% [81.5% - 92.6%]	82.4% [74.8% - 87.8%]	74.1% [65.9% - 80.7%]
Number of patients at risk		120	111	99
high risk recipient / low risk donor	83	84.3% [74.6% - 90.6%]	72.3% [61.3% - 80.6%]	62.5% [51.1% - 71.9%]
Number of patients at risk		70	60	51
high risk recipient / high risk donor	118	63.6% [54.2% - 71.5%]	47.5% [38.2% - 56.1%]	36.4% [27.9% - 45.1%]
Number of patients at risk		75	56	43

Conclusions: ELRS provides a 2-step decision-making tool to guide clinicians through the selection of candidates for early retransplantation and to optimize donor-recipient matching to reduce the risk of graft loss.

* Gastrointestinal bleeding, hepatorenal syndrome, hydrothorax and pulmonary hypertension.

LB-O-11

AFP-L3 and DCP tumor markers strongly predict early hepatocellular carcinoma recurrence after liver transplantation and should be an LT exclusion criterion

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Background: Alpha-fetoprotein (AFP) predicts hepatocellular carcinoma (HCC) recurrence after liver transplant (LT) but remains an imperfect tumor marker. The role of DCP (des-gamma-carboxyprothrombin) and AFP-L3 (AFP bound to *Lens culinaris* agglutinin) in predicting HCC recurrence remains incompletely characterized. While retrospective analyses hint at the prognostic ability of AFP-L3 and DCP, prospective studies have yet to confirm these findings.

Methods: This prospective single-center cohort study enrolled 203 consecutive patients undergoing LT for HCC (within or down-staged to Milan) between 2017-2021 by measuring AFP, AFP-L3, and DCP at the time of LT with a primary endpoint of time to HCC recurrence.

Results: At LT, median biomarker values were AFP 5.0 ng/mL (IQR 3.0-16.0), AFP-L3 8.3% (IQR 0.5-13.4), and DCP 1.0 ng/mL (IQR 0.3-3.2). Most (94.1%) patients received pre-LT local regional therapy (LRT). After a median post-LT follow-up of 2.2 years, HCC recurrence was observed in 12 (5.9%) patients. AFP-L3 and DCP outperformed AFP with AUROCs of 0.81 and 0.87 respectively, compared with 0.73 for AFP. A dual-biomarker combination of AFP-L3 ≥15% and DCP ≥7.5 predicted 58% of HCC recurrences whereas among 189 patients not meeting this threshold, only 7 (3.7%) experienced HCC recurrence. The Kaplan-Meier recurrence-free survival at 3 years post-LT was 41.6% for patients with dual-positive biomarkers compared to 97.0% for all others(p<0.001) with a C-statistic of 0.74.

Figure 1:

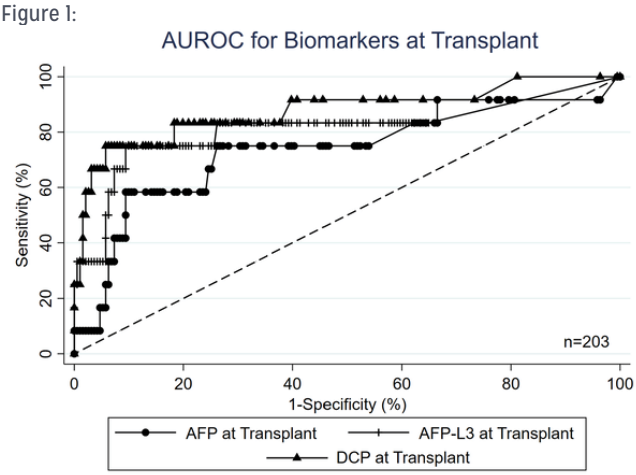
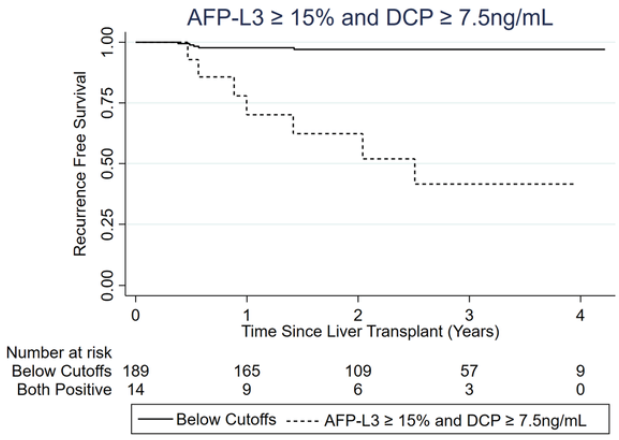


Figure 2:



Conclusions: Dual-positivity for AFP-L3 ≥15% and DCP ≥7.5 strongly predicted early post-LT HCC recurrence. This model could further refine LT selection criteria and identify high-risk HCC patients who likely should receive additional local-regional therapy with LT on hold until biomarker reduction is achieved.

LB-0-12

Role of non-tumor CCL11 in affecting CCR5⁺monocyte/macrophage activation and the immunosuppression of hepatocellular carcinoma

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Background: Tumor-associated macrophage has been well recognized in tumor microenvironment. We reported that M2-macrophages in adjacent non-tumor can promote hepatocellular carcinoma (HCC) invasiveness, leading to poor prognosis of patients (1). Here we aimed to investigate the role of CCL11 in modulating CCR5⁺monocyte/macrophage in tissue microenvironment of HCC.
(1) Yeung et al. Alternatively activated (M2) macrophages promote tumour growth and invasiveness in hepatocellular carcinoma. *Journal of Hepatology.*
Methods: The expression of CCL11-CCR5 signaling and monocyte/macrophage-specific markers in HCC were analyzed by qPCR and immunostaining. Their clinical relevance and prognostic value were analyzed by Pearson's test and Kaplan-Meier test. The functions of CCL11 in monocyte recruitment and macrophage activation were characterized*in vitro*.
Results: The non-tumor levels of CCL11 were significantly upregulated compared with tumor and normal liver (Fig. 1A). Non-tumor CCL11 was significantly associated with liver cirrhosis, tumor stages, distant metastasis and HCC recurrence (Fig. 1B, C). CCL11-receptor CCR5 was overexpressed i560pn non-tumor tissue and was colocalized with CD14 and CD68 (Fig. 2A). It suggested that CCR5⁺macrophages in non-tumor might play more critical roles than those in tumor (Fig. 2A). Moreover, HCC patients with CCR5^{hi}CD68^{hi}macrophages in non-tumor were significantly associated with poor survival (Fig. 2B). *In vitro*, CCL11 enhanced the recruitment of CCR5⁺monocyte (Fig. 3A) and activated it into CCR5⁺macrophage(Fig. 3B). Furthermore, non-tumor CCR5 was significantly correlated with CD4 (Fig. 4A) and Foxp3 (Fig. 4B) both in non-tumor and tumor tissue, indicating that activated CCR5⁺macrophage in non-tumor might be associated with the infiltration of Tregs, which may subsequently induce immunosuppression in HCC.

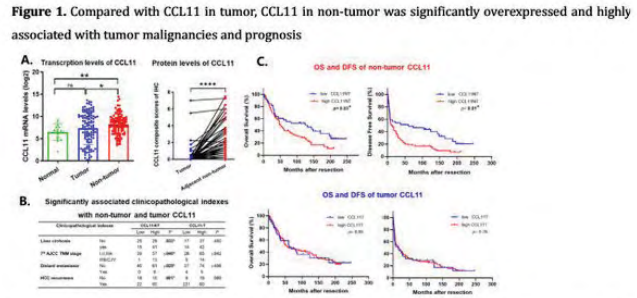

Figure 1. Compared with CCL11 in tumor, CCL11 in non-tumor was significantly overexpressed and highly associated with tumor malignancies and prognosis

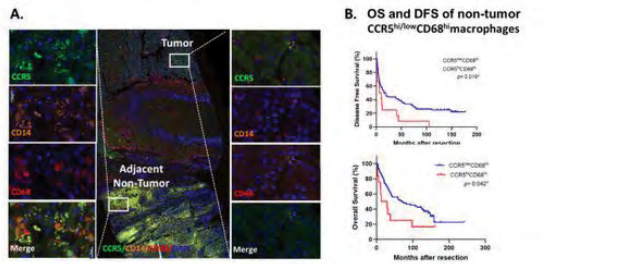

Figure 2. CCR5⁺macrophages in non-tumor might play more essential roles in HCC prognosis than CCR5⁺macrophages in tumor tissue

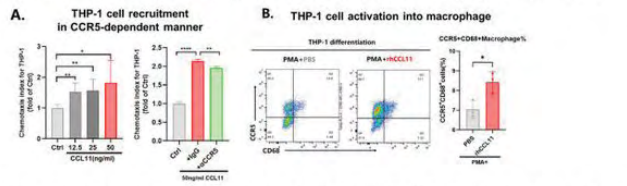

Figure 3. CCL11 promoted CCR5⁺monocyte recruitment and CCR5⁺CD68⁺macrophage activation *in vitro*

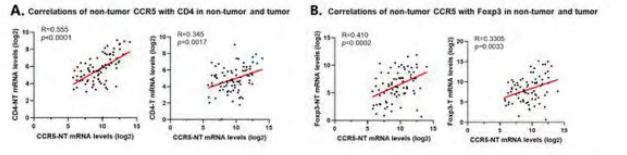

Figure 4. Levels of CCR5 in non-tumor were significantly correlated with CD4 and Foxp3 in non-tumor and tumor tissue, indicating the potential of CCR5⁺macrophage on inducing immunosuppression of HCC.

Conclusions: Overexpressed CCL11 in non-tumor tissuecould promote recruitment and activation of CCR5⁺monocyte/macrophage, which might induce immunosuppression in HCC and lead to poor prognosis.

LB-0-13

Benefits of fast track extubation following orthotopic liver transplantation

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Background: Fast-track extubation (FTE) after liver transplantation may be beneficial by reducing vasopressors requirements and duration of mechanical ventilation (MV). We investigate whether FTE is of clinical benefit - reducing vasopressor requirement, Acute Kidney Injury (AKI) and need for Renal Replacement Therapy (RRT).
Methods: Data were collected from consecutive adults undergoing deceased donor liver transplantation (May 2016 to December 2019) at the Royal Free Hospital. Multi-organ transplants, acute or acute-on-chronic liver failure, or patients who died <36 hours post transplantation were excluded. FTE was defined as immediate extubation in the operating theatre or <8 hours postoperatively. Primary outcome was the incidence of post-operative RRT. Secondary outcomes included; incidence and severity of AKI, duration of vasopressor support, ICU and hospital length of stay, reintubation requirement, mortality and dependency at three months post-transplantation.
Results: Data for 415 deceased donor transplant recipients were collected, 47 patients were excluded. Of the remaining 368 patients, 157 (42.7%) were FTE. A binomial regression model to generate a FTE propensity score was produced. Each additional APACHE II point and each unit of intraoperative blood transfusion reduced the likelihood of FTE by 9.6% and 17.7% respectively. Patients arriving in ICU during normal working hours were 2.6-fold more likely to be FTE.
216 patients, 108 in each cohort, were matched within 5% of their FTE propensity scores. A reduction in AKI stage 1 on postoperative day 1 and post-op RRT was observed in the FTE group vs non-FTE group (23.4% vs 36.4%, p=0.037 and 16.3% vs 7.5%, p=0.046 respectively). Vasopressor support and ICU stay was also significantly reduced in the FTE group vs non-FTE group (1 vs 2 days, p<0.001 and 3 vs 4 days, p<0.001 respectively).
Conclusions: FTE benefits both patients and institutions by reducing the requirements for organ support and length of ICU stay for patients.

LB-0-14

The role of portal vein pressure measurement in pediatric living donor liver transplantation

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[1]National Center for Child Health and Development, Organ Transplant Center, Tokyo, Japan, [2]Apollo Hospitals, Apollo Institute of Liver Sciences, Chennai, India

Background: We have reported several techniques to achieve adequate portal venous flow (PVF) which is a key component for good graft and patient outcomes after pediatric liver transplantation (PLT). However, the impact of the intraoperative portal vein pressure (PVP) on the post-transplant outcomes has not been described in PLT so far. Therefore we aim to examine the impact of intraoperative (PVP) on the early graft and patient outcomes.
Methods: We enrolled 211 recipients with biliary atresia with <10 kg body weight who underwent living donor LT (LDLT) between November 2005 to November 2021. We further divided the patients into two eras, pre PVP measurement era (Era1, n=115) and post PVP measurement era (Era2, n=96). We measured PVP at LDLT in 73 out of 96 patients in Era 2. PVP was measured at 3 different time points: after laparotomy (PVP1), after collateral interruption or before PV reconstruction (PVP2), and before abdominal closure (PVP3), respectively. PVF was simultaneously measured by a transit-time ultrasound flowmeter. Outcomes were compared between two eras as well as among low (<15 mm Hg) and high PVP3.
Results: The amount of ascites was larger in Era1 than that in Era2 at 14 days after LDLT (p=0.028). The incidence of portal vein complications in Era2 tended to be lower than those in Era1 (p=0.16). Among the patients in Era2, PVP3 was not related to the incidence of T-cell mediated rejection nor the amount of ascites. Furthermore, PVP3 was not related to PVF3. The 5 years patient and graft survival were significantly higher in Era2 than Era1 (Patient, 100% Vs 94.8%, p=0.028, Graft,100 % Vs 93%, p=0.015) respectively.
Conclusions: Regardless of PVP before abdominal closure, it is important to increase PVP before implantation as much as possible to achieve good graft function in the setting of PLT.

LB-0-15

Impact of donor age over 70 years in donation after circulatory death liver transplantation: a 15 years of experience

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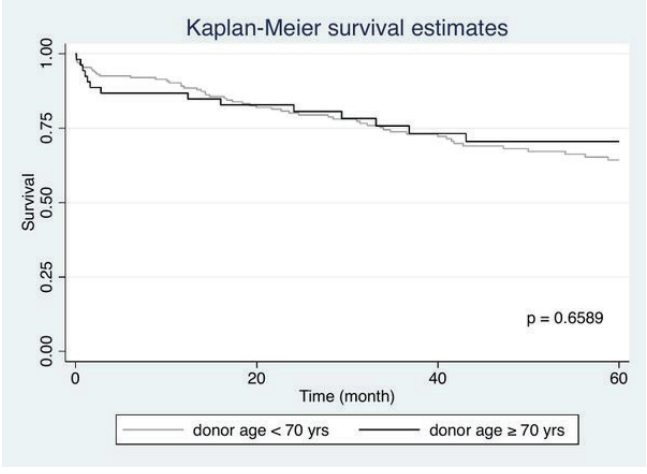
[1]CHU Liège, Liège, Belgium

Background: Advanced donor age has been identified as a risk factor in donation after circulatory death (DCD 3) liver transplantation (LT), associated with poor graft function and development of ischemic cholangiopathy. In this study, we evaluated the results after DCD 3 LT using grafts from donors over 70 years compared to younger grafts (<70 years).
Methods: We retrospectively analysed outcome after DCD 3 LT (n=228), comparing donors ≥70 years (n=53) and <70 years (n=175) from our center between 2003 and 2020. The two age groups were compared in terms of graft and patient survivals at 1, 3 and 5 years, in terms of

donor and recipient demographics, transplant conditions and laboratory values.

Results: The overall graft survivals at 1, 3 and 5 years were 88, 75, 70 per cent respectively. Graft survival rates were not significantly different at 5 years between the two groups (P = 0,536). No difference was noted in incidence of acute rejection, biliary strictures, hepatic artery thrombosis or retransplantation rates between the two groups. The time of cold ischemia was significatively lower in the older group (mean 235 min; SD 72) than in younger donor (mean 258 min; SD 72) (p=0.012). The posttransplant AST peak was significatively higher in the advanced age donor group than the second group with 2201±2703 U/L vs 1561U/L (SD 2151±2151 U/L), respectively (p= 0.04).



Conclusions: Results for DCD LT from 70-yr-old grafts were similar to those from younger donors. Advanced donors should not be discarded for liver donation if other donor risk factors (such as cold ischemia time and graft quality) are limited.

Poster Presentations: Advanced Liver Surgery

P-001

Gastric sleeve as an extra-anatomical roux for biliary reconstruction in a child's third liver transplant

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[1]University of Leeds, Leeds, United Kingdom, [2]St James's University Hospital, Department of Hepatobiliary and Liver Transplant Surgery, Leeds, United Kingdom

Purpose: We describe successful, innovative biliary reconstruction in a child's third liver transplant, using gastric sleeve as a Roux limb. This technique could prove a practical alternative to standard techniques in challenging biliary reconstruction.
Background: Paediatric retransplantation is not uncommon, due to the longevity of the children. With each retransplant, there are significant technical challenges. Ideally, biliary reconstruction is achieved by choledochocholedochostomy or choledochojejunostomy. We report a case wherein biliary reconstruction was complicated by 'short gut syndrome', needing technical innovation.
Case Presentation: The patient was diagnosed with biliary and ileal atresia at birth. The latter required major small and proximal large bowel resection, leaving about 40cm of proximal small bowel. Her short gut precluded early Kasai portoenterostomy, so at age 1 her biliary atresia was treated by the first liver transplant. Fourteen months later, enteral failure led to dependence on total parenteral nutrition (TPN) which was further complicated by TPN-induced cholestasis, recurrent sepsis, and chronic graft rejection. After achieving enteral independency, a second liver transplant was performed with choledochoduodenostomy. Consequently, she suffered recurrent episodes of cholangitis. These episodes contributed to graft failure by age 14, indicating a third transplant. To prevent cholangitis in the third graft, it was pertinent to avoid another choledochoduodenostomy. The innovative solution was a gastric sleeve Roux limb between the donor bile duct and the child's duodenojejunal flexure.
Outcome: Patient is well 8 years following the third liver transplant with normal graft function and maintained on dual immunosuppression.
Discussion: This is the first report of a gastric sleeve Roux limb for biliary reconstruction. This could be an important armamentarium for a surgeon in difficult retransplants and in patients with short gut syndrome.

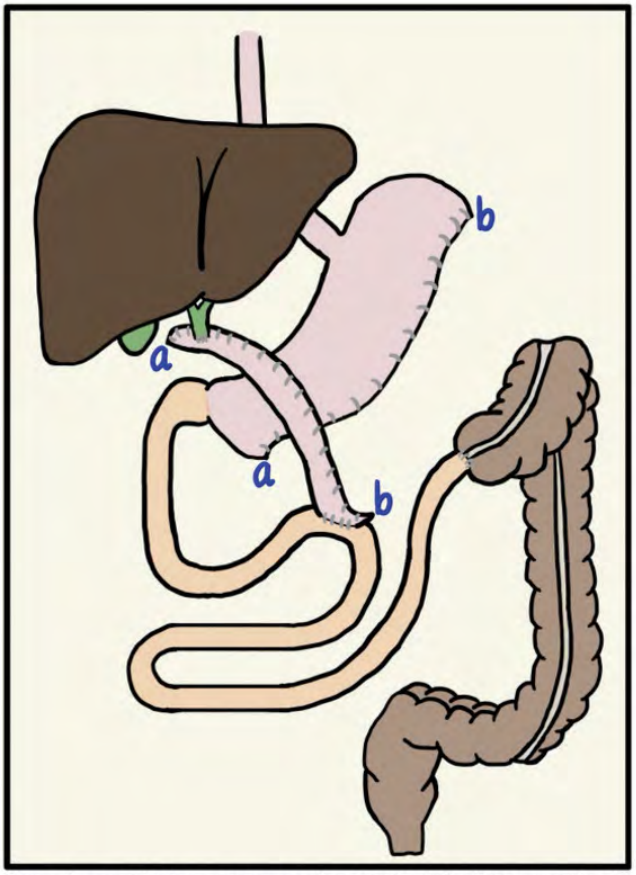

Figure 1 – gastric sleeve repurposed as Roux limb for liver transplant in paediatric patient with short bowel.

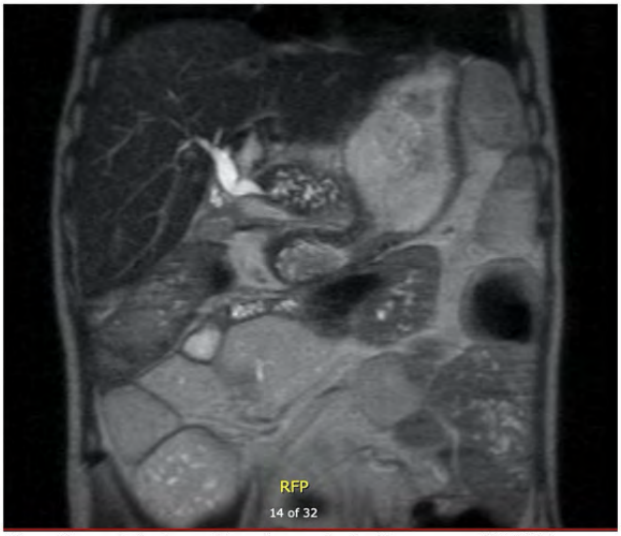

Figure 2 – gastric sleeve Roux demonstrated in a coronal MRCP image

P-004

Contemporary management of median arcuate ligament in liver transplantation

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Background: Median arcuate ligament (MAL) can impair arterial inflow through a newly anastomosed hepatic artery (HA) during orthotopic liver transplantation (OLT). Furthermore, approaches to ensure optimal vascular inflow in the presence of MAL are not standardised and include, HA reconstruction +/- release of MAL, aorto-hepatic jump graft (AHJG), laparoscopic interventions, radiological stenting of coeliac axis.
Methods: Based on the Cochrane systematic review protocol and PRISMA guidelines for reporting, this review explores the incidence of MAL, investigations, treatment options, and potential complications associated with MAL intervention in patients undergoing OLT.
Results: Incidence of MAL in patients undergoing OLT is between 1.6%- 12%. Majority (63.2%) had an open approach for their MAL intervention. HA thrombosis developed in 17% (7) patients without MAL intervention versus 2.6% (2) after MAL intervention. Seven grafts (5.9%) were lost after OLT in patients with MAL. Three (3.9%) patients developed arterial stenosis post MAL intervention.
Conclusions: We propose an algorithm for intraoperative assessment and management of liver transplant arterial inflow in the presence of MAL based on the HA flow changes with respiration, following clamping of recipient gastro-duodenal artery. A poor arterial flow with no variation with respiration and lack of evidence of aorto-iliac atherosclerosis indicates that an AHJG should be considered. In the presence of a 30-50% flow variation on respiration, the arterial inflow should be established preserving additional inflow from the recipient GDA. If flow remains poor, an open MAL release should be attempted prior to considering an AHJG.

P-005

Success in open surgical treatment of symptomatic polycystic liver disease: report from a single-center experience

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Background: Autosomal dominant polycystic liver disease (AD-PLD) is a rare hereditary disease often diagnosed due to significant and debilitating symptoms including abdominal distension, early satiety, weight loss, and abdominal pain due to hepatomegaly. Surgical management of AD-PLD includes cyst fenestration, partial hepatic resection, sclerosis and/or marsupialization, and in severe cases liver transplantation. The goal of operative management is resolution of symptoms, and resection is not a cure, rather, an intervention to resolve the significant symptomatology. This study demonstrates success of open operative management of symptomatic AD-PLD through the experience of a single-surgeon at a major academic medical center.
Methods: Twenty-four patients with AD-PLD were managed operatively from January 1996 to December 2020 at Oregon Health & Science University. Demographics, comorbidities, medical history, operative details, and follow-up data were reviewed. Detailed data was obtained regarding pre-operative and post-operative symptoms.
Results: The study cohort consisted of 24 patients (75% female). The median follow-up time was 11 months (range, 1-93 months). Nine patients (37.5%) had a history of previous laparoscopic or percutaneous treatment for symptoms, with subsequent recurrence. All patients had significant improvement in their symptoms following surgical treatment including partial resection, drainage, marsupialization, and sclerosis. Complications included ascites (16.7%) which resolved in all cases with diuretic therapy, postoperative ileus (12.5%), incisional hernia (20.8%), bile leak (8.3%), secondary bacterial peritonitis (4.2%), and pneumothorax provoked by central venous line placement (8.3%).
Conclusions: In patients with severe symptomatic AD-PLD, open surgical management including partial resection, drainage, marsupialization, and sclerosis provides an effective and definitive means for improving symptoms and quality of life with no major complications. Importantly, an open surgical approach offers long-term symptom relief to patients who have failed less invasive percutaneous and laparoscopic treatments.

P-006

Deceased donor organ flush with similar volumes of HTK and UW at a single U.S. organ procurement organization: adult and pediatric data

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Background: Histidine-tryptophan-ketoglutarate (HTK) and University of Wisconsin (UW) solutions are the two most commonly used preservation solutions. This study analyzes data from a single organ procurement organization to determine the actual clinical flush volumes used for HTK and UW for liver and pancreas grafts.
Methods: All procurements at Indiana Donor Network were analyzed (2016-2021). Variables included procuring center, solution, volumes, and vessels flushed. Donation after circulatory death (DCD) and pediatric procurements were analyzed separately.
Results: Data were analyzed from 1100 organ donor records. Of 877 non-DCD adult liver procurements, the majority of grafts were preserved with HTK (HTK n=792, 90%; UW n=85, 10%). Total volume was higher for UW (7L UW vs 4.5L HTK, p=<0.001), with higher volumes

of UW used in aortic flush (4L UW vs 3L HTK, p=0.01) and similar volumes for in-situ portal flush (2L UW vs 2L HTK, p=0.02). Volumes of UW and HTK were similar in DCD procurements. Of 206 non-DCD adult pancreas procurements, more UW was infused (4L UW vs 3L HTK, p=0.04). All DCD pancreas procurements used HTK. Solutions were infused at a volume of 61mL/kg for non-DCD livers, and 46mL/kg for pancreas. Of 45 pediatric liver procurements, HTK and UW solutions were infused at similar volumes. Of 17 pediatric pancreas procurements, greater UW was infused (2.5L UW vs 2L HTK, p=0.07). Solutions were infused at a volume of 141mL/kg for liver and 86mL/kg for pancreas.
Conclusions: Organ flush volume for non-DCD adult liver and pancreas procurements is higher for UW than HTK and similar for DCD procurements. Among pediatrics, the volumes infused of HTK and UW were similar in liver procurements, but higher for UW in pancreas procurements. Much higher volume per kilogram is used in pediatric organs. Because low-volume HTK flush is commonly used, this practice may be considered as a cost-saving measure for procurements.

P-008

Clinicopathological characteristics and surgical outcomes of colorectal cancer with liver metastasis: is right-sided colon cancer a risk factor for unfavorable outcome after metastasis?

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Background: To stratify the clinicophathological characteristics and outcomes of the patient with colorectal cancer liver metastases (CRLM) treated with liver resection.
Methods: A data from 1504 consecutive colorectal cancer patients who underwent surgical procedures from January 2009 to December 2018 in a tertiary hospital were collected. Among them, 598 were found to have either synchronous (n=318) or metachronous (n=280) liver metastases (CRLM), liver resection being carried out in 167 of them. Risk factors for unfavorable outcome after liver resection were analyzed.
Results: The 5-year survival rates was 51.1% with median survival of 68.9 months in CRLM patients who underwent liver resections. On univariate analysis of risk factors for unfavorable outcomes, five factors were found to be significant: right-sided colon primary (P=0.03), disease-free interval <12 months (P=0.04), initial serum carcinoembryonic antigen (CEA) >200ng/mL (P=0.01), size of the largest CRLM > 5cm (P=0.03), and positive resection margin (P=0.01). In multivariate analysis, three factors: right-sided colon primary (P=0.04), CEA >200ng/mL (P=0.01), and positive margin (P=0.04); were significant and independent risk factors. Kaplan-Meier survival analysis of 1504 patients with colorectal cancer revealed no significant difference in long-term outcome according to the location of the primary cancer in patients without CRLM. However, the survival of patients with right-sided colon primary and CRLM was significantly poorer than those with left-sided primary and CRLM. In the analysis of synchronous CRLM, simultaneous resection showed no statistically significant survival benefit, compared to sequential resection.
Conclusions: By analyzing clinicopathological data and outcomes of the included patients, the risk factors for unfavorable outcomes were stratified. Poor outcomes of right-sided primary cancer in CRLM patients may suggest the role of adjuvant chemotherapy after liver resection is of a great importance. In synchronous CRLM, a minor liver resection combined with primary colorectal cancer surgery is a feasible approach. A careful patient selection, however, must be undertaken.

P-009

Inflow reconstruction for portal vein thrombosis in deceased donor liver transplantation

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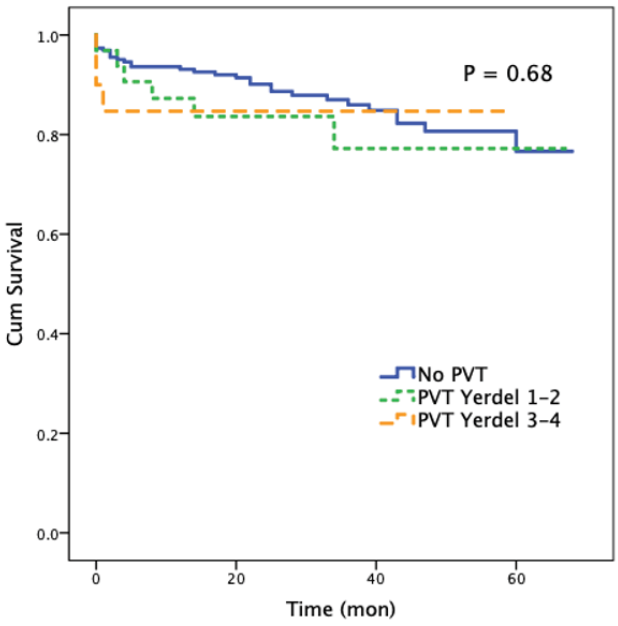
Background: Portal vein thrombosis (PVT) is a common complication of liver cirrhosis caused by discoagulation and impaired portal blood flow. Yerdel's classification is a widespread tool for defining the severity of PVT. According to it, 1-2 stages correspond to local thrombosis and 3-4 to severe. The last one remains a technically demanding and challenging condition for liver transplantation.
We aimed to provide additional data of PVT management in a high-volume Russian transplant center.
Methods: 282 DDLT was performed between January 2016 and September 2021. PVT has been presented in 55 cases (19.5%). Three cases were excluded from the analysis due to malignant thrombosis. The local thrombosis (stage 1-2) were presented in 32 cases. Twelve patients had a stage 3 PVT, and six patients had a Yerdel 4 stage PVT. Patients without PVT were analyzed as a control group (n=227).
Results: Conventional thrombectomy and end-to-end PV reconstruction were used in the local PVT group (n=29). Physiological (n=7) and non-physiological (n=1, reno-portal transposition without pre-existing shunt) techniques were applied in the severe PVT group. The reno-portal anastomosis was performed in 5 cases, including 4 cases of the pre-existing significant splenorenal shunt. The coronary-portal anastomosis was performed using a large left gastric (coronary) vein in two cases. And meso-portal jump-graft used in one case.

As shown in Figure 2, no significant difference in survival between the groups was evident. However, the group of advanced PVT (Yerdel3-4), was characterized by a higher rate of relaparotomy (p=0.006).



Conclusions: Sufficient portal inflow is necessary to secure graft and patient following the LT. Patients with advanced PVT may demonstrate outcomes comparable to non-PVT recipients if the appropriate surgical and perioperative strategy was chosen.

P-010

Living donor liver transplantation in unresectable huge hepatocellular caricinoma with congenital absence of the portal vein: a case report

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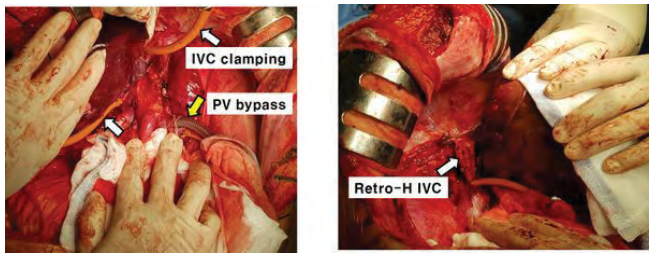

Fig 1. No tough total hepatectomy

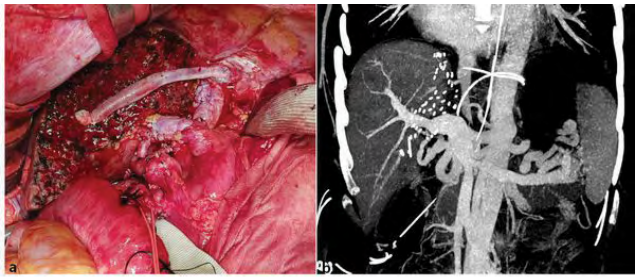

Fig 2. Post operative findings.

Congenital absence of te Portal Vein (CAPV) increased with the development of imaging techniques. A treatment method for HCC with CAPV has not yet been established. We report a transplant case of a patient with unresectable huge HCC with CAPV. A 34-year-old man visited the local hospital for reconstructive surgery after head trauma. A huge HCC was discovered incidentally during preoperative examination. He was healthy except for two head trauma. He visited our center for HCC treatment. Radical resection was impossible due to a large tumor of about 15 cm and multiple nodules suspected of hepatocellular carcinoma. He has a congenital absence of portal vein (CAPV) with a portal vein shunt. We decided to do LDLT. Prior to LDLT, embolization was performed twice to reduce tumor burden. LDLT underwent using right lobe from his brother on 28 March 2019. Before the liver mobilization we first did hilum dissection. The large collateral vein was dissected as long as possible. No-touch liver resection was performed with a left approach. (Fig 1.) The graft portal vein was anastomosed with a collateral vein. When the doppler was checked the post operative one day, Middle hepatic vein (MHV) and inferior right hepatic vein (IRHV) was undetected. We immediately inserted stents in the MHV and IRHV. He was discharged 14 days after surgery without further complications. (Fig 2.) The everolimus was added 1 month after transplantation and steroids were stopped 3 months after transplantation. He is doing well with no recurrence. Since hepatocellular carcinoma for CAPV is due to PV obstruction, LT may be a good choice for patients suffering from HCC with CPAV.

P-011

Simultaneous right lobe live donor liver transplantation and off-pump coronary artery bypass grafting

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Background: Advanced coronary artery disease is quite common among liver transplant candidates and is considered a contraindication for liver transplantation. On the other hand, liver failure also increases the risk for cardiac surgery. Thus, combined

liver transplantation and coronary artery bypass grafting might be an effective solution to overcome these concomitant severe conditions.

Methods: Among the 878 adult liver transplant recipients; two required combined liver transplantation and coronary artery bypass grafting. The cardiac procedure was performed off-pump on the beating heart and LIMA was used for LAD anastomosis while saphenous vein grafts were used for the RCA and OM (obtuse marginal) vessels. The first patient was 66 years old cirrhotic male due to HBV cirrhosis with a MELD score of 18 and severe CAD at LAD and RCA. The second patient was a 65 years old cirrhotic female due to NASH and HCC and severe CAD at LAD, RCA, and OM. Both patients underwent first coronary artery bypass grafting, then a right lobe live donor liver transplant procedure was performed.

Results: Both patients tolerated the procedures well and the postoperative courses were uneventful in the ICU in terms of heart and liver functions. They were discharged home on days 15 and 18 and are currently alive and well during the 10 and 43 months of follow-up.

Conclusions: Liver transplantation and coronary artery bypass grafting appear to be safe and effective in cirrhotic patients with advanced CAD. Patients seem to benefit most from multidisciplinary preoperative evaluation and coordination between cardiac and liver transplant surgery teams.

P-013

Management of hepatic duct in right lobe total robotic donor hepatectomy

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Description of the video:

Background: During right lobe (RL) total robotic donor hepatectomy (RDH), surgeons have different preferences of timing (early versus late) and techniques of right hepatic duct (RHD) division and closure, using Titanium clips, Hem-o-lok® clips, or suture closure. We describe our technique which is safe, reproducible and replicates the open technique. Of 3423 LDLT from 2004-21, 41 were RDH- the first 5 hybrid and 36 intended as total RDH. There were 4 conversions, while 32 were total RDH. Donors with graft size >1000gm, GRWR < 0.8%, donor remnant < 35%, multiple RIHV, >2 hepatic ducts, and Type C/D portal vein were excluded.

Technique: The RHD planning is done on preoperative 3D MRCP. After RL mobilization and cholecystectomy, the right hepatic artery is dissected on the right, from the undersurface of the bile duct with a needle driver and bipolar Maryland forceps. The inferior edge of the RHD is defined, the hilar plate lowered, the HD confluence and the left edge of the left HD identified. After 60-70% transection (including caudate), the HD confluence is displayed with traction on the cystic duct stump, and RHD(s) is/are divided with scissors. The HD stump is sutured with continuous 6-0 PDS; separately in case of multiple HDs. The remaining hilar plate is sharply divided, bleeding controlled with swab pressure and sutures. The transection is completed with the hanging maneuver. After graft removal, the hilar plate is oversewn with 6-0 PDS. HD stump is checked for leaks with methylene blue via the cystic duct.

Poster Presentations: Anesthesia / Critical Care Medicine / Acute Liver Failure

P-014

Prognostic value of intraoperative left ventricular global longitudinal strain in liver transplant recipients

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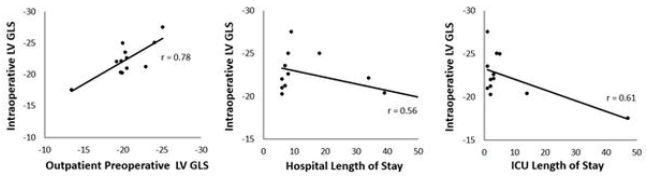
Background: Cirrhotic cardiomyopathy (CCM) in end-stage liver disease patients is characterized by abnormal cardiac function under states of stress. Recently, the CCM Consortium recommended utilizing left ventricular global longitudinal strain (LV GLS) to diagnose CCM. GLS represents the longitudinal shortening of myocardium during contraction and has been shown to be a predictor of postoperative outcomes, including in the liver transplant population. GLS has also been shown to be a more accurate indicator of LV function compared to traditional ejection fraction (EF). To date, there have been no studies of intraoperative GLS in liver transplant surgery. Here, we explore the utility of intraoperative GLS in predicting postoperative outcomes after liver transplantation.
Methods: We performed a single-center prospective observational study in patients undergoing liver transplant surgery who have had preoperative GLS calculated as part of their transplant evaluation. Intraoperative transesophageal echocardiography (TEE) images obtained prior to skin incision were used for LV GLS analysis. Patients were followed until hospital discharge. Our primary outcome was a composite of hospital length of stay, ICU length of stay, adverse cardiac events, and 30-day mortality.
Results: A total of 16 patients were enrolled with 4 patients excluded for poor-quality intraoperative TEE images. There was a strong correlation between preoperative and intraoperative GLS (r=0.78, p=.003). Intraoperative GLS was also correlated with hospital length of stay (r=0.56, p=.06) and ICU length of stay (r=0.61, p=.04). In contrast, there was no correlation of intraoperative EF to preoperative EF (r=-0.54, p=.07), hospital length of stay (r=-0.12, p=.71), or ICU length of stay (r=-0.08, p=.80).



Conclusions: Intraoperative LV GLS may provide prognostic value in postoperative outcomes after liver transplant surgery. In contrast, ejection fraction, in isolation, is not a reliable prognostic indicator.

P-015

Perioperative management of live donor liver transplantation: comparison of practice between the United States and the Republic of Korea

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Background: Living donor liver transplantation (LDLT) is an emerging alternative for deceased donor liver transplantation (DDLT). In the United States (US), LDLT represented 5.3% (442/8345) of all adult LTs while LDLT represented 74.8% (1118/1579) in the Republic of Korea. The authors conducted surveys of LDLT programs in both countries to explore patient management methods.
Methods: An electronic survey was distributed to the Directors of Liver Transplant Anesthesiology at LDLT programs in the US (n=37; identified via 2018 Scientific Registry of Transplant Recipients database) as well as in the Republic of Korea (n=16) between May and October 2021. The Quality & Standards Committee of the Society for the Advancement of Transplant Anesthesia (SATA) created the survey and collected responses in the US, while the Korean Society of Transplantation Anesthesiologists (KSTA) conducted the survey in Korea.
Results: The survey response rate was 100%.
Recipient: In both countries, there is no alteration from typical DDLT management. Most centers in the US selectively place a pulmonary artery catheter (PAC) while routinely use transesophageal echocardiography (TEE); in Korea, PAC and TEE are routinely used. Recipients in the US are routinely extubated in the operation room, while most recipients in Korea remain intubated at case end.
Donor: In the US, anesthesiologists participate in donor selection and pre-operative evaluation; they utilize enhanced recovery after surgery (ERAS) protocols and regional anesthesia techniques. However, in Korea, anesthesiologists are not typically involved in donor selection, nor do they rely on ERAS protocols or regional anesthesia techniques. Most centers in each country do not routinely utilize pre-operative autologous blood donation or intraoperative acute normovolemic hemodilution.
Conclusions: There are many similarities yet considerable differences in donor/recipient anesthetic management in LDLT between the US and Korea. These variations should be explored in more detail to assess their impact on patient outcomes.

P-017

Early extubation in liver transplantation

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Background: Early weaning from mechanical ventilation after liver transplantation (LT) is at the core of the debate on improving perioperative management of the recipient. We describe the application of early estubation in operating room (OR) and the clinical factor associated with early extubation.
Methods: prospective observational study of consecutive cadaveric LT at ISMETT from august 2018 to september 2021. The two groups extubated and not extubated in OR, were compared with t student and wilcoxon test. Univariate and multiple Logistic regression were applied to recocnize clinical factors associated with extubation.
Results:

Variable	Extubation in ICU=80	Extubation in OR=85	P value
Age	54.1 ± 9.8	56.7 ± 10	0.0900
BMI	26.9 ± 4.7	26.5 ± 4.2	0.5430
Child Pugh score	8.9 ± 2.9	7.4 ± 2.2	0.0003
Smoker	28(35%)	26 (31%)	0.5461
Surgery time (min)	460 ± 101	414 ± 94	0.0025
Anesthesia time (min)	633 ± 188	533 ± 93	<0.001
Colloid (ml)	1600 (1000-2250)	1250 (1000- 2000)	0.0085
RBC total units	3 (0-5)	0 (0-2)	<0.001
ICU stay (days)	5 (2-10)	3 (2-6)	0.0083

166 patient were enrolled: 85 patients (52%) were extubated in OR, 81 were extubatetd in ICU. Table 1 shows differences among the groups. Reintubation occured in 22 patients, 7 had been extubated in OR. Clinical factors associated with successful extubation in OR are: Child Pugh, Meld-NA, RBC transfused, colloids, Anesthesia time (all P values <0.005). The factors remained associated in a multiple model with extubation were: Child Pugh score(OR 0.86 [95% CI 0.72-0.99] p=0.046), intraoperative PRBC transfusion (OR 0.83 [95% CI 0.70-0.99] p=0.038).
Conclusions: Extubation in OR is feasible and safe. It is important to identify the correct timing of extubation for each patient, extubation should be timely and not early.

P-018

Intraoperative sodium shifts and the risk of developing osmotic demyelinating syndrome during liver transplantation

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Background: Hyponatremia is prevalent in end stage liver disease (ESLD). Large volume shifts, metabolic disturbances, and administration of hypertonic sodium-containing fluids including fresh frozen plasma and sodium bicarbonate are common during liver transplantation (LT). Severe hyponatremia is associated with increased mortality in LT populations; one cause of such mortality is Osmotic Demyelinating Syndrome (ODS)1. ODS is a devastating complication of rapid increases of serum sodium (referred to as Delta Sodium), which many patients undergoing LT experience2,3. We hypothesize that lower preoperative sodium in patients undergoing LT increases the risk of high Delta Sodium and ODS.
Methods: The incidence of ODS in a single center cohort of LT patients from 2013 to 2020 were evaluated. The association between ODS, Delta Sodium, and preoperative sodium levels were evaluated using multivariate logistic regression models including an interaction term between Delta Sodium and preoperative level.
Results: Preoperative sodium did not appear to be associated with increased ODS, R2 0.894, p = 0.17 in a multivariate logistic regression model. There was a trend of higher Delta Sodiums with higher rates of ODS, R2 = 0.343, p = 0.12.
Conclusions: While more severe hyponatremia is associated with higher rates of ODS, severe hyponatremia was also associated with higher Delta Sodium. Higher Delta Sodium is itself associated with increased risk of ODS4. However, for a given Delta Sodium, the risk of ODS did not seem to increase based on the severity of the hyponatremia. Therefore, though underpowered, this study suggests that increased rates of ODS in severe hyponatremia are not due to the severity of the hyponatremia itself, but rather that patients with severe hyponatremia are more likely to have larger Delta Sodium during liver transplantation. This is likely due to sodium content of blood products, fluids etc. administered, which cause larger increases in serum sodium in more severe hyponatremia.

P-019

Off the beaten track: 2D speckle-tracking strain analysis of left and right ventricular function during orthotropic liver transplantation

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Background: Liver transplantation (LT) surgery is a physiologically taxing procedure associated with significant alterations in cardiovascular function. Hypotension as a result of changes in intravascular volume, systemic vascular resistance, and metabolic composition have been well-described during liver transplantation. There is a paucity of data describing quantitative changes in right and left ventricular systolic function through the stages of LT.
Methods: 32 LT recipients were enrolled into this prospective, observational study. Pulmonary artery catheter (PAC, 30/32) and transesophageal echocardiography (TEE, 32/32) were utilized for intraoperative monitoring. TEE video clips were recorded at

pre-incision, anhepatic, neohepatic, and closing time points. Hemodynamic data recorded from the PAC were obtained at the same time points. TEE clips were processed post-hoc using a speckle-tracking strain echocardiography software suite to determine LV global longitudinal strain (GLS) and RV peak longitudinal systolic strain (PLSS.) Descriptive statistics of GLS, PLSS, and hemodynamic data were performed.
Results: Feasibility for performing speckle-tracking strain analysis was low for LV GLS (65%) and slightly better for performing RV PLSS (81%) at the pre-incision time point. Baseline GLS was –18.4% (S.D. 3.7; 95% CI -11.1% to -25.7%) and baseline PLSS –22.5% (S.D. 2.6; 95% CI –17.4% to –27.6%.) Both GLS and PLSS decreased in the anhepatic period, returning to near baseline at case conclusion. ANOVA calculation with Tukey's honestly significant difference confirmed statistical significance of these excursions.
Conclusions: Overall, feasibility for performing speckle-tracking strain is low in LT owing to difficulty in ideal image acquisition, distorted anatomy, and need for high-processing power from the image acquisition device. Speckle-tracking strain measures of left and right ventricular systolic function varied during LT. Additional analysis tying in hemodynamic data is needed to determine whether this reflects true changes in myocardial function or rather reflects the load dependent contributions to strain measurement.

P-020

Femoral-to-radial artery pressure gradient during reperfusion of living donor liver transplantation

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Background: The radial artery pressure is known to be frequently lower than the central pressure as reflected by femoral pressure in critical situations. This discrepancy may cause improper blood pressure management, but this has not been fully described during reperfusion of living donor liver transplantation (LDLT).
Methods: From November 2017 to April 2019, we consecutively enrolled adult LDLT patients with well-functioning radial and femoral artery cannulations during reperfusion. We presented blood pressures shown by radial and femoral artery cannulations at every minute starting from one minute before reperfusion to five minutes after reperfusion and estimated the difference. With a definition of mean blood pressure difference ≥10 mmHg between radial and femoral artery cannulations, we also provided the incidences of a significant femoral-to-radial pressure gradient every minute before and after reperfusion.
Results: Among 130 patients, 76 (58.5%) showed a significant femoral-to-radial pressure gradient from one minute before to five minutes after reperfusion. The incidence of a significant femoral-to-radial pressure gradient tended to increase at reperfusion (6.9% to 13.1%) and the peak incidence was shown at one minute after reperfusion (35.4%). At 2 minutes after reperfusion, it started to decline (23.1%). The incidences of femoral-to-radial pressure gradient were 14.6%, 12.3%, and 12.3% at three, four, and five minutes after reperfusion, respectively.

	Radial artery (n=130)	Femoral artery (n=130)	P-value	Femoral-to-radial pressure gradient
1 min before reperfusion	75.7 (±17.1)	78.8 (±13.0)	0.11	9 (6.9)
At reperfusion	81.7 (±68.3)	79.7 (±13.8)	0.74	17 (13.1)
1 min after reperfusion	70.6 (±21.4)	79.1 (±16.0)	<0.001	46 (35.4)
2 min after reperfusion	59.6 (±19.5)	62.4 (±19.6)	0.26	30 (23.1)
3 min after reperfusion	66.2 (±22.0)	68.1 (±24.0)	0.51	19 (14.6)
4 min after reperfusion	75.4 (±20.4)	77.0 (±19.9)	0.53	16 (12.3)
5 min after reperfusion	79.3 (±20.3)	82.9 (±18.7)	0.14	16 (12.3)

Conclusions: A significant femoral-to-radial pressure gradient is common during reperfusion of LDLT, peaking at one minute after reperfusion. Considering that reperfusion is a critical step of LDLT procedure, femoral artery cannulation may be helpful in blood pressure management during reperfusion of LDLT.

P-021

Reperfusion syndrome in liver transplant after normothermic perfusion

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Background: Normothermic Machine Perfusion (NMP) may inhibit proinflammatory responses, attenuating reperfusion syndrome (RS) during liver transplantation (LT). We compared RS in patients receiving donor livers from NMP or cold storage (CS) preservation.
Methods: Retrospective analysis on 11 LT patients whose donor liver underwent NMP using Organox metra NMP device (Group-OX) and 11 LT patients receiving a donor CS liver (Group-CS). Groups matched between patients': age, sex, BMI, MELD score and donors': gender, BMI and storage time. We compared RS incidence, inotrope use (adrenaline dose during RS, total amount and number of patients on noradrenaline during LT), mean arterial pressure (MAP) drop and blood product replacement post reperfusion. Data was examined for normality, and compared using Fisher exact test (categorical data) or Mann-Whitney (continuous data).
Results: The table shows percentage MAP drop and total adrenaline amount was significantly lower in the OX-group. Total amount and number of patients on noradrenaline was similar between groups. Total fluids and blood products administered was less for OX-group, however not statistically significant.

	OX	CS	p value
Haemodynamics			
RS present % (n)	18 (2)	54 (6)	0.183
MAP drop %	15.8 (5.3-27.4)	40 (26.7-53.8)	**0.007**
Adrenaline (mcg)	0 (0-20) n=3	20 (0-50) n=8	**0.088**
Noradrenaline (mg)	2275 (582-7050) n=9	1850 (861-5620) n=9	0.780
Total fluids (mls)	5090 (3541-9977)	7419 (4787-9904)	0.365
Blood (mls)	410 (0-775)	600 (375-1000)	0.223
Fresh frozen plasma (mls)	1100 (730-1897)	1342 (1061-1412)	0.705
Platelets (mls)	0 (0-209)	170 (0-233)	0.223

Conclusions: We observed reduced incidence of RS in patients receiving NMP compared to CS livers, with improved haemodynamics and lower adrenaline requirements. Larger prospective trials are needed to appreciate impact on perioperative management and outcome.

P-024

Platanosides (PTS) decrease acetaminophen (APAP) hepatotoxicity by inhibition of KEAP1/NRF2 complex formation, C-JUN *N*-terminal kinase (JNK) activation and JNK/SAB interaction

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Background: Oxidative stress contributes to APAP hepatotoxicity. Here, we investigated the potential utility of PTS isolated from American sycamore trees in decreasing APAP hepatotoxicity and the mechanisms of action.
Methods: Male mice received APAP (300mg/kg, i.p.) were treated with PTS (isoforms *EE*, *ZZ*, *EZ*, *ZE*, 1:1:1:1; 10mg/kg, *ig.*) immediately (0h) or 2h after APAP. *N*-acetyl-cysteine (NAC, 300mg/kg *ip.*) was given 2h after APAP. Mechanisms of action of PTS were studied by a joint strategy of *in vivo* and *in-silico* studies.
Results: At 24h after APAP treatment, widespread centrilobular necrosis occurred in 46% of liver tissue and serum ALT increased to 11,200U/L. PTS treatment at 0h markedly decreased necrosis to 23% and serum ALT to 2,750U/L. PTS and NAC treatment at 2h after APAP decreased necrotic areas to 20% and 19% and ALT to 4,500 and 3,800U/L, respectively. PTS also inhibited proinflammatory cytokine IL-1β formation and neutrophil infiltration after APAP overdose. APAP hepatotoxicity is linked to NAPQI formation, oxidative/nitrative stress, JNK activation and binding to Sab. *In silico* studies showed that PTS bind poorly to Cyp2E1 but are good ligands for the binding pockets of inducible nitric oxide synthase (iNOS), JNK, and the Keap1/Nrf2 complex, the last likely promoting dissociation of Nrf2 from Keap1. After APAP overdose *in vivo*, iNOS, 3-nitrotyrosine (3-NT), 4-hydroxynonenal (4-HNE) adducts increased, persistent JNK activation occurred, and JNK/Sab binding increased. PTS (0h) increased Nrf2 and thioredoxin-1 expression but decreased 4-HNE, iNOS, and 3-NT after APAP, indicating suppression of oxidative/nitrative stress. PTS also markedly inhibited JNK activation and binding to mitochondrial protein Sab after APAP overdose.
Conclusions: PTS represent a promising new class of liver protective agents for prevention and therapy of APAP hepatotoxicity with protection comparable to NAC. PTS appear to be protective via a polypharmacological mechanism involving decreasing oxidative/nitrative stress and preventing persistent JNK activation in addition to Sab interactions.

P-027

Risk factors for high intraoperative blood product requirement during liver transplantation

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Background: Liver transplantation (LT) is the most effective treatment for patients with end-stage liver disease. In general, the impaired coagulation profile and the presence of portal hypertension greatly increase in LT candidates the risk for severe bleeding. In particular, coagulopathy can develop or exacerbate during surgery in the anhepatic and/or neohepatic phases, when the metabolic graft liver function is still deficient, and hyperfibrinolysis and/or platelets sequestration in the graft occurs. In addition, previous liver surgery seems to predispose to an increased bleeding.
Methods: Data collected in 219 adult LT from deceased donor, grouped according to HTR (defined as the need of 5 or more red blood cell units), were compared. Logistic regression analysis was performed. Results were expressed as odds ratio with 95%CI.
Results: We found that previous portal vein thrombosis, hemoglobin, International Normalized Ratio (INR) at transplant and veno-venous by-pass independently predicted HTR (Table 1). HTR was always associated with poorer outcomes, including higher simplified acute physiology II score at Intensive Care Unit admission (p=0.0005), higher rates of pulmonary infections (p=0.0015), early rejection (p=0.0176), longer requirement of mechanical ventilation, (p<0.0001), more frequent need for hemodialysis after transplantation (p=0.0036), overall survival (p =0.0010) and rate of day-90 survival (p=0.0016), (Table 2).

Table 1. Multivariate analysis for a high transfusion requirement.

Variable	*p value*	Odds Ratio	95% CI
Portal vein thrombosis	0.0156	4.00	1.30-12.31
Hemoglobin, g/dL	<0.0001	0.67	0.57-0.79
INR	0.0010	2.40	1.42-4.06
Veno-venous by-pass	0.0048	3.82	1.50-9.70

Table 2. Effect of high transfusion requirement (HTR) on main clinical outcomes obtained at day-90 follow-up

Variable	No HTR (n = 94)	HTR (n =1 25)	*p value*
SAPS-II	31 (23-47)	39 (31-51)	**0.0005**
Mechanical ventilation, hours	18 (14-24)	36 (18-68)	**<0.0001**
Pulmonary infections	3 (3.2)	20 (16)	**0.0015**
Hemodialysis post-LT	0	10 (8.0)	**0.0036**
^Early rejection	11 (11.7)	27 (21.6)	**0.0176**
ICU LoS, days	4 (3-6)	6 (4-10)	**<0.0001**
post-LT RBC units	0 (0-1)	1 (0-2)	**0.0003**
post-LT FFP units	0 (0-0)	0 (0-0)	0.5487
post LT PLT units	0 (0-0)	0 (0-1)	**<0.0001**
Day-90 survival, %	97.8 (92.5-99.7)	85.6 (78.2-91.2)	**0.0016**

^ data of 5 patients were missing.

Conclusions: Given the negative impact exerted by RBC on LT outcome[1], identified specific risk factors for HTR and confirmed the negative impact on clinical outcomes, including recipient survival. Prospective investigations are worth to assess whether correcting pre-transplant Hb and INR levels may effectively reduce blood product need and improve prognosis.

1. Avolio AW, Franco A, Schlegel A et al. Development and Validation of a Comprehensive Model to Estimate Early Allograft Failure among Patients Requiring Early Liver Retransplant. JAMA Surg 2020; 155: e204095.doi:10.1001/jamasurg.2020.4095.

P-028

Octreotide infusion and intraoperative transfusion requirements during orthoptic liver transplantation

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Background: High portal venous pressure contributes to blood loss during liver transplantation (LT). Octreotide is an established treatment for reduction in portal pressure. We compared transfusion requirements of patients receiving Octreotide against a control group.

Methods: Retrospective analysis of 12 patients who received octreotide infusion 50mcg/hour (OT group), and 33 patients in the control group (CT). Outcome measures included volume of blood, blood products and fluids administered intraoperatively. Data was analysed using Mann-Whitney U or Student t-test where appropriate.

Results: There was no significant difference between the groups in age, aetiology of liver disease, graft type, Childs Pugh score, baseline haemoglobin, platelet count, fibrinogen and thrombo-elastography (TEG) parameters. Baseline International Normalisation Ratio (INR), Model of End Stage Liver Disease (MELD) and United Kingdom End Stage Liver Disease (UKELD) risk scores were higher in the OT group.

Of all blood (Packed Red Cells (PRC) and Cell Salvage Blood (CSB)), blood products (Fresh Frozen Plasma (FFP), platelets, cryoprecipitate, colloid and crystalloid infusions), only significantly higher volume of FFP in CT group (Median 0 (0-3545)ml vs 1225 (0-19200)ml, p=0.013) and significantly higher volume of CSB (Mean 2500 (500-6000) ml vs. 0 (0-3000)ml, p<0.01) in OT group were observed. The absolute volume of PRCs was lower in the OT group (279.5 ((0-4148)ml vs 887 ((0-17138)ml, p=0.078), however not statistically significant.

Conclusions: A high prognostic scores (MELD and or UKELD) and increased INR, associated with increased blood loss, in the octreotide group may have confounded our results. Further limitations were our limited sample size and short-term outcome measures in a complex patient group undergoing complex surgery. We conclude that octreotide warrants larger scale investigation as a low risk intervention with a theoretical potential to improve patient outcomes.

Like other studies, we were not able to demonstrate a clear benefit of octreotide in reducing transfusion requirements during LT.

P-029

Severe triple vessel coronary artery disease diagnosed two days after liver transplantation: a case report

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A 66-year-old man with alcohol-related liver cirrhosis and type-2 diabetes mellitus but no further risk factors for ischaemic heart disease and excellent functional capacity, underwent transthoracic echocardiography (TTE) and dobutamine stress echocardiography (DSE) as part of his work up prior to orthotopic liver transplantation (OLT). His TTE showed no regional wall motion abnormality (RWMA) and normal biventricular function but an estimated PASP of 50mmHg, which was subsequently confirmed with right-heart catheterization (PA pressure 48/16mmHg; mPAP 28mmHg). During DSE he developed asymptomatic inferolateral ST depression at a workload of 9.5 METS. There were no RWMAs, and he achieved a maximum heart rate of 83% predicted. 10 years prior to this, he had a positive treadmill test at a routine health check, which lead to coronary angiography that was normal. On advice of the cardiologists, the patient did not undergo further cardiac investigation prior to OLT.

He was monitored intraoperatively with continuous ECG, invasive arterial blood pressure, a pulmonary artery catheter

and transoesophageal echocardiography (TOE). Baseline ECG was unremarkable. Induction of anaesthesia, dissection and anhepatic stages were uneventful but on reperfusion he developed marked ST depression in the inferior leads. Mean arterial pressure and cardiac output were maintained (MAP 83mmHg, CI 2.4-3.7L/min/m^2) and his TOE did not show any RWMAs. After administering a glyceryl-trinitrate infusion (2mg/hr) and 20mmol magnesium sulphate the ST depression resolved. At skin closure, these ECG changes reoccurred, but no with no evidence of cardiac compromise (CI 4.1L/min/m^2; 0.16mcg/kg/min noradrenaline).
After being extubated in theatre and well on the critical care unit, he was discharged to the ward on day 2, but subsequently developed chest pain, pulmonary oedema and anterolateral ST depression with elevated troponin. TTE showed multiple RWMAs and coronary angiography revealed severe triple vessel disease. He was scheduled for coronary artery bypass grafting one-month post-OLT.

P-031

First hybrid robotic liver transplantation - a case report of anaesthesia management

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Introduction: Building on significant experience of robotic living donor hepatectomy, this report highlights the safe practice of a hybrid approach in the hepatectomy phase of living related liver transplantation.
The planned liver transplant procedure was divided into two steps. The first step was a total hepatectomy, performed using the Robotic da Vinci ® Surgical System, in a minimally invasive fashion. During the hepatectomy, the cirrhotic liver was safely dissected through standard four robotic arms ports and one assistant operated 12 mm trocar inserted via umbilicus. The second step was transplant of the graft via midline incision instead of classical Mercedes Benz incision.
Case report: On arrival in the operating room anesthesia was induced with propofol, fentanyl and atracurium; two arterial lines, CVC and 8 Fr sheath were placed. Anesthesia was maintained with oxygen and air mixture, sevoflurane, and infusions of fentanyl and atracurium. During the procedure she required minimal doses of nor-epinephrine and epinephrine infusions.
Robotic phase was associated with hemodynamic stability achieved, with goal directed fluid management, less blood loss and minimal use of blood products; intra-peritoneal pressure was curtailed with myorelaxation; coagulation management was guided by Thromboelastography (TEG) and acid base & electrolytes balance optimization. Due to precise robotic dissection, the next stages especially post-perfusion phase remained uneventful.
This approach with comparatively small incision required less analgesic control and hence no post operative nausea and vomiting. Anaesthesia was reversed, trachea was successfully extubated, and the patient was transferred to intensive care unit uneventfully.
Conclusion: The number of minimally invasive robotic surgeries is growing globally, due to the advantages including clearer imaging, accuracy, stability, and range of motion, translating into reduced peri and post operative complications. Early recovery and mobilization due to smaller incisions leads to greater patient satisfaction, especially in long awaited liver transplant recipient's patients.

P-032

Fast tracking and early on table extubation following living donor liver transplantation, can we expand the criteria?

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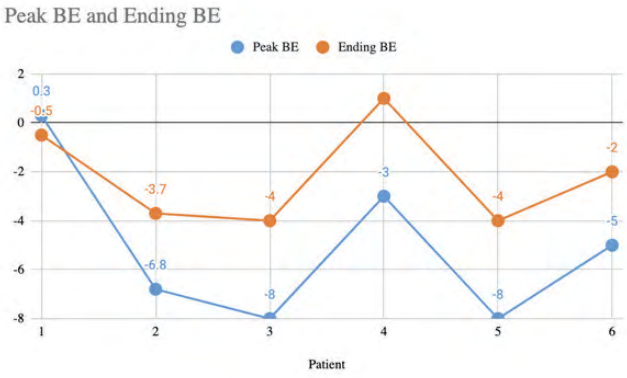
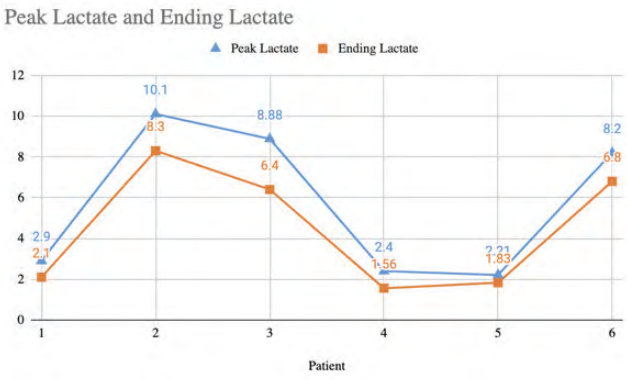
Background:
Traditionally, patients were kept intubated for 48 hours in the postoperative period.
Living donor liver transplantation poses a different set of challenges.
Most of the predictors mentioned in the literature were, low MELD, low BMI, and with stable comorbidities etc. for early extubation following living donor liver transplantation.
We assessed the feasibility of fast tracking and early extubation in our patients, who were not fitting in those mentioned predictors in the literature.
Methods: We present a case series of 6 patients who were fast tracked and extubated early, following living donor liver transplantation, out of 22 patients over the last 6 months.
Results:
All these patients were aged more than 45 yrs, with an average age of 55.8 yrs, average MELD score of 20.8, Child status C, some of our patients had cardio pulmonary comorbidities.
patient 2, was COPD, post asymptomatic COVID, with CoRad score3 on HRCT,
patient 5, was class 3 obese with no OSA,
patient 6, had Hypertension, CAD- triple vessel disease, post CABG 7 yrs back,
The intraoperative metabolic parameters like base excess and Lactates were showing good correction and all of them had very minimal inotropic support at the time of extubation, with Norepinephrine < 0.05mcg/kg/minutes. There was no post reperfusion hemodynamic instability or PRS in our patients, the average GRWR in our patients was 0.94, the mean anhepatic period, warm ischemia and cold ischemia times were pretty low. None of them had any significant postoperative complications.





Conclusions: We propose, we can safely fast track and extubate early, following living donor liver transplantation with high MELD scores, and stable comorbidities. Further, large studies are needed to look for the feasibility of expanding the criteria for early extubation.

P-034

Transfusion in liver transplantation: tilt study

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Background: Liver transplantation (LT) is characterized by abundant blood loss and coagulopaty. We describe the application of a strategy of fluid and blood restriction and analized the characteristic associated with RBC units transfusions.
Methods: Prospective observational study of consecutive cadaveric LT at ISMETT from August 2018 to September 2021. Patients were diveded in two groups: receiving RBC units and not receiving. They were compared with t student and wilcoxon test. Univariate and multiple Logistic regression was applied to recocnize clinical factors associated with RBC transusion.

Results: A total of 166 patient were enrolled, 73 were free from hemotransfusion, patients who received blood transfusion (n=93, 56%) needed an average of 3 (2-7) RBC units (903 mL). Table 1 shows differences among the two groups. The median estimated intraoperative blood loss was 875 mL. Only 18 patients (19%) received more than 6 RBC units. The factors that in a multiple model remained associated with RBC transfusion are: Child Pugh score (OR 1.69 [95% CI 1.063-2.69] p=0.0265), Hemoglobin preoperative amount (OR 0.41 [95% CI 0.25-0.68] p=0.0005), surgery time (OR 1.023 [95% CI 1-1.04] p=0.0228) and Noradrenaline dose (OR 2.23 [95% CI 1.01-4.95] p=0.0475).

Variable	Patients without transfusion = 72	Patients with transfusion = 93	P Value
Age	57 ± 9.5	54.2 ± 10.2	0.0726
Child Pugh Score	6.8 ± 1.6	9.1 ± 2.8	<0.001
Meld-Na Score	15.7 ± 6.7	23.5 ± 8.8	<0.001
HCC	52 (72%)	32 (34%)	<0.001
Mc Cluskey Index	1.5 ± 0.7	2.8 ± 1.3	< 0.001
Previous abdominal surgery	23 (36%)	35 (37.6%)	0.8407
Hemoglobin (g/dL)	12.5 ± 1.9	9.4 ± 1.8	<0.001
Total blood loss (ml)	400 (300-500)	1000 (1000-2500)	<0.001
Hospital stay (day)	15.9 (9-13)	32.8 (26-36)	<0.001

Conclusions: A strategy of blood restriction is feaseble and safe.

Poster Presentations: Basic Science / Translational Research

P-036

Assessment of bile duct injury of donor livers during ex situ normothermic machine perfusion

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Background: End-ischemic ex situ normothermic machine perfusion (NMP) enables assessment of donor liver viability prior to transplantation. To further improve ex situ viability assessment, it is critical to understand liver and bile duct physiology during NMP in relation to pre-existing (histological) injury. The objective of this study was to assess the relation between biochemical bile composition and biliary histology, and to validate the decision to either transplant or decline livers based on biliary viability criteria.
Methods: Forty-two livers that were initially nation-wide declined for transplantation were included in our NMP clinical trial. Based on chemical composition of bile samples, hepatobiliary viability was assessed and livers were either secondary declined (n=17) or accepted (n=25) for transplantation. Bile duct biopsies were taken before and after NMP and histological damage was assessed using a histological scoring system. In addition, injury, function, and evidence of regeneration of the peribiliary glands (PBG) and the peribiliary microvasculature were examined using immunohistochemistry.
Results: Bile ducts of livers that were accepted for transplantation after NMP revealed less damage of the PBG and microvasculature, a larger progenitor cell population, more proliferating cholangiocytes, and increased numbers of mature cholangiocytes after NMP compared to livers that were not transplanted. The first bile produced during NMP had a higher viscosity than at the end of NMP, and bile viscosity correlated with mucus production by the PBGs. Total PBG mass strongly correlated with biochemical evidence of bile duct function (bile pH, bicarbonate, and glucose).
Conclusions: This study confirms that bile pH, bicarbonate, and glucose are accurate markers of bile duct viability. Favorable bile composition identifies livers that have better-preserved biliary architecture, such as PBGs and microvasculature, indicative of an intact regenerative capacity. Increased biliary viscosity at the start of NMP can be explained by an increased mucus production by PBGs, probably in response to pre-existing preservation injury.

P-037

Co-administration of alpha-1 antitrypsin in rat hepatocyte transplantation enhances engraftment of donor cells

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Background: Hepatocyte transplantation (HT) is a highly promising alternative to whole liver replacement for treatment of liver-based metabolic diseases. However, early cell loss, up to 70%, severely undermines HT success, due to triggered instant blood-mediated inflammatory reaction (IBMIR). α-1 Antitrypsin (AAT) decreases IBMIR leading to better cell engraftment and function in models of islet transplantation. This work aims to assess the effect of AAT in HT and evaluate its usefulness for clinical application.
Methods: 200-250gm Lewis female rats were given Retrorsine (30mg/kg) twice to inhibit proliferation of host cells. Animals underwent a 70% hepatectomy followed by HT ($20x10^6$ Lewis male hepatocytes). AAT (120mg/kg) was given either through the tail vein (group 1) or mixed with transplanted cells (group2). Further doses of AAT were given in the tail vein every 3 days. Group 3 had HT but no AAT. Rats were sacrificed after 2 weeks, livers harvested for Y-chromosome qPCR detection and histological analysis. Rats of the same age (group 4) were used as controls for histology analysis.
Results: Rat livers recovered original mass after resections without any difference in any group. qPCR data for SRY gene showed a significant increase of engrafted male cells in group 2 as compared to group 1 (4.93%±3.61 vs 0.35%±0.25, p=0.02). Ki67 staining seemed to confirm this data, indicating high number of proliferative cells in group 2, though not significantly when compared to group 3 (15.9% vs 8.6% positive cells, ns). Interestingly, preliminary data indicate that liver regeneration in group 3 resulted in hepatocyte hypertrophy which did not happen in group 2 (cell size 3232±249 vs 1624±66, p=0.0003; n=3, N≤2 and 1913 for group 4).
Conclusions: AAT reduces cell loss in HT when administered together with hepatocytes rather than through a systemic circulation, also possibly modifying the liver regeneration process, requiring more investigation.

P-040

Recipient/donor PNPLA-3 I148M polymorphism interactions impact metabolic changes in HCV recipients

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Background: Liver transplantation is considered the primary treatment for HCV related end-stage liver diseases with concern

related to post-transplant long-term metabolic outcomes.
Methods: We enrolled 138 HCV LDLT recipients (and donors) who survived more than one 1-year post-transplantation. These cohorts who have no history of DM nor hypertension before transplantation were genotyped for rs738409 variants (both recipients and donors) and assessed retrospectively for the metabolic syndrome (Mets).
Results: Recipients' age was 47.7 ± 8.9, mostly males (81.9%). Beyond one year, 59 (42.8%) had metabolic syndrome. Recipient's GG showed statistically significant high means of FBS (114.5± 10.3, P= 0.00), WC (103.8 ± 8.2, p= 0.01), TGs (156.4 ± 24, p= 0.01), over CC (95.8 ± 14.4, 98.9 ± 8.5, 131.4 ± 42.7, 182.7 ± 34.7 and 28.2 ± 3.4 respectively). Donor Pnpla3 genotypes showed no statistically significant relations to studied parameters. CC/CC donor/recipient Pnpla3 combination was protective from post-transplant obesity, new-onset diabetes and metabolic syndrome (p = 0.00). In multivariate logistic regression analysis, recipients' CG (OR 6.2, CI 95% 2.1 – 17.8) and GG (OR 22, CI 95% 5.7 – 85.2) were the main baseline predictors for Mets.
Conclusions: Recipients' PNPLA-3 polymorphism carries a risk for Mets development in LDLT recipients while Recipient/Donor PNPLA-3 CC/CC gene combination seems to be protective.

P-042

A multiomics approach to hepatic IRI: integrating mRNA, miRNA, and DNA

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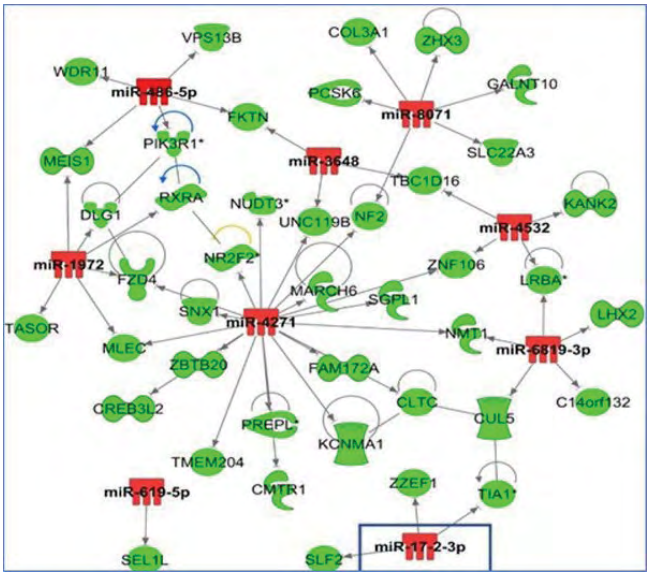
Background: Hepatic ischemia reperfusion injury (IRI) is a pathological process that affects all liver transplant (LT) recipients, impacting graft viability and function. Integrating multiple layers of omics data has the potential to reveal critical information about the transcriptional regulatory mechanisms propagating IRI and eventually culminating in graft dysfunction.
Methods: High-throughput gene expression, miRNA, and DNA methylation arrays were done in pre-implantation and post-reperfusion biopsies from deceased donor liver tissue. Differential expressed genes, miRNAs and CpGs (FDR<0.05) were identified between high *vs.* low IRI groups and at each time point and data was integrated using IPA. CRISPR-activation(a) was used to modify target miRNA expression in human primary hepatocytes (HPH).
Results: Percent steatosis (p<0.001) was significantly associated with high (n=20) *vs.* low (n=20) IRI. Cold ischemia time between IRI groups was not significant (p=0.62). A total of 20 differentially expressed miRNAs were identified between the two timepoints in the high IRI group. Within the high IRI group, 16 out of 20 miRNAs correlated to 70 differentially expressed gene targets in the same samples and following the predicted directionality in expression (Fig. 1). The integrated list of DEGs from the high IRI group showed activation of cell death, growth failure, and inhibition of transport of molecules (p<0.001). MiRNAs were also associated with differentially methylated CpGs at their gene regulatory regions (i.e., MIR17 (TSS1500), MIRLET7A2 (TSS200), MIR144|MIR451 (TSS1500), MIR27B (3UTR|TSS1500). MiR-17 (found to associate with DNAm and mRNA regulation), was modified using CRISPRa to examine downstream effects on potential targets. Activating miR-17 resulted in the increased expression of downstream targets (c-MYC, CYP7A, SMAD4, TGFB1), demonstrating a potential therapeutic target.



Conclusions: These preliminary integrative analyses support a role for miRNAs as regulators of pathways of donor organ damage in hepatic IRI and likely targets for intervention.

P-043

Small molecule mediated reprogramming of mesenchymal stem cells in to hepatocyte-like cells and hepatic tissue

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Background: Derivation of hepatocytes from mesenchymal stem cells using a cocktail of growth factors (GF) is a complex time consuming process and thus limiting its potential applications. We aimed to develop a small molecules (SM)-based differentiation strategy to obtain functional hepatocyte-like cells (dHep) from rat bone marrow-derived mesenchymal stem cells (MSC) and to develop hepatic tissue using decellularized human liver extracellular matrix (DLEM).

Methods: Rat bone marrow MSCs (Passage 2-6) obtained from 4-week-old Wistar rats were seeded in a 0.5% gelatin coated 6-well plate for 24 hr and then serum starved for 48 hr in Dulbecco's modified Eagle's medium with all the supplements before differentiation with SM and GF-based protocols. Subsequently, dHep obtained were injected in the spleen of acute liver injury (ALI) rat model to assess their function. MSC repopulated DLEM was cultured in αMEM media to develop hepatic tissue with SM and GF-based protocols in 14 and 23 days respectively.
Results: SM-based differentiation happened in 14 days and included 4 stages namely definite endoderm, hepatic competence, hepatic specification and hepatic differentiation-growth. Differentiation by GF protocol happened in 3 stages without hepatic competence in 23-28 days. dHep obtained by both protocols were similar and was capable of ameliorating liver injury with improved liver function and tissue damage in ALI rat model by Day 5 of transplantation. Hepatic tissue obtained by SM-protocol had significantly higher level of gene expression for albumin, HNF4α and CYP2e1 while GF-protocol showed higher experrision of genes associated with early stages of liver development like CHD, GPX1, CEPB1α and genes indicative of progenitors and immature hepatocytes like AFP, EpCam, CK19. Heat map analysis showed enhanced hepatocyte-specific gene expression in DLEM as compared to differentiation in 2-dimensional cultures.
Conclusions: SM-based differentiation is a faster and simpler way to obtain dHep and hepatic tissue from MSCs.

P-044

Characterization of extracellular vesicles generated during normothermic *ex vivo* liver perfusion

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Background: Extracellular vesicles (EVs) produced by the donor liver are important mediators of transplant rejection through the semi-direct pathway of allorecognition. However, donor-derived EVs are also responsible for "cross-decorating" recipient dendritic cells, which induces tolerance. Therefore, depending on the local environment, EVs from the transplanted liver can be immunogenic or tolerogenic. Normothermic ex vivo liver perfusion (NEVLP) is an exciting advancement in organ preservation. However, NEVLP can be pro-inflammatory, and EVs produced in this environment have not been characterized.
Methods: Livers were procured from male Lewis rats aged 8-12 weeks and underwent NEVLP at 37°C for 285 min (n=10). Perfusate samples were collected at 45 min and 285 min and EVs extracted using size-exclusion columns. Nanoparticle tracking analysis (NTA) was used to assess the size and concentration of EVs. Transmission electron microscopy was used to visualize EV-sized particles and spectral cytometry was used to assess surface protein expression.
Results: EVs were successfully enriched from perfusate samples using size-exclusion columns. NTA revealed the particle concentration increased throughout perfusion with $1.4x10^9 \pm 7.8x10^8$ particles/mL at 45 min and $8.6x10^9 \pm 3.8x10^9$ particles/mL at 285 min. Particle size remained relatively unchanged at the two time points, with average sizes of 108.5 ± 32.2nm and 107.8 ± 5.0nm, at 45 min and 285 min, respectively. Electron microscopy visually revealed vesicle-shaped particles ranging from 50 to 120nm. Spectral cytometry showed nearly all EVs were positive for the EV-associated tetraspanins CD9 and CD63. Of these EVs, only 2.0% were positive for MHC class II, indicating the majority of EVs were produced by non-immune cells.
Conclusions: In this first study to characterize EVs produced by the liver during NEVLP, we show EVs are continually produced during NEVLP and are primarily derived from non-immune cells. Further analysis of the EVs produced during NEVLP are required to determine their immunogenic or tolerogenic nature.

P-045

Reduction of ischemic reperfusion injury during 24 hours in a porcine model through normothermic liver perfusion during hepatectomy

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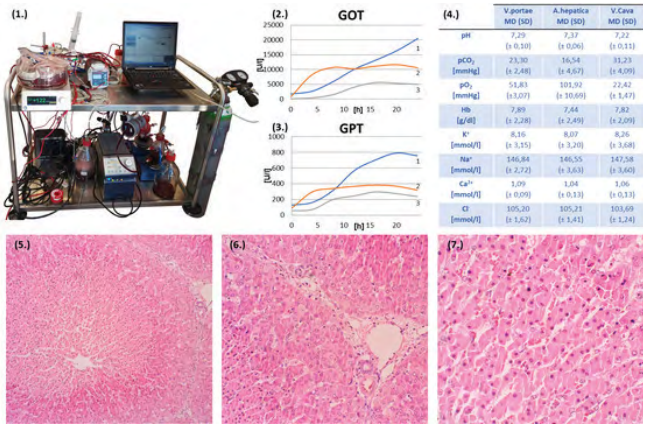
Background: Machine perfusion of livers has gained wide popularity. The effect of normothermic perfusion during hepatectomy has not yet been investigated. Our conducted experiments aim to show how normothermic liver perfusion during hepatectomy improves liver survival after 24 hours.
Methods: Three porcine livers (2.69 kg ± 0.39) were used. A mobile normothermic liver perfusion system with a dual, pressure regulated physiological blood supply via A. hepatica and V. portae was developed. The liver was perfused with oxygenized, heparinized, leukocyte-depleted red cell concentrate and blood serum during surgery. After hepatectomy, the livers were perfused for 24 hours in a stationary liver perfusion system and maintained in a closed circuit system with implemented vertical diaphragmatic movement and dialysis with individually adjustable dialysate. Heparin (1,000 I.U./h), Epoprostenol (0.007 mg/h), Insulin (12 I.U./h), Tauroursodeoxycholic acid (5 mmol/h), and William's E medium (15 ml/h) were added in the portal vein perfusion. pH and temperature were monitored permanently, blood gas analysis was performed hourly, as well as four-hour sampling for determination of liver enzymes.

Results: The warm ischemic phase during surgery was 10.2 min (± 3min). The pH, blood pressures, oxygenation in arterial and portal blood, and potassium, sodium, calcium, and chloride were maintained within the physiological range. An average GOT value of 7437.52 ± 3737.92 U/l and average GPT value of 332,38 ± 147,20 U/l were revealed, showing a significant difference ($p < 0.05$) compared to previously performed normothermic liver perfusion experiments (n= 4) without intraoperative intervention.



1: Mobile perfusion unit; 2-3: GOT and GPT; 4: BGA mean values from experiments 1 to 3; 5-7: Lob. hepatis sinister lateralis after 24h;
Conclusions: Through this series of experiments, we demonstrated that normothermic perfusion during hepatectomy is feasible with minimal warm ischemic time and significantly reduces injury during surgery and a subsequent 24-hour perfusion.

P-046

Galectin-3 is predictive of 30-day acute rejection following liver transplantation

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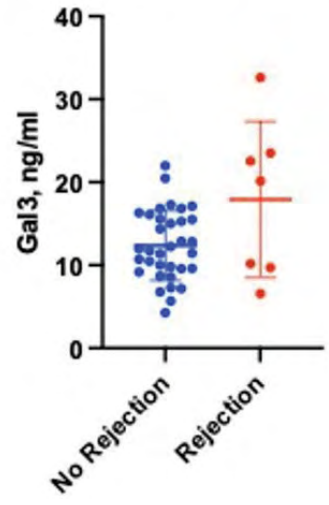
Background: Galectin-3 (Gal3) is a beta-galactoside binding lectin that plays a key role in inflammation and immune response. Studies on Gal3 in liver transplantation are limited. The aim of this study was to investigate the association between circulating Gal3 levels and post-liver transplant acute rejection.
Methods: Citrated plasma was collected from recipients at time of transplant. Gal3 was measured using standard ELISA. The primary outcome of interest was biopsy-proven acute cellular rejection (ACR) within 30 days of transplant. Continuous data is presented as mean (standard deviation) and compared using two-tailed t-test. Logistic regression was used to evaluate for an association between Gal3 and rejection. ROC curves were used to assess the predictive power of Gal-3 for ACR.
Results: Plasma was collected from 41 recipients. 7 (17%) recipients had 30-day ACR (Table 1). Recipients with ACR had significantly higher Gal3 levels at time of transplant (17.91 ± 9.39 vs. 12.39 ± 4.20 ng/ml, $p = 0.02$, Figure 1). There was a significant association between transplant Gal3 and 30-day ACR (OR 1.18, 95% CI 1.09 – 1.38, $p = 0.04$). A transplant Gal3 level > 17.29 ng/ml was significantly predictive of 30-day ACR (OR 13.78, 95% CI 2.04 – 92.97, AUC = 0.74, $p = 0.007$).

Table 1. Recipient Demographics

Characteristic at Transplant	No rejection (n = 34)	Rejection (n = 7)	P-value
Age, years	54.18 (12.19)	49.29 (17.55)	0.4
Weight kg	78.38 (15.12)	84.21 (11.94)	0.3
Female	16 (47%)	1 (14%)	0.1
Non-Hispanic Caucasian	22 (65%)	6 (86%)	0.3
O blood group	16 (47%)	6 (86%)	0.06
Alcohol cirrhosis	16 (47%)	2 (29%)	0.4
Hepatocellular carcinoma	6 (18%)	2 (29%)	0.5
Na-MELD	24.85 (9.83)	31.29 (11.02)	0.1
Living donor	1 (3%)	1 (14%)	0.2
Cold ischemia time, minutes	307.26 (84.71)	296.57 (136.26)	0.8
Warm ischemia time, minutes	32.03 (9.68)	32.86 (11.14)	0.8
Donor age, years	36.70 (13.75)	35.50 (16.79)	0.9
Female donor	16 (47%)	4 (57%)	0.6

Figure 1. 30 Days Acute Rejection (p = 0.02)



Conclusions: Gal3 is a useful biomarker that can be used at time of transplant to predict early acute rejection. Using Gal3 to risk stratify recipients can guide clinical decisions regarding immunosuppression regimen and surveillance labs and biopsies.

P-047

A universal solution for static and dynamic preservation for DCD liver grafts – a preclinical study

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Background: Machine perfusion improves outcomes of donation after circulatory death (DCD) liver grafts. However, no preservation solution suitable for both static and dynamic preservation has been developed to date. The IGL-2 preservation solution was designed to protect the microcirculation of the graft during cold perfusion due to a higher oncotic power, additional anti-oxidant agents and vasodilators coupled with a reduced viscosity.
Methods: We compared IGL-2 with standard preservation solutions in a porcine model of DCD liver graft. In the static model, grafts underwent static cold storage for 6 hours with either IGL-2 (IGL-2-Static group, n=7) or University of Wisconsin solution (UW-Static group n=5). In the dynamic model, grafts underwent static cold storage for 6 hours followed by 2 hours of end-ischemic hypothermic oxygenated machine perfusion (HOPE) with IGL-2 (IGL-2-HOPE group, n=5) or Belzer MPS (MPS-HOPE group, n=5). In both models, grafts were reperfused with whole autologous porcine blood under normothermic conditions using the Liver Assist perfusion device to simulate transplantation.
Results: After static preservation, peak AST (105 vs 71UI/100g/L, p=0.073), lactate levels (1.8 vs 2.4 mmol/l, p=1) and cumulative bile production (6 vs 7ml, p=1) were comparable between IGL-2-Static and UW-Static groups. After dynamic preservation, peak AST (63 vs 114 UI/100g/L, p=0.222), lactate levels (1.03 vs 1.22mmol/l, p=0.151) and cumulative bile production (10 vs 17.2 ml, p=0.841) were comparable between IGL-2-HOPE and MPS-HOPE groups. The composite viability criteria, defined by a lactate clearance $\leq$ 1,7mmol/l and cumulative bile production $\geq$ 10mL after 2h of reperfusion, were reached in 1/7, 0/5, 4/5 and 3/5 grafts in the IGL-2-Static, UW-Static, IGL-2-HOPE and MPS-HOPE groups, respectively.
Conclusions: This preclinical study suggests that IGL-2 is a potential universal preservation solution suitable for both static and dynamic preservation of marginal liver grafts. These results pave the way for a first-in-human trial using a universal preservation solution to facilitate dynamic graft preservation.

P-049

Persistent biliary hypoxia and lack of regeneration are key mechanisms in the pathogenesis of post-transplant non-anastomotic strictures

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Background: Non-anastomotic biliary strictures (NAS) are a major cause of morbidity after orthotopic liver transplantation (OLT). Although ischemic injury of peribiliary glands (PBGs) and peribiliary vascular plexus (PVP) during OLT has been associated with the later development of NAS, the exact underlying mechanisms remain unclear. We hypothesized that bile ducts of patients with NAS suffer from ongoing biliary hypoxia and lack of regeneration from PBG stem/progenitor cells.
Methods: Forty-two patients, requiring retransplantation for either NAS (n=18), hepatic artery thrombosis (HAT; n=13) or non-biliary graft failure (controls; n=11), were included in this study. Histomorphologic analysis of perihilar bile ducts was performed to assess differences in markers of cell proliferation and differentiation in PBGs, microvascular density, and hypoxia. In addition, isolated human biliary tree stem cells (hBTSCs) were used to examine exo-metabolomics during *in vitro* differentiation toward mature cholangiocytes.
Results: Bile ducts of patients with NAS or HAT had significantly reduced indices of PBG mass, cellular proliferation and differentiation (mucus production, secretin receptor expression, primary cilia), reduced microvascular density, and increased PBG apoptosis and hypoxia marker expression, compared to controls. Metabolomics of hBTSCs during *in vitro* differentiation toward cholangiocytes revealed a switch from a glycolytic to oxidative metabolism, indicating the need for oxygen.
Conclusions: NAS are characterized by a microscopic phenotype of chronic biliary hypoxia due to loss of microvasculature, resulting in reduced proliferation and differentiation of PBG stem/progenitor cells into mature cholangiocytes. These findings suggest that persistent biliary hypoxia is a key mechanism underlying the development of NAS after OLT.

P-050

Rejection after liver transplantation: what can we learn from transcriptomic analysis?

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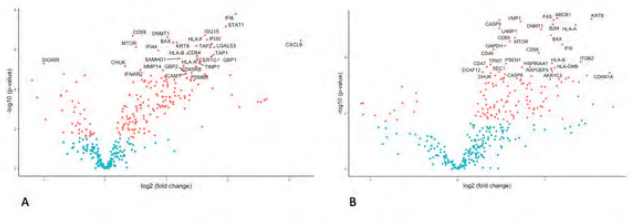
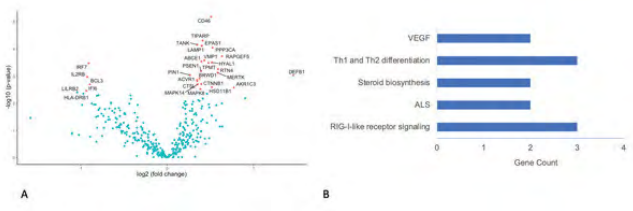
Background: Acute cellular rejection (ACR) can occur at any time following liver transplantation (LT); initial ACR within 6 months occurs in up to 70% of recipients, with approximately 20% experiencing one or more recurrent ACR episodes. Chronic rejection (CR) has been associated with multiple ACR episodes in some studies, and is the ultimate cause of graft failure in 15% of LT recipients. We sought to determine whether there were transcriptomic differences in ACR and CR after LT.
Methods: A total of 38 formalin fixed paraffin embedded (FFPE) liver biopsy specimens were included (9 normal liver tissue, 21 ACR, 8 CR). Specimens from recipients with HBV, HCV, or autoimmune hepatitis were excluded. RNA was isolated from FFPE sections, and gene expression was measured using the NanoString platform. Differential gene expression (DE) analysis and pathway analysis (PA) using the KEGG database were performed, with Benjamini Hochberg p-value correction for false discovery rate.



Results:
There were significant differences in DE between ACR and normal liver tissue (Figure 1A, 142 genes), and in PA there was significant upregulation of genes involved in the common rejection module (n=4 genes). Similarly, there were significant differences in DE between CR and normal (Figure 1B, 145 genes). In DE comparing ACR and CR, significant differences in 28 genes were identified (Figure 2A), with PA demonstrating small differences in a variety of immunologic pathways (Figure 2B).



Conclusions: Compared with normal liver allograft biopsies, both ACR and CR show enrichment of pathways associated with rejection and antigen processing. Only ACR showed overexpression of genes present in the common rejection module. These findings are the foundation for identifying unique pathways associated with recurrent ACR leading to CR, which will aid development of novel treatment strategies.

P-052

Analysis of intracellular signaling mediated by the aryl hydrocarbon receptor (AHR) in liver-resident NK cells

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Background: We previously reported an adoptive immunotherapy approach that used liver-resident natural killer (lr-NK) cells derived from donor liver graft perfusate to prevent tumor recurrence after LT. Lr-NK cells have antitumor activity via TNF-related apoptosis-inducing ligand (TRAIL). Using mice models, we also reported that aryl hydrocarbon receptor (AhR) was involved in lr-NK cells maturation and TRAIL expression. In this study, we analyzed lr-NK cells mRNA to investigate the intrinsic mechanism of lr-NK cells.
Methods: We sorted lr-NK cells into TRAIL+/- NK cells and performed microarray analysis. The pathway from AhR to the TRAIL gene was analyzed by Ingenuity pathway analysis. Lr-NK cells mRNA was treated with the AhR agonist 6-formylindolo[3,2-b] carbazole (FICZ). Maturation gene expression was analyzed by RT-PCR. The antitumor effect of FICZ administration was also analyzed in an in vivo liver metastasis model.
Results: Microarray analysis results showed mRNA expression levels of AhR (fold change: 10.1) to be dynamically upregulated in TRAIL+ NK cells. RT-PCR analysis of lr-NK cells mRNA revealed that expression levels of T-bet and Eomes were significantly decreased ($p<0.01$), whereas those of Foxo1 were significantly increased ($p<0.01$) in the FICZ group. In the liver metastasis model, metastases were significantly suppressed in the FICZ group (tumor occupied area ratio: Control vs. FICZ: 8.5±1.1% vs. 1.5±1.2%).
Conclusions: The maturation gene expression of lr-NK cells is altered via FICZ-AhR signaling and is involved in TRAIL expression. This study provides new insights into intrahepatic immunity related to tumor recurrence after LT.

P-053

Delineating the biological mechanisms of liver regeneration in fibrotic liver

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Background: The liver has a tremendous capacity for regeneration. Even patients with decompensated cirrhosis can have recompensation with removal of the insulting agent (virus, alcohol consumption…). The mechanisms underlying regeneration in the fibrotic liver have not been well delineated. Here, we aimed to understand mechanisms underlying regeneration in fibrotic livers.
Methods: Liver fibrosis was induced to male C57BL/6J mice by carbon tetrachloride (CCl4), which resembles human stage 3 fibrosis. Following CCl_4 injury, mice underwent 2/3 partial hepatectomy. Liver regenerations were analyzed at 2 and 7 days (n=8 mice per group) post-hepatectomy respectively, which represent the peak and the termination of liver regeneration. Resected and regenerated liver tissues were stained by H&E, Sirius Red, and with anti-a-smooth muscle actin antibody to determine progression of fibrosis, activation of hepatic stellate cells (HSCs). Gene expression of from regenerating fibrotic livers was analyzed and compared to their respective sham laparotomy controls (n=3 mice) by gene expression array and Ingenuity Pathway Analysis to characterize specific signals and genes modulating fibrotic liver regeneration.
Results: Fibrotic liver achieved 62% of the control liver weight by 2 days, and 92% of control liver volume by 7 days. Fibrotic regenerating livers could not regenerate as effectively compared to normal liver, and showed lower expression level of liver proliferation genes. Signaling pathways involved in fibrosis regeneration are different from those of normal regeneration. Interestingly, we observed that regenerated fibrotic liver exhibited reduced fibrosis compared to control fibrotic livers, with decreased collagen deposition and hepatic stellate cells activation.

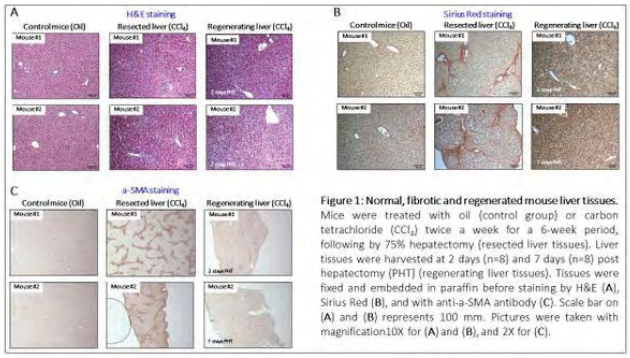

Figure 1: Normal, fibrotic and regenerated mouse liver tissues. Mice were treated with oil (control group) or carbon tetrachloride (CCl_4) twice a week for a 6-week period, following by 75% hepatectomy (resected liver tissues). Liver tissues were harvested at 2 days (n=8) and 7 days (n=8) post hepatectomy (PHT) (regenerating liver tissues). Tissues were fixed and embedded in paraffin before staining by H&E (**A**), Sirius Red (**B**), and with anti-a-SMA antibody (**C**). Scale bar on (**A**) and (**B**) represents 100 mm. Pictures were taken with magnification10X for (**A**) and (**B**), and 2X for (**C**).

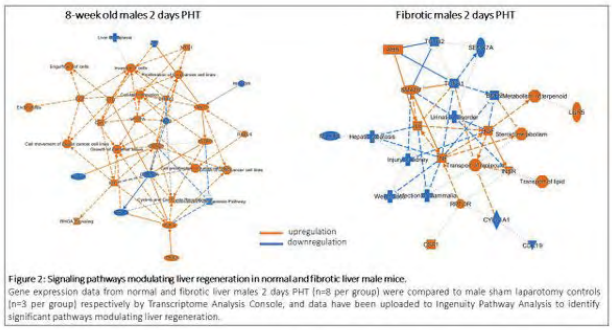

Figure 2: Signaling pathways modulating liver regeneration in normal and fibrotic liver male mice. Gene expression data from normal and fibrotic liver males 2 days PHT (n=8 per group) were compared to male sham laparotomy controls (n=3 per group) respectively by Transcriptome Analysis Console, and data have been uploaded to Ingenuity Pathway Analysis to identify significant pathways modulating liver regeneration.

Conclusions: Fibrotic livers could not regenerate as effectively compared to normal liver, with lower expression level of liver proliferation genes. Interestingly, we observed that regenerated fibrotic liver exhibited reduced fibrosis. These data suggest that fibrotic liver tissue can be replaced with healthy liver tissue through the regenerative process, representing a capacity that can be exploited.

P-054

Utility of donor derived cell-free DNA in liver transplantation

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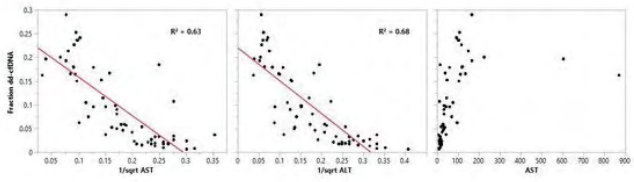
Background: As a non-invasive measure of allograft injury, quantifying the fraction of donor-derived cell-free DNA (dd-cfDNA) has proven to be useful technique in kidney transplantation. Its utility in liver transplantation, however, remains unproven. Specifically, whether the dd-cfDNA fraction adds any additional information on allograft status over the standard liver function tests (LFTs) is unclear.
Methods: We evaluated the correlation of dd-cfDNA with standard postoperative LFTs after liver transplantation in a prospectively collected cohort of patients at the University of Florida. Adult recipients of orthotopic whole liver grafts were enrolled under an IRB approved protocol. Dd-cfDNA was measured in up to

fifteen plasma samples obtained at the same time as standard-of-care LFT measurements between two weeks and one year after transplantation. The study included patients with stable liver function, as well as patients being evaluated for rejection or infection. 38 patients were enrolled and 112 specimens were tested for dd-cfDNA fraction.
Results: In 28 samples with LFTs all within normal limits, dd-cfDNA fractions were below 10%. Conversely, all samples with dd-cfDNA fraction greater than 10% hadeither elevated alanine aminotransferase (ALT) or alkaline phosphatase. There was a close correlation between dd-cfDNA % and 1/sqrt(AST) or 1/sqrt(ALT) (R2 = 0.63 and 0.68, respectively). When examined on an individual patient



basis, this correlation was tighter with few exceptions.
Conclusions: Given these findings, dd-cfDNA quantification does not appear to provide additional sensitivity over standard LFTs for routine monitoring of posttransplant allograft injury in liver transplantation.

P-055

Relevance of the oxidative and endoplasmic reticulum stress against ischemia insult during cold fatty liver graft preservation: a comparison between three preservation solutions

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Background: Oxidative stress is one of the main causes of damage during liver reperfusion, especially when the organ presents steatosis; although the origins of this oxidative damage can already be seen during the ischemic phase. In this communication we evaluate different parameters related to oxidative stress and the subsequent endoplasmic reticulum stress when UW and HTK preservation solutions were compared to IGL2 one (a modified IGL-1 preservation solution increased higher concentration of oncotic agent (PEG35) and antioxidants).
Methods: Fatty liver from Male obese Zücker rats (11 weeks old) were rinsed and stored in IGL-1 modified solution (IGL-2), UW and HTK solutions, respectively at 4ºC. Then livers were subjected to Ringer solution washout and stored at-80ºC until assays.
Results: Aminotransferases as general markers for liver damage (AST/ALT) were measured. Glutathione in its oxidized and reduced form (GSH and GSSG) were measured, as well as its ratio. Sub products of lipoperoxidation were measured as AOPP, TBARS, CAT and SOD, as well as the 4-HNE and one of its inhibitors: the mitochondrial enzyme ALDH2. Endoplasmic reticulum stress (ERS) was measured as GRP78, P-PERK, IRE1-alpha and ATF4. Decrease in reticulum stress markers well correlated with a decrease in damage and lipoperoxidation.
Conclusions: These data confirm that the choice of preservation solution and its composition, is crucial being this especially true for IGL2 (showing high PEG35 and glutathione concentrations) when compared to UW (HES as oncotic agent) and HTK (no oncotic), respectively. Graft protection is exerted in part by PEG35, and glutathione reinforced the prevention of the toxic 4HNE and lipid peroxidation, through mitochondrial ALDH2 mechanisms which were concomitant with the prevention ERS and DAMPs. These data revealed the relevance of mitochondrial machinery during the graft cold storage.

P-056

Sterile inflammation in ischemic fatty liver preservation

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Background: Sterile inflammation is one of the main causes of liver graft damage, and it initiates a cascade of events that more likely will result in the failure of the organ after the reperfusion. In this communication we evaluate different parameters related to sterile inflammation and cell energy levels when three preservation solutions are used, two of them commercially available (University of Wisconsin and HTK preservation solutions) and a modified IGL-1 preservation solution with increased concentration of oncotic agent (PEG35) and antioxidants.
Methods: Fatty liver from Male obese Zücker rats (11 weeks old) were rinsed and stored in IGL-1 modified solution (IGL-2), UW and HTK solutions, respectively at 4ºC. Then livers were subjected to Ringer solution washout and stored at-80ºC until assays.
Results: Aminotransferases as general markers for liver damage (AST/ALT) were measured. Total ATP was measured, which correlated with levels of autophagy measured as LC3b, Beclin-1 and pAMPK/AMPK. Components of the inflammasome were measured (NLRP3, IL-1B) as well as some of its triggers known as DAMPs (such as HMGB1). Vasodilatory effect of nitric oxide (NO) was measured as eNOS.
Conclusions: These data confirm that the levels of autophagy and cell related energy are lied to sterile inflammation occurred during cold static graft preservation, in which PEG35 and glutathione are determinant protective factors for avoiding the extension of the damage.

P-060

Ex vivo machine perfusion in liver transplantation: a systematic review of pre-clinical studies

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Background: Over the past few years, machine perfusion (MP) has entered the clinical arena and holds promise to change the current standards of liver allograft preservation, reconditioning, and viability assessment. Regardless of its already known clinical benefits, there are still a plethora of unanswered questions, which call for powerful animal models and high-quality preclinical evidence with translational potential. Hence, we aimed to provide not just a thematic overview on the available preclinical literature on MP science using *in vivo* liver transplantation models, but also to explore methodical and reporting standards for the first time in this field.

Methods: A systematic literature search was performed in the following databases:PubMed, Web of Science, Embase. Following screening, included studies were evaluated using an established reporting quality score based on the Animals-in-Research: Reporting-in-vivo-Experiments (ARRIVE)-checklist, and further study details were collected and recorded.

Results: A total of 61 studies were included comprising a period of 31 years. Over 70% of the included studies were published after 2010. Interestingly large animal models were more frequently used with 36 studies using porcine models (59.0%) followed by rat models (n=23; 33.7%). The highest number of studies were focusing on hypothermic machine perfusion (n=24). The median ARRIVE score was 40 (range: 15-61). The reporting quality was significantly higher in the post ARRIVE era ($P<0.0001$). Articles from Europe and the American continent showed better adherence to the ARRIVE-guidelines than those from Asia ($P\leq0.001$, $P\leq0.05$ respectively). Interestingly, the reporting of funding in the paper, showed an association with a higher ARRIVE-score.

Conclusions: In the coming years, preclinical research will be essential to explore the full potential of MP technology in liver transplantation, especially in terms of allograft therapies and novel viability parameters. Improving reporting and methodological standards is crucial for reproducibility and subsequent translation.

Poster Presentations: Comorbidities and Liver Transplantation Outcomes

P-061

The outcomes of patients undergoing third liver transplant surgery

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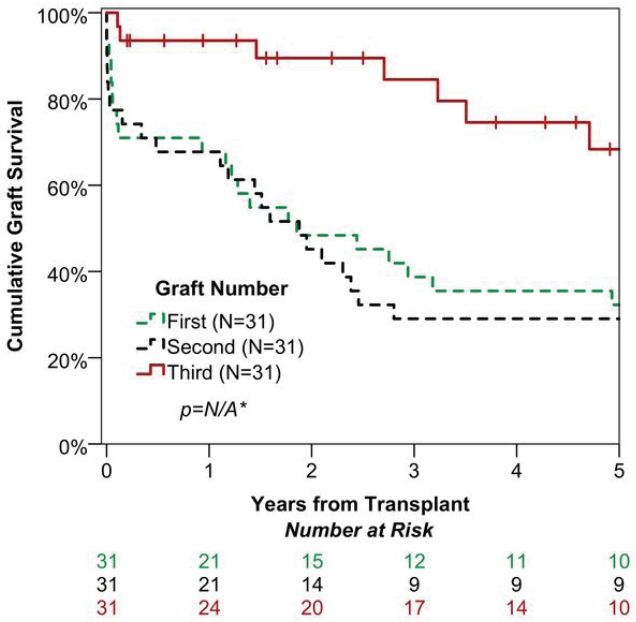
Background: The outcomes, benefits and utility of a third orthotopic liver transplant (OLT) in the same recipient are not well defined, and remain a topic of discussion. This clinical and ethical discussion requires careful balancing of organ availability, the minimum threshold for success, and transplant benefit. The aim of this study was to describe the outcomes of third OLTs performed at our institution.
Methods: A single centre retrospective review of all patients undergoing a third OLT between January 1989 and May 2021 was performed. Donor and recipient characteristics, as well as graft outcomes were extracted from hospital medical records. Long-term graft survival of the third OLT was evaluated, and factors predicting this were assessed.
Results: During the study period, 31 patients underwent a third OLT, at a median age of 31 (interquartile range [IQR]: 23-46) years, and with a median United Kingdom End Stage Liver Disease (UKELD) of 60 (IQR: 53-62). The most common indications were hepatic artery thrombosis (42%), recurrent autoimmune disease (19%) and chronic rejection (19%). All patients received whole liver grafts from donation after brain death donors, as per our institutional policy. Median donor risk index was 1.50 (IQR: 1.40-1.75). The 90-day mortality rate was 6% with one- and five-year graft survival rates of 94% and 68%, respectively. None of the donor or recipient factors considered were found to be significantly predictive of long-term graft survival, although these analyses had limited statistical power, given the sample size.



Conclusions: Third OLTs can achieve acceptable long-term outcomes. Patient selection and access to third liver transplantation may have favoured younger patients, although high UKELD was not eschewed. The decision to deny third transplants should not be based on a presumption of futility.

P-062

A comprehensive bibliometric analysis of the most influential articles from the last four decades of liver transplantation research

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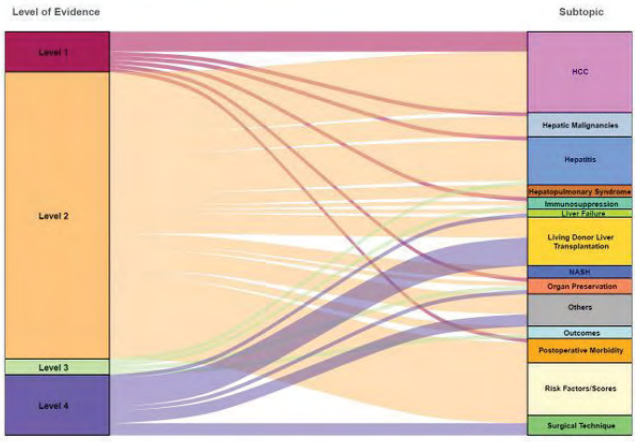
Background: Nearly 40 years have passed since the 1983 National Institute of Health-NIH Consensus-Development-Conference, which has turned liver transplantation-LT from a clinical experiment

into a routine therapeutic modality. Since, clinical LT has changed substantially. Here, we aimed to comprehensively analyze the most influential trends in LT science over a four-decade period.
Methods: A total of 106,523 search items were identified between 01/1981-05/2021. Top-100 published papers were selected using two distinct citation-based strategies to minimize selection bias. Data were obtained from the Web-of-Science-Core-Collection©. Various bibliometric-, statistical tools were used for data synthesis and visualization.
Results: Citation count for the final dataset of the top-100 papers ranged between 255-4,721. Most articles were published by US authors (n=60). The most prolific institution was the University of Pittsburgh (n=14). The highest number of influential papers was published in Annals of Surgery (n=22), however Hepatology publications resulted in the highest total citation of 9,417. Only 10% of the articles were classified as evidence level-1. Over 90% of first/last authors were male. Our data depicts the evolution of research focus from early technical innovations, over advancements in organ preservation and immunosuppression, to the direction of currently emerging topics, such as the use of machine perfusion technologies.

Figure 1. Level of evidence and distribution of topics of the top-100



canonical papers in liver transplantation science.
Conclusions: In summary, this bibliometric analysis highlights some key trends on the basis of a large dataset of highly influential canonical studies over a four-decade period. This analysis not only provides an important cross-sectional and forward-looking guidance to clinicians, funding-bodies, and researchers, but also draws attention to important socio-academic or demographic aspects in LT.

P-063

Effects of ligation of the left renal vein on liver transplantation outcomes

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Background: The presence of spontaneous splenorenal shunts (SSS) is a common finding in patients with end-stage liver disease. SSS may cause complications in liver transplantation by reducing portal venous outflow to the liver graft during reperfusion. One strategy to increase portal flow in patients with SSS during liver transplant is the ligation of the left renal vein (LLRV). This procedure redirects venous flow from the left kidney towards the splenic vein and therefore to the portal vein. There are theoretical concerns over the possibility that LLRV may cause short- or long-term impairment of renal function.
Methods: We retrospectively reviewed the medical records for all liver transplants from 2012 to 2021. Information on demographic variables, preoperative and postoperative markers of renal function and surgical technique were obtained. Correlation between different variables was tested using Pearson correlation and the Kruskal-Wallis test, while survival of different groups was compared using the log-rank test.
Results: Of the 646 liver transplants performed in that period, 165 (25,5%) had SSS. Of these, in 72 cases (43,6%) LLRV was executed. Significantly lower graft and patient survival was observed in liver transplants with SSS (p<0,001). Execution of LLRV had no statistically significant impact on patient or graft survival, time spent on the intensive care unit, time to hospital discharge, or clinical and biochemical parameters of liver and kidney function. There was also no statistically significant difference in the number of patients requiring postoperative hemodialysis between the LLRV and the no LLRV groups.
Conclusions: Patients with SSS who underwent liver transplantation had significantly lower graft and patient survival. While no adverse outcomes were detected associated with LLRV, we were also unable to detect any significant benefits in survival or other postoperative outcomes. Further studies are necessary to properly identify possible subgroups of patients who may benefit from LLRV in the presence of SSS.

P-066

Development of a radiomics-based model to predict graft fibrosis in liver transplant recipients: a pilot study

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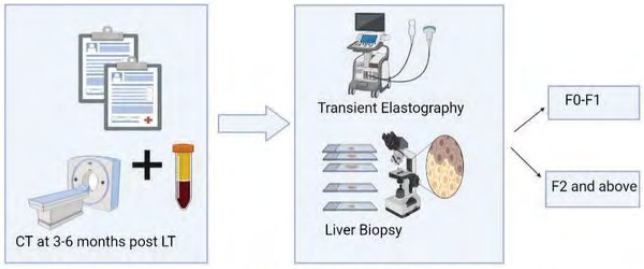
Background: Recurrent fibrosis complicates 40% of liver transplants (LT), compromising long-term survival. We evaluated the ability of a model combining radiomic features on CT scans alongside longitudinal clinical variables within the first 6 months post-LT to flag patients at risk of developing significant graft fibrosis in long term. We hypothesized that radiomic features (subtle perfusion, biliary and parenchymal changes) early on post-LT could provide insight into the long-term life span of the graft, beyond the longitudinal clinical information.



Aim: to develop and validate a radiomics CT-based model to predict onset of significant graft fibrosis (F2 and above) in the long-term post-LT

Methods: Computed Tomography of 254 patients at 3-6 months post-LT between 2009 – 2018 were analyzed. Volumetric radiomic features were extracted from portal phase using PyRadiomics, an Artificial Intelligence-based tool. The primary endpoint was advanced graft fibrosis (≥F2 on transient elastography or histopathology). A 5-fold cross-validated LASSO model using clinical and radiomic features was developed.
Results: 75 patients (29.5%) developed ≥F2 fibrosis by a median of 19 (4.3 – 121.8) months from transplant. The original first order maximum calculated at venous phase, a radiomic feature reflecting venous perfusion, significantly predicted future graft fibrosis (OR 0.52, 95%CI 0.38 - 0.71, p<0.001). Among the clinical variables, primary etiology, p=0.012) donor age (p=0.003), recipient age at transplant (p=0.003), recurrence of primary etiology (p=0.001), brain-dead donor (p=0.001), tacrolimus use at 3 months post-LT (p=0.004) and APRI score at 3 months post-LT (p=0.001) were significantly associated with ≥F2 fibrosis on multivariate analysis. Our model combining clinical and radiomic features predicted graft fibrosis with AUC 0.814 (95%CI 0.749 - 0.90), sensitivity 0.863 and specificity 0.559.
Conclusions: Our pilot study provides proof-of-principle that a combination of radiomic, clinical and laboratory features early post-transplant can prognosticate advanced graft fibrosis.
This tool would serve to individualize the management of liver transplant recipients, by addressing any modifiable risk factors among the derived ranked features predicting advanced fibrosis.

P-067

Histological score of necroptosis executor phosphorylated MLKL is associated with increased risk for early allograft dysfunction after liver transplantation

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Background: Early allograft dysfunction (EAD) following liver transplantation (LT) remains a major threat to liver graft survival. The clinical relevance of necroptosis, a type of regulated necrosis, in human LT remains largely unexplored. In this study, we aimed to investigate the role of necroptosis in human hepatic IRI and whether necroptosis is associated with post-transplant EAD.
Methods: We conducted a retrospective cohort study of 64 LT recipients.Human liver biopsies were obtained at the end of the back table procedure (T0) and ~1 hour after reperfusion (T1). The phosphorylated mixed lineage kinase-like (pMLKL) was assessed by immunohistochemistry and presented as an H-score based on the percentage of positive cells and the labeling intensity.The pMLKL-index was calculated by dividing the pMLKL score at T1 by that at T0.A similar analysis was done on liver tissue collected from rats 24 hours after LT and sham-operated rats.
Results: pMLKL expression is exclusively visible in the portal triad in both human and rat liver biopsies that underwent IRI. The pMLKL score was significantly elevated in rat biopsies compared to the sham(1.78 vs. 0.18, p<0.01). In human LT, the pMLKL score at T1 was significantly higher than T0 in EAD patients rather than non-EAD patients (1.88 vs. 0.70, p<0.01). ROC curve revealed a high predictive value of pMLKL score at T1 (AUC 0.70) and pMLKL-index (AUC 0.82) for EAD.The pMLKL-index significantly correlates with serum ALT (rho=0.458,p<0.001), AST (rho=0.417,p<0.01), LDH (rho=0.381,p<0.01) within 24 hours after LT. Logistical regression analysis revealed that pMLKL-index (HR=1.25, 95% CI 1.03-1.51) was an independent predictor of EAD development. Immunohistochemistry on serial sections identified most pMLKL-positive cells as α-SMA$^+$/CD34$^+$/Fibulin-2$^+$/Elastin$^+$ myofibroblast.
Conclusions: The pMLKL expression in the portal triad increased significantly after reperfusion in both human and rat LT. The pMLKL-index is an independent predictor for post-transplant EAD. The pMLKL-positive cells share similar features with portal fibroblast, potentially suggesting an unexplored role of portal fibroblast necroptosis in hepatic IRI.

P-068

Rising indication of non-alcoholic steatohepatitis as transplant indication in historically low risk areas

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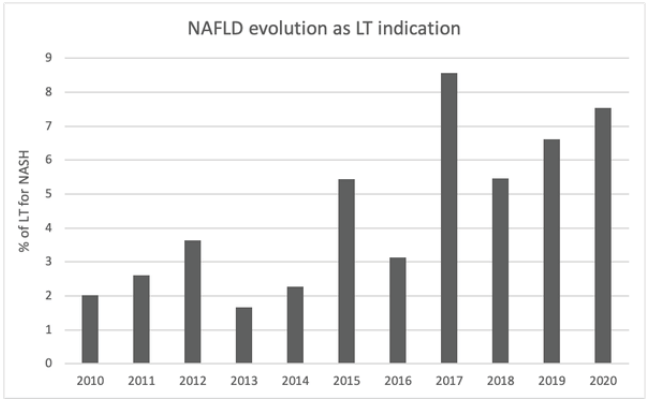
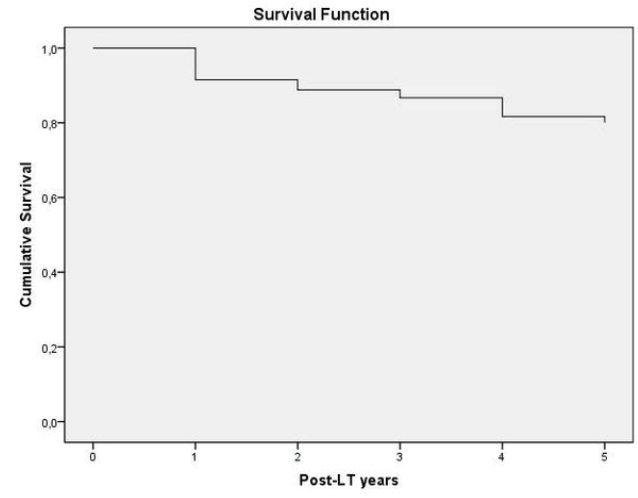
Background: Non-alcoholic fatty liver disease (NAFLD) is becoming one of the most common chronic liver diseases in Spain, particularly in individuals with features of metabolic syndrome, yet its exact prevalence and incidence are not completely known. In fact, non-alcoholic steatohepatitis (NASH) is a growing indication for liver transplantation (LT) in our setting. Our aim was to describe NAFLD evolution as a LT indication and the most frequently found features associated with this indication.

Methods: Patients undergoing LT for NASH-related cirrhosis from 2010 to 2020 in five reference LT centers in Spain were included in the analysis. Medical records were reviewed to determine NASH-associated comorbidities and survival at different follow-up points after LT.

Results: NASH-related cirrhosis was the LT indication in 118 patients from 2010 to 2020. The percentage of LT for NASH increased 3.8-fold between 2010-2020, from 2.0% to 7.5%. Comorbid conditions were found in most patients; 77.1% had obesity, 59.3% type 2 diabetes mellitus (T2DM), 61.9% hypertension (HTN), 37.3% dyslipidemia (DL) and 22.0% a history of prior cardiovascular disease (CVD). While posttransplant complications were frequent, survival was similar to that of other indications with a cumulative proportion surviving of 0.92 and 0.8 at 1- and 5-year post-LT, respectively, and only 2 cases of graft loss due to recurrence of primary disease.





Conclusions: NAFLD is an increasingly common indication for LT in our country. However, the incidence is still far from that described in countries like the US. As reported, most of these transplant candidates have significant comorbid conditions associated with posttransplant complications and poorer long-term outcome. Yet, in the short-midterm transplant survival is similar to that reported by the Spanish Liver Transplantation Registry.

P-069

Can endothelial biomarkers before LT together with classical cardiovascular risk factors be useful to predict cardiovascular risk after LT?

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Background: Cardiovascular (CV) disease is an important cause of morbidity and mortality after liver transplantation (LT). In the general population endothelial biomarkers have been associated with cardiovascular (CV) risk. Little is known about this relationship in LT candidates.
Aim: To analyse pre-LT serum biomarkers (day 0) and to evaluate if they have an association with CV risk after LT alone or in combination with classical CV risk factors.
Methods: Frozen plasma of 125 LT with a low cardiovascular risk between 2014-2017 were analysed. At one year, patients with a high Framingham risk score (FRS) or with metabolic syndrome (MS) were considered at high risk of CVD. Endothelial biomarkers measured were: lpPLA2 measured by ELISA and adiponectine, VCAM1, IL6, TNF alfa and proBNP by Luminex. A multivariate analysis with clinical and endothelial biomarkers was done.
Results: Mean age was 56 years, 78% were men, HCV cirrhosis was the most frequent aetiology (36%) followed by alcohol (25%). Before LT, 20% had arterial hypertension and 19% diabetes. At one yr post-LT, 33% were considered to have a high CV risk by FRS or MS. Logistic regression showed that age before LT (OR= 1.06; p=0,025), DM before LT (OR=5,77; p<0,001) were associated with high CV risk. Plasma levels of LpPLA2, adiponectine, TNF alfa and ProBNP were associated with Liver function (MELD and Child) (p<0.05). LpPLA 2 showed a tendency towards a high CV risk (OR=2.82, p=0.089). A model with clinical and endothelial biomarkers was created. DM (OR 9.6 3-31 p<0.001), obesity (OR 5.1 IC 1.62-16 p=0.005), tobacco use (OR 4.44 IC 1.26-15 p=0.02) and lpPLA2(OR 8.18 IC 1.5-44 p=0.015) were significantly associated with CV risk post-LT.
Conclusions: Clinical variables such as age, obesity, DM before LT and tobacco use in combination with endothelial biomarkers (LpPLA2) could be useful to predict CV risk after LT.

P-070

Trends in liver transplantation for acute liver failure: a Spanish multicenter study

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Background: ALF is a critical illness with high morbi-mortality. LT has improved outcome. Aims: to asses if there have been changes in aetiology, profile and outcomes of patients LT due to ALF in a Spanish multicenter cohort and to identify factors associated with mortality.
Methods: Retrospective study of LT due to ALF cohort from 11 hospitals between 2001-2020. Baseline features, comorbidities, biochemical data, acute complications, early and late outcomes were recorded.
Results: 218 adults LT due to ALF (2001-2020). The cohort was subdivided in 4 time-groups (G1:2001-2005; G2:2006-2010; G3:2011-2015; G4:2016-2020). The number of ALF LT remained stable (G2: 2.5%, G3:2.2%. G4:2.7%.). Median age: 41yrs, 62% women, AHT 11.5%, diabetes 3.7%, dyslipidaemia 8.3%, MELD 34 (29.5-38.1), 83.5% caucasic. Main LT indications were viral (26.2%), cryptogenic (26.1%), autoimmune (22.5%), and DILI (17%). 87% meet King's College criteria. 38% had severe encephalopathy, 22% renal impairment (RI) with haemodialysis, 23% required mechanical ventilation (MV). There was a trend towards an increase of LT for autoimmune (21%, 21%, 31%, 29% in G1-4 respectively, p=0.88) and DILI (12.5%, 14%, 18%, 21% in G1-4, p=0.72). Women seem more susceptible to ALF TH over time (58%, 53.5%, 65.6% and 67% in G1-4, p=0.4). Complications in the early post-LT period were infections (58.7%), RI (25%) and primary dysfunction(24%). Late post-LT complications were AHT (30%), RI (20%) and diabetes (17%). 27% patients died. Main causes of death were infections(41.5%) and liver-related (20%). Survival was 85%, 81% and 70% at 1, 5 and 10 years. Diabetes, MV, ascites and creatinine were independently associated with poorer survival (HR 4.05, p=0.054; HR 2.74, p=0.037; HR 2.48, p=0.048 and HR 1.47, p=0.007, respectively).
Conclusions: LT for ALF remained stable in the last years in Spain. Autoimmune and DILI seem to increase over time, being women more susceptible to ALF TH. Patients with diabetes, ascites, high creatinine levels, and MV were associated with poor outcomes after LT.

P-071

Dynamic detection of graft fibrosis after liver transplantation using deep-learning algorithms

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Background: Early detection of graft fibrosis after liver transplantation (LT) is essential to avoid disease progression. Deep learning algorithms (DLAs) work well with large datasets to find non-linear associations in longitudinal parameters. In this study, we aimed to detect significant graft fibrosis (F2 and above) and derive predictive ranked features using DLAs trained on longitudinal follow-up data.

Methods: This retrospective study includes 1,744 liver biopsies with 591 cases (F2 and above), 1302 controls and 167091 repeated measures of 25 longitudinal demographic, clinical and laboratory parameters from date of transplant to biopsy obtained between Jan 1992-Jun 2020. A validation set (47 cases, 102 controls) with associated Transient Elastography (TE) readings was used to show generalizability of our model. We compared the accuracy of Long Short-Term Memory Networks (LSTMs) algorithm with other DLAs, serum fibrosis biomarkers, and TE for detecting graft fibrosis.
Results: LSTM, with AUC values of 0.798 in the test set and 0.705 in the validation set, outperformed other DLAs, serum fibrosis biomarkers, and TE in detecting significant fibrosis (F2 and above) . Also, LSTM provided AUCs of 0.785 and 0.772 for detecting F3 and F4, respectively. LSTM significantly improved AUC values by 22% and 16% respectively compared to APRI and FIB-4 scores (Figure 1). Recipient and donor age, creatinine, ALT, AST, bilirubin, weight, and tacrolimus/cyclosporine serum levels were found among the top ranked predictive features for graft fibrosis (Figure 2).

Figure 1: Comparison of AUC, Sensitivity, Specificity, Positive Predicted Value (PPV), Negative Predicted Value (NPV) and % of determinates obtained through our approach against AST to Platelet Ratio Index (APRI) and Fibrosis-4 (FIB4) Index on the main dataset's test set.

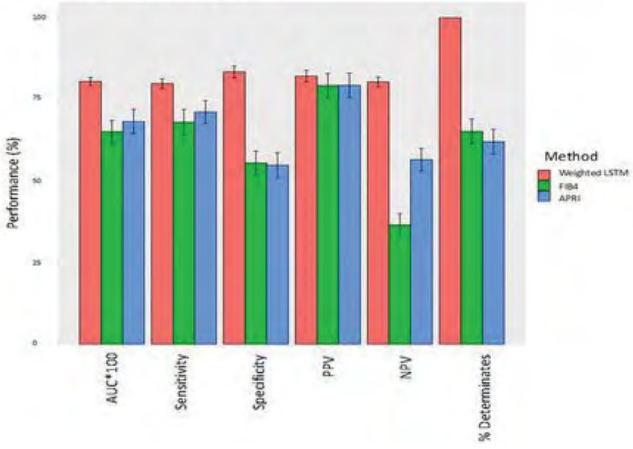
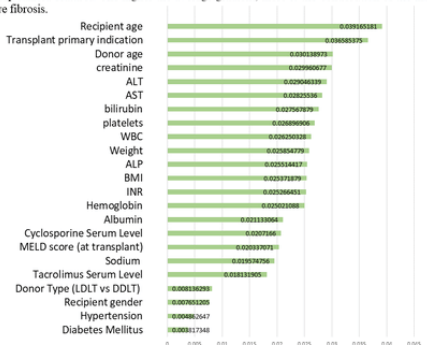


Figure 2: List of top-ranked features. The higher the average gradient, more is the contribution of the individual feature in predicting severe fibrosis.



Conclusions: In this study, we demonstrated that DLAs trained on longitudinal clinical and laboratory data can help in earlier detection of graft fibrosis. DLAs can guide clinicians to tailor their management based on modifiable predictive features (such as weight and tacrolimus serum level) for every LT recipient.

P-072

Postoperative negative-pressure incision therapy following liver transplant (ponilitrans study): a randomized controlled trial

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Background: Postoperative complications of surgical incisions are frequent in the context of liver transplantation due to several risk factors (immunosuppression, surgical time, hospital stay or politransfusions). Negative pressure wound therapy (NPWT) is well established for the treatment of open wounds and its use having been recently indicated on closed surgical incisions. The evidence to justify this intervention is still limited.
Methods: A prospective single-center randomized controlled study was conducted in patients undergoing elective liver transplant. Participating patients were randomly assigned to receive prophylactic use of NPWT or standard surgical dressing on the closed surgical incision of the liver transplant. The primary endpoint was surgical site infection (SSI) incidence at 30 days postoperatively. Secondary endpoints included surgical site events (SSI, dehiscence, haematoma and seroma). The study was registered in ClinicalTrials.gov (NCT04039659).
Results: From December 2018 to September 2021, 108 patients were enrolled in this study, including 54 in the treatment group and 54 in the control group. The incidence of SSI at 30-days postoperatively was lower in the treatment group compare to control group with no statistically differences between both groups (7.4% vs 13%, P = 0.34). The rate of surgical site events was also lower in the treatment group compare to control group with no statistically differences between both groups (22.3% vs 27.8%, P = 0.45). Seroma was significantly associated with a body mass index of 30.35 kg/m^2 (P = 0.03).
Conclusions: Prophylactic use of NPWT on primarily closed incisions did not significantly reduce incisional SSI and surgical site events rates after liver transplant when compared with standard surgical dressing.

P-074

The prevalence and impact of left ventricular diastolic dysfunction on outcomes in liver transplant recipients

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Background: We aimed to assess the prevalence and characteristics of patients with pre-transplant left ventricular diastolic dysfunction (LVDD) and its potential impact on post-transplant morbidity and mortality.
Methods: We performed a retrospective study of 80 consecutive cirrhotic patients undergoing liver transplantation (LT) from 1/1/2021 to 10/31/2021 at the University of Maryland Medical Center. Data were collected on pre-transplant demographics, cardiovascular risk factors, etiology of liver disease, Model for End-Stage Liver Disease score (MELD-Na), Child Pugh score (CP), and presence of coronary artery disease (CAD); and post-transplant hospital and intensive care unit (ICU) stay, readmission rate, new major cardiovascular event (MACE), and mortality rate. Left ventricular diastolic function was assessed by transthoracic echocardiogram using the American Society of Echocardiography 2016 guidelines.
Results: Patients were divided into three groups according to left ventricular diastolic function, 55 (68.8%), 10 (12.5%), and 15 (18.8%) had normal, indeterminate, or abnormal diastolic function, respectively. Mean follow up time in days was 166.9 days post-transplantation (range, 0-320), 4 patients (5%) died, 7 (8.8%) developed MACE, and 41 (51.3%) were readmitted at least once. There were no significant differences ($p \geq 0.05$) among the three groups with regards to prevalence of HTN, DM, HLD, obesity, smoking history, or obstructive CAD; or post-transplant incident MACE, duration of hospital or ICU stay, readmission rate, or mortality rate. However, patients with normal left ventricular diastolic function had longer mean survival time in days compared to patients with indeterminate and abnormal diastolic function (184.0 vs. 106.9 and 144.2 days, respectively, p=0.02).
Conclusions: The prevalence of LVDD in cirrhotic patients undergoing LT was 18.8%. Although larger sample size and longer follow-up are required to obtain more conclusive results, our study suggests that LVDD may be associated with lower mean post LT survival time.

P-075

Conut score predicts early morbidity after liver transplantation: a collaborative study

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Background: Liver transplantation (LT) is burdened by the risk of postoperative morbidity. Identifying patients at higher risk of developing complications can help allocate resources in the perioperative phase. Controlling Nutritional Status (CONUT) score, based on lymphocyte count, serum albumin, and cholesterol levels, has been applied to various surgical specialties, proving reliable in predicting complications and prognosis. Our study aims to investigate the role of the CONUT score in predicting the development of early complications (within 90 days) after LT.
Methods: This is a retrospective analysis of 209 patients with a calculable CONUT score within two months before LT. The ability of the CONUT score to predict severe complications, defined as a Comprehensive Complication Index (CCI) ≥42.1, was examined. Inverse Probability Treatment Weighting was used to balance the study population against potential confounders.
Results: Patients with a CCI ≥42.1 had higher CONUT score values (median: 7 vs. 5, P-value<0.0001). The CONUT score showed a good diagnostic ability regarding post-LT morbidity, with an AUC=0.72 (95.0%CI=0.64-0.79; P-value<0.0001). The CONUT score was the only independent risk factor identified for a complicated post-LT course, with an odds ratio=1.39 (P-value<0.0001). The 90-day survival rate was 98.8% and 87.5% for patients with a CONUT score <8 and ≥8, respectively.
Conclusions: Pre-operative CONUT score is a helpful tool to identify patients at increased post-LT morbidity risk. Further refinements in the score composition, specific to the LT population, could be obtained with prospective studies.

P-076

Nonalcoholic steatohepatitis: a rapidly increasing indication for liver transplantation in India

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Background: There has been a considerable increase in patients with Non-alcoholic fatty liver disease (NAFLD/NASH). Availability of high-efficacy drugs for Hepatitis B and Hepatitis C infection may have changed the disease prevalence. We aimed to study the impact of this changing epidemiology in patients with End Stage Liver Disease (ESLD) who underwent Liver Transplantation (LT) over a 10-year period, and re-evaluate the relevance of this paradigm shift in the practice of LT.
Methods: The study population was stratified in two time categories, 2009-2014 (Period 1) and 2015-2019 (Period 2). Demographics, type of transplant: LDLT or deceased donor LT (DDLT), disease aetiology, and comorbidities were analysed between the two time periods.
Results: Out of 1017 adult patients 277 in Period 1 and 740 in Period 2, there was a significant increase in NASH (85 (30.7%) and 311 (42%), P=0.001) and decrease in Hepatitis C patients (49 (17.7%) and 75 (10.1%),

P=0.002) undergoing LT between Period 1 and Period 2, respectively. There was a significant increase in hepatitis C related Hepatocellular carcinoma (HCC) (13 (26.5%) and 38 (50.7%), P=0.009), but not NASH HCC (18 (21.2%) and 62 (19.9%), P=0.879) or Hepatitis B HCC (16 (35.6%) and 37 (35.6%), P=1.0), respectively, between two periods. A Cox regression analysis showed a strong association between coronary artery disease (HR= 1.963) and NASH. Patients transplanted for NASH had a lower 5-year survival compared with viral hepatitis (75.9% vs 87.4%; P = 0.03).

Conclusions: Our study shows NASH as the most common indication for liver transplantation, surpassing viral hepatitis. Increase in patients with NASH undergoing LT is a major concern due to its association with obesity, diabetes mellitus and coronary artery disease. Encountering patients with such comorbidities may pose a significant challenge to the transplant team in future.

P-077

Efficacy of GLP-1 receptor agonists and SGLT-2 inhibitors for the treatment of diabetes mellitus in liver transplant recipients

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Background: GLP-1 receptor agonists (GLP-1RA) and SGLT-2 inhibitors (SGLT-2i) are novel anti-diabetic agent classes with cardioprotective benefits beside weight loss and glycemic control in patients with type 2 diabetes mellitus (DM). However, limited data exists surrounding the efficacy and safety of these agents in the liver transplant (LT) population.

Methods: In this single-center retrospective study, 122 adult LT recipients were included who had pre-existing or new-onset diabetes and were on either GLP-1RA (liraglutide, semaglutide), SGLT-2i (canagliflozin, dapagliflozin, empagliflozin), or both for at least 3 months. Metabolic and clinical parameters including blood glucose, hemoglobin A1c (HbA1c), weight, body mass index (BMI), liver enzymes and renal function were collected at 3-, 6-, 12-, 18-, and 24-months following initiation of the novel anti-diabetic medications. Adverse effects including changes in serum immunosuppressant levels and incidence of graft failure were also recorded.

Results: LT recipients who were started on dual anti-diabetic agents at baseline had a higher BMI (p=0.011) and higher levels of liver enzymes (AST, p=0.004; ALT, p<0.001). Combined treatment with both GLP-1RA and SGLT-2i resulted in significant decreases in AST (p=0.008) and ALT (p=0.002) at 6 months when compared to the monotherapy groups (Table 1). Changes in Hb1Ac, glomerular filtration rate (GFR), and tacrolimus serum level were statistically similar at different timepoints for all three groups. No significant increase in adverse outcomes were found amongst all three groups (Table 2).

Parameter	GLP-1RA (n=32)	SGLT-2i (n=78)	GLP-1RA and SGLT-2i (n=12)	Total (n=122)	p value
HbA1c ± SD					
0 – 3 months	-2.15 ± 1.98 (4)	-0.50 ± 0.48 (5)	-1.77 ± 1.46 (3)	-1.37 ± 1.46 (12)	0.22
0 – 6 months	-1.46 ± 2.26 (5)	-2.30 ± 2.97 (2)	-2.20 ± 1.70 (4)	-1.88 ± 1.99 (11)	0.84
0 – 12 months	-4.20 (1)	-0.70 ± 0.83 (4)	-1.95 ± 1.48 (2)	-1.56 ± 1.55 (7)	0.09
0 –18 months	N/A	-1.20 ± 0.71 (2)	N/A	-1.20 ± 0.71 (2)	-
0 – 24 months	N/A	-0.50 (1)	N/A	-0.50 (1)	-
GFR ± SD					
0 – 3 months	-1.22 ± 7.01 (24)	0.36 ± 7.12 (44)	3.44 ± 10.67 (9)	0.23 ± 7.58 (77)	0.29
0 – 6 months	0.04 ± 11.36 (19)	0.15 ± 9.11 (33)	7.00 ± 11.22 (8)	1.03 ± 10.24 (60)	0.21
0 – 12 months	0.07 ± 9.22 (15)	0.32 ± 10.99 (31)	-5.50 ± 6.36 (2)	0.00 ± 10.23 (48)	0.75
0 –18 months	-14.75 ± 34.85 (4)	-4.32 ± 14.46 (19)	9.00 (1)	-5.50 ± 18.63 (24)	0.45
0 – 24 months	-20.00 ± 32.70 (3)	-2.65 ± 15.12 (17)	19.00 (1)	-4.10 ± 18.88 (21)	0.16
AST ± SD					
0 – 3 months	0.65 ± 8.27 (23)	-4.49 ± 14.43 (59)	-26.56 (64.76)	-5.37 ± 24.05 (91)	0.013
0 – 6 months	-0.68 ± 11.43 (22)	-0.63 ± 11.52 (48)	-31.00 (73.71)	-3.40 ± 24.99 (77)	0.008
0 – 12 months	-1.33 ± 6.37 (18)	-0.33 ± 18.39 (39)	-4.00 (7.07)	-0.76 ± 15.33 (59)	0.93
0 –18 months	-4.50 ± 14.29 (4)	-2.26 ± 16.42 (23)	8.00 (NA)	-2.21 ± 15.72 (28)	0.79
0 – 24 months	-3.25 ± 10.78 (4)	0.80 ± 10.22 (20)	6.00 (NA)	0.36 ± 10.05 (25)	0.67
ALT ± SD					
0 – 3 months	1.22 ± 12.14 (23)	-7.86 ± 30.57 (59)	-54.18 ± 113.79 (11)	-11.10 ± 47.94 (93)	0.004
0 – 6 months	-1.05 ± 14.88 (22)	-3.10 ± 28.34 (48)	-61.11 ± 115.48 (9)	-9.14 ± 47.58 (79)	0.002
0 – 12 months	-8.22 ± 10.09 (18)	-4.13 ± 40.14 (40)	-2.50 ± 2.12 (2)	-5.30 ± 33.14 (60)	0.91
0 –18 months	-2.00 ± 11.96 (5)	-6.13 ± 33.29 (24)	8.00 (1)	-4.97 ± 30.12 (30)	0.88
0 – 24 months	-5.50 ± 12.71 (4)	3.25 ± 23.15 (20)	5.00 (1)	1.92 ± 21.34 (25)	0.76
Tacrolimus level ± SD					
0 – 3 months	-0.87 ± 2.11 (15)	-1.01 ± 1.91 (37)	0.65 ± 2.70 (8)	-0.76 ± 2.11 (60)	0.13
0 – 6 months	-1.36 ± 2.54 (19)	-0.25 ± 3.32 (28)	-1.42 ± 5.32 (5)	-0.65 ± 3.38 (43)	0.59
0 – 12 months	0.25 ± 1.85 (10)	-0.72 ± 3.09 (24)	4.65 ± 6.86 (2)	-0.15 ± 3.17 (36)	0.06
0 –18 months	0.27 ± 1.40 (3)	-2.19 ± 3.28 (16)	N/A	-1.81 ± 3.17 (19)	0.23
0 – 24 months	-1.10 (1)	-1.26 ± 3.60 (16)	N/A	-1.25 ± 3.48 (17)	-

Hb1Ac; hemoglobin A1c, GFR; glomerular filtration rate (mL/min/1.73 m2), AST; aspartate aminotransferase, ALT: alanine transaminase; SD, standard deviation; N/A, data not available

Table 1: Changes in metabolic parameters at 3-, 6-, 12- , 18-, 24-months following initiation of a novel anti-diabetic agent.

Adverse outcome	GLP-1RA (n=32)	SGLT-2i (n=78)	GLP-1RA and SGLT-2i (n=12)	Total (n=122)	p value
Graft failure, %	3.13 (1)	5.13 (4)	0 (0)	4.10 (5)	0.99
Mortality, %	3.13 (1)	5.13 (4)	0 (0)	4.10 (5)	0.99
Development of cardiovascular disease, %	15.63 (5)	10.26 (8)	8.33 (1)	11.48 (14)	0.75
UTI, %	0 (0)	0 (0)	0 (0)	0 (0)	-
GI complications, %	0 (0)	1.28 (1)	0 (0)	0.82 (1)	0.99
Malignancy, %	6.25 (2)	2.56 (2)	0 (0)	3.28 (4)	0.72

UTI; urinary tract infection, GI; gastrointestinal

Table 2: Percentage of adverse outcomes in LT recipients with type 2 DM following initiation a novel anti-diabetic therapy.

Conclusions: GLP-1RA and SGLT-2i are safe to use in LT recipients. Combination therapy may be more effective than single-agent treatment for targeting recurrent or de novo NASH in LT recipients with DM. Further studies are required to evaluate the long-term safety and efficacy of these agents in this population.

P-078

The impact of post-reperfusion syndrome on recipient mortality and graft failure in living donor liver transplantation

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Background: Post-reperfusion syndrome (PRS) during liver transplantation (LT) is known to be related to higher morbidity and mortality.

However, most of the studies that investigated effect of PRS on prognosis could not control various pharmacological interventions and are mainly based on deceased donor LT (DDLT), thus the prognosis in the living donor LT (LDLT) is unclear.
By utilizing our institution's standard protocol in LDLT and no prophylactic use of pharmacological interventions before or after reperfusion, we aimed to investigate the effect of PRS on graft failure and post-transplant mortality in LDLT.
Methods: With approval of IRB, medical records of adult recipients (age ≥ 19 years) who received LDLT between April 2010 and December 2019 at Samsung Medical Center were retrospectively reviewed. Primary outcome was the effect of PRS on mortality and graft failure. Secondary outcome was the effect of PRS on other postoperative outcomes including the lengths of ICU and hospital stay, rejection.
Results: A total of 399 patients were enrolled. The incidence of PRS was 35.3%. To reduce confounding variables, patients were divided to two groups, No PRS group and PRS group, and then matched at a 1:1 ratio with the factors that are known to be associated with prognosis. Before matching, only the length of ICU stay showed significantly longer in PRS group than no PRS group (P<0.001). After matching, 120 paired sets of patients were generated and all postoperative outcomes including death, graft failure, and the lengths of ICU and hospital stay did not show significant difference (Table 1). Cox regression analysis on postoperative mortality and graft failure showed that PRS was not a risk factor.

Table 1. Postoperative outcomes before and after matching

	Before matching				After matching			
	No PRS (n=258)	PRS (n=141)	P	SMD	No PRS (n=120)	PRS (n=120)	P	SMD
Death, n (%)	58 (22.5)	33 (23.4)	0.932	0.0	22 (18.3)	29 (24.2)	0.344	0.1
Death cause, n (%)			0.297	0.3			0.647	0.3
HCC recur	30 (11.6)	8 (5.7)			10 (8.3)	8 (6.7)		
Sepsis	15 (5.8)	10 (7.1)			5 (4.2)	10 (8.3)		
Thrombus	2 (0.8)	1 (0.7)			0 (0.0)	1 (0.8)		
Rejection	2 (0.8)	3 (2.1)			2 (1.7)	2 (1.7)		
CVA	1 (0.4)	2 (1.4)			0 (0.0)	1 (0.8)		
PNF	1 (0.4)	0 (0.0)			0 (0.0)	0 (0.0)		
Others	4 (1.6)	5 (3.5)			3 (2.5)	4 (3.3)		
Graft failure, n(%)	59 (22.9)	35 (24.8)	0.752	0.0	22 (18.3)	31 (25.8)	0.213	0.2
ICU stay, d	5.7 (2.5)	7.7 (6.8)	<0.001	0.4	6.17 (3.1)	6.67 (3.4)	0.24	0.2
Hospital stay, d	36.3 (35.5)	39.0 (40.2)	0.498	0.1	36.1 (31.3)	38.4 (42.8)	0.635	0.1
Rejection, n (%)	33 (12.8)	26 (18.4)	0.17	0.2	14 (11.7)	22 (18.3)	0.206	0.2

HCC recur: hepatocellular carcinoma recurrence, CVA: cerebrovascular accident, PNF: primary graft non-function, ICU: intensive care unit

Data are shown as number (frequency).

Conclusions: In this study, PRS did not affect mortality and graft-failure in LDLT. Only the length of ICU stay showed statistical difference before matching.

P-079

Utility of panel reactive antibody level in simultaneous liver-kidney transplant recipients

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Background: The liver is considered an immunologically tolerant organ against graft destruction by antibodies. Simultaneous liver-kidney transplants (SLKT) are often performed under the assumption that the liver confers an immunologic protection to a kidney allograft. This study evaluated post-transplant kidney outcomes in non-sensitized versus sensitized SLKT recipients.
Methods: A single-center, retrospective study assessment of SLKT recipients between January 2014-December 2019. Sensitization was defined as PRA level ≥20%. Primary outcome was estimated glomerular filtration rate (eGFR, mL/min/1.73m^2) at 1-year post-transplant. Secondary outcomes included eGFR at 1, 3, and 6- months, PRA level trends, pre-existing and *de novo* donor-specific antibody (DSA), rejection, graft and patient survival.
Results: Fifty-two patients were included in the analysis: 21 with PRA <20%, 31 with PRA ≥20%. Median (IQR) eGFR 1-year post-transplant was 67.7 (56.5, 91.9) in the <20% versus 51.6 (40.8, 68.5) in the ≥20% PRA group, p=0.01. Patients with PRA ≥20% were more likely to have pre-existing DSA: 84% vs 38% for <20% PRA, p=0.001. Similar rates of developing *de* novo DSA were observed: 57% vs 42% for PRA <20% vs ≥20%, respectively, p=0.40. No significant differences in acute rejection occurred. Kidney graft and patient survival were 100% 1-year post-SLKT.

Table 1. eGFR after SLKT

eGFR (mL/min/1.73m^2)	Total	Pre-transplant PRA		p-value
		<20%	≥20%	
	(n=52)	(n=21)	(n=31)	
1 month	72.1 (43.4, 95.9)	87.4 (56.0, 101.7)	64.7 (29.6, 82.5)	0.07
3 months	68.0 (54.0, 90.8)	82.6 (68.5, 92.7)	56.9 (44.5, 79.4)	0.01
6 months	63.1 (51.1, 89.8)	90.4 (61.6, 92.8)	61.2 (37.0, 71.3)	0.01
1-year	58.1 (44.2, 75.2)	67.7 (56.5, 91.9)	51.6 (40.8, 68.5)	0.01

Figure 1. Class I PRA Levels

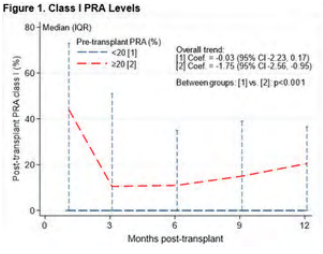
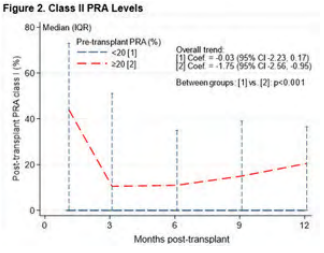


Figure 2. Class II PRA Levels



Conclusions: Study findings suggest a role for PRA level ≥20% and pre-existing DSA on post-transplant renal allograft function and warrant further investigation.

P-080

Characteristics and trends of liver transplantation in a cohort of patients with primary sclerosing cholangitis: a retrospective multicenter study

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Background: Primary sclerosing cholangitis (PSC) is a rare cholestatic liver disease characterized by inflammation and progressive fibrosis of the intra- and extrahepatic bile ducts. The only treatment is liver transplantation (LT), and the disease may recur after it.
Methods: Retrospective multicenter study of PSC patients treated in 8 hospitals in a Mediterranean geographic area between 2000 and 2020. Charts were reviewed compiling demographic, clinical, radiological and histological variables both related to diagnosis, treatment, monitoring and outcome.
Results: Cohort of 112 PSC-patients (mean age 41.59 ± 16.4 years), 42% women, large duct PSC (76%). In the course of the disease, 22.9% developed cirrhosis, and 17.4% required LT after a median time of 4.58 years (mean 6.4 years); among these, the disease recurred in 33.3%. During follow-up, 6.4% of the patients died. Of the 20 patients diagnosed before 2005, 35% required LT, compared to 13.6% of the patients diagnosed after 2005 (p = 0.024).
Statistically significant differences were found in the onset of the disease between patients who required LT at follow-up than those who did not. Regarding the clinical presentation, transplant patients were found to have more jaundice at diagnosis than non-transplant patients (35,7% vs 11,9%; p = 0.022). 38.5% of patients with cirrhosis at diagnosis required LT during follow-up, compared to 12.2% of patients without cirrhosis at diagnosis (p = 0.015). There were no statistically significant differences between the personal history of hypertension, DL and diabetes mellitus and the need of LT. The presence of positive autoantibodies or inflammatory bowel disease did not increase the need of LT in our cohort.
Conclusions: LT remains the only effective treatment to change the course of the disease. The presence of cirrhosis and jaundice on debut seems to be associated with the need for LT in the long term. However, the recurrence of the disease is high.

P-081

Long-term outcome of elderly patients after liver transplantation. An Italian multicentric observational study

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Background: The number of elderly patients evaluated for liver transplantation (LT) continues to increase due to the aging of the general population and the better management of hepatic diseases. However, the results in this category of patients are controversial. This study aims to evaluate the outcome of LT in elderly patients (age> 65 years) compared to patients aged 50-59 years in an Italian multicentric cohort.
Methods: During the study period, 693 patients enrollable in the present study were transplanted. Two cohorts were created consisting of, respectively, patients aged 50–59 years (group A; *n*=519, 74.9%) and patients aged ≥65 years (group B; *n*=174, 25.1%). Data of the two groups were balanced using a stabilized inverse probability therapy weighting.
Results: The Group B patients more commonly presented an Early Allograft Dysfunction (23.9 vs. 16.8%, P=0.04). Nevertheless, the Group A patients had longer hospital stays after LT (median: 14 vs. 13 days; P=0.02).At multivariable Cox regression analysis, patient age ≥65 years was an independent risk factor for patient death (hazard ratio, HR=1.76; P=0.002) and graft loss (HR=1.63; P=0.005).The 3-month, 1-year, and 5-year patient survival rates were 91.1, 88.5, and 82.0% vs. 82.6, 79.8, and 66.4% in Groups A and B, respectively (log-rank P=0.001).
The 3-month, 1-year, and 5-year graft survival rates were 90.2, 87.2, and 79.9% vs. 81.5, 78.7, and 66.0% in Groups A and B, respectively (log-rank P=0.003).
A sub-analysis focused on cases with CIT≤420 minutes reported similar 3-month, 1-year, and 5-year survival rates (92.0, 91.1, and 85.4% vs. 92.0, 89.3, and 81.2% in Groups A and B, respectively; log-rank P=0.30).
Conclusions: In conclusion, no substantial differences exist in morbidity between elderly and younger patients in the early course. However, the mid- and long-term results are poorer. Minimization and optimization of CIT are required to maintain satisfactory patient and graft survival rates.

P-082

Significance of gene polymorphism on infectious complications and rejection after liver transplantation

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Background: Clinical application of gene polymorphism is a key of precision medicine in the field of organ transplantation.
Aim: To investigated impacts of gene polymorphism of FcrR2A (131H/R) and FcrR3A (158 F/V) in infectious complications and FOXP3 (rs3761548) in acute rejection (ACR) after liver transplantation.
Methods: One hundred and one patients underwent liver transplantation (LT) consisting of 16 deceased donor LT and 85 living donor LT from 2011 to 2020 were enrolled. Background data, operative data, and postoperative data including treated ACR, steroid resistant ACR (SRACR), de novo DSA, positive CMV antigenemia, CMV diseases requiring treatment, blood stream infection (BSI) of any kind of bacteria, gram positive coccus BSI, BSI accompanied with bacteria other than streptococcus epidermidis, and survival were collected. The relationship between the 3 polymorphism and these factors were analyzed with JMP pro15.
Results: Variation of genotypes were HH/RH/RR: 62/37/2 in FcrR2A, FF/VF/VV: 64/30/7 in FcrR3A, and AA/AC/CC: 13/6/82 in FOXP3, respectively. Genotypes of FcrR2A were significantly associated with incidence of positive CMV antigenemia (HH/RH/RR: 68%/41%/100%, p=0.01), CMV diseases (65%/35%/100%, p=0.01), but not with BSI. FcrR3A or FOXP3 had no significant association. In 23 patients who were treated with rituximab for preformed DSA, genotypes of FCrR2a were significantly associated with the incidence of treated ACR and SRACR (HH/RH/RR:14%/75%/0%, p=0.01 and 0%/38%/0%, 0.03, respectively) and those of FOXP3 were associated with SRACR (CC/nonCC: 5.6%/40%, p=0.04).
Conclusions: Genotypes of FcrR2A were significantly associated with CMV infection in our whole cohort and FcrR2A and FOXP3 were with SRACR in rituximab-treated patients. Gene polymorphism could have a potential to contribute to organ transplantation as precision medicine. A large scale multicenter study is running currently under a fund of Japan Agency for Medical Research and Development.

P-083

Impact of extremes of body mass index on postoperative outcomes and long-term survival in patients undergoing living donor livertransplantation: experience from a large volume center

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Background: The surgical outcomes and prognosis in patients with high or low body mass index (BMI) undergoing liver transplant (LT) remains controversial. The study aims to analyse the relationship between BMI and postoperative outcomes in a large cohort of patients undergoing living donor liver transplantation (LDLT).
Methods: Out of 3503 LTs, the study was conducted in 2030 patients adult LT (2007 LDLT) recipients from June 2010 till May 2021 at Medanta-The Medicity Hospital, Gurugram, India. The study cohort had 1723 males and 307 females with a mean age was 49.7±10.35yrs. Patients were stratified into 3 groups; Group 1 patients (BMI <18 kg/m2, n=59); Group 2 patients (BMI in between 18 to 34.9 kg/m2, n=1922) and group 3 (BMI ≥ 35 kg/m2, n=49).
Results: There was no significant difference regarding ICU stay, hospital stay or mortality among the three groups. The median (25-75 IQR) ICU stays in groups 1,2 and 3 were 5 (5-6), 5 (5-6), and 7.15 (5-7) days. The median (25-75 IQR) hospital stays in groups 1,2 and 3 were 16 (12-22), 14 (12-18) and 15 (13-22). Figure 1 shows the survival in these groups, p=0.193.

Figure 1: Patient survival in groups 1, 2 and 3.

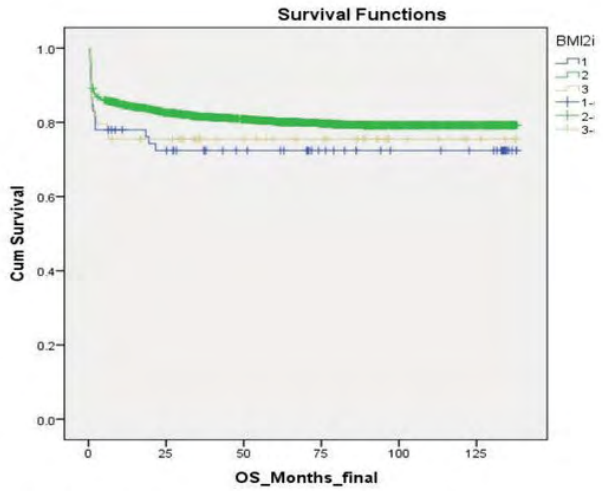

Figure 1: Patient survival in groups 1, 2 and 3

Conclusions: Patients with extremes of BMI, i.e., less than 18 and more then 35 have as good post-transplant outcomes and long-term survival as those within this range, and should not be denied LDLT.

P-084

Gender disparity in liver transplantation

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Background: Gender disparity plays an important role in transplantation medicine. However, there are still not enough data in the literature about gender specific aspect of liver transplantation. The aim of the study is to evaluate the gender disparity in liver transplantation.
Methods: Pre-, intra- and postoperative data as well as donor data of all patients, who underwent LT between 2010 and 2020, including gender specific data were retrospectively evaluated. Gender specific data were statistical compared and analyzed in order to identifiy significant gender disparities.
Results: Out of 779 patients,33.5% were female. Gender-matched transplantations were performed in 57% of LT. The median labMELD at time of LT was significantly higher in female. Significant differences between male and female were seen in etiology, waitlist time, duration of surgery and perioperative death. Overall survival and outcome was better in female recipient. Survival of gender-matched and -mismatched LT were not significantly different.

	Female	Male	p-Value
Time on wait-list (day)	188	274	0.04
labMELD at transplantation	17	19	0.01
High Urgent Listing	4.8%	15.8%	0.001

Table: Preoperative data

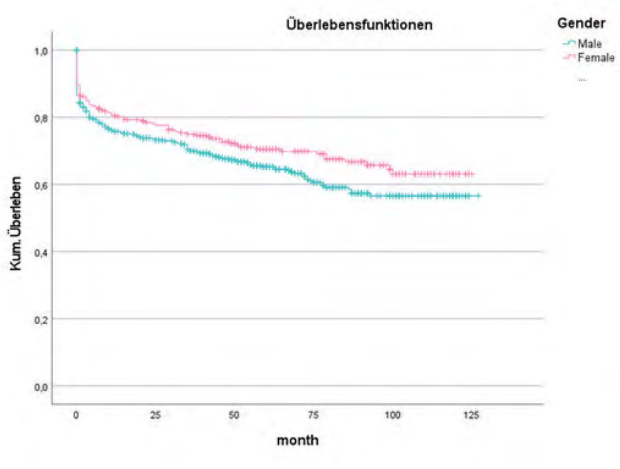

Figure: Overall survival female vs. male, p<0.001
Conclusions: Gender disparity have significant impact on the outcome of LT and need to be evaluated in further studies. It should be considered for an optimal patient selection and organ allocation.

P-086

Prevalence of coronary artery disease in liver transplant recipients from a single centre in India

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Background: Coronary artery disease (CAD) is one of the leading cause of early mortality following liver transplantation (LT). A thorough preoperative evaluation for screening CAD is mandatory.
Methods: We performed a retrospective database analysis of all adult LT performed in our centre between October 2018 and September 2019 after institutional ethical committee approval. Primary objective was prevalence of angiographically proven CAD in our population applying our institutional protocol for cardiac evaluation. Other parameters studied were the prevalence of risk factors, interventions made for CAD, postoperative complications in this cohort and those with CAD and survival at 30 and 90 days. Data expressed as mean ± SD and proportion.
Results: A total of 382 adult patients (age >18 years) underwent LT during the study period. Mean age group was 50.87 ± 11.35 years. 212 (55.5%) patients underwent coronary angiogram (CAG) as per protocol. Prevalence of CAD was found to be 28.01 % (107) and it was more common in males compared to females (31.1% vs 20.3%). 31 (14.6%) were found to have significant CAD defined by >70% obstructive lesion on CAG. 5 (16.12%) patients underwent pre LT angioplasty. There were no coronary angiogram related complications among these patients. Significant statistical association between diabetes, hypertension and CAD was observed. 16 (4.2%) patients had postoperative cardiac complications; 1 (0.3%) patient had acute heart failure who was known CAD with a ejection fraction of 45%. 3 (0.7%) patients had post-operative stress cardiomyopathy, 1 had atrial fibrillation while others had self limiting ectopics. 30 day mortality was 7.5% in the entire cohort and among them only 1 (0.26%) patient died due to cardiac event.
Conclusions: Approximately one third of patients presenting for LT seem to have CAD. By having stringent criteria for performing CAG and a dedicated experienced cardiologist, we can minimise cardiovascular morbidity and mortality in LT recipients.

P-088

Real life efficacy and tolerability of tenofovir alafenamde fumarate in liver transplant recipients: a multicenter study

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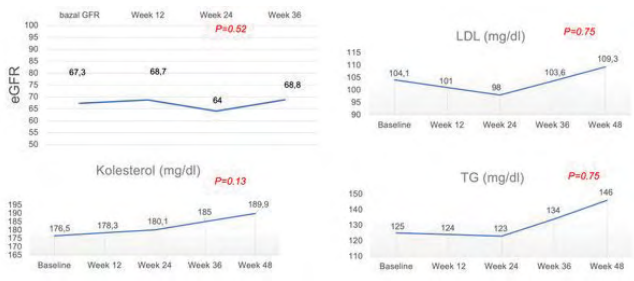
Background: We aimed to determine the real-life efficacy and tolerability of tenofovir alafenamide fumarate (TAF) in liver transplant recipients.
Methods: This is a multicenter retrospective study. A total of 196 recipients were enrolled into the study. The primary endpoints were virological and biochemical response at week 24 and 48 of the treatment, the secondary endpoint was tolerability of TAF. Median duration of the TAF treatment was 11.6 months (range: 6 – 60 months).
Results:



A total of 108 recipients who had at least 6 months follow-up were included in the analysis. Mean age was 58±10 years, 74% were male. Of these, 80% were on tacrolimus-based and 38% on everolimus-based treatments. Median duration from LT to TAF initiation was 24.5 months (range:0–252 months). Seventeen patients received TAF treatment as first-line therapy, whereas 91 patients switched to TAF treatment. Renal dysfunction and osteoporosis were the most common indications for TAF treatment. Baseline median serum ALT level was 25 IU/L (range: 10-96 U/L) and baseline median HBV DNA level was 890 IU/mL, respectively. Virological and biochemical response were 90% and 71% at week 24, and 100% and 92% at week 48, respectively. From baseline to the last follow-up, improvement in ALT at every 24 weeks compared by linear mixed model was significant; - 3.226 IU/ml [95% CI: (-5.62) - (- 0.84); p=0.009]. After the switch to TAF treatment, none of the patients experienced HBV reactivation. TAF treatment was well tolerated. Renal functions and lipid profile remained stable during TAF treatment (Figure 1). No serious adverse events were reported. No graftrejection was observed.
Conclusions: The present study indicates that TAF is effective and tolerable in liver transplant recipients.

P-092

The effect of liver transplantation for argininemia-the largest experiences in a single center

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Background: Argininemia is a rare urea cycle disorder due to arginase-1 deficiency, characterized by progressive spastic paraplegia. Advances in diagnosis and treatment have increased the number of patients receiving effective management; however, not all symptoms are prevented under traditional therapies. There are rare reports on liver transplantation (LT) for treating patients with argininemia.
Methods: We conducted a retrospective study of patients who had been done LT in our center between January 2015 and November 2019. Eleven patients with argininemia were included for their poor response to protein restriction dietary and alternative therapy of nitrogen scavengers. The details on coagulation, liver function, histopathological examination of liver samples, and other clinical presentations were extracted. The Grading Scale for evaluating neurological status and classification of physical growth and quality of life was used to assess the effect of LT.
Results: High levels of arginine were detected in all of the patients, and liver enzymes were elevated in nine of the patients. Nine patients presented coagulation dysfunction without bleeding symptoms. Spastic paraplegia, irritability, intellectual developmental disability, and growth deficits were the hallmarkers of those patients, and four patients had repeated generalized tonic-clonic seizures before the operation. Seven novel mutations were found in those patients. The indication for LT in this series of patients was progressive neurological impairments. After LT, the coagulation index and plasma arginine returned to normal, and seizure episodes were controlled in that four patients. All patients survived to date. LT restored arginine metabolism, liver function and inhibited neurological deterioration, which provides criteria for future recuperation. The neurological status, growth deficit, and quality of life improved significantly after LT without severe complications.
Conclusions: LT is an effective treatment for argininemia, which could halt neurological damage and improve quality of life. LT should be conducted early on argininemia patients who have responded poorly to traditional therapy.

P-093

The unexplored ventricle: right ventricular (RV) evaluation in patients with cirrhosis listed for liver transplantation

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Background: The pre-operative evaluation of the right ventricle and its function is critical in the decision-making process on the eligibility for transplantation of the cirrhotic patient. Currently, RV assessment standards are based on measurement of heart chamber volume and systolic pulmonary artery pressure.I n our study we investigate the contractile capacity of RV and the degree of cardiac fibrosis in patients assessed for liver transplantation.
Methods: Patients undergoing LT evaluation between October 2020 to October 2021 were prospectively evaluated. RV global Longitudinal strain (RVGLS) and RV free wall strain (Rvfws) were measured by speckle tracking and indexed to echocardiographic estimated PASP. In a subgroup of patients with reduced RVGLS and Rvfws a cardiac Magnetic Resonance Imaging (c-MRI) was performed to define the abnormalities in the myocardium. Late gadolinium enhanced (LGE) in T1 phase was used as a marker of myocardial fibrosis. Results were compared to a retrospective group of 50 healthy patients.
Results: RV basal diameter and RV thickness were significantly higher in patients with end-stage liver disease compared to controls. Patients with cirrhosis had more impaired RV global longitudinal strain (-15.3 ± 6.2% compared to healthy controls, p= 0.009) and RV free wall longitudinal strain (-18.3 ± 5.1% compared to controls, p = 0.046). RV global longitudinal strain and RV-free wall strain in cirrhosis were significantly reduced in 48 patients than controls. RV strain reduction was found also in cirrhotic with normal RV volume and PASP (p=0.002). In those with RV strain reduction, c-MRI showed myocardial fibrosis; LGE (5.3 ± 3.1 vs. 0%, P < 0.001). LGE negatively correlated with RV ejection.
Conclusions: RV function in cirrhotic patients evaluated for LT is frequently impaired. A second-line evaluation based on echo strain and c-MRI allows to identify RV dysfunction and myocardial fibrosis.

P-096

Role of immune activation and senescent profile as prognostic markers for cancer onset in patients undergoing liver transplantation

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Background: Patients with hepatocellular carcinoma (HCC) are at higher risk for post-transplant malignancies (PTM). Immune activation and senescence have been frequently implicated in cancer development, however, no data are available concerning their prognostic role in patients undergoing liver transplant (LT). The aim of the study was to analyze these profiles in patients transplanted for HCC (LT-HCC) and for other causes (LT-non-HCC).
Methods: Patients who underwent LT between October 2016 and February 2021 at Multivisceral Transplant Unit, Padua University-Hospital were enrolled. Patients characteristics, HCC presence and features and immunosuppression were recorded. Exclusion criteria: ≤18 years old, follow-up shorter than 30 days or previous neoplastic history other than HCC. All PTM were registered. Markers of T (CD3+CD4/8+CD38+) and B (CD19+CD10-CD21-CD27+) cell activation, T (CD3+CD4/8+CD28-CD57+) and B (CD19+IgD-CD27-) cell senescence were evaluated by flow cytometry at transplantation (baseline).
Results: A total of 116 patients were included: 45 LT-HCC and 71 LT-non-HCC. LT-HCC patients were older than LT-non-HCC (median 60 vs 53 years, p=0.011), but comparable for sex, liver disease etiology, immunosuppressive schedule. At baseline, levels of activated CD8, memory B-cells and senescent CD4, CD8 and B-cells were significantly higher in LT-HCC patients than LT-non-HCC ones. During 27.4(7.7-41.7) months of follow-up, 6 PTM occurred: 4 in LT-HCC (8.9%) and 2 in LT-non-HCC (2.8%). Patients developing PTM showed significantly higher baseline levels of immune activation than patients without malignancies. Within LT-HCC group, levels of senescent cells were significantly higher in patients with PTM compared to the others [%CD8+CD28-CD57+: 22.45(17.72-25.86) vs 10.82(5.21-25.16), p=0.098; %CD4+CD28-CD57+: 14.33(10.23-21.12) vs 2.65(1.10-13.11), p<0.001].
Conclusions: Our findings suggest that patients undergoing LT for HCC have a higher immune activation and senescence profile compared to other recipients, possibly representing an additional risk factor for PTM. Moreover, immune activation and exhaustion may be prognostic factors for PTM occurrence regardless of the cause of transplantation.

P-097

Pilot study on wearable device to quantify physical activity in patients on the waiting list for liver transplantation

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Background: Regular physical activity improves muscle mass, and is highly desirable in patients listed for liver transplantation (LT). Novel tools such as wearable activity/fitness trackers might provide well quantifiable data on the amount of physical activity performed by patients awaiting and after LT. In this study we aimed at evaluating the feasibility of monitoring of physical activity through a wearable wristband activity tracker.

Methods: We conducted a prospective single centre study following up consecutive patients on the waiting list for LT. Patients were provided an activity tracker, and were given specific information on its function. They were followed-up every three months until LT. We collected steps provided by the activity tracker, liver frailty index (LFI) and clinical variables at each time point.

Results: We included 35 patients with cirrhosis on the waiting list for LT (25 male; mean age 59 (IQR 51-63) years; 14 with hepatocellular carcinoma; 21 Child-Pugh B class). During the follow-up 28 patients underwent LT, whereas 3 died before LT and 4 were delisted (2 because too sick for LT and 2 who improved). 32 patients (91%) were able to wear and use the activity tracker correctly.

Mean step count /day on inclusion was 7183 (IQR 3983-9035), and mean LFI was 3.56 (IQR 2.98-3.83; 11 robust, 19 pre-frail and 5 frail). No correlation was found between steps and LFI. 10 patients received nutritional support. Patients requiring nutritional support showed a lower step count/day vs. patients not receiving it:4501 (IQR 3946-5994) vs. 7786 steps/day (IQR 4099-9220; p=0.326), although not statistically significant.

Conclusions: Physical activity monitoring through wristband tracker is feasible and well accepted on the waiting list setting. Patients requiring nutritional support showed reduced mobility, and represent a group requiring more intensive follow-up during a future potential pre-habilitation program.

P-101

Development and validation of an Egyptian score for new-onset hypertension risk after living-donor liver transplantation

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Background: New-onset hypertension after living-donor liver transplantation (NH-LT) is a potential threat that has modifiable and non-modifiable risk factors. We tried to develop and validate a score for predicting the likelihood of NH-LT aiming at improving the management and outcome of these cases.

Methods: ***Study design and participants***

We included a cohort of 262, and 85 liver transplant recipients as development and validation sets, respectively. All cases were not hypertensive prior to transplantation and followed up for 24 months.

Participant data

Data were retrieved through interviews, physical examinations, and laboratory tests within two years of transplantation.

Statistical analysis

IBM-SPSS (version 26) was used.

Development of a new screening score

Multiple logistic regression with backward elimination was run to predict NH-LT. We intentionally used only categorized variables to develop a user-friendly screening score. We created a weighted scoring system by rounding up all regression coefficients in the final model to the nearest integer.

Validation

We evaluated our scoring system the validation data set by computing standard validation measures including sensitivity, and specificity.

Results: ***Development of de novo hypertension risk score***

Table 1 presents the final regression model. Age, smoking history, HCV etiology, ABO group, cold ischemia time, and RBC transfusion units were significant predictors of NH-LT with a score ranging from zero to 8 points (AUC=0.73, P<0.001). A cut-point of ≥5 points designate an individual as having a high risk for NH-LT as shown in figure (1).

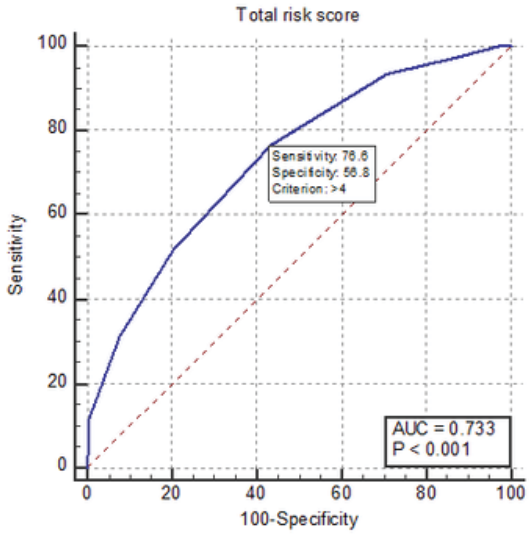
Validation of de novo hypertension risk score

The cut-point defined approximately 29.3% (N=29) of the liver transplant recipients as high risk for NH-LT with 55% sensitivity, and 81.5% specificity (AUC=0.68, P=0.003)

(1): Risk factors for post-liver transplantation new-onset hypertension

Risk factor	P value	OR (95% CI)	Log (OR)	Score assigned
Age (years)				
≤48	-	Reference	-	0
>48	0.038	2.057	0.72	1
Smoking history				
Negative	-	Reference	-	0
Positive	0.001	2.865	1.05	2
Chronic hepatitis C				
Negative	-	Reference	-	0
Positive	0.065	3.293	1.19	2
ABO group				
A/O/AB	-	Reference	-	0
B	0.010	2.372	0.86	1
Cold ischemia				
≤25 minutes	-	Reference	-	0
>25 minutes	0.070	1.799	0.59	1
RBC transfusion units				
0-2 units	-	Reference	-	0
>2 units	0.026	2.020	0.70	1

OR = odds ratio. CI = confidence interval. All three methods of backward elimination (cond produced the same ORs.



Conclusions: A simple new score might help predicting the likelihood of new-onset hypertension after living-donor liver transplantation.

P-102

First report of long-term outcomes of deceased donor liver transplantation from India

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Background: Scarcity of deceased donor livers has resulted in a 10-fold raise in living donor liver transplantation (LDLT) performed throughout Asia with India emerging a new leader in the numbers LDLTs performed per year. However, number of deceased donor liver transplantation (DDLT) performed has improved with the establishment of simplified legal framework for certification of brain death and organ donation. In the study, we present the long-term outcomes of DDLTs performed by our team.
Methods: All consecutive patients who underwent LT from August 2009 till December 2019 by our transplant team at various centers in the state of Tamil Nadu, India were included in the study. The program was established initially at a primary center in the year 2009 and with the evolution of the initial experience, transplant programs were expanded to the others centers from the year 2015. Pre-operative clinical data, intra-operative characteristics and post-transplant outcomes of DDLT were analyzed from our prospective database.
Results: A total of 1147 LDLTs (793 adults, 354 children) and 362 DDLTs (331 adults, 31 children) were performed during the study period at 12 centers in Tamil Nadu. The most common indications for DDLT were end-stage liver disease (74.9%) and hepatocellular carcinoma (17.9%). Median (range) age was 51 (0.7-75) years in 307 male and 55 female recipients. The common etiologies were alcohol (25.4%) and non-alcoholic steatohepatitis (21.5%) in adults and metabolic liver disease (32.2%) and biliary atresia (29%) in children. Median (range) model for end-stage liver disease score was 16 (6-39). Forty-eight split, 11 combined liver-kidney, and 4 auxiliary DDLTs were performed. One-, 3- and 5-year overall survival was 87.2%, 80.4% and 76.6% in adults and 80.6%, 80.6% and 80.6% in children respectively.
Conclusions: Successful DDLT program was established in a predominantly LDLT region and good long-term outcomes were achieved.

P-103

Living donor domino liver transplantation using livers from patients with MSUD: a case series of five patients and literature review

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Background: Although the liver of a patient with maple syrup urine disease (MSUD) cannot properly metabolize branched-chain amino acids due to the lack of branched-chain alpha-keto acid dehydrogenase (BCKDH) complex, it can still exert other hepatic functions. In fact, the BCKDH complex is adequately expressed in other tissues. Therefore, the livers of MSUD patients can be safely transplanted into non-MSUD patients as grafts for domino liver transplantation (DLT).
Methods: We report a series of 5 patients who underwent DLT using liver grafts from MSUD patients. Among them two patients received whole-liver grafts, and three received partial grafts for auxiliary liver transplantation. We also review the literature on the prognosis of patients undergoing DLT using liver grafts from MSUD patients.
Results: The primary disease was alleviated in four patients who received liver grafts from MSUD patients, without any symptoms of MSUD. The remaining one patient underwent a second liver transplantation because of graft atrophy and recurrence of the primary disease. This study strictly complied with the Helsinki Declaration and the Declaration of Istanbul.
Conclusions: Evidence from short- and long-term follow-up has demonstrated that livers from MSUD patients can be used as grafts in non-MSUD patients, thus expanding the donor pool of living donors. Livers from MSUD patients can be used as domino

grafts, with good outcomes in the recipients. However, when livers from MSUD patients are used as grafts for auxiliary DLT, there are still issues unsolved, including intraoperative inflow and outflow revascularization and postoperative atrophy of the liver grafts.

P-107

Outcome of adult patients with Budd Chiari syndrome waitlisted for liver transplant

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Background: Budd-Chiari Syndrome (BCS) is a complex disease group characterised by hepatic venous outflow obstruction and caused by a heterogenous array of diseases. After initial medical and often radiological interventions, Liver Transplant is the last resort to manage this cohort of patients. The aim of this study is to look for the risk factors and post-transplant outcomes for patient with BCS proceeding to liver transplant (LT).
Methods: Data was collected retrospectively between 2004 and 2021 for adult patients who underwent LT for BCS in Liver Unit, QE. Data on demographics, underlying pathology, pre-transplant interventions and transplant related outcomes was collected and reported using descriptive statistics.
Results: 14 (64%) of the 22 waitlisted patients underwent liver transplant. Among those 14 patients, there was higher female propensity, 9/14 (62%). Mean age at the time of transplantation was 40 years. Underlying cause was found to be myeloproliferative disease in 5/14 (35%), JAK-2 mutation in 2/14 (14%), and Factor V Leiden deficiency and polycythemia rubra vera in 1 patient each respectively. Radiological interventions such as balloon venoplasty 3/14 (21%), hepatic vein stent 4/14 (28%), and TIPSS 5/14 (36%) were conducted pre-transplant. Post-transplant, there was no mortality or early graft dysfunction. 3/14 (21%) patients required re-transplantation; 2 for severe thrombotic complications and one patient for recurrence of BCS. Of the 8 patients who did not undergo LT, 2 patients were de-listed due to contraindications, 1 was still on active wait list and 5 (23%) patients died.
Conclusions: This is a comprehensive data from a tertiary care Liver Transplant unit of patients with BCS from the time of stenting or wait-listing. Patients who undergo liver transplantation have good post-transplant outcomes however there is a significant subset of patients who would not survive without a liver transplant.

P-108

Liver re-transplant for acquired familial amyloidotic polyneuropathy after domino liver transplant

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Background: Orthotopic liver transplantation (OLT) as a specific treatment for transthyretin (TTR) amyloidosis was introduced, based on the hypothesis that removal of the liver, the main source of mutant TTR, would stop amyloid formation.
Shortage of deceased liver grafts led to alternative methods trying to expand the donor pool. As livers from TTR amyloidosis patients have an intact structure and function, sequential liver transplant, also known as *domino* (DLT), was introduced as a concept in which the explanted organ in one patient is transplanted into a second patient.
Domino grafts were used under the assumption that several decades would pass before clinical symptoms due to amyloid accumulation would emerge, but since the first report in 2005, several cases of acquired Familial Amyloid Polyneuropathy (aFAP) were reported, and its development ranged from 3 to 9 years after transplantation. The introduction of mutated TTR produced by the transplanted liver graft turn the DLT recipient at risk of developing acquired Familial Amyloid Polyneuropathy (aFAP).
Methods: Donor and recipient patients assessment.
Neurological examination, salivary biopsy, sural nerve biopsy, and electromyography.

The inclusion criteria for retransplantation were:

- Symptoms and survival > 5 years
- No recurrence of malignant disease
- Positive electromyography (EMG) signs
- Positive salivary or sural biopsy
- Polyneuropathy Disability Score (PND) 2 or 3

Results: In 22 patients with acquired FAP a retransplant was considered. It was performed in 18 patients.
Regarding FAP symptoms, 8 patients refer an improvement of symptoms, other two related the same but are deceased, and 3 patients showed a worsening of symptoms.
Conclusions: In LT programs where sequential LT is performed receptors with clinical disease have been increasingly identified, and their management is often challenging. The main therapeutic option is liver retransplant (LrT) with a deceased donor organ, but the outcomes and clinical course of post LrT are largely unknown.

P-110

Risk factors for the development of non-alcoholic fatty liver disease after liver transplant

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Background: Non-alcoholic fatty liver disease (NAFLD) is considered to be the most prevalent liver disease in the world. Many patients with NAFLD suffer disease progression to non-alcoholic steatohepatitis (NASH), potentially leading to cirrhosis and end-stage liver disease. Cirrhosis due to NASH is increasingly more common as an indication for liver transplantation, and recurrence of NAFLD and NASH is a significant concern in the long-term follow-up of these patients. The development of NAFLD in liver transplant patients is associated with a multitude of factors. Of particular concern are the effects of immunosuppressant drugs, as both calcineurin inhibitors and corticosteroids are known to have significant metabolic side effects.
Methods: We retrospectively reviewed the medical records for 282 liver transplants in a single tertiary center. Correlation between different variables and the presence of steatosis in liver biopsies was tested using Pearson correlation, Kruskal-Wallis test and the Mann-Whitney U test.
Results: Of the 282 liver transplants performed in that period, 21 (7.4%) eventually developed NAFLD on the liver graft. Median time to occurrence of steatosis after the transplant was 673 days. Receptor BMI prior to the transplant was significantly higher (p=0.004) in the postoperative NAFLD group (with a 29.3 median compared to 25.6). Postoperative BMI was significantly higher (p=0.004) in the NAFLD group (with a 29.3 median compared to 25.7). Blood levels of tacrolimus were also significantly (p<0.001) higher in the NAFLD group (with a median of 5.3 ng/ml in patients with no steatosis, and 10.25 ng/ml in patients with severe steatosis). There was no direct relationship between blood tacrolimus levels and receptor BMI.
Conclusions: The development of NAFLD in the graft is of significant concern in the long-term management of liver transplant patients. Higher receptor BMI and blood tacrolimus levels are associated with the development of NAFLD, and may be the target for future interventions.

P-112

Management of premalignant cystic lesions of the pancreas in patients undergoing liver transplantation

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Background: Incidental pre-malignant pancreatic cystic lesions (pPCL) are increasingly being detected in patients undergoing liver transplantation (OLT). The impact of chronic immunosuppression upon pPCL may elevate risk of progression to pancreatic cancer. This systematic review assesses prevalence, outcome, and management of pPCL in patients undergoing OLT.
Methods: Systematic literature searches were performed, using multiple electronic databases and MeSH headings, in accordance with Cochrane review guidelines.
Results: Data on 658 patients were identified from 13 manuscripts. Median age was 59 years with a prevalence of 6.2%. Majority of studies focused on branch duct intraductal papillary mucinous neoplasms. Average cyst size, at diagnosis, was 10.3 mm. Six (0.9%) patients underwent pancreatic resection, post-OLT, for suspected "worrisome features" on imaging. One death was due to pancreatic related cancer, post-OLT.
Conclusions: Based on the review, the authors suggest:

1) patients with pPCL undergoing OLT, without "worrisome features", should be followed conservatively,

2) presence of pPCL alone should not preclude eligibility for OLT, nor should chronic immunosuppression be altered,

3) follow-up should parallel standard approach applied in immunocompetent patients, as development of "worrisome features" of cancer is rare and does not appear to be hastened by immunosuppression,

4) resection is recommended for surgically fit patients without portal hypertension that develop "worrisome features."

P-113

Bacterial contamination of salvaged autologous blood during deceased donor liver transplantation: an observational study

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Background: Bacterial contamination is the main cause of post-transplant infections. Thus, the salvaged blood contaminated with bacteria may act as the causes of increased post-operative infections. We aimed to evaluate bacterial contamination of salvaged autologous blood during deceased donor liver transplantation (DDLT).
Methods: Salvaged autologous blood samples were drawn from DDLT recipients between November 2019 and October 2021. Intraoperative blood salvage were performed using Cell Saver 5

(Haemonetics, Braintree, MA, USA). Blood samples (20mL, each) were collected in the anhepatic (#1) and post-reperfusion phase (#2). In addition, leukocyte depletion filter (LDF) was applied to the autologous blood sample acquired from the post-reperfusion phase (#3). All samples were immediately inoculated in blood-culture bottles.
Results: From a total of 44 patients, 9 (20%) and 17 (37.8%) cases were positive in blood culture at anhepatic and reperfusion phase. There was a significant change in the incidence of salvaged blood contamination from anhepatic to reperfusion phase (P = 0.016, odds ratio = 2.44). *Enterococcus faecium, coagulase negative staphylococcus*, and *enterococcus faecalis* were the frequently detected strains in the salvaged blood. In addition, *Staphylococcus aureus, Escherichia coli, Klebsiella pneumonia, Acinetobacter baumannii, Raoultella ornithinolytica, Stenotrophomonas maltophilia, Streptococcus mitis/Streptococcus oralis* were identified. Bacterial contamination of salvaged blood was removed by LDF in 5 (29.4%) out of 17 cases of salvaged blood after reperfusion. There was no significant difference in the contamination of salvaged blood regardless of the LDF application (P = 0.126, odds ratio = 0.60).
Conclusions: We found that bacteria frequently contaminated salvaged autologous blood during DDLT. LDF did not effectively reduce contamination of the salvaged blood.

P-116

Histological correlates of refractory renal dysfunction after liver transplantation

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Background: Kidney dysfunction is common after liver transplantation (LT), and is often attributed to calcineurin inhibitors (CNIs). Very few studies have looked at histological causes of renal dysfunction in the post-liver transplant setting as kidney biopsy is an invasive procedure.
Methods: The study is a retrospective analysis of the histological findings and diagnosis in all patients who underwent a kidney biopsy after liver transplant from 2010-2020. Kidney biopsy was indicated in those with median eGFR 31 mL/min/1.73 m² with proteinuria of at least 0.8 gm/day and/or an active urinary sediment, in whom correction of pre-renal factors and potential drug (including CNI) nephrotoxicity was unsuccessful. Data is shown as mean± standard deviation or medians (25-75 interquartile range).
Results: The study cohort consisted of 24 patients (all males), aged 52±7 years. Kidney biopsies were done at 3 (1-5 years) after LT. There were no complications related to the procedure. At the time of renal biopsy, the median serum creatinine was 2.25 (1.52-2.95), proteinuria was 1.78 (2.9-4.9) gm/day (data available in 17 patients), and chronic kidney stage was 3 (3-4). Fifteen patients were diabetics (including 5 patients with new onset diabetes after LT), twenty were hypertensives. Twenty-two patients were on CNIs. The diagnoses on kidney biopsies were diabetic nephropathy (n=6), focal segmental glomerulosclerosis (n=5), CNI nephrotoxicity (n=3), IgA nephropathy (n=3), thrombotic microangiopathy/diabetic nephropathy or IgA nephropathy (n=2), chronic glomerulonephritis (n=1), hypertensive glomerulopathy (n=1), membranous glomerulonephritis (n=1), acute tubulointerstitial nephritis (n=1), and C1q nephropathy (n=1).
Conclusions: Kidney biopsy is a very useful tool to diagnose the cause of unexplained renal insufficiency in LT recipients and allows optimal management. Diabetic and hypertensive nephropathy were common in this cohort whereas CNIs were an uncommon cause of renal impairment.

P-117

The safety and outcomes of isolated portal-to-jagular venovenous bypass in liver transplant recipients: a contemporary single center experience

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Background: Venovenous bypass (VVB) is a technique during liver transplantation (LT) that involves the use of extracorporeal circulation of blood that is redirected from the portal vein to central circulation via the axillary or internal jugular (IJ) veins. In our center, a single drainage canula is placed in the portal vein and a single return cannula is placed in the IJ vein. We hypothesize that isolated IJ VVB will decrease transfusion requirements and improve postoperative outcomes.
Methods: We performed a single-center retrospective observational cohort study in patients undergoing liver transplant surgery. Patients were divided into 2 groups, those who had VVB during LT surgery (VVB group) and patients who did not (No-VVB group). Main outcomes include the volume of PRBCs and FFP transfused, ICU and hospital length of stay (LOS), and incidence of acute kidney injury (AKI) within 48 hours postoperatively.
Results: A total of 134 patients were studied, of which 65 patients had VVB, and 69 patients did not. The VVB group received significantly less volume of pRBCs transfusion with a mean of 995.1 ml (714.7 - 1275.5 95% CI) compared to 1631 ml (1266.5-2002.6 95% CI) in the No-VVB group, p = 0.0067. Similarly, the VVB group received significantly less FFP transfusion volume with a mean of 638 ml (392-884 95% CI, p = 0.0063) compared 1168 ml (877-1460 95% CI). There was no difference in AKI within 48 hours, ICU and hospital LOS between the 2 groups. There were no significant complications related to VVB cannulation.
Conclusions: Isolated portal to jugular VVB is a safe procedure and is associated with lower transfusion rates in patients undergoing LT.

P-118

Outcomes in liver transplantation for hepatocellular carcinoma versus incidental hepatocellular carcinoma

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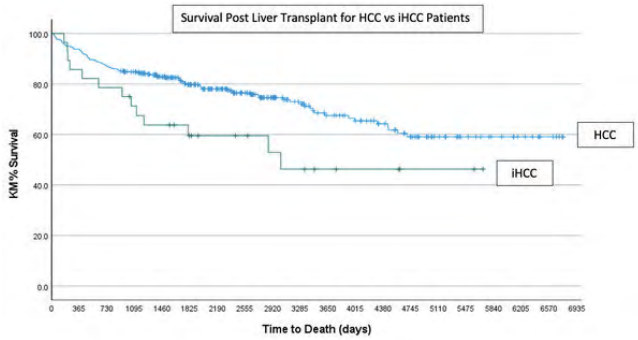
Background: Hepatocellular carcinoma (HCC) is the fifth most common cancer and the third most common cause of cancer-related mortality worldwide. Liver transplant improves the survival for patients with HCC and underlying cirrhosis. The outcomes of patients receiving transplant for liver disease but found to have incidental HCC (iHCC) at the time of explant is unknown. The aim of this study was to compare patient characteristics, patient and allograft survival of liver transplant recipients with known HCC versus iHCC.
Methods: We retrospectively reviewed outcomes of 364 liver transplant recipients from 2002-2018 with a diagnosis of cirrhosis and the presence of known HCC (n=335) vs iHCC (n=28). Patient characteristics, MELD score and transplant characteristics were evaluated with outcomes regarding patient and allograft survival. All analyses were conducted in SPSS 25 (IBM, Tx). Two-sided P-values less than 0.05 were considered statistically significant.
Results: Median follow-up was 36 months. There were no differences between the groups for age, gender, ethnicity, CMV status, rejection, types of transplant donors, cause of liver disease, blood type and co-morbidities. The patient and allograft survival was 72% for patients with pretransplant diagnosis of HCC vs 53% for iHCC [log-rank p= 0.026] (Figure). Patients with iHCC had significantly higher biological MELD score compared to the known HCC patients [25.9 vs 14.2,p < 0.01].



*HCC – hepatocellular carcinoma, iHCC incidental hepatocellular carcinoma

Conclusions: Liver transplantation for HCC in the setting of cirrhosis is performed to improve short and long- term survival, however, the diagnosis of iHCC on explant pathology appears to have a negative impact on patient survival. While there are not obvious pre-transplant factors to identify patients who may have iHCC, there should be a consideration for close monitoring of potential HCC recurrence as well as allograft dysfunction post-transplant in this patient population.

P-119

Prognostic factors for patient survival in adult liver retransplantation

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Background: In patients who suffer from graft failure after liver transplantation, a retransplant is currently the only potentially curative therapeutic option. While the results for liver retransplantation have progressively improved in recent years, outcomes of liver retransplants remain worse than those observed for primary transplants. Considering the limited availability of liver graft donors, long waitlist times and significant waitlist mortality, the selection of patients which may be considered for liver retransplant must be based on ethical and objective allocation policies. These policies should be based on the assessment of prognostic factors and scoring systems.
Methods: We retrospectively reviewed the medical records for all liver transplants in a tertiary hospital in the period ranging from 2011 to 2021. Patients who underwent more than one liver transplant were selected for the study. The impact of preoperative risk factors on survival was assessed using Cox regression analysis and the log-rank test.
Results: Of 646 liver transplants, 43 (6.6%) were retransplants. Most (48.8%) were performed up to 30 days after the primary transplant. Overall patient survival was 58.1%. Mortality was significantly higher (92.3%) in patients requiring preoperative mechanical ventilation (MV) when compared to those not requiring MV (43.3%) (p=0.003). Postoperative pulmonary infection was also significantly higher in patients requiring preoperative MV (23.1%) (p=0.015). Patients requiring preoperative administration of vasopressor agents had a significantly higher mortality (80%) when compared to hemodynamically stable patients (42.9%) (p=0.03). Higher preoperative leukocyte counts (p=0.024), receptor age (p=0.002) and total ischemia time (p=0.026) were also inversely correlated with survival for liver retransplants.
Conclusions: Survival after liver retransplant was significantly lower in patients requiring preoperative mechanical ventilation and infusion of vasopressor agents. Higher leukocyte counts, receptor age and total ischemia time were also correlated with higher postoperative mortality. These factors should be taken into account when selecting patients who may be candidates for liver retransplantation.

P-122

The prevalence and impact of impaired left ventricular global longitudinal strain on outcomes in liver transplant recipients

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Background: We aimed to assess the prevalence and characteristics of patients with impaired pre-transplant left ventricular global longitudinal strain (GLS) and its impact on post-transplant morbidity and mortality.
Methods: We performed a retrospective study of 80 consecutive cirrhotic patients undergoing liver transplantation (LT) from 1/1/2021 to 10/31/2021 at the University of Maryland Medical Center. Data were collected on pre-transplant demographics, cardiovascular risk factors, etiology of liver disease, Model for End-Stage Liver Disease score (MELD-Na), Child Pugh score (CP), and presence of coronary artery disease (CAD); and post-transplant hospital and intensive care unit (ICU) stay, readmission rate, new major cardiovascular event (MACE), and mortality rate. Left ventricular GLS was considered impaired if the value was <-18%.
Results: Mean follow-up time in days was 166.9 days post-transplantation (range, 0-320), 4 patients (5%) died, 7 (8.8%) patients developed MACE, and 41 (51.3%) were readmitted at least once. GLS was available in 23 patients, 7 (30.4%) of which had impaired GLS. Compared to patients with normal GLS, patients with impaired GLS were older (mean age 55.8 years vs. 46.2 years, p=0.03), had higher mean MELD-NA (35 vs. 30.8, p=0.04), higher mean creatinine (2.17 mg/dL vs. 1.38 mg/dL, p=0.05), lower mean Hgb (7.6 g/dL vs. 9.4 g/dL, p=0.05), lower mean LVEF (61.4% vs. 64.3%, p=0.003), lower mean GLS (-14.24% vs -21.93%, p<0.05). However, they were not significantly different regarding the presence of obesity, smoking history, or obstructive CAD; or post-transplant readmission, MACE, or mortality rates (p≥0.05). Furthermore, patients with impaired GLS had shorter mean survival time in days (89.1 vs. 149.6 days, p=0.05).
Conclusions: The prevalence of impaired GLS in cirrhotic patients undergoing LT was 30.4%. Although a larger sample size and longer follow-up are required to obtain more conclusive results, our study suggests that patients with impaired GLS may have lower mean post LT survival time.

P-123

The prevalence and impact of impaired left ventricular global longitudinal strain on outcomes in liver transplant recipients without arrhythmia or structural heart disease

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Background: We aimed to assess the prevalence and characteristics of patients without arrhythmia or structural heart disease (SHD) but with impaired pre-transplant left ventricular global longitudinal strain (GLS) and its impact on post-transplant morbidity and mortality.
Methods: We performed a retrospective study of 80 consecutive cirrhotic patients undergoing liver transplantation (LT) from 1/1/2021 to 10/31/2021 at the University of Maryland Medical Center. Data were collected on pre-transplant demographics, cardiovascular risk factors, etiology of liver disease, Model for End-Stage Liver Disease score (MELD-Na), Child Pugh score (CP), and presence of arrhythmias or SHD; and post-transplant hospital and intensive care unit (ICU) stay, readmission rate, new major cardiovascular event (MACE), and mortality rate. Left ventricular GLS was considered impaired if the value was <-18%.
Results: 68 patients were included. Patients had a follow up mean time of 173.1 days after transplantation (range, 0-320), 3 patients (4.4%) died, 6 (8.8%) patients developed MACE, and 32 (47%) were readmitted at least once. GLS was available in 18 patients, 5 (27.7%) of which had impaired GLS. Compared to patients with normal GLS, patients with impaired GLS were older (mean age 57.4 years vs. 46 years, p=0.04), had higher mean MELD-NA (35.2 vs. 29.9, p=0.03), and lower mean left ventricular ejection fraction (61% vs. 64%, p<0.05). However, they were not significantly different regarding the presence of HTN, DM, HLD, obesity, or smoking history; or post-transplant readmission, length of hospitalization, ICU stay, MACE, or mortality rates (p≥0.05). Furthermore, patients with impaired GLS had shorter mean survival time in days (86 vs. 156.6 days, p=0.04).
Conclusions: The prevalence of impaired GLS in cirrhotic patients undergoing LT without arrhythmia or SHD was 27.7%. Our study suggests that patients without arrhythmia or SHD but with impaired GLS may have lower mean post LT survival time.

P-124

Application of diffuse reflectance spectroscopy for non-invasive real-time assessment of macrovesicular steatosis in liver donors: proof of concept & preliminary results of clinical trial

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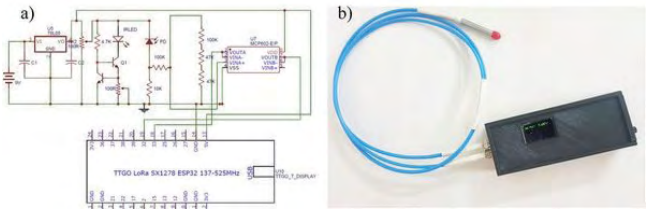
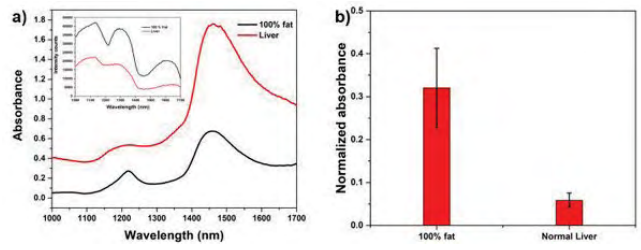
Background: Macrovesicular Steatosis (MS) is an independent risk factor for adverse post-liver transplant (LT) outcomes. While a formal liver biopsy is the gold-standard diagnostic test for MS, it is not universally feasible. Other tests like a frozen-section biopsy are plagued by issues of fallibility. The development of an accurate, non-invasive, handheld, real-time device for quantification of MS would fill this lacuna. We aimed to apply the principle of diffuse reflectance spectroscopy (DRS) for real-time quantification of MS. (Clinical Trial No: CTRI/2021/01/030223)
Methods: DRS is based on the principle of tissue illumination and the measurement of reflectance. By fitting the analyzed data from reflected light into a mathematical model, tissue characteristics such as its structure and composition can be estimated. A handheld device was designed and developed with a single infrared light emitting diode LED-photodetector arrangement coupled between through a fibre-optic reflection probe bundle.



Results: 50 abattoir retrieved large animal livers with varying percentage of fat were utilised for initial proof-of-concept analysis. The specific absorption spectrum of fat peaked at 1200 nm and the normal liver had a Gaussian response at 1200 nm(Figure 1A).The calculated absorbance response of fat and liver was noted to be 0.3203 ± 0.09 and 0.058 ± 0.01 respectively(Figure 1B). The absorbance values were evaluated against the gold standard biopsy results. Calibration of the device on human livers was performed on 15 live liver donors.A sensitivity of 98% and specificity of 80% was noted. Further analysis on 35 deceased donor livers will be performed.



Conclusions: Once the results of the calibration phase are accrued and confirmed with a validation cohort, our device will be linked with a smartphone application incorporating the algorithm. This would allow for a real-time high-resolution image along with MS percentage to be remotely transmitted using the mobile network to the concerned senior members of the transplant team.

P-126

Days alive and out of hospital (DAOH) following simultaneous liver kidney transplantation (SLKT)

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Background: Outcome following SLKT using graft survival and mortality may not reflect the impact of the transplantation upon patient experience. Days alive and out of hospital (DAOH) is a patient-centered outcome representing a composite of length of stay (LOS), hospital readmission and mortality and reflects the patient's experience of the entire care episode. DAOH for CKLT may be decreased in (1) patients receiving DCD allografts due to increased risks for vascular and biliary complications and (2) patients requiring dialysis prior to transplantation.
Methods: Following IRB approval, the medical record was reviewed for the first year LOS, any readmission and mortality for all CLKT from 2014 thru 2019. Recipient and donor data, and perioperative variables as well as donor category (DCD vs DBD) were included. Primary outcome was DAOH at 365 days.
Results: Table 2: Quasi-Poisson regression for $DAOH_{365}$

VARIABLE	EFFECT	OR	P-VALUE	OR (95% CI)	P-VALUE
DONOR TYPE	DCD VS DBD	1.05 (0.99, 1.2)	0.29	1.09	0.06
AGE	Per 5 year increase	0.98 (0.95, 1.00)	0.08	0.98 (0.95, 1.00)	0.06
COLD ISCHEMIC TIME	Per 2 hour increase	0.002 (0.84, 0.96)	0.002	0/92 (0.86, 0.96)	0.006
TRANSFUSION BURDEN	Per 5 unit increase	0.98 (0.97, 0.99)	0.002	0.99 (0.98, 1.00)	0.005

Table 1: Outcomes by Group

	DBD (n=53)	DCD (n=31)	TOTAL (n=84)	p- value
DAOH365(median)	345.0 (339.0, 356.0)	349.0 (330.5, 357.5)	348.0 (336.8, 357.0)	0.91
Ischemic Cholangiopathy (yes, %)	1 (1.9%)	3 (9.7%)	4 (4.8%)	0.14
ERCP required (yes, %)	11 (20.8%)	13 (41.9%)	24 (28.6%)	0.05
Hepatic Artery Complications	6 (11.3%)	4 (12.9%)	10 (11.9%)	1.00
Graft Failure LIVER	3 (5.7%)	3 (9.7%)	6 (7.1%)	0.66
Delayed Graft Function KIDNEY	17 (32.1%)	19 (61.3%)	36 (42.9%)	0.01
Death w/in 1 year	3 (5.7%)	0 (0.0%)	3 (3.6%)	0.29

Conclusions: In patients who underwent CLKT, the donor type (DCD v DBD) did not signicantly impact the DAOH365. There was an association between higher transfusion burden and CIT with reduced DAOH365.

Poster Presentations: Donation after Circulatory Death and Machine Perfusion

P-132

How to combine normothermic regional perfusion and machine perfusion in donation after circulatory death liver transplantation? Answers from an Italian national survey

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Background: There is increasing evidence that normothermic regional perfusion (NRP) and machine perfusion (MP) can improve the liver transplant (LT) outcomes from donation after circulatory death (DCD), and these technologies are variously used in many countries. A combined protocol with NRP and subsequent MP has spread in Italy, yielding good results despite the stand-off period of 20 min. We have therefore designed a national survey to investigate practices and policies of DCD among the Italian centers.
Methods: We have conducted an Internet-based national survey. All the 21 centers performing adult LT were invited to participate. The questionnaire was divided into 2 parts. The first part investigated the general attitude towards DCD-LT. The survey automatically ended after this part if the participating center had not performed any LT from DCD. The second part included questions about each center's protocols.
Results: The overall response rate was 100%. Eleven (52.4%) centers had a program for DCD-LT with NRP. Organization and availability of personnel were perceived as the main difficulties in starting such a program. Between 2015 (start of the activity in Italy) and 2020, 119 transplants from controlled DCD were performed. The overall utilization (proposed/transplanted) was 69.2%. The acceptance rate on NRP and MP was 80% and 95.9%, respectively. Pump flow and gross aspect were considered the most useful parameters in liver selection during NRP, followed by lactate clearance. Subsequent MP was routinely used in 10 (90.9%) centers. Eight centers used hypothermic MP, one center used normothermic MP, and the remaining one chose the MP type depending on the case.
Conclusions: This survey shows that NRP with MP is the most used protocol for the preservation of DCD livers in Italy. Although some heterogeneity exists in the type and purpose of MP between centers, this approach ensures a high overall utilization rate despite the prolonged ischemia.

P-134

Utilising NRP to 'rescue' extended criteria DCD livers that have been declined by all UK transplant centres

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[1]*Royal Infirmary of Edinburgh, University of Edinburgh, Transplant Centre, Edinburgh, United Kingdom*

Background: Normothermic regional perfusion (NRP) has been shown to significantly improve clinical outcomes following liver transplantation with donation after circulatory death (DCD) grafts, largely by mitigating the harmful effect of prolonged warm ischemia. Emerging reports have also shown that NRP significantly improves outcomes for DCD kidney transplantation. In our centre, it has recently become standard practice to attend every DCD donor with NRP. The aim of this study was to explore the potential of NRP for 'rescuing' extended criteria DCD livers that have been declined by all UK transplant centres.
Methods: Data on all DCD-NRP attended between 2013-2021 were retrospectively collected. The primary endpoint was to explore the impact of using NRP on graft utilisation by rescuing livers not originally considered for transplantation.
Results: 114 DCD-NRP were undertaken in the study time period. The liver was accepted before team arrival in 97 DCD-NRPs, 48 (49.5%) of which were successfully transplanted. The reasons for declines were predominately due to poor function on NRP and prolonged time to asystole (82%). The team attended 17 donors when livers were declined by all centres before team arrival. On NRP, 7 of these demonstrated good function (primarily with rapid fall in lactate and minimal rise of ALT, Fig.1) and were re-offered for transplantation, resulting in 5 rescued livers that were successfully transplanted (30%).

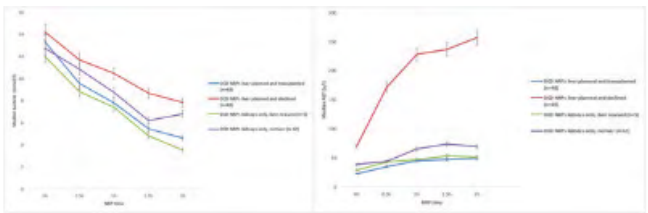

Fig. 1 Trajectory of lactate clearance and ALT rise in the DCD-NRP cohort
Conclusions: These are the first reported cases showing that NRP could unconventionally help to safely utilise the enormous proportion (often 50%) of DCD liver grafts that are declined by all centres before organ retrieval and assessment has commenced.

P-136

Defining the boundaries of viability assessment criteria during NRP

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Background: Viability assessment of livers in donors after circulatory death (DCD) using normothermic regional perfusion (NRP) depends on objective evaluation of graft function using a combination of parameters. Macroscopic appearance, lactate clearance, ALT (reflecting hepatocyte injury), glucose metabolism and bile production remain the basis of the decision making whether to transplant a donor liver or not. The aim is to define the boundaries of the objective viability assessment criteria and their impact on DCD-NRP liver grafts utilisation.
Methods: Prospectively collected data from all DCD-NRP retrievals attended by the Edinburgh Transplant Centre team were retrospectively analysed (2013-2021). The primary endpoint was to investigate the correlation between viability assessment parameters currently utilised in routine clinical practice for NRP with DCD-NRP liver graft ultilisation outcomes. Appropriate statistical comparisons were performed with SPSS (IBM).
Results: Out of 114 DCD-NRP retrievals performed, 53 livers (46.5%) were successfully transplanted and 62 (53.5%) were not used. NRP blood tests at 0, 0.5, 1-, 1.5- and 2-hours data (Fig.1) showed that delta lactate is significantly lower in the group from which livers were successfully transplanted, compared to the group from which livers were discarded; mean ± SD of -8.0 ± 3.1 vs -6.2 ± 4.6, p=0.03. Similarly, delta ALT demonstrated a significantly lower rise in the transplanted group, mean ± SD = 28.0 ± 41.6 when compared with declined livers, 190.3 ± 240.6, p=<0.001.

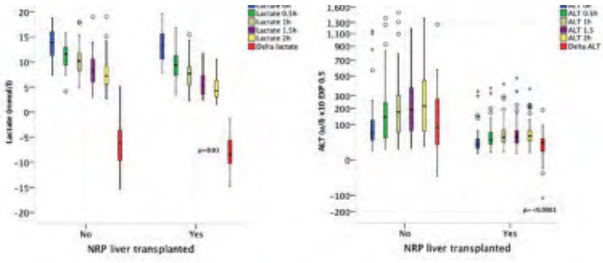

Fig.1 Delta lactate and ALT correlation with NRP liver utilisation

Conclusions: The trajectory of lactate clearance and ALT rise over 2 hours of NRP provided reliable and valid viability assessment criteria in defining the boundaries for safe DCD-NRP liver transplantation. A move toward assessment of delta lactate and delta ALT (instead of absolute numbers), would greatly assist objective organ assessment by removing the 'noise' of inter-donor variation and could significantly improve donor organ utilisation.

P-137

Outcome of donation after circulatory death grafts in adult cholestatic liver disease recipients: a national cohort study

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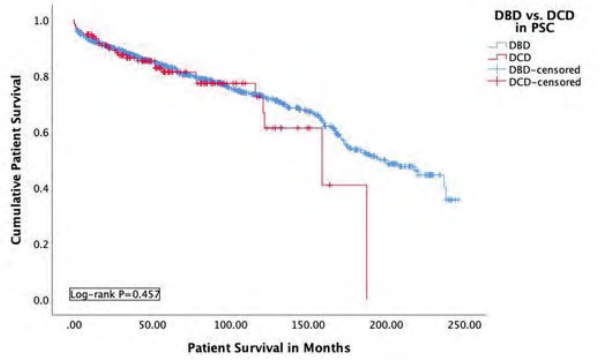
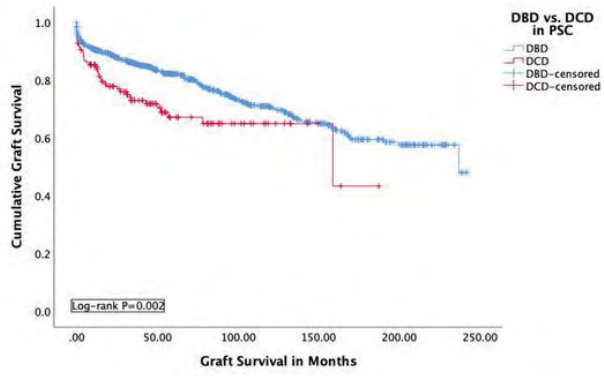
Background: Cholestatic liver diseases (Primary Biliary Cholangitis; PBC and Primary Sclerosing Cholangitis; PSC) account for 10-12% of all adult liver transplantations (LT) in the UK. There are conflicting reports of worse or similar outcomes when donation after circulatory death (DCD) grafts are used in recipients with PSC and outcomes are unknown in recipients with PBC. This study aims to investigate outcomes of this group of patients with DCD transplantation and compare to DBD grafts.
Methods: The NHSBT database identified patients transplanted for PBC or PSC as primary indication between 2000 and 2019.
Results: Of the 2424 LTs, 2169 were primary, liver only transplants [PBC–1060 (49%), PSC–1109 (51%)]. 16% and 12% of PBC and PSC transplants were with DCD grafts, respectively. PSC cohort were younger (mean 47 vs. 55 years; p<0.001), predominantly male (71% vs. 14%; p<0.001) with higher MELD (17.7 vs. 16.7; p=0.002). The 1-, 5- and 10-year graft (90%, 80% and 70% vs. 96%, 88% and 84%; p<0.001) and patient survival (92%, 85% and 78% vs. 96%, 90% and 86%; p=0.012) was significantly worse for the PSC compared to PBC cohort. Disease recurrence (5.5% vs. 2.9%;p=0.007) and retransplant rate (14.2% vs. 7.8%;p<0.001) were higher for the PSC cohort. When donor type was compared, there was no difference in graft and patient survival between DBD and DCD grafts for PBC recipients. However, DCD graft survival was significantly worse than DBD graft survival in the PSC cohort (85%, 70% and 65% vs. 92%, 85% and 78%; p=0.002), but there was no difference in patient survival.
Conclusions: DCD grafts are less utilised in the PSC cohort when compared to PBC. Whilst the graft survival is inferior for PSC patients who receive DCD livers, equivalent patient survival justifies using these grafts in clinically urgent recipients.





P-138

Two compartment evaluation of liver grafts during acellular room temperature machine perfusion (ACRTMP) in a rat liver transplant model

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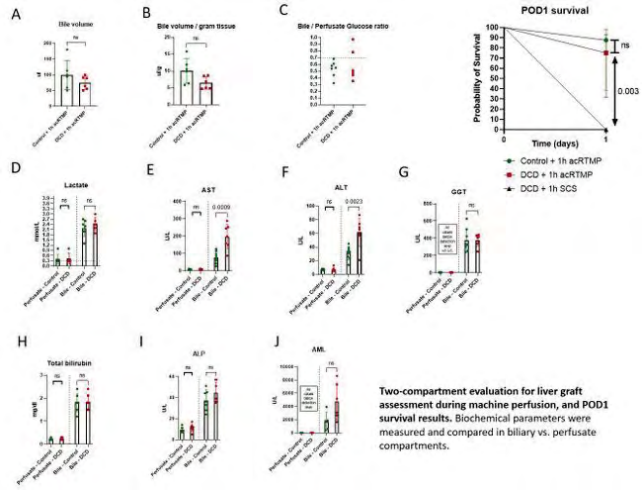
Background: Subnormothermic machine perfusion (SNMP) of liver grafts is currently less clinically developed than normo- and hypothermic approaches, but may have logistical advantages. At intermediate temperatures, the oxygen demand of the graft is low enough to be satisfied with an acellular perfusate, obviating the need for oxygen carrying molecules. This intermediate metabolic rate, however, is sufficient to support the production of bile, which is emerging as an important indicator of graft injury and viability. In this study, we hypothesized that the biliary compartment would be more sensitive than perfusate in detecting graft injury during SNMP.

Methods: To test this hypothesis in a rat model, we performed liver transplants with DCD and control liver grafts after 1 hr of acellular room temperature machine perfusion (acRTMP) or static cold storage (SCS). Point of care liver function tests were measured in biliary and perfusate samples after 1 hr of machine perfusion. Following transplantation, rats were sacrificed at 24 hr for assessment of post-transplant graft function and histology.

Results: Point-of-care liver function tests were significantly more concentrated in the biliary compartment than the perfusate compartment during acRTMP. DCD liver grafts could be distinguished from control liver grafts by significantly higher markers of hepatocyte injury (AST, ALT) in the biliary compartment, but not in the perfusate compartment. Classical markers of cholangiocyte injury, such as GGT, AML, and ALP were detectable in the biliary compartment, but not in the perfusate compartment. In comparison to SCS, graft preservation by acRTMP produced a significant survival benefit in DCD liver transplantation (75% vs 0%, p<0.0030).



Two-compartment evaluation for liver graft assessment during machine perfusion, and POD1 survival results. Biochemical parameters were measured and compared in biliary vs. perfusate compartments.

Conclusions: Together, these findings demonstrate that during acRTMP, the biliary compartment may be a more sensitive indicator of graft injury than the perfusate. Moreover, acRTMP provides superior graft preservation to SCS in rat DCD liver transplantation.

P-141

Use of machine perfusion in extended criteria DBD donors

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Background: The use of extended criteria donors (ECD) for liver transplant (LT) may increase the donor pool to face the chronic organ shortage. However, these grafts are at higher risk of primary nonfunction, delayed graft function, biliary complications and

complications following liver transplantation. Machine perfusion (MP) may improve perioperative outcomes of LT recipients of ECD grafts.
Methods: We included patients that underwent LT in our center between 2003 through 2021 with ECD liver grafts. Marginality was defined for cold ischemia time (CIT) > 8 hours or macrosteatosis >30%. 53 patients were identified and divided in MP group (time interval 2018 – 2021) and no-MP group (time interval 2003 – 2017). All MPs were hypothermic (D-HOPE) with Liver-Assist, that became available in our center since 2017.
Results: Live grafts from no-MP group underwent biopsy with mean macrosteatosis of 8.77% (SD +/- 11.2) and microsteatosis of 11.5% (SD +/- 15), while in the MP group macrosteatosis was 30.8% (SD +/- 14) and microsteatosis 31.1% (SD +/- 18.3), p< 0.05. D-HOPE was performed for a mean of 3.36 hours (SD +/- 98.5). There was a single episode of PNF in both groups, early allograft disfunction was similar in the two cohort, respectively 63.4% and 72.7%. Mean hospital stay in no-MP group was 18.4 days (SD +/- 12.8), versus 10.4 (SD +/- 2.7) days in the MP cohort (p < 0.05). No biliary or vascular complications were registered in the MP cohort, while 24.5% and 16.9% had respectively biliary and vascular complication in the no-MP.
Conclusions: Despite the higher degree of steatosis in the MP group, the incidence of complications was comparable to the no-MP group, with statistically significant shorter post-operative in-hospital stay. Therefore, the use of D-HOPE machine perfusion should be considered to reduce the risk of complications in liver grafts from ECD-DBD.

P-142

Salvage of declined extended criteria DCD livers using abdominal normothermic regional perfusion (ANRP)

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Background: In donation after circulatory death (DCD), combined donor risks factors and extended functional warm ischemia during the agonal phase increase the risk of complications post-transplantation. Therefore, high risk DCD livers are often declined. Abdominal Normothermic regional perfusion (aNRP) provides the opportunity to re-evaluate the organs after the agonal phase. This study investigates if DCD livers that are declined by the entire Euro-Transplant region, can be salvaged with aNRP.
Methods: Between October 2018 and April 2021, aNRP was undertaken in livers from DCD donors which were declined by all centers in the Euro-Transplant region. Protocol acceptance criteria were: functional warm ischemia time <1hour, stable ALT levels <200U/l, decreasing lactate during aNRP, demonstration of a glucose peak, bile pH >7.45 and bile glucose <3mmol/L. Outcomes were compared with standard DCD and DBD donor livers transplanted in the same period.
Results: After withdrawal of life-support 28 of 43 potential donors had asystole within two hours, in which case aNRP was initiated. In 3 (10%) of the cases perfusion problems occurred, 5 of the grafts (18%) were declined based of liver assessment, and 20 (71%) of these livers were transplanted. The main differences during aNRP between transplanted and the assessed non-transplanted grafts were ALT levels of 53 (34-68) U/L vs. 367(318-488; p=0.001) and bile production in 100% vs. 50% of the grafts (p=0.024). Postoperative peak ALT was significantly lower in the aNRP group 783 (575-1767) U/l compared to the standard DCD cohort (1079 (718-1682), p=0.001) and comparable to the DBD cohort (713 (442-1217). Graft and patient survival at 6 months after transplantation were both 95%, similar to comparator cohorts. The incidence of ischemic cholangiopathy was 11%, which was not different from DBD livers (7%; p=0.657).
Conclusions: aNRP can safely select and rescue DCD livers that are deemed unsuitable for transplantation. Outcomes are comparable with DBD transplantation.

P-143

Donation after circulatory death liver transplants are higher and unevenly distributed in the United States after the implementation of the acuity circle allocation policy

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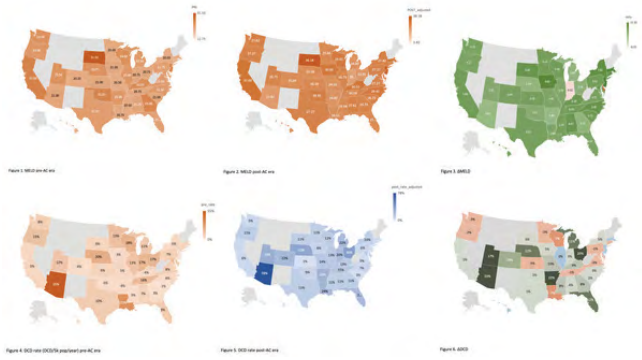
Background: This study aimed to assess the impact of the recently (02/2020) implemented Acuity Circles (AC) liver allograft allocation policy on MELD at transplant and Donation after Circulatory Death (DCD) rates.
Methods: Study period: 01/2016- 08/2021. Data retrieved from SRTR database. Inclusion criteria: All DCD liver transplants (LT). The cohort was dichotomized into a pre- and post-AC era. DCD rate (defined as DCD/ 50k population/year) was calculated for each State. The change (Δ) on the DCD rate (ΔDCD) and the MELD (ΔMELD) between the two periods was also calculated.
Results:

1. Total LT increased in the post-AC era (26%/50k vs. 15%/50k, p=0.0567).

2. DCD LT increased in the post-AC era (15%/50k vs.10%/50k, p=0.0885).

3. MELD increased in the post-AC era in nearly all States



(ΔMELD, fig.1, 2 & 3).

4. Uneven distribution of pre- & post-AC DCD activity, with a few States driving DCD LT in the US (fig.4 & 5).

5. Arizona and Louisiana had the highest pre-AC DCD rates (58%/50k & 31%/50k, respectively; fig.3).

6. The top post-AC DCD rate was reached in Arizona (78%/50k, fig.5).

7. Top post-AC ΔDCD was noted in Arkansas & Arizona (fig.6).

8. The highest ΔMELD was noted in low DCD/ negative ΔDCD

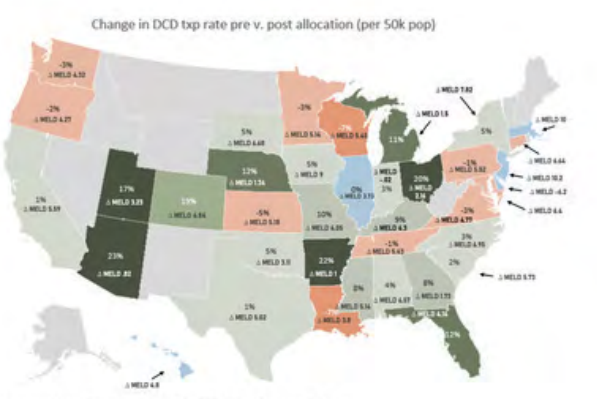


Figure 7. Combined map ΔMELD &ΔDCD in the post-AC era

areas (fig.7).

9. The lowest ΔMELD was noted in areas with the highest DCD rate (fig.7)

10. The State with the highest DCD rates pre-AC had the highest ΔDCD (fig.5).

11. 10/11 States with negative ΔDCD were located North of the 35°.

Conclusions: AC implementation coincided with an increase in the overall LT & DCD LT activity. However, causation remains to be clarified, given the concurrent opioid crisis and SARS-CoV-2 pandemic. There was remarkable DCD rate variation. States with high DCD rates/ΔDCD demonstrated greater adaptability in the allocation change, maintaining low ΔMELD across eras.

P-144

Increased use of DCD liver grafts does not adversely affect outcomes: a single-center experience

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Background: Donation after circulatory death (DCD) donors are underutilized in liver transplantation (LT), partly due to fear of inferior outcomes. Our center has evolved from a low- to high-DCD liver utilization program. We hypothesized that there would be a difference in donor and recipient characteristics as well as recipient outcomes between high and low DCD utilization eras.
Methods: Single-center, retrospective review from 1/1/2011 to 12/31/2020. Early era (EE, 1/1/11-12/31/15) donor and recipient characteristics and recipient outcomes of DCD LT were compared to late era (LE, 1/1/16-12/31/20).
Results: In EE and LE, 9 and 114 DCD LTs were performed, respectively. Cumulative incidence of EE and LE hepatic artery thrombosis (p=0.69), biliary leaks (p=0.08) and strictures (p=0.85) were comparable. Graft and patient survival at 1,3, 6, and 12 months were similar (p=0.40 and p=0.72). LE donors were older (p=0.02), had longer cold ischemia time (CIT) (p<0.01), and shorter donor warm ischemia time (WIT) (p<0.01). Recipients of DCD LTs had less hepatocellular carcinoma (HCC) in EE (p=0.02).

Table 1: DCD donor/recipient characteristics			
Variables	2011-2015 N=9	2016-2020 N=114	Test Statistic
Recipient Age: years (mean ± sd)	54.56 ± 12.53	56.47 ± 9.53	P=0.79[1]
Recipient Gender:			P=0.928[2]
Female	3 (33%)	33 (29%)	
Male	6 (67%)	81 (71%)	
MELD-Na (mean ± sd)	13.50 ± 9.03	18.42 ± 7.95	P=0.08[1]
HCC Any Diagnosis: No	3 (33%)	80 (71%)	P=0.02[2]
Days on waiting List (mean ± sd)	200 ± 173	284 ± 731	P=0.175[1]
Donor Age (mean ± sd)	28.00 ± 7.71	37.10 ± 11.71	P=0.016[1]
GT (hrs) (mean ± sd)	4.26 ± 1.18	5.43 ± 1.33	P=0.004[1]
DCD Warm Ischemia Time (min) (mean ± sd)	20.88 ± 3.56	14.97 ± 5.01	P<0.001[1]
Warm Ischemia Time (min) (mean ± sd)	41.0 ± 13.3	42.6 ± 18.1	P=0.385[1]
Length of Stay (Days) (mean ± sd)	9.56 ± 9.10	10.43 ± 12.73	P=0.973[1]
PNF : Yes	0 (0%)	1 (0.1%)	P=0.778[2]
Initial days in ICU (post-transplant) (mean ± sd)	2.22 ± 2.33	2.86 ± 5.77	P=0.57[1]

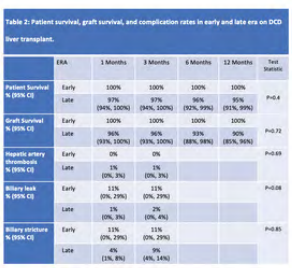

Table 2: Patient survival, graft survival, and complication rates in early and late era on DCD liver transplant.							
	ERA	1 Months	3 Months	6 Months	12 Months	Test Statistic
Patient Survival % (95% CI)	Early	100%	100%	100%	100%	
	Late	97% (94%, 100%)	97% (94%, 100%)	96% (92%, 99%)	95% (91%, 99%)	P=0.4
Graft Survival % (95% CI)	Early	100%	100%	100%	100%	
	Late	96% (93%, 100%)	96% (93%, 100%)	93% (88%, 98%)	90% (85%, 96%)	P=0.72
Hepatic artery thrombosis % (95% CI)	Early	0%	0%			P=0.69
	Late	1% (0%, 3%)	1% (0%, 3%)			
Biliary leak % (95% CI)	Early	11% (0%, 29%)	11% (0%, 29%)			P=0.08
	Late	1% (0%, 3%)	2% (0%, 4%)			
Biliary stricture % (95% CI)	Early	11% (0%, 29%)	11% (0%, 29%)			P=0.85
	Late	4% (1%, 8%)	9% (4%, 14%)			

Conclusions: We demonstrate a 1166% increase in single-center DCD LTs without compromised morbidity or patient and graft survival, despite LE having older donors, longer CIT, and less HCC patients. These data suggest more liberal LT with DCDs did not jeopardize outcomes. Wider adoption of liberal DCD donor acceptance nationally may increase organ supply, particularly for lower MELD patients.

P-145

Initial experience with *ex-situ* normothermic liver machine perfusion

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Background: With the growing acceptance of the role for the expansion of suitable indications for liver transplantation, such as selected cases of hilar cholangiocarcinoma and unresectable colorectal liver metastases, the imbalance between clinical need for liver transplantation and supply of suitable donor organs is likely to widen in Europe for the foreseeable future. Novel organ perfusion technologies are likely to play a fundamental role in maximising utilisation of all donor organs and facilitating the safe transplantation of marginal grafts. Herein we describe the initial experience of implementing Normothermic Machine Perfusion (NMP) in a liver transplant centre just before the onset of the COVID-19 pandemic.
Methods: Retrospective analysis of a prospectively-maintained comprehensive database encompassing donor characteristics, perfusion parameters and post-transplantation outcomes.
Results: Between February 2020 and October 2021 (20 months), 37 liver grafts were perfused with NMP and 23 proceeded to transplantation. The indications for NMP included logistics – 16 grafts (69%), further assessment of marginal grafts – 5 (22%) livers and facilitation of a predicted difficult hepatectomy (e.g. redo transplant) – 2 livers (9%). Overall, a total of an additional 15 livers, 3 kidneys and one pancreas were transplanted that absolutely could not have been transplanted without NMP (e.g. logistics, unacceptable cold ischaemic time with static cold storage) and a further 7 livers were successfully transplanted that may have been declined without the additional reassurance of dynamic functional assessment and safe prolongation of preservation time. No grafts were lost as a result of perfusion with NMP.
Conclusions: NMP is a safe and effective technique for improving graft utilisation in liver transplantation and has become an integral component of routine clinical practice since its introduction in Edinburgh. As collective experience with NMP increases, the prognostic predictive ability of serum (and potentially bile) analysis on the machine is likely to improve graft utilisation further.

P-146

Sequential hypothermic and normothermic machine perfusion for recovery of a cardiac death deceased donor (DCD) liver graft

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Liver grafts from donors after cardiac death (DCD) are used in Italy despite longer mean functional warm ischemia time (fWIT) due to national regulations. Normothermic regional perfusion (NRP) represents the standard for organ recovery during procurement and allows dynamic evaluation of liver function. Hypothermic machine perfusion (HOPE, D-HOPE) improves the outcomes of DCD liver grafts,however it doesn't allow an objective evaluation of liver recovery in case of extended criteria donors (EC). The recipient is a 67-year-old man, with HBV related cirrhosis and hepatocellular carcinoma (HCC) with partial response after TACE. The donor was a 66-year-old male, Maastricht III DCD, fWIT 48 minutes. At cross clamp after 253 minutes of NRP lactate level was 16 mmol/L. Therefore, we decided to perform sequential D-HOPE and normothermic machine perfusion (NMP) to carefully evaluate liver function. Perfusate samples were collected every 20 minutes for the first our and every 30 minutes for the following hours. D-HOPE lasted for 100 minutes, then NMP was set up. The 37°C target temperature was reached after 21 minutes and the perfusion lasted for 345 minutes. Transaminase levels increased progressively during NMP reaching 6625 U/l and 6354 U/l, respectively. Conversely, lactates decreased from 14.4 mmol/l to 1.3 mmol/l, with normal bilirubin (0.3 mg/dl) and progressively increased glucose metabolism (Table 1). Macroscopic appearance of the graft was optimal, therefore we decided to proceed with the transplant and started the recipient hepatectomy at T5 of NMP. The post-operative outcome was eventful, and the patient was discharged in good general conditions on post-operative day 13. After 3 moths the patient is in good general conditions with normal liver function. Sequential machine perfusion may represent a valuable strategy to increase the safety in EC-DCD liver grafts, combining the regeneration effect of D-HOPE with the functional evaluation of NMP, and thus reducing the discard of potentially transplantable liver grafts.

CHECK POINT	AST (U/l)	ALT (U/l)	Glucose (mg/dl)	Bilirubin (mg/dl)	Lactate (mmol/l)	INR
T0	1563	1969	260	0,3	14,4	-
T1	2252	2630	288	0,3	14	-
T2	2834	3140	286	0,3	10,5	-
T3	3025	3582	285	0,3	7,6	-
T4	3834	4041	275	0,3	3,9	-
T5	4373	4461	260	0,3	1,7	-
T6	4361	4885	251	0,3	1,6	-
T7	5187	5399	233	0,3	1,5	-
T8	6033	5965	213	0,3	1,4	-
T9	6119	6229	205	0,32	1,4	-
T10	6616	6399	188	0,37	1,3	-
T11	6625	6354	183	0,3	1,3	-
p.o.d. 1	3618	1649	159	2,08	7	2,6
p.o.d. 5	99	569	134	2,9	-	1,4
p.o.d. 10	21	107	110	1,9	-	1,34
p.o.d. 13 (discharge)	19	48	129	1,3	-	1,2

P-147

MELD - NA 15 and lower – way to go forward- DCD liver transplant or wait for a higher MELD score?

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Background: Liver transplantation following donation after cardiac death (DCD) continues to be a subject for heated debate, bigger controversy is if MELD score of 15 not sick enough for DCD liver transplant. Whereas OPTN data shows 47.1 % of listed patients with MELD -Na less than 15 at time of listing. We analyzed data of DCD donors for LT in order to identify risk factors for graft and patient survival.

Methods: This was a retrospective cohort study using data reviewed by screening SRTR/UNOS of patients that underwent liver transplantation with DCD donor at University of Miami from 2017 to 2021. Different surrogates were analyzed, including donor, recipient, procurement and transplant operation characteristics. The primary outcome was patient and graft survival. Continuous variables were analyzed using a 2-sided student t-test. Categorical variables were presented as frequencies and proportion and compared using chi-squared or Fisher's exact test as appropriate. Univariable Cox proportional hazards models were fit in order to assess the impact of individual covariables on the instantaneous rate of events, with time-to-event analysis also being ascertained through Kaplan-Meier estimates.

Results: 54 cases were analyzed, liver only transplants, excluding SLKs .Alcoholic cirrhosis was the most prevalent etiology for liver disease. The 1-year survival rate following liver transplant using DCD donors was 90.7% If separated by MELD score at the time of transplant, results showed a survival of 100% with MELD < 15 and 87% with MELD>15.

Conclusions: DCD donors are excellent options to increase the availability of organs for patients waiting for a LT. With close to 50% of the waitlist dominated by patient with MELD lower than 15 , successful use of DCD livers with 100 % patient survival is the way forward in future thereby , reducing the waitlist mortality and morbidity due to decompensations and prevent wait list drop outs.

Poster Presentations: Donor Selection Criteria / Patient Selection / Organ Allocation

P-150

Impact of the high baseline anti-a/b antibody titer on the clinical outcomes in abo-incompatible living donor liver transplantation

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Background: Recently, advances in desensitization protocol have made ABO-incompatible (ABOi) living donor liver transplantation (LDLT) feasible option in the era of organ shortage. Although, multiple sessions of plasmapheresis can successfully reduce preformed anti-A/B titer prior to transplantation, the clinical significance of baseline anti-A/B antibody titers remains uncertain. The aim of this study is to investigate the clinical outcomes of ABOi LDLT in patients with a high baseline anti-A/B antibody titer.
Methods: A total of 50 patients who received ABOi LDLT from 2010 to 2020 at two tertiary hospitals were evaluated retrospectively. Two centers used a protocol composed of rituximab, plasmapheresis, and/or splenectomy. The patients were classified according to baseline anti-A/B titer (<1:256, n=88 or ≥1:256, n=62) and compared the clinical outcomes among these groups. Graft survival rates were calculated using the Kaplan-Meier methods according to the groups.
Results: In the high baseline titer group, the number of plasmapheresis required to reach the target titer (1:16) was significantly higher (4.4±2.2 sessions) than in the low baseline titer group (1.9±1.2 sessions, P<0.001). 14 (16.4%) patients in high baseline titer group and 7 (9.2%) patients in low baseline titer group experienced postoperative titer rebound to ≥1:32, (P=0.014). The occurrence of both cellular rejection and antibody-mediated rejection did not show a significant difference (P=0.251 and P=0.147, respectively). The 1-,3-, and 5-year graft survival was not different among groups (high titer vs. low titer; 94.2%, 83.3%, and 59.0% vs. 92.1%, 86.3%, and 79.5%, P=0.326). In multivariate analysis showed that high baseline anti-A/B titer and postoperative rebound titer did not adversely affect clinical outcomes after ABOi LDLT.
Conclusions: Although, the patients with high baseline anti-A/B titer showed the higher tendency of postoperative antibody rebound, the baseline and rebound anti-A/B titer may not be as important factors for clinical outcomes of ABOi LDLT if appropriate desensitization is performed.

P-151

MAID donor as a viable source of liver grafts: the Toronto experience

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Background: In North America, the number of patients needing a liver transplant exceeds the number of available donors. In 2016, medical assistance in dying (MAiD) or euthanasia became allowed in Canada. Aim of the study was to report the clinical outcomes of liver transplants from donors after MAiD at our institute, and compare the same with donors after cardiac death (DCD) and deceased brain dead (DBD) donors.
Methods: All patients having undergone deceased donor liver transplantation at the Toronto general hospital between 2016 and 2021 were included in the study. The recipient peri-operative and post-operative variables and the donor physiologic variables were analyzed and compared between the three groups.
Results: A total of 807 patients underwent deceased donor liver transplantation during the study period including brain dead (n=719;89%), DCD (n=77;9.5%) and MAID (n=11; 1.4%). There was no significant difference between the mean post-operative AST levels between the brain dead (870 U; IQR=63-1152), DCD (1040 U; IQR=69-1325) and MAiD (1087 U; IQR=516-1439) groups (p=0.1). The average post-operative hospital stay was comparable between the three groups (21.5 vs 20.3 vs 22.8 days; p=0.7). The overall incidence of biliary complications was 7.4%(n=60), the most common being strictures (n=25;3.1%), highest among the MAID recipients [27.2% vs 15.6%(DCD) vs 6.2%(DBD); p=0.001]. There was no significant difference in the 1-year (98.4% vs 96% vs 100%; p=0.07) and 3-years (89.1% vs 88% vs 100%; p=0.08) survival among the 3 groups. The overall mortality of cohort was 7.4% (n=60).
Conclusions: Despite the expected physiological hemodynamic challenges among the MAiD and DCD compared to brain dead donors, there was no significant difference noted in the short-term and long-term graft outcomes among the three groups. The MAiD donors could potentially be considered as a viable source of organs to meet the shortage of grafts with results comparable to the other established forms of donation.

P-152

Changes in the trend of deceased donors in Korea: establishment of the regional trauma center and KODA

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Background: South Korea shows extremely high activity in living donor liver transplantation because it has been selected as an alternative to overcome the shortage of deceased donors. With the establishment of the Korea organ donation agency (KODA) as an independent organ procurement organization (IOPO), a large number of donor-managing hospitals were selected as a policy. Separately, the nationwide regional trauma center project was carried out in earnest from 2015. This study aims to analyze how the trend of deceased donor recruitment and donation has been changed according to national policy factors such as IOPO activities and the establishment of regional trauma centers.
Methods: From 2010 to 2019 Among the KONOS data, deceased donors were discovered and managed by hospitals and analyzed in relation to the establishment of regional trauma centers and the activities of IOPO.
Results: A total of 62 centers had 4,395 cases of deceased donors, and a total of 3,863 recipients underwent deceased donor liver transplantation. Cerebrovascular events were the most common cause of death among donors, and head trauma-related death accounted for 26.1%, accounting for the second most common cause. When the increased rate of deceased donors was analyzed by dividing into the early period (2010-2014) and the late period (2015-2019) based on 2015 when regional trauma centers began to be active. 53 non-traumatic centers had cases from an average of 29.3 cases to 31.0 cases (6.2% increase). On the other hand, 9 regional trauma centers showed a statistically significant increase from an average of 39.8 cases to 70.3 cases (75.9% increase).
Conclusions: In Korea, according to the national policy, the pattern of hospitals where deceased donors occur is changing. It is necessary to educate and communicate with regional trauma centers staff for recruiting more deceased donors through the discovery of potential deceased donors.

P-153

Use of an mini-subcostal incision for living donor right hepatectomy: a series of 189 consecutive cases

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Background: Living donor hepatectomy is now a well-established surgical procedure. However, a large abdominal incision is still required, which results in a large permanent scar, especially for a right liver graft. Minimally invasive surgery has been widely used for donor operations. This study aimed to determine the safety and feasibility of mini- subcostal incision for living donor right hepatectomy.
Methods: We reviewed 1456 patients who underwent living donor right hepatectomy (LDRH) between January 2015 and December 2019 at Asan Medical Center. We performed 1:1 propensity score matching of the LDRH with mini- subcostal incision and the LDRH with conventional incision (J-shape), with 144 patients subsequently included in each group.
Results: The total operation time (P =0.018) were longer in the mini-subcostal incision group. None of the donors required intraoperative transfusion or experienced any irreversible disabilities or mortalities. The length of postoperative hospital stay was significantly shorter in the mini- subcostal incision group (P =0.043). The rate of complications in donors was similar between the 2 groups. Graft steatosis were independent predictors of postoperative morbidity after LDRH with mini- subcostal incision on multivariable analysis. Vascular and biliary complication rates in recipients were similar between the 2 groups.
Conclusions: LDRH with mini- subcostal incision is feasible when performed at an experienced living donor liver transplantation center. Donor safety is paramount in living donor liver transplantation. In centers with difficulties in performing pure laparoscopic donor right hepatectomy, LDRH with mini-subcostal incision can be an alternative to pure laparoscopic donor right hepatectomy.

P-154

Increased DCD utilization increases transplant volumes and diminishes waitlist mortality

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Background: In 2020 in the United States, 13,009 candidates were added to the liver transplant (LT) waiting list while 1,109 were removed for death, and 1,243 removed for becoming too sick. The aim of this study is to evaluate the impact of DCD utilization upon a single center waitlist outcomes.
Methods: We compared adult LT candidates in two periods (Period 1 [n=372]; January 2014 - December 2017 and Period 2 [n=342]; January 2018 – October 2021). Analysis was confined to waitlist activity, person-years and transplant rates per 100 person-years on the waiting list and post-transplant outcomes. Graft- and patient-survival between DBD and DCD grafts (segmental grafts were excluded) were compared after propensity score matching.
Results: During Period 1, more patients were removed from waitlist for death or becoming too sick (19.1% vs 9.7%, p<0.001), and the median waiting time was longer (13 vs 5 months, p<0.001). During Period 1 and Period 2, 189 and 253 LT were performed on 425.2 and 180.7 (p<0.001) person-years on the waitlist, respectively. Comparing the Transplant rates per 100 person-years on the waitlist increased from 0.44 (95%CI 0.38-0.51) to 1.4 (95%CI 1.23-1.57). In Period 1 and

Period 2, 11/165 (6.7%) and 50/228 (21.9%) of LT were with DCD grafts, respectively, with a significant increase utilization per year (from 2.7% in 2014 to 27.1% in 2021, Pearson's R =0.89, p=0.003). Overall, patients receiving a DCD graft had lower median MELD score at transplant (24 vs 29, p<0.001), longer median waiting time (8 vs 4 months, p=0.002), and shorter lengths of stay following transplant (8 vs 10 days, p=0.041). When comparing the 147 DBD to the 53 DCD the graft- (84.7% vs 85.3%, p=0.69) and patient- (85.4% vs 83.6%, p=0.45) 5-year survival were similar.
Conclusions: Utilizing DCD grafts significantly diminishes single center wait list mortality without negatively impacting post-transplant survival.

P-159

Impact of median meld at transplant policy on transplant for HCC at a single center

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Background: Hepatocellular carcinoma (HCC) is the most common primary malignant hepatic tumor. Currently, liver transplantation may be the optimal treatment for HCC. Patient selection criteria was dramatically changed when UNOS adopted the Median MELD at Transplant (MMaT) policy on September 29, 2019. This decreased the maximum exception MELD in our transplant region. The effect on patients transplanted for HCC is not yet clear.
Methods: Retrospective review was conducted for patients transplanted with HCC between January 1 2018 and November 1 2021. Patient demographics, laboratory values, and outcomes were compared before and after the adoption of this policy.
Results: One-year transplant survival was 90.3 vs 85.8% p=0.065 between the 2 groups. 75 patients were transplant in the 21 months prior to MMaT policy and 62 after adoption, p=0.03. The waiting time to transplant was 12.1 months in both groups. The median MELD was different in the two groups with patients' having a biologic meld of 13 before MMat and 21 after adoption (p=0.02). The MELD at transplant was also different with the pre-MMat group being 32 and the post-MMaT group of 26 (p <0.001). There was a significant difference in the number of patients transplanted for HCC with 86.7% transplanted before MMaT vs 27.4% after (p<0.001). The number of patients with exception at transplant were distinct with 78.7% prior and 59.7% post-MMaT (p=0.02) The patients transplanted after the policy change had decreased functional status with lower Karnofksy scores (p=0.01).
Conclusions: There has a been a significant decline in the number of patients getting transplanted for HCC since implementation of the MMaT policy with sicker patients with higher MELD scores being transplanted. The short-term survival of patients transplanted at our center has not changed but the long-term consequences of this policy remain unclear and the long-term impact needs careful attention.

P-160

Evolution of donation after circulatory death liver transplantation in the United States

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Background: With the shortage of organs for liver transplantation (LT), different solutions have been proposed to expand the donor pool: utilization of extended criteria organs, living donation, machine perfusion and donation after circulatory death (DCD) organs. The aim of this study is to evaluate the trend of DCD liver graft utilization in the last decade in the U.S. and determine the impact of increased DCD LT if all centers utilize these organs.
Methods: Using the OPTN database, we collected the annual total LT and DCD volume and calculated the % of total LT volume comprised of DCD LT for active adult transplant centers in U.S. between January 1, 2010 and December 31, 2020.

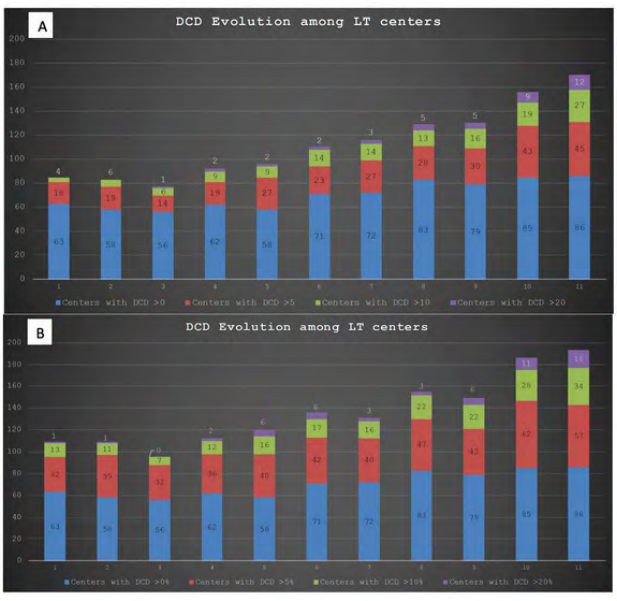

Figure 1: DCD trend in the last decades among the LT centers in US.
A: absolute volume increase of LT with DCD B: percentage volume increase of LT with DCD.

Results: In 2010, 32 and 13 transplant centers did 5% or 10% DCD donors, respectively. In 2020, the centers that used 5% or 10% of DCD donors increased to 57 and 34 centers, respectively. In 2020, 45, 27 and 12 centers did more than 5, 10 or 20 DCD LT/year, respectively.

Based on the 2020 data, if all active adult LT programs do at least 5 or 10 DCD LT/year, we would increase LT by 278 or 694 LT/per year.
Conclusions: We found that there has been an increase in the number of LT programs utilizing DCDs as well as the volumes of programs that utilize DCDs. The theoretical impact of the wider adoption of DCD LT would substantially increase the volume of LT in the US.

P-162

Seventy is the new sixty: University of Modena experience with liver transplantation in elderly patients

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Background: The extended life expectancy has led surgeons to modify selection criteria for surgical indications accordingly. Age criteria changed for liver transplantation in the last decades as well, moving the cut-off age from 65 years to 70 years. We present our experience with LT in recipients older than 70 years.
Methods: All transplanted patients between 2019-2021 older than 70 were included in this analysis. The LT workup program, regardless from age or comorbidities, includes basal and stress echocardiogram, pulmonary tests, vascular doppler ultrasound (carotids axis and lower limbs), gastroscopy and colonoscopy, total body computed tomography (CT) scan and an infective screening. Coronary CT or coronarography can be performed in presence of multiple risk factors or when appropriate according to the anesthesiologist.
Results: 15 cases were included, with a median age of 72 years. The indication for liver transplantation was HCC in 12 cases, autoimmune cirrhosis in 2 cases, 1 case for metastasis from colorectal cancer. Male/female ratio 11/4, median Charlson Comorbidity Index 7 (5-10), median MELD 13 (7 - 27). One patient received a donation from a living donor (LDLT). Three patients had a recurrence (2 cases of liver localizations from HCC, 1 pulmonary from colorectal metastasis) after a median interval of 1 year, 3-year survival was 80%. Median ICU stay was 1 day, while median in-hospital stay was 10 days (range 5-50), 6 patients experienced complications 3a according to Clavien-Dindo, 90-days mortality was 13%.
Conclusions: Highly selected elderly patients can receive LT with good perioperative outcomes and survival. Case-selection process is crucial and should be based on the biological age despite of the chronological one.

Poster Presentations: Immunosuppression and Tolerance Induction

P-163

Artificial intelligence based dosing of tacrolimus in liver transplantation: prospective, randomized Phase 2 trial

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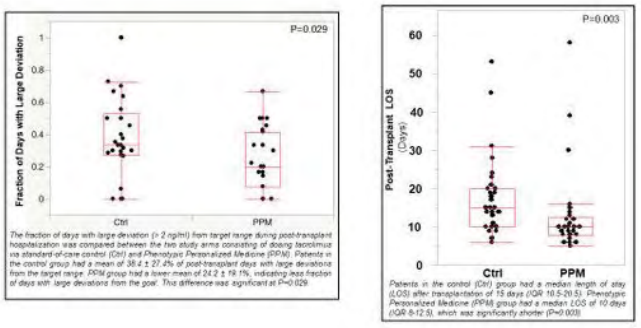
Background: Inter- and intra-individual variability in calcineurin dose requirements necessitates empirical clinician-titrated dosing that frequently results in deviation from target ranges, particularly during the critical early post-transplant period. We have developed an artificial intelligence-based approach, Phenotypic Personalized Medicine (PPM), to individualize drug dosing.
Methods: In this single-center, randomized, partially blinded trial, participants were assigned immediately prior to liver transplantation 1:1 to standard-of-care clinician-guided dosing or PPM-guided dosing. Blood tacrolimus trough levels were measured daily until patient discharge. The primary outcome measure was fraction of days with large (> 2 ng/ml) deviations from target range. Secondary outcomes included post-transplant length of stay, fraction of days outside-of-target-range, mean area-under-the-curve outside-of-target-range, graft rejection, graft failure, death, infections, nephrotoxicity, or neurotoxicity. Patients were followed until discharge from hospital.
Results: Sixty-two patients were screened and randomized. 31 were assigned to the control group and 31 to the PPM group. Fraction of post-transplant days with large deviation from target range was higher in the standard-of-care group than in the PPM group (38.4 ± 27.4% versus 24.2 ± 19.1%; P=0.03). Median length of stay was longer in the standard-of-care group than the PPM group [15 days (IQR 10.5-20.5) versus 10 days (IQR 8-12); P=0.003]. There were no significant differences in fraction of days outside-of-target-range, mean area-under-the-curve outside-of-target-range, graft rejection, graft failure, death, infections, nephrotoxicity, or neurotoxicity. No tacrolimus dosing related adverse events occurred during the trial.
Conclusions: In this randomized prospective clinical trial of AI-based personalized dosing of tacrolimus in patients after liver transplantation, PPM-guided dosing resulted in a lower fraction of inpatient days where the tacrolimus trough blood levels had a large deviation from the target range. PPM patients also had 33% shorter post-transplant length of stay than patients receiving standard-of-care tacrolimus dosing.



P-164

De novo metabolic syndrome in liver transplant patients after immunosuppression withdrawal

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Background: After liver transplantation (LT) operational tolerance is successfully achievable only in well-selected recipients and it is associated with reduced immunosuppression (IS)-related side effects. Recent evidences showed high incidence of de novo metabolic syndrome (MS) in LT recipients, but it has not been explored yet in patients who weaned IS.
Methods: A retrospective single-center study was conducted aiming to define the incidence of de novo MS in patients who completely or partially (less than 25% of initial IS doses) withdraw IS drugs after LT (TOL-group) compared to these who couldn't wean IS drugs (non-TOL-group). MS was defined as the presence of ³3 parameters (obesity, hypertriglyceridemia, low HDL-cholesterol, hypertension, hyperglycemia). All patients enrolled in IS withdrawal trials were included, except patients transplanted for non-alcoholic-fatty-liver-disease, chronic rejection and with a post-withdrawal follow-up <5 years.
Results: Out of 386 LT performed between 1993-2013, 91 (23.6%) LT recipients underwent IS withdrawal and 77 (84.6%) patients [55(71.4%) male] were enrolled in the study. IS withdrawal was started at a median age of 62 (34-73) years and after a median time of 6 (1-20) years form LT. Forty-two (54.5%) patient could completely (n=32,41.6%) or partially (n=10,13%) withdraw IS (TOL-group), while 35 (45.5%) couldn't suspend IS (non-TOL-group). Among groups, at the time of transplantation and IS withdrawal, patients' characteristics were similar. After 5 years from IS withdrawal, de novo MS was more frequent in non-TOL group compared to TOL-group [9(25.7%) vs 3(7.1%), p=0.031], and it was significantly associated only to Calcineurin Inhibitors-based regimen before the start of IS withdrawal protocol [HR=.160 (IC95%:0.30-0.849, p=0.031].
Conclusions: Advances in IS management and selection of patients who may suspend IS after LT permitted to achieve a success rate of operational tolerance in almost 50% of patients enrolled in IS-withdrawal protocols. Suspension of IS might protect the development of post-transplantation de novo MS at long-term.

P-165

Prolonged-release Tacrolimus is associated with reduced cardiovascular disease and improved survival following liver transplantation

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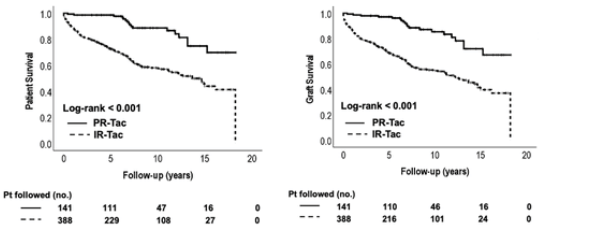
Background: Prolonged release Tacrolimus (PR-Tac) as an immunosuppressant after liver transplant (LT) results in improved adherence and lower drug peak concentration (Cmax). Our study aimed to investigate its impact on renal function, metabolic syndrome, cardiovascular disease (CVD), and graft and patient survival in comparison to immediate-release Tacrolimus (IR-Tac).
Methods: We analysed data on 531 patients who received their first LT at the University of Alberta from 2001 to 2015.
Results: No significant differences observed in baseline characteristics except higher BMI in the PR-Tac group (28vs.26; p<0.001). Patients on PR-Tac had significantly lower rates of CVD post-LT (16(11%)vs.80(21%),p=0.02) with PR-Tac being protective against CVD (HR0.45,p<0.01). Use of PR-Tac was not associated with CKD (HR=0.78,p=0.25). There were no significant differences between the groups with regards to rejection episodes, de-novo hypertension, diabetes, or dyslipidemia (Table-1). Individuals on PR-Tac had enhanced graft (15.61±0.53vs.10.69years ±0.41,p<0.001) and patient survival (15.95±0.51vs.11.31years±0.41,p<0.001) compared to individuals on IR-Tac.(Figure-1)

Table-1 Post transplant immunosuppression and patient characteristics.

	PR-Tac	IR-Tac	p-value
Tacrolimus	135 (95%)	365 (94%)	0.68
Episodes of rejection	53 (37%)	141 (36%)	0.84
BMI 1 year post-LT (kg/m2)	28 [±6]	27 [±5]	**<0.01**
Chronic kidney disease	72 (52%)	208 (56%)	0.48
De novo Diabetes	33 (23%)	63 (16%)	0.07
De novo Hypertension	72 (51%)	177 (46%)	0.33
De novo Dyslipidemia	57 (40%)	123 (32%)	0.08
De novo Cardiovascular Disease	16 (11%)	80 (21%)	**0.02**
De novo Metabolic Syndrome	40 (28%)	89 (23%)	0.21
Graft lost	20 (14%)	172 (44%)	**<0.001**

Figure 1: Patient survival and Graft survival are significantly higher in individuals on PR-Tac (p <0.001).



Conclusions: Use of PR-Tac post-LT is associated with significantly improved graft and patient survival, with the latter likely related to lower rates of CVD.

P-168

Complex case of mediated antibody rejection after two episodes of steroid - resistant acute cellular rejections in liver transplantation

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Mediated antibody rejection represents a dangerous complication after liver transplant with unfavorable outcome, due to diagnostic difficulties and non-standard treatment.
We report the case of a 21-year-old woman undergoing urgent liver transplantation (MELD 44) for acute liver failure on cirrhosis due to unrecognized Wilson's disease. Immunosuppression: Tacrolimus, Basiliximab, steroid. On day 7, first worsening of liver function with histological evidence of mild acute cell rejection (RAI 3) treated with 3 boluses of Solumedrol (1500 mg). In the 13th POD second episode of acute cell rejection (RAI 4) unresponsive to steroid therapy, that we treated with thymoglobuline. An attempt to introduce Everolimus failed due to toxicity. After initial improvement, in the 29th POD there was third severe worsening with sudden rise in bilirubin from 3.4 to 22.1 mg/dL. Absence of changes in the biliary tract on MRI-cholangiography. On biopsy absence of acute cell rejection, evidence of normal bile ducts, Kupffer cell hypertrophy, pericentral intrahepatocyte and intracanalicular cholestasis, foamy hepatocyte modification, rare acidophilic bodies, C4d negative, suspected for antibody-mediated rejection. Negative serum DSA. Treatment with two cycles of plasmapheresis and human immunoglobulins (1.5g/ kg/day) was performed, followed by the normalization of hepatic indices.
She was discharged at 50th post-transplant day.

Immunosuppression at the discharge: Tacrolimus (tacrolimus serum concentration: 10-12 ng/mL) and Mycophenolate mofetil (20-30 mg/kg/day).
Hepatological follow-up at 9 months with patient in excellent performance status and maintenance of normal hepatic functioning indices for 6 months.
In conclusion, the mediated antibody rejection still represents a fearful complication, the choice of treatment and the timing is important to avoid the concrete risk of graft loss.

Poster Presentations: Liver Transplantation during Covid-era

P-169

How to start new liver transplantat program in COVID era

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Background: In the era of Covid pandemia, when there is a risk of infection of the recipient and donor, resources for providing and treating patients with a end-stage liver disease are significantly reduced. Nevertheless, the need to treat pat ients with terminal liver diseases requires the continuation and creation of new transplantation programs. In this presentation, a generalization of the aspects of creating a new transplant program in the conditions of the Covid era is carried out.
Methods: Despite the general difficulties and the reduction in the number of transplants, the Moscow Clinical Scientific Center has opened a new liver transplant program in the covid era. Different obstacles and important factors for creating new liver transplant program were analyzed.
Results: The creation of a new liver transplantation program in the Covid era includes:
1) solving problems related directly to the liver transplantation program: a) training surgeons, anesthesiologists, ICU, hepatologists, b) creating contracts with the administration of health systems, c) purchasing the necessary equipment, d) solving the financial support of the transplantation program;
2) measures aimed at preventing covid infection which include: donors and recipients screening through an adequate history of exposure, fever, recent hospitalization, or ICU admissions and screening for SARS-CoV-2 infection based on the patient's history for the previous 2 weeks, assessing the virus (nasopharyngeal swab) by PCR, and chest CT scan.
Conclusions: A new liver transplant program can be successfully organized in the era of a pandemic, taking into account all the factors and difficulties associated both directly with liver transplantation and Covid infection.

P-170

COVID-19 in liver transplant recipients portend high mortality: a multicentric Indian experience

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Background: There is insufficient knowledge regarding the impact of COVID-19 on liver transplant recipients (LTRs). This study attempts to identify the common presentations, risk factors, treatment approaches and outcomes for Covid-19 infected post LTRs.
Methods: A questionnaire was sent to all major liver transplant centres in India in July 2021. Retrospective data of LTRs contracting Covid-19 till October 2021 were obtained from 5 centres.
Results: Out of 327 LTRs (mean age- 48 ±12, males-85.3%) who contracted COVID-19, the majority were live donor transplants (93.7%) performed in adults (94.2%). The infection occurred more than 2 years after liver transplantation(LT) in 64.8% while only 1.9% contracted the infection within 3 months. Comorbidities included diabetes (58.5%), systemic hypertension (32%), chronic kidney disease (CKD) (8.2%) and coronary artery disease (3.2%). The infection was hospital acquired in 25.1% and symptoms were fever (81%), respiratory (47.5%) and gastrointestinal (8.4%) whilst 9.6% remained asymptomatic. During illness, 84% continued their immunosuppression, while 12% had minimisation and 4% cessation. Overall 31% required admission(mean hospital stay 12±7 days), 18.4% oxygen supplementation, 5.5% ICU care and 2.1% invasive ventilation. Treatment modalities used were azithromycin(11.3 %), antivirals (25.3%) and other antibiotics (11.6%). Hydroxychloroquine, convalescent plasma and immunomodulators were administrated in less that 1%. Transient rejection or graft dysfunction occurred in 1.2% and all recovered. Only 29.2% were vaccinated. Persistent respiratory symptoms and COVID related thrombotic complications were reported in 8% and 0.6% respectively. The overall mortality was 7.3%, predominantly due to secondary bacterial infection. On multivariate analysis, CKD, presentation with dyspnoea and hospital acquired infection was associated with mortality. Age, other comorbid conditions, immunosuppressive strategy, antimetabolite continuation and duration from transplant did not impact mortality.
Conclusions: Although the disease presentations and risk factors of Covid-19 infection following LT were similar to that of the general population, the mortality was high (7.3%). Dyspnoea on presentation, Co-existing CKD and hospital acquired infection were the risk factors for mortality.

P-171

Impact of COVID-19 to mortality in waiting list for liver transplantation. Single center study

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Background: Severe coronavirus disease-2019 (COVID-19) seems to be important factor for mortality in patients with end-stage liver disease in waiting list for liver transplantation(LT). The aim of the present research is to investigate the incidence of COVID-19 in patients with MELD score higher than 15 in waiting list of single center (Moscow Clinical Scientific Center) and assess impact of Covid infection to mortality.
Methods: Demographic data, underlying disease, history of drug use and participants' outcomes were collected. The diagnosis of SARS-CoV-2 infection for all patients was confirmed using a nasopharyngeal swab specimen with real-time RT-PCR and CT scan.
Results: During the study period (**11.2020-11.2021**) 390 patients in waiting list for LT with MELD score more than 15 were enrolled. Among them 214 (53,8%) patients were Covid infected during investigated time. Of these infected patients 84 (40%) were asymptomatic, 65 (31%) with mild, 58 (27,6%) with moderate and 7 (3,3%) with severe disease. 27 (7%) patients underwent LT. 22 (5,6%) awaiting LT patients died because of liver cirrhosis complications. 6(1,5%) in waing list died because of Covid infection.
Conclusions: The incidence of COVID-19 in waiting list was high but this do not increase mortality significantly. Comparative studies are recommended to identify risk factors for COVID-19 in patients with end stage liver disease.

P-172

Predictive factors of antibody response after anti-SARS-CoV-2 vaccine in liver transplant recipients

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Background: A weak immune response to 2 doses of anti SARS-CoV2 vaccine was observed in solid-organ transplant recipients. The aim of our study was to search for predictive factors of an antibody response to the vaccines and describe their efficacy and tolerance in a large population of liver transplant (LT) recipients.
Methods: This is retrospective monocenter study conducted at Paul Brousse Hospital in France. All adult LT recipients followed up in our transplant center and vaccinated with at least one dose of vaccine from January 2021 to September 2021 were included. A strong immune response to vaccination was defined as the presence of antibodies titration to SARS-CoV-2 spike protein > 250 U/ml after 2nd or 3rd dose of vaccine.
Results: 745 patients were included, 642 (85.5%) had 2 doses and 343 (46%) patients had three. Mean age at vaccination was 59.1(±14.5) years and mean time from LT to vaccination was 12.1 (±9.7) years. The prevalence of anti-SARS-CoV-2 antibodies was 11% (19 patients) before the first dose, 40.8% (n=53) before the second, 66.2%(n=392) before the third, and 72.5% (n=271) after the third. 190 (36.7%) patients had a strong antibody titration after 2nd injection and 139 (47.6%) after 3rd. Patients who had strong response had, in time of vaccination, lower Tacrolimus blood concentrations (p = 0.04), lower Mycophenolate (p < 0.001) and corticosteroid doses (p = 0.009) and longer time since LT (p = 0.004). In multivariate analysis, predictive factors of strong response were time since LT>9.8 years (p = 0.001), while use of corticosteroids (p < 0.001) and high mycophenolate dose (p < 0.001) were correlated with an absence of strong response.
Conclusions: A strong immune response was detected to less than a half of LT recipients after 3 doses of anti-SARS-CoV-2 vaccine. These patients remain at risk for Covid-19, especially in case of high levels of immunosuppression.

P-173

High antibody response in relation to immunosuppressive blood levels in liver transplant recipients after SARS-COV-2 vaccination: an observational, cohort study

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Background: Several studies showed that the antibody responses to SARS-CoV-2 vaccines in solid organ transplant (SOT) recipients is reduced, with positive serology ranging from 30% - 65%. Until now, no study evaluated the effect of immunosuppressive blood levels on the IgG SARS-CoV-2 anti-spike antibody response after SARS-CoV-2 vaccination.
Methods: In this observational, cohort study, we determined the immunogenicity to SARS-CoV-2 vaccination in liver transplant (LT) recipients in relation to the immunosuppressive blood levels after the 2nd dose of mRNA vaccines or the vector vaccine ChAdOx1 nCoV19.
Results: A total of 476 LT recipients were included: 430 received mRNA-1273 vaccine, 25 received BNT162b2 mRNA vaccine and 21 received ChAdOx1 nCoV19 vector vaccine. Positive IgG SARS-CoV-2 serology test could be determined in 79·0% (376/476) of the LT recipients. LT recipients vaccinated with the mRNA-1273 vaccine had significantly higher IgG SARS-CoV-2 anti-spike antibody

levels compared to the other two vaccines, p<0·001. The use of mycophenolate mofetil (MMF), regardless the blood level, suppressed the IgG SARS-CoV-2 anti-spike antibody response and resulted in suboptimal responders to the SARS-CoV-2 vaccines, whereas the other immunosuppressive agents did not have that effect.
Conclusions: SARS-CoV-2 vaccination was highly effective in our LT recipient cohort. The mRNA-1273 vaccine results in a superior IgG SARS-CoV-2 anti-spike antibody response. MMF suppresses the IgG SARS-CoV-2 anti-spike antibody response, regardless the blood levels of MMF and the type of vaccination. As a consequence, lowering the dose of MMF has no effect on the immunogenicity to SARS-CoV-2 vaccines. Discontinuation of MMF around vaccination for every patient on MMF therapy is suggested to achieve an optimal antibody response.

P-174

Outcomes of COVID-19 in living donor liver transplant (LDLT) adult and pediatric recipients: an experience from a high-volume transplant center

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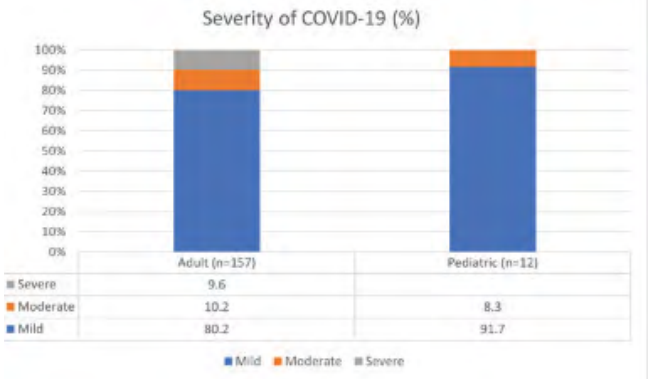
Background: Corona Virus Disease – 2019 (COVID-19) has affected Liver Transplantation (LT) program in multiple ways as immunosuppression and comorbidities increase the risk of severe disease. We present our experience with COVID-19 in LT recipients.
Methods: Prospectively maintained database of 3503 patients who underwent predominantly LDLT from Aug-2004 to Nov-2021 was analyzed. Cohort of 169 patients (both adult and pediatric) who were diagnosed with COVID-19 from Apr-2020 to Oct-2021 was selected. All eligible patients were advised to get fully vaccinated.
Results: One-fifty-seven adult recipients developed COVID-19 [mean age 47.1 ± 10.7 years, 139 male;18 female). Median time from LT to diagnosis was 4 (IQR 1-8) years; 21 had COVID-19 within 3 months of LT. Ninety-three (59.2%) patients were managed with home isolation and 64 (40.8%; all with moderate or severe, and some with mild disease) hospitalized. Mycophenolate dosage was reduced in mild to moderate disease, and only corticosteroids were given in severe disease, disease severity shown in *Figure 1*. Overall, 17 patients (10.8%) died due to COVID-19; 5(23.8%) within 3 months of LT. After recovery from COVID-19, there was no death over a follow up of median 7(IQR 6-14) months.
Twelve pediatric recipients developed COVID-19 with mean age 13.1 ± 7.2 years (6 boys;6 girls). Median time from LT to COVID-19 was 7 (IQR 4.7-10.2) years. Ten (83.3%) children were managed at home isolation and 2 (16.7%) required hospitalization. Disease severity shown in *Figure 1* with majority [11 patients (91.7%)] having mild disease. Two (16.7%) children died due to COVID-19.



Conclusions: COVID-19 is associated with increased mortality especially in the early post-transplant period. This can be minimized with full vaccination pre- and post-transplant, COVID appropriate behavior, close monitoring of home isolation patients, and early hospitalization with COVID directed therapy for at-risk patients with mild to moderate disease.

P-176

Liver transplantation activity during COVID-19 pandemic in Italy: a gamble or an urgent activity to be preserved anyway?

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Background: During the COVID-19 pandemic, the Italian National Transplant Center (CNT) urged and supported the preservation of donation and transplantation activities, as urgent and life-saving. Our study aimed at assessing whether this indication was correct and at quantifying the impact of the pandemic on transplantation activity (TA) and of SARS-CoV-2 infection on Solid Organ Transplant Recipients (SOTRs), in particular those who underwent the transplantation in 2020. We focused our analysis on liver TA (LTA) and on liver transplant recipients (LTRs).
Methods: Through the collaboration between the CNT information system and the integrated National Institute of Health surveillance system we were able to identify the Covid positive (COVID+) SOTRs and compare them with the non-transplanted COVID+ population (COVID+ non-SOTRs).
Results: In the year 2020, TA decreased by only 9.9% compared to 2019. In LTA the same percentage drops to 7.6%. SOTRs were confirmed to be more at risk of SARS-CoV-2 infection and mortality than non-SOTRs [Cumulative Incidence (CI) 4.96%vs.3.63%, p<0.001 and Case Fatality Rate (CFR) 12.6%vs.3.63%, p<0.001]. LTRs resulted less at risk of SARS-CoV-2 infection and mortality compared to the other kind of SOT (CI 3.8% and CFR 8.3%, p<0.05). Recipients

undergoing SOT during 2020 had a higher incidence of SARS-CoV-2 infection compared to the other SOTRs (CI 6.37%vs.4.96%, p<0.05) but their CFR was lower (9.05% vs 12.6%, p<0.05); their CI of infection and mortality resulted comparable to that of the population on the waiting list (CI 6.4% and CFR 9.5%, p=ns). LTRs were confirmed to be less at risk of infection and mortality (CI 4.3% vs 6.37% and CFR 2% vs 9.05%, p<0.05).
Conclusions: These results showed as the indication to continue the TA has been right and that the SOTs performed during 2020 were carried out safely. LT recipients seemed to have a CI of infection and mortality comparable to COVID+ Non-SOTRs.

P-177

COVID-19 in 823 transplant patients: a systematic scoping review

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Background: Management of COVID-19 in transplant patients is a big challenge. Data on immunosuppression management, clinical picture, and outcomes are lacking. Therefore, we summarized the primary research on COVID-19 in transplant patients regarding the immunosuppression clinical presentation, and clinical outcomes.
Methods: Search strategy
We performed a systematic search of MEDLINE, EBSCO, CENTRAL, CINAHL, LitCovid, Web of Science, and Scopus electronic databases. We searched the references of the relevant studies.
Selection Criteria
Primary reports of solid organ transplant patients who developed COVID-19 were included with checking for overlap of cases.
Data collection and analysis
We provided a descriptive summary of immunosuppression therapy, clinical presentation, management, outcomes, and mortality.
Results: We identified 74 studies reporting 823 cases of solid organ transplantation with COVID-19. Among 372 patients with sufficient data, 114 (30.6%) were mild COVID-19, 101 (27.2%) moderate, and 157 (42.2%) severe or critical.
The most common symptoms were fever (n= 577, 70%), cough (n= 520, 63%), dyspnea (n= 277, 33.7%) and diarrhea (n= 153, 18.6%).
Major outcomes included intensive care unit admission, invasive ventilation, and acute kidney injury, which occurred in 121 (14.7%), 97 (11.8%), and 63 (7.7%) of patients, respectively. Mortality was reported in 160 (19.4%) patients, which were comparable with the general population.

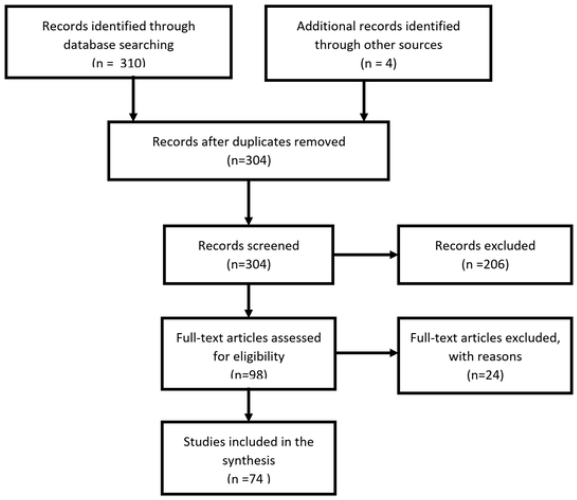

Figure 1. Study flowchart

Table 2. Common Immunosuppressive therapy at baseline and changes after COVID-19 diagnosis

Drug	Baseline	Discontinued	Reduced	Maintained	Started
CNI (No., %)	463/524 (88.4%)	168	91	60	4
MMF (No., %)	358/524 (68.3%)	203	34	21	1
Steroids (No., %)	313/524 (59.7 %)	8	5	104*	143
mTORi (No., %)	40/524 (7.6%)	14	1	2	-

Conclusions: COVID-19 in solid organ transplant patients probably has a more disease severity, worse major outcomes (Intensive care admission, invasive ventilation, acute kidney injury), and higher mortality than in non-transplant patients.

P-178

Inter-hospital referrals for alcohol-related liver disease from 2020 to early 2021

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Background: Alcohol sales in the United States increased in 2020 and early 2021, relative to recent prior years. We previously reported an increase in inter-hospital care escalation requests to our urban tertiary care center in Baltimore, Maryland, for alcohol-related liver

disease (ALD) from mid-2019 through late 2020, which coincided with reported increases in alcohol consumption during the time. We aimed to characterize ALD-related inter-hospital care escalation requests to our center from the first quarter (Q1) of 2020 through the second quarter (Q2) of 2021.

Methods: Patient and referring-hospital data were prospectively collected for care escalation requests to the inpatient hepatology unit of the Johns Hopkins Hospital. Patient clinical information and acceptance into the unit were compared across yearly quarters from Q1 2020 to Q2 2021. The Kruskal-Wallis test was used to compare continuous variables. Categorical variables were compared using the nonparametric linear-by-linear test.

Results: Overall, from Q1 2020 to Q2 2021, our center received 506 inter-hospital care escalation requests, of which 49% were for ALD. 55% of ALD-related requests were accepted for transfer. There was no appreciable difference in ALD-related referrals or the proportion of ALD patients accepted by our center across quarters.

Conclusions: ALD-related referrals comprised nearly half of the inter-hospital care escalation requests we received during the study period. Furthermore, ALD-related referrals have not decreased in frequency through mid-2021, suggesting that it continues to be a regional concern.

Table 1. Demographic and clinical information of patients referred for inter-hospital transfer to the Johns Hopkins Hospital adult inpatient liver unit stratified by yearly quarter from the first quarter (Q1) of 2020 to the second quarter (Q2) of 2021.

	Overall (*n* = 506)	2020 Q1 (*n* = 65)	2020 Q2 (*n* = 70)	2020 Q3 (*n* = 116)	2020 Q4 (*n* = 96)	2021 Q1 (*n* = 86)	2021 Q2 (*n* = 73)	*P* value
Age, median (IQR)	51.1 (39.0, 62.0)	54.0 (35.0, 63.0)	51.0 (38.0, 61.0)	51.0 (38.5, 62.5)	52.5 (41.5, 64.5)	53.0 (38.0, 59.0)	53.0 (43.0, 63.0)	0.67
Male, n (%)	299 (59)	38 (58)	45 (64)	77 (66)	55 (57)	41 (48)	43 (59)	0.16
Liver disease*, n (%)								
ALD- recent drinking	198 (39)	26 (40)	25 (36)	49 (42)	37 (39)	30 (35)	31 (42)	0.97
ALD- other	49 (10)	6 (9)	6 (9)	13 (11)	9 (9)	8 (9)	7 (10)	0.98
NASH	45 (9)	6 (9)	6 (9)	9 (8)	10 (10)	5 (6)	9 (12)	0.73
HCV	22 (4)	6 (9)	2 (3)	4 (3)	4 (4)	4 (5)	2 (3)	0.24
DILI	24 (5)	2 (3)	1 (1)	6 (5)	8 (8)	5 (6)	2 (3)	0.48
Other	168 (33)	19 (29)	30 (43)	35 (30)	28 (29)	34 (40)	22 (30)	0.94
ALD accepted for transfer, n (%) **	137 (55)	16 (50)	16 (52)	39 (63)	26 (57)	18 (47)	22 (58)	0.88
Total accepted for transfer, n (%) ***	291 (58)	33 (51)	37 (53)	77 (66)	52 (54)	46 (54)	46 (63)	0.43
Proportion of accepted that were transferred, n (%)	158 (54)	18 (28)	26 (37)	46 (40)	21 (22)	23 (27)	24 (33)	0.13

*Patients may have had more than one diagnosis. "ALD"- Alcohol-related liver disease. "ALD- recent drinking" is ALD with < 6 months of sobriety. "ALD-other" is ALD with > 6 months of sobriety.
**Signifies the proportion of candidates with ALD who were accepted for transfer.
***Signifies the total proportion of all inter-hospital transfer requests accepted.

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Improving access and continuity of care to liver patients in the COVID-19 era

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Background: Morbidity and mortality from coronavirus disease (COVID-19) was alarming despite efforts to curb the spread of the disease in 2020. Multiple studies have highlighted COVID-related delays in seeking care and complications in 2020 in patients with heart disease, cancer, and other chronic, potentially life-threatening health problems. Liver cancer patients need frequent cross-sectional imaging and interventions to prevent growth and spread of tumors outside the liver, which would preclude them from transplant, the only curative option for patients with unresectable tumors. We noted a significant drop in the number of patients with hepatocellular carcinoma (HCC) that were being referred to and seen at our large tertiary care hospital early in the pandemic (in the liver cancer clinics) and also delays in obtaining scans and arranging follow ups.

Methods: We aimed to assess the improvement in access to and continuity of care after implementing rapid interventions including web-based outreach and patient-centric telehealth services in the COVID pandemic. We reviewed our prospectively maintained database to assess new referrals and clinic volumes pre-pandemic, during the pandemic, and after intervention implementation.

Results: The number of new patients with HCC seen by our liver transplant center dropped by 4.4% during the first 4 months of the COVID pandemic (March-June 2020) relative to the previous 4 months. However, our client volumes quickly rebounded, with a 51.2% growth in average monthly referrals in the second half in 2021 after we implemented our new outreach program. Overall, we saw a 68.0% increase in referrals from 2019 to 2020, and an additional 8.8% growth in 2021 despite ongoing COVID surges.

Conclusions: Early recognition and prompt implementation of outreach and telehealth services led to a significant improvement in care access and maintaining continuity of care in our patient population. referrals and patient visits in our liver tumor clinics.

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Mucormycosis complicating COVID-19 infection in post-liver transplantation recipient: course and outcome

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Introduction: Outcome of Covid infection in post liver transplantation recipients carries conflicting results. We hereby present a case of post-transplant COVID-19 infection complicated by mucormycosisCaseFemale patient 47 year old had LDLT at 2016 for hemochromatosis since then she had one attack of BPAR and was on cyclosporine/everolimus and low dose prednisone 5mg with stable liver functions .On August 2021 she was presented to ER with hypotension, fever and hypoxia elevated liver enzymes (ALT124u/l,AST90 u/l) acute kidney injury (serum creatinine 3.2mg/dL) and the diagnosis of Covid-19 infection was confirmed by nasopharyngeal swab Covid PCR.

She was admitted to intermediate care and received steroids, oxygen and fluid therapy with hold of cyclosporine and everolimus, patient was discharged from hospital after 3 weeks.
After hospital discharge, the patient suffered from sudden acute loss of vision in left eye with proptosis.
CT Para nasal sinus and MRI orbit and cavernous sinus were done and diagnosis of mucormycosis (figure1) was done and confirmed later by histopathology after Para nasal sinuses debridement.
Amphotericin B started with total dose of 2 gm and surgical debridement was done twice, during the course of anti-fungal therapy, cyclosporine and everolimus were holded and she suffered from several attacks of hypokalemia and arrhythmias, as side effects of amphotericin B,

which was managed by medical treatment. Patient was discharged from hospital after 6 weeks on oral posiconazole and restart cyclosporine only. She is on regular follow up every 2 weeks with stable liver and renal functions but lost her left eye.
Conclusion: Covid infection carries a wide spectrum of severity in post transplant patients varies from mild to severe cases, however, complicated cases must be anticipated with judicial management including multidisciplinary team.

P-182

Successful living donor liver transplantation following Covid19

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Background: Covid-19 pandemic has had a major effect on liver Transplantation, decompensated cirrhotic patients with comorbidities are more susceptible to complications following covid-19, increasing mortality.
Methods: We present a case series of 5 chronic liver disease patients and 2 donors, who were Covid 19, reverse transcriptase-polymerase chain reaction (RT-PCR) positive for mild to moderate acute respiratory syndrome coronavirus-2 (SARS-CoV-2) pre transplant.
Results: Five patients underwent living donor liver transplantation following mild to moderate covid 19 illnesses, not requiring any hospitalisation. and two donors pre surgery.
Patient 2, was mild covid 19, 4 months back, High resolution CT of chest showed Co-Rad score of 3
Patient 4, after 4 weeks of covid 19 positivity, with obesity class 3,
Patients 6 and 7, were related donors, for patients 1 and 2 respectively.
All patients had, predominantly uneventful intraoperative period, patient 2 and 4 were extubated on table, rest within 8-12 hrs.
Patient 4 and one of the donors (patient 7) had bile leak, postoperatively, and managed conservatively with ERCP and biliary stenting.
All were discharged successfully following surgeries.

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7
Age	57	57	39	49	45	34	21
Sex	male	female	male	male	male	male	male
Etiology	NASH	NASH	Ethanolic	NASH	Ethanolic	Donor Hepatectomy	Donor Hepatectomy
MELD Na	21	24	36	26	28		
Covid 19 pre transplant	7 months	4 months	4 weeks	6 weeks	4 weeks	4 months	7 months
Post op complications	Nil	Nil	Sepsis	bile leak	Nil	bile leak	Nil
Comorbidities	Diabetes	Diabetes, COPD, HRCT ground glass opacities, CoRad 3	Nil	Obesity 3, No OSA	Nil	Nil	Nil

Conclusions: Decompensated liver disease patients who get affected with covid 19, can successfully undergo liver transplantation to avoid waitlist mortality, though further large multicentric studies are required to corroborate the feasibility.

Poster Presentations: Living Donor Transplantation

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Long-term quality of life after liver donation: a cross-sectional study in an established LDLT program

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Background: There are few long-term studies of quality of life (QoL) in living liver donors. This study aimed to analyse QoL in the living liver donors up to 13 years post-donation.
Methods: Between June 2007 and Oct 2021, 108 living donor liver transplant (LDLTs) were completed in our unit. A one-time cross-sectional survey was emailed to 101 living donors (7 were lost to follow-up). Validated short-form survey (SF-36), along with additional questions were used to explore the donors long-term QoL.
Results: 49 (48.5%) donors completed the SF-36 survey. Median age at donation was 23 years (range 20-59 years), 67% were females, 31 donated to a child and 18 donated to adults. The median time from donation was 48 months (2-156 months). Among the responders, only two donors had significant post-op complications: re-exploration for bleeding and conservative management of bile leak. Two donors had incisional hernia repairs from previous donation procedures. Only one donor is on long-term pain killers due to chronic wound pain, and none were on any mental health related medications. 42 (86%) donors returned to work at a median of 3 months from donation (2 weeks to 24 months). 14 (29%) donors changed their work after donation surgery, 8 (16%) felt they were able to work less than 100% compared to before surgery and two donors felt their employers supported them poorly despite their donation surgery. 8 (16%) donors felt their long-term personal income was affected by donation.
Conclusions: Most living liver donors maintain excellent health related QoL, supporting the belief that living donation does not negatively affect their physical and mental health. However, the study does show that a small percentage of living liver donors suffer physical, mental, and work-related issues, which needs close attention and a targeted support.

QUESTIONS (few selected from SF-36)	RESPONSES
Would you recommend liver donation to your friend if one of their family member needs a liver transplant?	*94% strongly agree or agree*
How is your general health?	*98% excellent, very good or good*
Compared to one year ago, how would you rate your health now?	*92% felt the health is same or better, but 8% felt it is worse or somewhat worse now than a year ago*
Does your health limit activities during a typical day?	*35% of donors felt it limited a little or lot*
During the past few weeks, have you had to cut down on the amount of time you spent on work or other activities due to your physical health?	*10% felt they had to cut-down work due to their physical health*
Emotional problems interfered with your normal social activities with family, friends, neighbors, or groups?	*16% felt emotional problems affected them severely (1 donor), moderately (4 donors), slightly (3 donors)*
During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)? [Accomplished less than you would like]	*12% of them felt they accomplished less than they would like due to emotional problems*
How true or false is each of the following statements for you? [My health is excellent]	**10% felt their health is not excellent**

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Living donor liver transplantation for patients with BCS, Mansoura experience

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Background: Budd Chiari syndrome is a rare condition, that involves obstruction of the hepatic venous outflow. There are different causes which ultimately, if not properly managed, leads to end stage liver disease. Liver transplantation is the last resort for these patients. In this study we will present our experience in living donor liver transplantation for those high risk patients.
Methods: In the period between April 2004 and April 2021 we performed 830 LDLT cases including 21 BCS patients. We retrospectively reviewed the medical records of BCS patients, specially looking for the possible causes, operative techniques, its modifications and the outcomes of those patients.
Results: Out of 22 patients, 2 had TIPS inserted, 2 had a radiological diagnosis of HCC and 3 patients had PVT. All recipients received ABO identical or compatible right lobe grafts without the MHV from related donors. The aetiology was found to be Idiopathic in 17 patients. Total occlusion of the IVC was not routinely done and no veno-vnous bypass was used in any case. The IVC was preserved

in all cases but one case where the IVC at the level of the RHV was fibrotic and the RHV was anastomosed to the suprahepatic portion of the IVC via a native portal vein graft. Anterior sector drainage using PTFE grafts was done in 8 cases. The median ICU and Hospital stay was 9.8 and 30.5 respectively. The 3-month mortality was 5 patients (23%). The 1, 3, 5 year survival was 75%, 72%, 72%, respectively.
Conclusions: LDLT for BCS patients still carries a higher risk of early postoperative mortality and morbidity. The need for major modifications in the technique is usually not present. The availability of vascular grafts and meticulous technique is essential to improve the results.

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Supraumbilical midline incision for donor hepatectomy

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Background: Morbidity related to large incisions, both short- and long- term, in the form of pain, infection, psychological impact of a large scar and incisional hernia are major concerns for healthy adults who undergo open donor hepatectomy.
Methods: We retrospectively studied our prospectively collected data of 250 donors (of the total 3470 living donor liver transplants from 2004-21), who underwent open supra-umbilical midline donor hepatectomy from January 2011 to July 2021. Perioperative and long-term outcome variables were compared with a similar number of matched donors who underwent donor hepatectomy through the conventional incision in last two years (2019 to present). The only exclusion criterion at present is previous subcostal incision.
Results: Mean BMI was 23.5 in the midline group vs 25.8 in the conventional group. In the midline and conventional groups, the proportion of right lobe, left lobe and left lateral sector grafts was 71.2%, 5.2% and 23.8% versus 94.8%, 3.2% and 2%. The mean blood loss in the two groups was similar - 570.62 ml and 656.9 ml (p 0.161). The mean operative time was higher in the midline group [579.5 vs 491.55 min (p = 0.0320)] whereas the mean hospital stay was lower in the midline group [5.79 versus 6.46 days (p < 0.0001)]. The mean static pain score (visual analogue scale) in the midline and conventional groups were 1.34 and 2.34 respectively (p < 0.01). The postoperative wound infections were lesser in midline group (11 versus 35, p < 0.01). Three patients in the conventional group required secondary suturing for burst abdomen while one patient developed incisional hernia. None of these complications occurred in the midline group.
Conclusions: Midline approach in donors offers more benefits compared to the conventional incision in terms of improved cosmesis by avoiding a large scar, reduced post-operative pain, reduced wound infection rate and early discharge.

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Laparoscopic living donor hepatectomy: a new standard for left-sided grafts?

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Background: The question of how to transform the pediatric LT program to a totally mini-invasive approach for the donor remains. We aimed to review our path from the initial implementation to the routine use of the laparoscopic approach with the preservation of favorable recipient outcomes.
Methods: Between May 2016 to September 2021, 435 pediatric patients underwent primary LDLT using left-sided grafts. Of these patients, left lateral section (LLS) transplantation was performed in 379 cases. And left lobe (LL) transplantation in 56 cases. Laparoscopic living donor left lateral sectionectomy (lapLDLLS) were performed in 181 cases. Laparoscopic living donor left hepatectomy (lapLDLH) was applied in 21 cases.
Results: The laparoscopic approach has been gradually implemented since 2016 and routinely used in almost each case by the 2019. The learning curve for the lapLDLLS was proctored and consisted of 37 cases.
The median operation time for open LLS (OLDLLS) was 290 min, for apLDLLS - 215 min (p<0.05). The average blood loss for OLDLLS was 150 ml, and for lapLDLLS - 50 ml (p<0.05).
The median length of hospital stay (LOS) was 7 days for OLDLLS and 5 days in the group of lapLDLLS (p<0.05).
In the LL group, the lapLDLH had a lower average operation time (325vs.360 min, p<0.05), lower blood loss (140vs.300 ml, p <0.05) and shorter LOS (7vs10 days).
The incidence rate of complications did not differ between the lap and open groups.
Recipient survival and complication rates were equal in all groups.
Conclusions: Both LapLDLLS and LapLDLH are safe, and reproducible, with significantly decreased blood loss and a shorter LOS with the open procedure. Left-sided grafts could be considered as the best way for the implementation of a mini-invasive approach in living liver donors. However, the laparoscopic approach remains a technically demanding and challenging procedure with the necessary training under the proctorship.

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Outcomes of abo-incompatible adult living donor liver transplantation for patients with hepatocellular carcinoma beyond the Milan criteria

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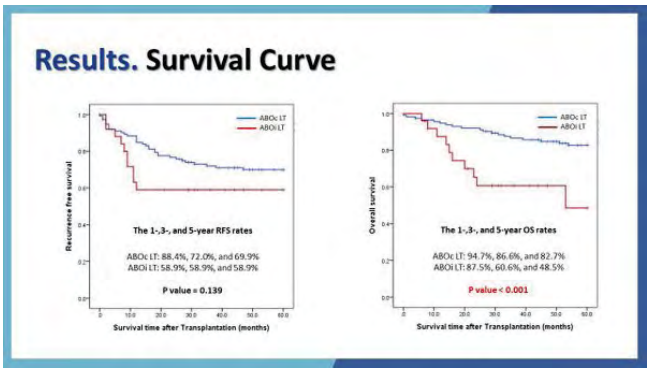
Background: Given the organ scarcity, ABO incompatible (ABOi) living donor liver transplantation (LDLT) emerged as a treatment option for hepatocellular carcinoma (HCC) and underlying liver disease. Milan criteria became standard criteria but expansion beyond the Milan criteria have resulted in similar post-transplant outcomes, thus suggesting LT is a viable treatment option for HCC presenting beyond the Milan Criteria. However, there was few reports the outcome of the patients receiving ABOi LDLT in beyond the Milan Criteria. The aim of our study was to review the HCC-related survival outcomes in the ABOi and ABO compatible (ABOc) groups in the beyond Milan Criteria

Methods: We retrospectively reviewed the medical records of patients undergoing LDLT for HCC from January 2000 to July 2021 at two tertiary centers in Korea. In total of 114 patients underwent ABOc and 25 patients underwent ABOi LDLT for HCC presenting beyond the Milan Criteria. The eligibility of the beyond Milan Criteria was assessed using preoperative findings by imaging study.

Results: There was no significant difference in pre-transplantation tumor staging, recipient and donor demographics between groups. In terms of operative outcomes and pathologic outcomes, there was no significant difference. The overall patient survival at 1-,3-, and 5-year was 88.4%, 72.0% and 69.9% after ABOc LDLT and 58.9%, 58,9% and 58.9% after ABOi LDLT, respectively (P=0.139). The recurrence free survival at 1-,3-, and 5-year was 94.7%, 86.6% and 82.7% after ABOc LDLT and 87.5%, 60.0% and 48.5% after ABOi LDLT (P<0.001). Recurrence type (intrahepatic versus extrahepatic) was no significant difference in both groups.



Conclusions: Although, recurrence free survival was significant poor in ABOi LDLT for patients with HCC presenting the beyond Milan Criteria than ABOc LDLT, overall survival was comparable between groups. ABOi LDLT may be a option for HCC with beyond Milan Criteria.

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Steroid-free living donor liver transplantation using rabbit antithymocyte globulin induction reduces incidence of acute cellular rejection

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Background: The efficacy of induction immunosuppression using rabbit antithymocyte globulin (RATG) in a steroid-free protocol with calcineurin minimization has been described in deceased donor liver transplantation. Steroid avoidance in liver transplantation has been found to reduce post-transplant cytomegalovirus infection, diabetes mellitus, and other medical sequelae. However, induction immunosuppression using RATG in a steroid free protocol has not been well described in the living donor liver transplant population. This abstract examines this protocol in a living donor liver transplant cohort in relation to the incidence of acute cellular rejection and patient and graft survival.

Methods: The outcomes of 22 consecutive living donor liver recipients who underwent transplantation from 2016-2021 at a single institution and who received RATG induction with only a single dose of preoperative methylprednisolone were evaluated. Mycophenolate mofetil was initiated postoperatively with delayed initiation of tacrolimus. Patients were weaned to tacrolimus monotherapy at 6 months. Differences between groups were evaluated by means of two proportions z-test.

Results: The most common indications for liver transplantation in this cohort were nonalcoholic steatohepatitis (26%), autoimmune hepatitis (21%), and hepatocellular carcinoma (21%). 68% of recipients were female. Recipients' mean age was 56 years ± 9.6. 73% received right lobes. Mean MELD was 17±6.5 (range 6-29). One year patient survival was 94.7 %, as compared to 89% in the multi-institutional A2ALL trial (p=0.22). Death censored one year graft survival was 88.9%. Biopsy proven allograft rejection was 5.3%, as compared to 26% in A2ALL (p=0.02). No recipient required steroid taper for treatment of biopsy-proven rejection.

Conclusions: This is the largest reported series of living donor recipients using a steroid-free protocol with RATG induction demonstrating excellent outcomes and low rates of acute cellular rejection.

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Complete transition from open to laparoscopy: 8-year experience with more than 500 laparoscopic living donor hepatectomy

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Background: We designed this study to comprehensively review the laparoscopic living donor liver transplantation of our institution.
Methods: Living donor liver transplantation cases performed since the first laparoscopic living donor hepatectomy, until reaching 500th laparoscopic cases were reviewed. Laparoscopic cases were compared to open cases in a yearly basis, regarding the donor selection, donor morbidity, recipient morbidity and operation time.
Results: Between 2013 to July 2021, 775 living donor liver transplantations, 506 laparoscopic and 269 open cases were performed. Complete transition to laparoscopy was achieved in 2020. Variation of bile duct type of donor became similar in 2018. (P=1.000) There were no differences in the occurrence of grade III complication of donor and recipient throughout the study period. Mean donor operation time were significantly longer in the laparoscopy group which became similar since 2017 (P=0.313) There were no differences in the mean operation time of recipients throughout the study period. Regarding graft survival and overall survival of the recipient, there were no difference between the two group throughout the period.
Conclusions: In the initial period, donor selection existed especially for bile duct variation maintaining the safety of the donor and recipient. However, with accumulated experience, complete transition to laparoscopy became possible.

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Hepatic venous territory mapping in living donor liver transplantation using right liver graft: an objective parameter for venous reconstruction

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Background: This study evaluated the clinical implication of hepatic venous territory mapping in living donor liver transplantation.
Methods: Living donor liver transplantations performed using the right graft since 2017 were included. Hepatic venous volume mapping was started in 2019. Risk factors for graft failure and overall survival were analyzed. Analysis for factors related to occlusion of the reconstructed vein was performed.
Results: Among 445 patients included, 213 underwent hepatic venous mapping. Hepatic venous mapping itself was not a significant factor for graft (HR=0.958, CI=0.441-2.082, P=0.913) and overall survival. (HR=0.627, CI=0.315-1.247, P=0.183) Inferior hepatic vein occlusion was a significant risk factor for both graft survival (HR=8.795, CI=1.628-47.523, P=0.012) and overall survival (HR=11.13, CI=2.460-50.30, P=0.002). In a subgroup with middle hepatic vein reconstruction, occlusion was a significant risk factor for overall survival. (HR=3.289, CI=1.304-8.296, P=0.012) In patients with middle hepatic vein reconstruction whose venous territory volumes were measured, right anterior volume ≥300cm^3 was protective for vein occlusion. (OR=0.317, CI=0.152-0.662, P=0.002) In patients with V5 reconstruction, V5 volume ≥150cm^3 was protective for vein occlusion. (OR=0.253, CI=0.087-0.734, P=0.011).
Conclusions: Inferior and middle hepatic vein reconstruction has a significant impact on clinical outcomes. Hepatic venous territory mapping can provide an objective measure for the successful reconstruction of venous branches.

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Outcomes of pediatric liver transplantation in inherited metabolic diseases: a single-center's experience

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Background: The knowledge so far limited on indications and outcomes of pediatric liver transplantation (LT) for inherited metabolic diseases (IMDs).
Methods: Demographic data, pretransplant clinical and laboratory profiles, post transplant outcomes and survival rates of twelve patients under 18 years underwent liver transplantation for IMDs from January 2015 to June 2021 were analyzed.
Results: Twelve (6 female, 6 male) of 104 (11.5%) patients were with a diagnosis of IMD. Four of the patients were diagnosed with primary hyperoxaluria type 1, two with crigler-najjar syndrome, one each with maple syrup urine disease, propionic acidemia, tyrosinemia type1, glycogen storage disease type1a, Wilson disease and, homozygous familial hypercholesterolemia, respectively. The mean current and age of transplantation of the patients were 8,7 (1-14,2) and 6,5 (0,3-12,8) years, respectively. Their mean follow-up time was 2,7 (0,5-6,1) years. The distribution of LT indications were poor metabolic control (42%), the need for frequent hospitalization due to acute life- threatening attack (17%), progressive neuromotor retardation (8%) target organ failure (33%), respectively. Mean time between diagnosis and LT was 2,7 (0,5-6,1) years. No neurological,

hematological, and metabolic complications were observed after LT. Biliary stricture in two (16.7%), artery anastomosis separation in one (8.3%) and ascites infection in one (8.3%) patient developed. 1-year patient and graft survival rates were both 100%. A significant difference was observed between preoperative and current height and weight standard deviation score of the patients, respectively (p=0.001and p=0.006).
Conclusions: LT is a good therapeutic option to improve the metabolic control and the quality of life of IMDs. Survival rates are ecxellent compared to other LT indications, for the IMD patients with appropriate timing and indication.

P-205

Preoperative percutaneous portal vein recanalization in Yerdel's grade IV portal vein thrombosis

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Background:
Complete thrombosis of the portal vein (PV) and superior mesenteric vein (Yerdel's grade IV) is a relative contraindication to liver transplantation in many centres. We describe our experience in grade IV portal vein thrombosis (PVT) with percutaneous ultrasound-guided portal vein recanalization with the creation of a transjugular intrahepatic portosystemic shunt (PVR-TIPSS) followed by early living donor liver transplantation (LDLT).
Methods:
Since August 2020, five patients including one child with chronic liver disease (CLD) and Yerdel's grade IV PVT underwent PVR-TIPSS prior to LDLT. For recanalization of PV transjugular (through TIPSS) approach is preferred over percutaneous transhepatic access, in view of ascites. TIPSS then promotes maintaining patency of the recanalized PV. Additionally trans- splenic access can be used to achieve recanalization of difficult thrombus. Patients were followed up for procedure related complications and PV flow before and after LDLT.
Results:
PVR-TIPSS was successful in establishing portal vein flow in all the 5 patients. One died from hepatic decompensation and sepsis 24 days later without transplant. Three underwent LDLT and one is awaiting LDLT. The two adult LDLT recipients had cryptogenic CLD, and the paediatric patient had glycogen storage related CLD. They underwent LDLT 12, 17 and 54 days after PVR-TIPSS procedure. One patient had intraperitoneal bleeding post PVR-TIPSS which was controlled by balloon tamponade. Recipient PV could be anastomosed end to end to graft PV in all cases. One adult patient died on post- operative day 11 due to sepsis with a patent portal vein; the other two patients had an uneventful post-operative course.
Conclusions:
Pre-transplant PVR-TIPSS is feasible, safe, and effective in re-establishing PV inflow in carefully selected patients with decompensated CLD and complete thrombosis of the porto-mesenteric venous axis. This subsequently allows physiological reconstruction of graft PV inflow during LDLT in a difficult group of patients often refused transplantation.

P-206

Etiological trends and outcomes of adult liver transplantation: dynamics of the last decade

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Background: We studied the changing etiologies of underlying liver disease and outcomes of adult patients who underwent liver transplantation (LT) at our institute over the last 10 years.
Methods: Prospectively maintained data of consecutive patients who had LT between June-2010 and September-2020 at our living donor LT predominant center was retrospectively analyzed after approval of institute's ethics committee. Patient demographics, etiology trends and overall survival were evaluated. Survival between different etiologies was compared using Kaplan-Meir curves (log-rank test).
Results: Out of total 3503 LTs, 2,356 LTs were performed during the study period and 2,104 adult LDLTs [median age (years): 51 (IQR: 42-57), n=1751 (83.2%) males] were analyzed. Median MELD (IQR) of the patients was 17 (13-22). Twenty (0.95%) patients underwent deceased donor LT. Fifty-eight (2.75%) patients were transplanted for acute liver failure. Alcohol (22-35%) remained to be the most common chronic insult. Between 2010 and 2020, Hepatitis B (16.8% vs 11%) and Hepatitis C (21.4 % vs 12.7%) related cirrhosis has shown a significant reduction as an indication for LT whereas non-alcoholic liver disease (NAFLD) related or cryptogenic cirrhosis emerged as the second most common indication. Other indications such as autoimmune liver diseases, acute liver failure, drug induced liver injury accounted for nearly 10% of all LTs (Figure 1a). Cumulative overall patient survival at 5 and 7 years was 81% and 78.6%. There was no difference in overall survival between patients with different etiologies (p= 0.205) (Figure 1b).

Figure 1a. Trends of indication for liver transplantation between 2010 and 2020

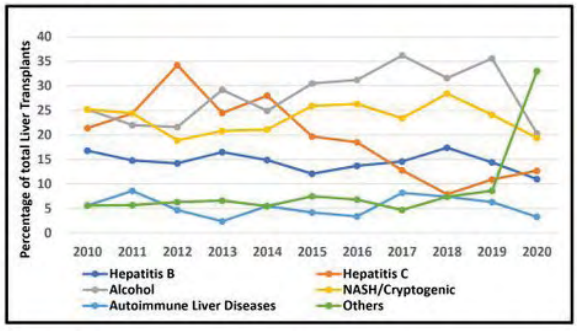
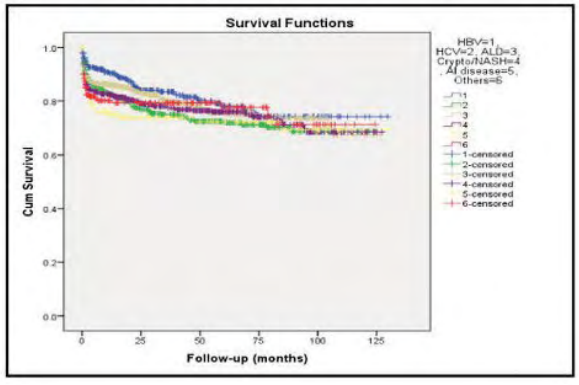


Figure 1b. Etiology-wise Kaplan-Meier Survival Curves of liver transplant recipients.



Conclusions: Over the last decade, alcohol remained to be the most common etiology of chronic liver disease requiring LT at our center. NAFLD related cirrhosis rose to second spot as an indication for LT. On the other hand, viral cirrhosis shown a significant decline. Overall survival was similar between various etiologies.

P-207

HCV core antigen and residual HCV RNA in the native liver of living donor liver transplant recipients with chronic hepatitis C

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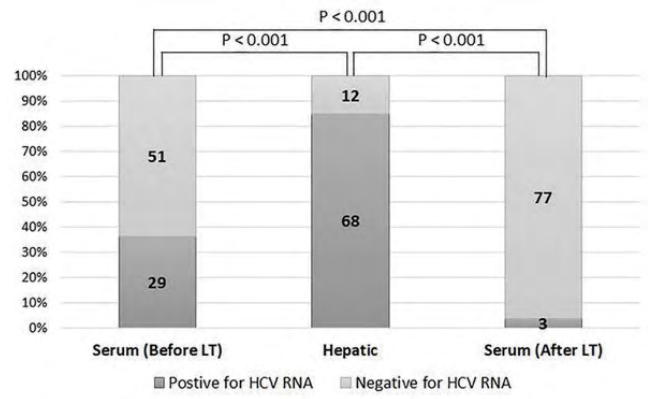
Background: With the highly effective direct-acting antiviral (DAA) therapy, the number of liver transplants for hepatitis C virus (HCV) has decreased worldwide. However, similar to the phenomenon occurring in COVID-19 infection, the residual virus reservoirs in target organ is warranted to be explored due to the potential replication and disease recurrence. Hence, we aim to investigate the significance of hepatic HCV RNA identification as well as the discrepancy between HCV RNA and HCV core antigen (HCV Ag) in native liver of chronic hepatitis C recipients undergoing living donor liver transplantation (LDLT).

Methods: Between Feb 2016 to Aug 2019, we prospectively enrolled 80 serum anti-HCV positive recipients who underwent LDLT. HCV RNA extracted from the native liver tissues was subjected to one-step reverse transcribed qPCR, using the TopScript One Step qRT PCR Probe Kit with HCV qPCR probe assay and human GAPDH qPCR probe assay on ViiA 7 Real Time PCR System. Hepatic HCV Ag was identified from the native liver tissues by employing the qualitative enzyme immunoassay technique. All experimental steps were based on the protocol provided by Human HCV Ag ELISA Kit (Cat. No. MBS167758).

Results: Among 80 recipients, 85% (68/80) positive HCV-RNA was significantly higher in the native liver tissues than in the serum before (29/80, 36.3%; p = 0.000) and after LDLT (3/80, 4.4%; p = 0.000). In contrast, hepatic HCV Ag was 100% negative identified in all 80 explanted native liver.



Hepatitis C virus core antigen (HCV Ag) assay in all 80 explanted native liver.

Controls	OD (450nm)	Result (HCV Core Antigen)
Blank	0.089	Negative
Blank	0.093	Negative
Blank	0.073	Negative
Positive control	0.363	Positive
Positive control	0.339	Positive
Positive control	0.384	Positive
Negative control	0.058	Negative
Negative control	0.058	Negative
Negative control	0.057	Negative
Samples		Result (HCV Core Antigen)
N=80	less than control	Negative

1. Quality Control:
   OD blank ≤1.00
   OD positive ≥1.00
   OD negative ≤1.00
2. Cutoff Value (average Negative Control value + 0.15)=0.2076667
   PS: While OD sample < Cutoff Value: Negative
   While OD sample ≥ Cutoff Value: Positive

Conclusions: Significant positive HCV-RNA identification in the native liver suggested that pre-LDLT serum HCV RNA should be underestimated in the real status of HCV activity. HCV Ag assay may have lack of sensitivity and negative predictive value in liver tissues. In contrast to serum HCV RNA and HCV Ag, a great discrepancy might be described between hepatic HCV RNA and HCV Ag in the liver tissue.

P-208

Impact of previous abdominal surgery on laparoscopic donor hepatectomy for living donor liver transplantation

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Background: Laparoscopic donor hepatectomy(LDH) has many advantages over open donor hepatectomy. However, previous abdominal surgical history can be considered to cause difficulties in laparoscopic surgery. Few studies have evaluated the impact of previous abdominal surgery (PAS) on LDH. Therefore, we studied the effect of PAS on LDH.

Methods: This study is a retrospective study conducted at a single center. We reviewed the data of 361 patients who underwent LDH at Samsung Medical Center from January 2017 to December 2020. These patients divided into 72 patients with previous abdominal surgery(PAS) group and 289 patients with non-previous abdominal surgery(non-PAS) group. Two groups were compared with respect to operation factors such as estimated blood loss, operation time, and intraoperative blood transfusion. Postoperative outcomes such as length of hospital stay, postoperative complications, AST, ALT, INR, albumin, and total bilirubin trends(preoperative,peak-postoperative and after 1 month) were also compared.

Results: 72 patients has previous abdominal surgical history [cholecystectomy (4), splenectomy(1), pyloromyotomy(1), cesarean section(28), appendectomy(19), uterine surgery(8), ovarian surgery(7), hernia repair(3), laparoscopic anterior resection(1)].

There was no statistical difference in estimated blood loss and operation time between the two groups. No donors received intraoperative blood transfusion.

	Non-PAS group (N=289)	PAS group (N=72)	*p* value
Operation time (min)	240 ± 45	230 ± 49	0.095
EBL (ml)	212.3 ± 118.0	197.2 ± 105.1	0.291
Transfusion during operation	0	0	-
Warm ischemic time (s)	274 ± 132	275 ± 178	0.973

Table 1 Operative characteristics of laparoscopic donor hepatectomy
PAS, Previous abdominal surgical history, *EBL*, Estimated blood loss

Complications occurred in 7 patients (9.7%) in the PAS group and in 26 patients (9%) in the non-PAS group, and there was no statistical difference between the two groups.

	Non-PAS group (N=289)	PAS group (N=72)	*p* value
Post op. hospital stay (day)	8.0 ± 2.3	8.5 ± 3.0	0.136
Early postoperative complications in 30 days	26 (9%)	7 (9.7%)	0.848
Clavien-Dindo classification			
I	0	1	
II	11 (3.8%)	2 (2.8%)	0.675
Wound complication	6	2	
Bleeding requiring transfusion	3	0	
Infection requiring antibiotics	2	0	
IIIa	10 (3.5%)	3 (4.2%)	0.773
PCD insertion d/t fluid collection	2	0	
ERBD insertion d/t bile leakage	8	3	
IIIb	5 (1.7%)	1 (1.4%)	0.839
Re-operation d/t bleeding	4	0	
Re-operation d/t bile leakage	1	1	

Table 2 Post-operative progression after laparoscopic donor hepatectomy
PCD, Percutaneous catheter drainage, *ERBD*, Endoscopic retrograde biliary drainage

There were no significant differences in the changes in AST, ALT, INR, albumin, and total bilirubin(preoperative,postoperative and 1 month). All donors fully recovered and returned to their normal activities.

Conclusions: The outcomes of our study show the feasibility and safety of LDH in patients with previous abdominal surgical history. Therefore, even if there is a history of PAS, LDH can be performed safely enough, so it is not a contraindication.

P-209

Pure laparoscopic versus open right hepatectomy in living liver donors: graft weight discrepancy

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Background: Recently pure laparoscopic right hepatectomy in living donor liver transplantation is widely performed, since the effectiveness and stability have been proven. However, the studies of volumetric evaluation in pure laparoscopic donor hepatectomy (PLDH) are relatively less known than that of conventional donor hepatectomy. The aim of this study was to analyze the difference between estimated graft weight (EGW) and actual graft weight (AGW) in pure laparoscopic donor right hepatectomy (PLDRH) and compare the correlation of EGW and AGW with conventional donor right hepatectomy (CDRH).
Methods: The medical records of 612 donors who underwent living donor liver transplantation between January 2014 and December 2020 at Seoul National University Hospital were retrospectively reviewed. Donors who underwent right hepatectomy were included. The CDRH group targeted patients from January 2012 to October 2015, and the PLDRH group targeted patients from March 2016 to December 2020.
Results: There were 119 donors who underwent CDRH and 376 donors who underwent PLDRH. Although there was no significant difference between CDRH and PLDRH group for EGW (792.3 169.9 g versus 792.2 171.3 g; P=0.994) and AGW (712.5 142.0 g versus 722.9 138.5 g; P=0.489), EGW was significantly higher than AGW in both CDRH (790.5 170.5 g versus 715.1 141.6 g; P<0.001) and PLDRH (792.7 171.2 g versus 722.9 138.5 g; P<0.001) group. However, EGW and AGW showed linear correlation in both CDRH (r=0.81, P<0.001) and PLDRH (r=0.76, P<0.001) group, with CDRH group closer to linearity.
Conclusions: The estimations of graft weight were not very different in PLDRH group compared to CDRH group. However, since AGW tends to be measured smaller in PLDRH group, it should be considered before surgery.

P-210

Holomedicine: the future of mixed reality technology in liver transplantation

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Background: The use of extended reality (XR) technology is well established in medical education, with limited adoption for surgical planning. Till date, there is no single device available that can be used for patient counselling, surgical planning, surgical training, and intra-operative surgical navigation. We describe a proof of concept (POC) study of Mixed Reality (MR) technology for liver transplantation.
Methods: Living donor liver transplant (LDLT) donor patients are recruited from the National University Hospital, Singapore. CT and MRI scans of the donor are segmented to visualize the hepatic artery, portal vein, and hepatic vein anatomy using LiverVision®, which is also used to simulate the cut-line and calculations of graft and future liver remnant (FLR) volumes. 3D STL files are uploaded onto the HoloLens2 MR device via Virtual Surgery Intelligency (VSI) to generate a 3D hologram. This is then used for patient counselling, surgical planning, surgical education, and intra-operative navigation. Operative and admission data were collected. User experience is recorded using the validated User Experience Questionnaire (UEQ). Open-ended feedback was also obtained.
Results: Three patients were included in the study. Median operating time was 338 mins (274 – 354), and mean bloodloss was 216mls (100 – 300). Mean length of stay was 6 days (5-6). There were no donor morbidities. UEQ data collected from the surgical team showed a positive UEQ scale (> 1.5) across all use areas measured including attractiveness, perspicuity, efficiency, dependability, stimulation, novelty. The advantage of MR technology was the ability to access image data intra-operatively without unscrubbing, and the ability to superimpose the hologram onto the patient or the laparoscopic monitor to provide real-time surgical navigation resulting in improved operating safety.
Conclusions: MR technology presents a never before opportunity to enhance liver transplant surgery from patient counselling to intra-operative surgical navigation and warrants further research and development into its capabilities and application.

P-211

AMR in ABOI-LDLT should not be the end of the road

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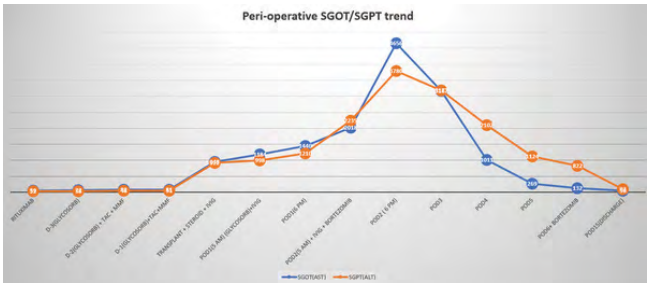
Background: ABOI-LDLT is increasingly being offered with improving results. Antibody Mediated Rejection (AMR) is one of the most feared complications.It's difficult to reverse and results in graft loss, retransplant or mortality.Early IVIG & Bortezomib can reverse this fulminant condition.
Methods: ABOI-LDLT (A to O) was performed with Rituximab and Immunoadsorption. CD19/20 counts were 64 (7.2%) / 75 (8.4%) initially which reduced to 1.9 (0.1%)/0(0) with rituximab. Anti-A titres (IgM/IgG) titres were 128/256 initially which reduced to 4/16 after immunoadsorption. LAI was +5, Graft weight was 860 and GRWR was 0.9. Cross-clamp was used and CIT, WIT was 98 min & 52 min respectively. Solumedrol (10mg/kg), IVIG (80mg) given prior to implantation and 4 pRBC's were transfused. Two duct-to-duct biliary

reconstruction was done. No post-perfusion hemodynamic instability was seen and urine output was adequate. Immuoadsorption repeated on POD1.
Results: Enzymes increased till POD2 with AST/ALT of 948/920, 1184/998, 2018/2235, 4656/3780 on POD0, POD1, POD2 (5am) & POD2 (6pm) respectively. Inj Solumedrol (POD1 (1 gm), POD2 (1 gm)) and IVIG (POD1 (60 mg), POD2 (60 mg)) was given. Peak INR was 7.08 (POD2), Peak lactate was 4.8 (POD2) and ALP/GGT did not show any significant change. Procalcitonin was elevated but cultures were negative and clinical parameters were acceptable. Other causes of hepatitis, CMV infection, Hep-B reactivation were not seen. Serial dopplers revealed a well-perfused liver graft. Biopsy not performed in view of coagulopathy. Due to refractory enzymes, Bortezomib (POD2 (2mg)) was given. Rituximab was not repeated. Enzymes started to reverse on POD3 and decreased until they normalized. INR normalized by POD10. Bilirubin increased till POD6.



(peak-6.14 mg/dl) and subsequently decreased. Anti-A IgM/IgG titres were 4/32 (POD0), 4/32 (POD1), 4/16 (POD2), 2/16 (POD3) & 4/32 (POD4) and remained stable. CD19/20 counts were 1.4 (0.7%)/0 (0) on POD2. Clinical condition and liver dopplers remained satisfactory throughout recovery until the discharge (POD15). Patient has no biliary or other complications at 6 month.
Conclusion: Graft dysfunction in ABOI-LDLT should be aggressively investigated. On suspicion or confirmation of AMR, early administration of IVIG and Bortezomib may help to salvage the graft.

P-212

Outcomes of midline-incision liver transplantation (MILT): a matched case-control study

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Background: Most innovations in living donor liver transplantation (LDLT) have focused on reducing the morbidity of the donor operation. While the recipient operation has undergone refinements in anastomotic technique, understanding of portal hemodynamics etc., the access has remained via large open incisions. These large incisions are associated with increased morbidity and wound related issues. Isolated reports of liver transplantations (LT) being performed via a midline incision exist. Nonetheless data on their safety, feasibility, learning curve etc. are lacking. We present our experience of midline incision Liver transplant (MILT) and compare the outcomes with a matched cohort of standard incision LDLT (SILT).
Methods: Review of a prospectively collected database of all patients who underwent MILT was performed. Their intraoperative and postoperative data was compared with a case matched (based on age, MELD & indication for LT) cohort of patients who underwent SILT.
Results: Outcomes of 62 patients who underwent MILT were compared with case-matched 158 SILT recipients. There was an increase in blood and plasma transfusion requirement in the MILT group by 2 (p=0.03) and 1 (p=0.02) units respectively. There were no differences in postoperative morbidity including rates of vascular or biliary complications (p=0.35) and early re-exploration rates (p=0.86). The hospital stay was numerically shorter in the MILT group, and there was no difference in the 90-day mortality between the two groups (p=0.89).
Tables
Conclusions: In this to-date largest series of MILT, we highlight the feasibility and safety of the MILT operation when compared with the SILT. We present the learning curve, appropriate patient selection and technical modifications needed to achieve these outcomes.

P-215

Evaluation of Albumin-Bilirubin (ALBI) score as a predictor of short-term outcome post living donor liver transplantation (LDLT)

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Background: The Albumin Bilirubin (ALBI) is a simple model score that was first introduced to predict long-term survival in patients with hepatocellular carcinoma. It has been introduced to evaluate post-liver transplantation (LT) outcome. This study aimed to evaluate the ability of the ALBI scoring system to predict short term (6 months) outcome of living donor liver transplantation (LDLT), in terms of morbidities and mortality.
Methods: This was a retrospective study that was conducted on adult patients who underwent LDLT at Al-Manial Specialized Hospital from 2010 to 2019. Only patients with completed medical records were included. Clinical and laboratory data were retrieved from those records. Pre-operative ALBI score and grades were calculated for all patients; grade I (ALBI score ≤ -2.60), ALBI grade II (score from -2.60 < to ≤-1. 39), and grade III (score >-1.39). They were correlated to morbidities and mortality post LT within the 1st, 3rd, and 6th months postoperatively.
Results: 167 adult patients were included; mean age was 48.7±8.6 and 92% males. Mean ALBI was -1.24 ± 0.59, where 1.8%, 31.1%, and 67.1% of

the patients belonged to ALBI grade I, II, and III, respectively. Biliary complications were found to be the most common early complication post LT (55.5%). During the 1st month postoperatively, high ALBI grades (II and III) were significantly related to nephrotoxicity and septicemia (P = 0.007 and 0.024, respectively), meanwhile, 6 months postoperatively, higher ALBI scores (-1.10 ± 0.55) were associated with an increased incidence of biliary complications (P=0.041). High ALBI grades were not significantly related to post-LT mortality (P = 0.17).
Conclusions: The pre-operative ALBI scoring system can be used as a predictor for early postoperative morbidity following LDLT; however, it was not significantly related to early mortality.

P-216

Biodegradable biliary stent experience in living donor liver transplantation

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Background: Biliary complications are important problems in living donor liver transplantation. The rate of biliary complications have been 10-40% in different studies. Several methods has been used in order to prevent and manage the biliary complications . Biodegradable biliary stent is a polymeric stent which has spiral in a double helix. Fast, medium and slow degrading stent are avaliable. Here in this study, we aimed to present our experience with biodegradable biliary stents.
Methods: Biodegradable slow degrading stents were used in our study. We used biodegradable stents in six patients. We placed stents intraoperatively during bile anastomosis in two cases because of the difficult anastomosis. Difficult anastomosis is defined by thin bile wall, tension risk on the anastomosis, and reanastomosis becasue of bile leakage. Four cases suffered from postoperative biliary complications and underwent percutaneous interventions. The datas of the patients, operative techniques, postoperative complications, biodegradable stent size and succes of the stents are given.
Results: Intraopeative stent placement was performed in two cases with end-to-end choledochocholedochostomy and two-bile-ends-to-choledoch. The etiology was criptogenic and Wilson disease. After 12 weeks, the choledoch part of the stents were degraded completely, but intrahepatic parts were degraded partially. The patients suffered form biliary stricture after degradation. Rest of the cases were suffereing from postoperative biliary stricture. One case was retransplantation becuase of primary bilary cirhosis, one case was pediatric case with biliary atresia. The bile continuity was perfomed by hepaticojejunostomy. The mean follow up time for cases with hepatiojejunostomy is 4 monthes. Other two cases were underwent percutaneous biodegradable stent placement after unsuccesfull ERCP attemps. Choledoch part of the stent degraded in one case after 12 weeks.
Conclusions: Biodegradable stents are effective in biliary strictures in cases with hepaticojejunostomy. However stents placed in choledochocholedochostomies degraded in 12 weeks with recurences.

P-218

Complications after living donor hepatectomy: analysis of 801 cases at a single center

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Background: Living donor liver tranplantation is mostly performed transplantation in countries where the cadaveric transplantation is insufficient. Living liver donation is one of the most selfless and humane act a person can perform. And great care should be taken. Here we want to give the complications seen after donor hepatectomy in our center.
Methods: We collected patients who underwent donor hepatectomy between July 2015 and December 2021. We performed 989 liver transplantation in which 801 of them were living donor liver transplantation. The data about demographics, operation type, postoperative complications, clavien Dindo postoperative complication classification, mean follow up were collected.
Results: Among 801 cases mean age of the patients were 32.6 years (range 18-55 years). Right hepatectomy is the mostly performed donor hepatectomy type. Total 51 complications among 46 (%5.74) patients were seen. Total 21 (%2.6) biliary leakage was seen. Seven (%0.87) of them were treated with percutenous drainage. Rest of them were followed up by drain which was put during the operation. Mean drain removal time was 13.2 days. Total 12 (%1.5) patients suffered from wound infection and treated with antibiotics. Pleural effusion was seen in 5 patients all of which were improved without any intervention. Pulmoner emboly was treated by intravenous heparin seen in two (%0.2) cases. Patients were underwent operation because of diaphram hernia (2 cases), gastric outlet obstruction (2 cases), ileus (1 case), postoperative bleeding (2 cases) and incisional herni (5 cases). None of the complications were grade 4.
Conclusions: Donor hepatectomy in living donor liver transplantion can be performed with low complication rates in experienced centers.

P-220

Timing and effect of liver transplantation in five patients with primary hyperoxaluria type 1

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Background: Primary hyperoxaluria type 1 (PH1) is a rare autosomal recessive disease. The liver-specific alanine-glyoxylate aminotransferase (AGT) deficiency, resulting in increased

endogenous oxalate deposition and end-stage renal disease ESRD). Early diagnosis and liver transplantation (LT) at an appropriate time can lead patients to a favorable prognosis and avoid the progression of ESRD and kidney transplantation.
Methods: We retrospectively analysed 5 patients diagnosed with PH1 in Liver Transplant Center of Beijing Friendship Hospital from Mar 2017 to Dec 2019.
Results: Our study included 5 patients (4 males, 1 female). The median onset age of patients was 4.0 years old (range: 1.0-5.0), the median diagnosis age was 12.2 years old (range: 6.7-23.5). Patients received LT in the median age of 12.2 years old (range 7.0-25.1), and the median follow-up time was 26.3 months (range: 12.8-40.1 months). All patients survived till now. All patients had difficulty in diagnosis at beginning, and three patients had progressed into end-stage renal disease (ESRD) at the time of diagnosis. Two patients received preemptive liver transplantation (pre-LT), and the glomerular filtration rate (eGFR) of them was maintained above 120ml/min/1.73m^2, which meant a better prognosis. Three patients received sequential liver and kidney transplantation (SLKT). After transplantation, serum and urinary oxalate decreased, and liver function recovered well. At the last follow-up, the eGFR of each patients was 179 ml/min/1.73m^2, 52 ml/min/1.73m^2, and 21 ml/min/1.73m^2, respectively.
Conclusions: PH1 has a high rate of missed diagnosis. Most patients have entered ESRD at the time of diagnosis. Organ transplantation is the only effective treatment at present. Different transplantation strategies should be adopted for patients with different renal function stages. Pre-LT is a more appropriate treatment.

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The blower-mister: a device for better visualization during biliary anastomosis in living donor liver transplantation

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Background:
- The bile duct reconstruction has been regarded as the Achilles' heel of living donor liver transplantation (LDLT) due to smaller, multiple ducts and difficult ductal anatomy.
- Continuous oozing from the hilar plate and the bile dribbling from the donor duct makes the vision difficult for the surgeon to take proper bites in the ductal wall.
- Inadvertent inclusion of the opposite wall of the duct can lead to biliary obstruction or stricture.
- Suction tube should be held close to the surgical field for proper suctioning of bile and blood which may hinder the view of operating surgeon.
- Herein, we introduce a cardiac surgery device (blower-mister) which can mitigate these issues in LDLT during biliary anastomosis .

Methods:
- We used a blower-mister for biliary anastomosis in 25 consecutive LDLTs
- CO2 jet is initially set at 5 L/minute, and is increased or decreased by adjusting the regulator according to the amount of bleeding and stiffness of the tissues.
- Time taken for anastomosis, clarity of surgical field (as graded by the surgeon), biliary complications were noted and compared with 25 other cases in which we used normal fine suction apparatus to get the clear surgical field.

Results:
- The use of a mister blower was found to reduce the time taken for biliary anastomosis with a clearer surgical field [13± 6.2 Vs18± 5.7, (p<0.5)].
- The incidence of biliary complications were not statistically different between two study groups

Conclusions:
- The use of the blower-mister device during biliary anastomosis in LDLT not only provides a clear surgical field but also keeps the bile duct lumen open so that the surgeon can take sutures easily with no fear of inadvertent inclusion of the opposite wall of the bile duct thereby reducing the duration of surgery.

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Donor outcomes in 108 living donor liver transplantations: can good outcomes be sustainable at a low-volume Western centre?

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Background: Living Donor Liver Transplantation (LDLT) has grown immensely in the Far East and South Asia over the last decade, whereas in the Western centres LDLT has limited uptake. The main limiting factor for the growth of LDLT has been concerns with donor morbidity and mortality. We report our LDLT donor outcomes from a low volume unit with a background expertise in cadaveric, split and paediatric LT and large volume liver cancer surgery.
Methods: Between June 2007 and Oct 2021, 108 LDLTs were completed in our unit. Donor morbidity were assessed using the Clavien-Dindo classification.
Results: Four donors were abandoned intra-operatively; liver lesion (n=1), complex arterial/biliary anatomy (n=3). Of the 108 completed donor hepatectomies, 43 (39.8%) were adult-to-adult (aLDLT) and 65 (60.2%) were adult-to-paediatric (pLDLT). Median donor age was 32 years and 52.8% were females. The graft was right lobe (83.7%) and left lobe (16.3%) for aLDLT, and left lateral (92.3%), reduced left lateral (6.2%) and left lobe (1.5%) for pLDLT. Overall, 83.3% of the donors had

no complications. 23.2% of aLDLT donors had complications, of which three (7.0%) were grade 3a (USS-guided drainage of collection) and three (7.0%) needed re-explorations for bleeding (grade 3b). 10.8% of pLDLT donors had complications and none were grade 3. The median LOS was 7 days for aLDLT and 5 days for pLDLT. At a median follow-up of 86 months, all donors were alive.
Conclusions: Our experience shows that donor hepatectomy for LDLT is a safe procedure in a low-volume Western unit, with other significant expertise. Our overall donor morbidity of 16.7% (5.5% were grade 3) is comparable or better than most high-volume centres across the world. Number of LDLT procedures performed by the unit shouldn't be a hindrance to the introduction nor sustaining a LDLT programme.

	Total No. of Donors (N=108)	Adult-to-Adult (n=43; 39.8%)	Adult-to-Paediatric (n=65; 60.2%)
Maximum post-op bilirubin (mg/dL)	24 (8-131)	41 (18-111)	19 (8-131)
Maximum post-op ALT (IU/L)	244 (73-1204)	206 (95-420)	322 (73-1204)
Blood transfusion	1 (0.9%)	1 (2.3%)	0 (0.0%)
No complications Grade 1 Grade 2 Grade 3a Grade 3b	90 (83.3%) 10 (9.3%) 2 (1.8%) 3 (2.8%) 3 (2.8%)	32 (74.4%) 4 (9.3%) 1 (2.3%) 3 (7.0%; USS guided drainage of collection) 3 (7.0%; reexploration for bleeding)	58 (89.2%) 6 (9.2%) 1 (1.6%) 0 (0.0%) 0 (0.0%)
Length of hospital stay (days)	6 (2-17)	7 (4-17)	5 (2-12)
Readmissions within first year	12 (11.5%)	7 (17.1%)	5 (7.9%)
Survival status (alive)	100%	100%	100%
Follow-up (months)	86 (1-166)	85 (0.5-166)	75 (0.5-161)

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Improving the safety of living donors for liver transplantation: analysis of 339 patients in one institution

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Background: In Japan, although the number of deceased donor liver transplantations is increasing, liver transplantation is still largely dependent on living donor liver transplantation (LDLT). Donor safety should be the highest priority in LDLT. Here, we report on the outcomes of living donors for LDLT, aiming to improve their safety.
Methods: We retrospectively examined postoperative complications among 339 living donors who underwent hepatectomy for LDLT between May 2001 and December 2020 at our institution.
Results: Donors included 165 males and 174 females with a median age of 34 years. Median height, weight and BMI were 165 cm, 59.7 kg and 21.8 kg/m^2, respectively. The recipients were 313 children and 26 adults, and the donor-recipient relationships were 161 mothers, 147 fathers, and 31 others. The graft types were 206 left lateral segments, 15 reduced left lateral segments, 70 left lobes, 15 left lobes with caudate lobe, 15 monosegments, 16 right lobes and 2 right posterior sections. The mean operating time was 5 hours 21 minutes, blood loss was 600 ml, and postoperative hospital stay was 11 days. Postoperative complications of occurred in 95 donors (28%). Bile leakage occurred in 46, including 30 left lateral segments, 8 left lobes, 2 left lobes with caudate, and 6 monosegments. Wound infections were recognized in 26 donors. Gastrointestinal tract obstruction occurred in 31, and 4 donors required readmission after discharge. Other complications included postoperative bleeding requiring blood transfusion, deep venous thrombosis, atrioventricular block, internal jugular venous thrombosis, rocronium anaphylaxis, intraperitoneal abscess, and liver abscess, but all resolved after approproate management.
Conclusions: Minimizing postoperative complications through careful surgical technique and appropriate perioperative management will improve the safety of living donors for liver transplantation.

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Early splenic artery embolization for splenic artery steal syndrome with refractory ascites and early graft dysfunction after live-donor liver transplantation

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Background: Splenic artery steal syndrome (SSS) with refractory ascites (RA) and early graft dysfunction (EAD) post liver transplant is rare. We present a case of a patient with decompensated cirrhosis who underwent live donor liver transplant (LDLT) complicated by SSS and RA with EAD which was managed by splenic artery embolization in the early post operative period [Post-operative day (POD)-15].
Methods: Case report: 47 year old lady with decompensated cirrhosis (Model for end stage liver disease score-18) due to Non alcoholic Steato-Hepatitis with Hepato-cellular carcinoma (segment 3-3 cm) who underwent Radio-frequency ablation 6 months back, underwent LDLT. Her intra-operative parameters were as follows: Graft recipient weight ratio (GRWR)-0.98, cold ischemic time- 190 minutes, warm ischemia time-36 minutes, anhepatic phase-80 minutes, no reperfusion injury, hepatic venous pressure gradient (HVPG)- normal at end of surgery (no intra-operative portal flow modulation done). She was extubated on POD1 and there were serial deterioration of liver functions from POD4 onwards with evidence of EAD and RA as per Kyushu/Soejima criteria (Total-Bilirubin 15.4 mg/dl and ascites 2.25 Litre on POD14, with transamitis). Biopsy on POD 14 revealed only cholestasis and angiogram showed decreased calibre hepatic artery without any thrombosis. splenic artery embolization (SAE) was done on POD15.
Results: There were marked decrease in portal vein velocity and

increase in hepatic artery peak velocity, activating hepatic buffer response, with 50% reduction in splenic venous flow following SAE. Ascites and serum total bilirubin got drastically reduced to <500ml/day and 6.2mg/dl respectively on POD21 at the time of discharge. There were no major post embolization morbidities except for mild asymptomatic splenic infarct at lower pole. Her graft function now normal at 33 months follow up.
Conclusions: Early SAE for combined SSS and RA with EAD is rarely reported. This case report reveals safety and efficacy of timely early SAE after post liver transplant EAD, SSS and RA.

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Diffuse vasospasm of anastomosed hepatic artery in living donor liver transplantation

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Hepatic artery obstruction can be critical to graft outcome after living donor liver transplantation (LDLT). We report a case of diffuse vasospasm of the hepatic artery, which developed right after anastomosis in LDLT. A 57-year-old male patient underwent ABO incompatible LDLT for HBV-related liver disease and hepatocellular carcinoma from his daughter. He was treated with rituximab and plasmapheresis before transplantation. Isoagglutinin titer was 1:8 at the time of LT. Right liver graft was laparoscopically retrieved from the donor. There was no event during warm ischemic time and reperfusion was successful. The graft hepatic artery was first anastomosed to the right hepatic artery stump of the recipient. However, the arterial pulse of the graft got weaker immediately. We made new anastomosis using same arteries and the pulse disappeared again. Finally, we used the right gastroepiploic artery (RGEA) for anastomosis. Nevertheless, the hepatic artery pulse still was not good. We attempted angiographic intervention immediately after operation. After injection of tissue plasminogen activator, we found diffuse vasospasm like 'beads on a string' with no mechanical stricture in RGEA and graft artery. We tried an infusion of lipo-PGE1 via arterial catheter and then observed improvement of the spasm. Thus, we decided to keep the continuous infusion of lipo-PGE1 via arterial catheter without additional intervention. Lipo-PGE1 was continuously infused at 6mcg/hr via arterial catheter as well as at 20mcg/hr intravenously overnight. Angiography on the next day showed healthy RGEA and anastomosis without spasm. We discontinued intra-arterial infusion of lipo-PGE1, while we kept intravenous infusion by postoperative 6th day according to the routine protocol. The recent computed tomography, performed 10 months post-LT, showed good arterial flow and no ischemic-type biliary strictures. In conclusion, angiographic evaluation could be helpful in situations of repetitive arterial obstruction and intra-arterial infusion of lipo-PGE1 might be effective in diffuse arterial spasm.

Poster Presentations: Pediatrics

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The diagnosis and treatment of posttransplant lymphoproliferative disorder in pediatric liver transplant recipients

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Background: To summarize the incidence, diagnosis and treatment experience of posttransplant lymphoproliferative diseases (PTLD) in the pediatric liver transplant recipients.
Methods: We retrospectively analyzed the clinical data of pediatric liver transplant (LT) recipients. The incidence, clinical symptoms, laboratory and imaging data of PTLD in pediatric liver transplant recipients were collected. The pathological results and treatment methods were analyzed. The prognosis was evaluated.
Results: A total of 749 pediatric LT patients were treated at Beijing Friendship Hospital from June 2013 to July 2021, and PTLD was confirmed in 45 patients (19,42.2%, male; 8,17.8%, donation after death), the incidence of PTLD was 6.0% (45/749) in children after LT. The median age of PTLD patients was 10.3 months (range, 4.6-146.7 mo). The median time for EBV DNA replication was 2.9 months (range, 0.9-35.1 mo) after the operation, and the median time of onset was 14.6 months (range, 1.2-46.5 mo). 90.2% (41/45) of patients with PTLD had superficial lymphadenopathy. Pathological results of 93.3% (42/45) patients showed positive EBER by in situ hybridization. In 43 patients, PET-CT revealed increased FDG metabolism in the associated enlarged lymph nodes. All 45 patients were treated with reduced immunosuppressive drugs, and some of the patients were treated with targeted therapy, chemotherapy, surgical resection and adoptive immunotherapy depends on its pathological types. Twelve patients were in stable condition, two patients died of progressive disease, and 31 patients achieved complete or partial remission. After treatment with reduction in immunosuppression, rejection occurred in 6 patients, and liver function improved after administration of the immunosuppressive drug.
Conclusions: Primary EBV infection and immunosuppression after LT in children may increase the risk of PTLD. Monitoring EBV DNA replication load and decreasing immunosuppression are essential methods to treat PTLD. However, after reducing the level of immunosuppression, we should pay close attention to the liver function and guard against rejection.

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Social determinants of health that may affect outcomes in pediatric acute liver failure

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Background: Pediatric acute liver failure (PALF), characterized by rapidly deteriorating liver function, coagulopathy and mental status changes, affects previously healthy children of all ages and backgrounds. This study aims to evaluate social determinants of health that may be associated with worse patient outcomes.
Methods: A retrospective cohort of children (<18 years) admitted with PALF at our large, tertiary-care center between 2001-2021 was identified by ICD codes. Clinical and social variables were stratified by outcome (spontaneous recovery (SR), liver transplant (LT), death) for analysis.
Results: Overall, 116 patients were identified. The median age at presentation was 5.2 years [1.8, 13.8] (IQR), with 49% female and 39.7% Hispanic. Most patients recovered (51.7%), while 37% underwent LT and 11.2% died. As shown in Table 1, children who died more often lived in an apartment setting or group home (46.2% and 15.4%, p=0.002) as compared to children who recovered, who were more likely to live in a house or condo (70%, p=0.002). Children who received LT were more likely to have married parents (37.2%, p=0.01) or parents in a committed relationship (25.6%, p=0.01). Caregivers of children who recovered more often spoke English as their first language, or were bilingual with English as one of their primary spoken languages (56.7% and 23.3%, p=0.007) when compared to caregivers of children who died or required LT. No difference in clinical outcome based on insurance status or caregiver educational achievement was observed.

SOCIAL VARIABLE	SR (60)	LT (43)	DEATH (13)	TOTAL (116)	P = 0.002
HOUSING					
HOUSE/CONDO	42 (70)	28 (65.1)	5 (38.5)	75 (64.7)	
APARTMENT	17 (28.3)	12 (27.9)	6 (46.2)	35 (30.2)	
GROUP HOME	0	0	2 (15.4)	2 (1.7)	
UNKNOWN	1 (1.7)	3 (7)	0	4 (3.4)	
CAREGIVER PREFERRED LANGUAGE					p = 0.007
ENGLISH	34 (56.7)	17 (39.5)	7 (53.8)	58 (50)	
SPANISH	12 (20)	15 (34.9)	3 (23.1)	30 (25.9)	
BILINGUAL (ENGLISH)	14 (23.3)	11 (25.6)	1 (7.7)	26 (22.4)	
BILINGUAL (NOT ENGLISH)	0	0	1 (7.7)	1 (0.9)	
UNKNOWN	0	0	1 (7.7)	1 (0.9)	
CAREGIVER MARITAL STATUS					p = 0.01
MARRIED	14 (23.3)	16 (37.2)	4 (30.8)	34 (29.3)	
SINGLE	10 (16.7)	4 (9.3)	2 (15.4)	16 (13.8)	
UNKNOWN	31 (51.7)	8 (18.6)	5 (38.5)	44 (37.9)	
NOT MARRIED, COMMITTED	4 (6.7)	11 (25.6)	2 (1.4)	17 (14.7)	
DIVORCED/SEPARATED	1 (1.7)	4 (9.3)	0	5 (4.3)	

Table 1. Social determinants stratified by clinical outcome.

Conclusions: This single center review of PALF demonstrates that social determinants of health may impact clinical outcomes. Children who recovered were more likely to live in households that spoke English and were more likely to reside in presumably stable financial environments based on housing type. Further investigation is needed to further characterize these observations.

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Long-term outcome and risk factor analysis of biliary complications in pediatric liver transplantation

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Background: Biliary complication after liver transplantation (LT) is one of the most important factors which affect graft outcomes and quality of life. There are few reports on long-term observation of biliary complications in pediatric LT.
Methods: We retrospectively studied the incidence and risk factors of biliary complications in 596 consecutive recipients who underwent primary pediatric living donor liver transplantation (LDLT) at our institution between November 2005 and June 2021. The follow-up time was 73.3 (0.3-195.4) months.
Results: Biliary reconstruction consisted of Roux-en-Y (RY) anastomosis in 576 cases and duct-to-duct (DD) anastomosis in 20 cases. Ductplasty of graft bile ducts was performed in 39 cases. Biliary complications were observed in 38 episodes in 37 cases (6.2%), including 30 cases of stricture and 8 cases of leakage. There were no cases of re-transplantation or death caused by biliary complications.
The interval from LT to the therapeutic intervention of biliary stricture was 210 (14-4995) days. Four patients had a non-anastomotic biliary stricture. Twenty-four patients were successfully treated by balloon dilatation with percutaneous transhepatic biliary drainage. Five patients with complete anastomotic obstruction or recurrent episode of stricture required surgical revision. One patient underwent primary biliary reconstruction.
Positive episode of cytomegalovirus (CMV) infection within 90 days after LDLT was detected as a risk factor of biliary stricture in multivariate analysis (p=0.027, odd's ratio: 2.58). Earlier cases before 2015, long cold ischemic time, DD anastomosis, and cases without biliary stent tended to be risk factors of biliary stricture (p=0.064, p=0.096, p=0.080, and p=0.050, respectively). Graft type and number of graft bile ducts were not associated with a biliary stricture.
Conclusions: CMV infection was related to biliary stricture in pediatric LDLT. RY biliary reconstruction with stent tube was favorable procedure to avoid biliary stricture in pediatric LDLT.

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Living donor liver transplantation versus deceased donor liver transplantation in children

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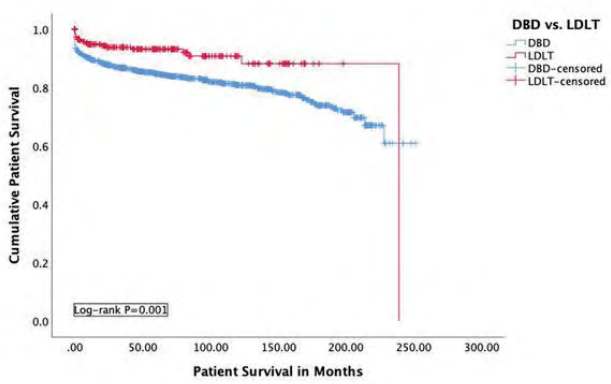
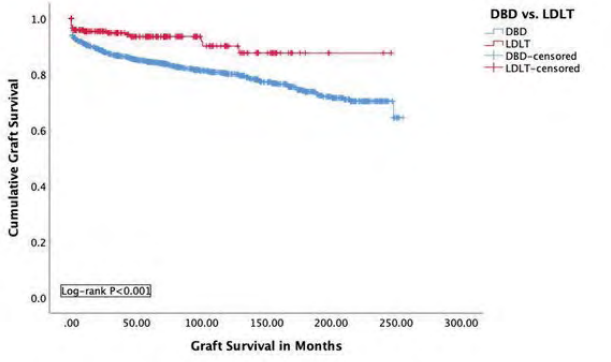
Background: Partial graft deceased donor (DDLT) and living donor liver transplantation (LDLT) can address organ shortage for paediatric recipients. However, concerns persists on the outcome and technical complications of LDLT compared to the usual excellent outcomes with DDLT. This study compares outcomes of paediatric partial graft DDLT and LDLT in the UK national cohort.
Methods: Data of paediatric LTs performed between 2000 and 2019 were obtained from NHSBT.
Results: Over a 20-year period, 2030 paediatric LTs were performed in the UK (liver-intestine, liver-kidney, liver-pancreas and domino-LTs were excluded). 1953 recipients were included. 1610 (82.4%) were DBDs, 71 (3.6%) DCDs and 272 (14.0%) LDLTs. After excluding 428 whole LTs, split/reduced DBDs (n=1182) were compared with LDLTs (n=272): The DBD cohort were older (mean 4 vs. 3 years; p=0.004), heavier (15 vs. 13 kg; p=0.001), greater need for urgent transplant (19.6% vs. 5.5%; p<0.001) and longer time on wait-list (110 vs. 96 days;p=0.001). There were more left lateral segment grafts in LDLT group (77.6% vs. 58.5%) and more left lobe (35.2% vs. 19.1%) and right lobe (6.3% vs. 3.3%) in DBD cohort. Re-transplant was more common in DBD cohort (13.9% vs. 5.1%; p<0.001). Portal vein thrombosis in the graft (5.9% vs. 2.3%; p=0.002) were more common in LDLT cohort. There was no difference between the two cohorts with respect to HAT, biliary complications or re-explorations for bleeding. Graft and patient survival was worse in DBD cohort at all time period post-transplant, with or without the exclusion of urgent transplants.
Conclusions: LDLT may offer many advantages including reduced waiting time and better long-term graft and patient survival. LDLT should continue to be expanded to optimise outcomes for children on waiting list. This data may help future practices by appropriate counselling of families on the outcomes of LDLT.





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Short-term impact of graft congestion for pediatric living donor liver recipients

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Background: Liver function of congestive areas of graft liver in pediatric liver transplantation is unclear and it is controversial whether the congestive area such as median segment without middle hepatic vein (MHV) should be added to a small graft.
Methods: Among 158 pediatric patients after biliary atresia surgery who underwent the first living donor liver transplantation at Kyoto University between 2006 and 2020, 50 recipients with graft to recipient weight ratio (GRWR) < 2% were analyzed.
Fifteen recipients of left lobe graft without MHV were categorized as Congestion group, and 33 recipients of left lobe graft with MHV and left lateral graft were categorized as non-Congestion group. We compared the postoperative course between the two groups (Study 1). And as further study, non-congestive graft to recipient weight ratio (ncGRWR) in Congestion group was calculated from preoperative CT images of the donor. 19 recipients who had GRWR < 1.5% in non-Congestion group (small non-Congestion group) were selected to match GRWR with ncGRWR in Congestion Group. We compared the postoperative course between the two groups (Study 2).
Results: Study 1: In Congestion group, PT-INR was significantly worse at postoperative day 3 and 14 (P=0.025 and P=0.011, respectively), and the amount of ascites was significantly larger up to 2 months postoperatively (P=0.0027) than in non-Congestion group.
Study 2: Although patients in Congestion group had similar ncGRWR (1.10 vs 1.07 %, P=0.88) and significantly higher GRWR than in small non-Congestion group (1.38 vs 1.07 %, P=0.022), the amount of ascites was significantly larger up to 2 months postoperatively (P=0.011), and the amount of albumin and -globulin required during hospitalization were also significantly larger (P=0.029 and P=0.018, respectively) than in small non-Congestion group.
Conclusions: Addition of congestive areas to a small graft to simply increase GRWR may have a negative impact on short term postoperative course in pediatric recipients.

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Indocyanine green fluorescence imaging as an adjunct for the localization of a bile leak after split liver transplantation.

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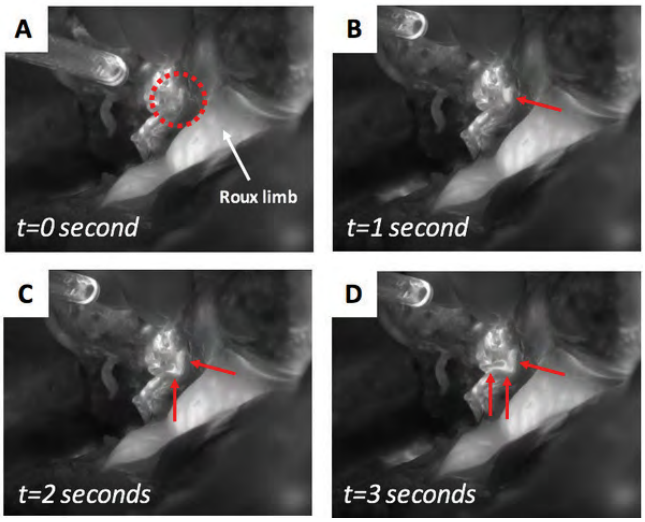
Introduction: Localizing a bile leak after pediatric liver transplant can be challenging especially after technical variant graft (many possible sources of leakage: multiple biliary anastomoses, orphan ducts). Preoperative imaging is often unable to localize the leak. We present a case where using indocyanine green (ICG) fluorescence imaging helped precisely localize a leak after pediatric split liver transplant.
Case presentation: A 5-year-old girl with methylmalonic acidemia received a split left lobe transplant to treat recurrent episodes of hyperammonemia. The biliary anastomosis consisted of a single end-to-side Roux-en-Y choledochojejunostomy. Nine days after transplant, she developed a bile leak. Imaging confirmed the hepatic artery was patent. She was taken to the operating room for exploration. The bilio-enteric anastomosis was intact. Despite prolonged inspection of the cut surface under 4.5x magnification, the leak could not be visualized. ICG fluorescence imaging was used to help localize it. The patient was given 0.5mg/kg of ICG intravenously. After waiting for the ICG to be excreted through the biliary system, the cut surface was inspected using a near infra-red detection device and a discrete area of bile leakage was noted along the cut edge of the liver (Figure 1). The leak was repaired.

Postoperatively, there was no recurrence of bile leak. Twelve months after transplantation, the patient is alive and well with a normally functioning graft.
Conclusion: ICG undergoes uptake by the hepatocytes followed by an exclusive hepatic clearance and biliary excretion. It has been used in delineating the biliary anatomy and guiding the bile duct division during living donor hepatectomy and in detecting bile leaks after non-transplant hepatectomy. ICG constitutes an additional tool in the arsenal of diagnostic measures available to the surgeon to assist with the intraoperative identification and management of bile leaks after liver transplantation.

Figure 1.



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Five cases of familial hypercholesterolemia treated by liver transplantation

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Background: To investigate the clinical effect and prognosis of liver transplantation (LT) for familial hypercholesterolemia(FH).
Methods: A retrospective analysis was performed on the preoperative characteristics, operative conditions and postoperative follow-up of 5 children who received LT for FH admitted to our center from December 2014 to July 2021.
Results: The patients' primary clinical manifestation was a progressive increase of palpable yellow masses in buttocks and joints and decreased activity tolerance, accompanied by increased blood cholesterol and low-density lipoprotein. The patients above had systemic vascular involvement, including arterial stenosis and lipid plate formation, especially in coronary arteries, and some patients had clinical symptoms. All patients were confirmed to have FH by genetic test and biochemical blood test (heterozygous/homozygous LDLR mutation). The age of the first onset varied between 1 year to 6 years. All 5 children were male, with the preoperative blood cholesterol level of 15.33±4.67 mmol/L and the blood LDL level of 10.69±2.80mmol/L. Preoperative low-fat diet and lipid-lowering drugs had poor efficacy. They received LT at 149, 124, 92, 45 and 72 months, and all donor livers were from cadavers. On the first day after LT, their blood cholesterol level was 5.56±1.88 mmol/L and their LDL level was 4.06±1.75 mmol/L. The liver function of 5 patients recovered gradually, blood cholesterol was in the normal range and normal diet was resumed. The patients have been followed up for 6 to 80.7 months, and all children survived without progression of cardiovascular diseases. The clinical manifestations such as suffocating, squatting and precardiac discomfort were significantly reduced after operation.
Conclusions: LT is a means to cure FH. It should be performed before the occurrence of cardiovascular diseases in children, and satisfactory quality of life can be achieved after transplantation.

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Factors determining the long-term outcome among pediatric living donor liver transplantation recipients: Indonesia pediatric intensive care experience

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Background: Transplantation is the only definitive treatment for end-stage liver disease. Early identification of prognostic variables associated with high mortality is important for desirable outcome. This study aimed to identify factors determining the long-term pediatric living donor outcome in living donor liver transplantation (LDLT) recipients in Indonesia.
Methods: This is a retrospective study involving 40 pediatric LDLT recipients. Data collection was conducted from April 2015 to November 2018 at Indonesian transplantation centres. Subjects were divided into survivors and non-survivors group according to one-year mortality post-transplantation data. The factors investigated were recorded during in-hospital stay after LDLT surgery.
Results: The one-year mortality rate of this study was 15%. PICU length of stay was significantly shorter in survivors (16.5 (9.75-23.25); p=0.050) as well as mechanical ventilation days (1.5 (1.0-4.2); p=0.036). No significant difference in the VIS score among the two groups (5.0 (0.0-10.0) vs 5.0 (5.0-21.8); p=0.868). Post-LDLT infection rates between the two groups were not significantly different

(p=0.307). The peak procalcitonin count and day-3 procalcitonin was significantly higher in non-survivors (21.51 (11.15-88.29) vs 2.81 (3.23-15.77); p=0.039) and (2.81 (1.38-4.57) vs 5.12 (3.06-14.25)) respectively. No significant difference was found in peak leukocyte counts between the two groups (p=0.810). The median PELD score among survivors was significantly lower (16.0 (13.0-18.25) compared to non-survivors (19.0 (17.0-25.0); p=0.048). Among LDLT recipients, 52.5% and 35.0% of subjects were classified into mild and severe undernourished according to the mid-upper arm circumference-to-age measurements. However, nutritional status did not significantly affect the outcome of the patients (p=1.000).
Conclusions: Long term mortality of LDLT recipients were influenced by in-hospital PELD score, length of mechanical ventilation, and procalcitonin level. Length of stay in PICU is shorter in survivors compared to non-survivors. Nutritional status, VIS score, and infection rates did not alter mortality rates.

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Infections among pediatric living donor liver transplantation in Indonesia Tertiary Hospital

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Background: Children with end-stage liver disease are more susceptible to infections which can be further aggravated by the use of immunosuppressants. This study aimed to investigate the association of pre-transplantation infections and the incidence of post-transplantation infections in pediatric living donor liver transplantation (LDLT) recipients.
Methods: A retrospective study with forty LDLT recipients was conducted with data taken from April 2015 to November 2018 in an Indonesian tertiary hospital. Subjects were grouped into two according to detection of pre-transplant infections within 60 days prior to LDLT surgery.
Results: The median age of study participants were 16.0 (11.2-23.2) months. The most common diagnosis were biliary atresia, accounting to 67.5% of the LDLT recipients. Thirteen subjects had at least one infections before LDLT, comprising of respiratory tract (38.5%), urinary tract (23.1%), gastrointestinal (23.1%), and other infections. Post-LDLT, 31 out of 40 had at least one infections with respiratory system as the most common organ involvement (67.7%). Urinary tract and gastrointestinal infections were found in 48.4% and 41.9% subjects respectively. All subjects received empirical antibiotics post-surgery with penicillin as the most common antibiotics (57.5%) administered. There was no significant difference in the incidence of post-LDLT infections (27.5% vs 47.5%; p=0.451) and sepsis (12.% vs 25%; p=0.599) between two groups. However, a significant difference in the peak leukocyte counts post-LDLT in subjects who had pretransplant infection 25,375 (21,720 – 41,135) compared to healthy subjects 20,390 (11,885 – 26,530) was found. No significant difference in peak procalcitonin and length of hospital stay between the two groups.
Conclusions: Our findings suggest than pre-LDLT infection did not have a significant effect on post LDLT clinical outcomes. Hence, this study implicates that post-LDLT infections are affected by other factors throughout-and post-LDLT.

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Hyaluronan in the fetal extrahepatic bile duct increases in response to injury

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Background: Biliary atresia (BA) is an obliterative cholangiopathy and represents the primary indication for liver transplantation in children. The etiology is uncertain, but compelling evidence points toward a prenatal cause. However, an early response of the fetal extrahepatic bile duct (EHBD) to injury remains unknown. The objective of this study was to identify unique features of the fetal and neonatal EHBD injury response with pathophysiological relevance.
Methods: Mouse, rat, sheep, and human EHBD samples were studied at different developmental time points. Models included a fetal sheep model of prenatal 14- to 21-day injury, human BA EHBD remnants and liver samples taken at the time of the Kasai procedure, EHBDs isolated from neonatal rats and mice, and spheroids generated from primary neonatal mouse cholangiocytes that were cultured in either collagen or hyaluronan. A bile duct-on-a-chip device was used to study swelling of a collagenous matrix with and without hyaluronan.
Results: A thick layer of hyaluronan encircling the lumen was identified as a unique feature of the normal perinatal EHBD. This layer, which was surrounded by collagen, was significantly thicker in ducts subject to prenatal injury, in parallel with extensive peribiliary gland (PBG) hyperplasia and mucus production, and increased serum bilirubin levels. BA remnants and liver samples similarly showed increased hyaluronan centered around ductular structures, compared with age-matched controls. High molecular weight hyaluronan has a positive effect on spheroid growth, supporting the pro-regenerative environment seen *in vivo*. Increased

hyaluronan levels in the matrix lead to a decreased lumen diameter.
Conclusions: A dense layer of hyaluronan around the lumen that decreases rapidly after birth is a surprising feature of the mammalian fetal and neonatal EHBD. Prenatal injury causes an increased thickness of the hyaluronan layer, with extensive PBG hyperplasia and mucus production, possibly leading to increased bilirubin levels, swelling and obstruction of the EHBD.

P-245

Are left lobe split liver pediatric grafts associated with worst outcomes when compared to segment 2-3 split grafts?

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Background: Left lobe (LL)-right lobe split transplants are more complex anatomically than segment 2-3 (LLS)-right trisegment splits and may have worse outcomes. To evaluate this hypothesis, we compared the outcomes after pediatric LL and LLS split liver transplant and evaluated the effect of experience over time on outcomes.
Methods: A single center retrospective review of all LLS (n=86) and LL (n=36) split liver transplants was performed. Comparisons were made between eras: early (1997-2009: LLS n=44, LL n=19) and modern (2009-2021: LLS n=42, LL n=17). (p value <0.05 significant).
Results: Patients receiving a LLS were significantly younger (1.7±1.9 vs. LL 6.9±3.8 years, p<0.001). There was no difference in early post-transplant complications (<30 days) between groups: hepatic artery thrombosis (HAT) (LLS 8/86 9.3% vs. LL 5/36 13.9%, p=0.45), portal vein thrombosis (LLS 12/86 14.0% vs. LL 4/36 11.1%, p=0.67), or bile leak (LLS 15/86 17.4% vs LL 9/36 25.0%, p=0.39). The rate of retransplantation for HAT was similar (LLS 3/86 3.5% vs. LL 3/36 8.3%, p=0.26). Overall, LLS grafts had a non-significant superior 3-year patient (PS) (LLS 87.1% vs LL 75.0%, p=0.11) and graft survival (GS) (LLS 80.0% vs. LL 66.7%, p=0.1). In the modern era, there was a significant improvement in both 3-year PS and GS survival compared to the early era (LLS PS: 79.5% vs. 95.2%, p=0.033; LLS GS: 70.5% vs. 90.5%, p=0.026; LL PS: 63.2% vs. 88.2%, p=0.089; LL GS: 52.6% vs. 82.4%, p=0.066) but the survival between groups was still equivalent (PS LLS 95.2% vs. LL 88.2% p=0.35; GS LLS 90.5% vs. LL 82.4%, p=0.38).
Conclusions: Segments 2-3 and LL split liver transplants have comparable outcomes. Patient and graft survival after pediatric split liver transplant have improved with increased surgical expertise for both types of graft explaining the lack of significant difference when comparing outcomes.

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Role of SpyGlass™ cholangioscopy in biliary complications in pediatric liver transplant recipients

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Background: Management of post transplant biliary strictures is based on biliary dilation by endoscopic retrograde cholangiopancreatography (ERCP) or percutaneous way with bilioplasty sessions, depend on the type of anastomosis (peroral or percutaneous); the rate of success resolution is almost 50-70% with the endoscopic ERCP approach and 76% on the percutaneous way. Single-operator cholangioscopy (SpyglassTM) allows the endoscopic approach under direct vision of the biliary tree with less morbidity and complications compared to conventional methods and its percutaneous approach is a novel technique for the management of biliary pathology that is not accessible by peroral way.
Methods: Retrospective observational study of pediatric patients with biliary anastomosis stricture refractory to conventional management, in patients with a surgical history between January 2020 and June 2021, in a liver transplant referral center.
Results: Between January 2020 and June 2021, 7 patients underwent to SpyglassTM, median age was 4 yo. 6 of the 7 patients had a history of living donor liver transplant and one had a history of partial hepatectomy for hepatoblastoma with biliary stenosis. Stenosis approach was 85% percutaneous (6/7 patients). Visualization of the stenosis was 100%, in all case cholangioscopy was crucial for selective guidewire placement prior to planned intervention. The patient with untreatable stricture required bile duct reconstruction. Of the 6 patients operated successfully (85%), all required an average of 2 bilioplasty sessions in the 6-month follow-up. 5 patients were approached percutaneously and 1 orally; in the latter case requiring insertion of a nitinol-covered prosthesis, as an alternative for managing stenosis.
Conclusions: Cholangioscopy is an effective tool for the management of critical impassable stenoses in patients with altered postsurgical anatomy, and for the diagnosis and therapeutic management of post-transplant complications in the pediatric population with a living donor recipient with a lower rate of complications and reduces the need for biliary reconstruction.

P-247

Pediatric third liver transplantation: a single-center experience

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Background: Pediatric retransplantation is an accepted practice for graft failure and complications in Australasia. As 15% of children require a third transplant, this is a growing cohort with limited data in the literature.
Methods: We review nine patients from the commencement of our transplantation program in 1986 up to 2020 assessing demographics, prognosis, and outcome measures.
Results: Third transplant patient survival was comparative to first and second transplant patient survival at 5 years. All deaths were within the post-operative period and secondary to sepsis. Operative times and transfusion volumes were increased at third transplant (1.8 and 4.5 times compared to first transplant, respectively). Learning difficulties and psychological disturbances were prevalent (83% and 66.6%, respectively).
Conclusions: While recent mortality outcomes appear comparable to undergoing a second liver transplant, third transplant operations were more complex. Neurological impairment and psychological disturbance appear to be prevalent and need to be considered in pre-transplant counseling.

P-250

Efficacy of abdominal sonography in evaluating intra-abdominal fluid collections in febrile paediatric liver transplant recipients

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Background: Febrile episodes during the immediate posttransplant period could be due to several causes. Abdominal Ultrasonography (USG) is performed as a part of the septic screening to look at intra-abdominal collections. If the patient continues to spike fever, computerized tomography (CT) scan which is the gold standard is commonly performed. Here we looked at the utility of USG abdomen in comparison with a CT scan in evaluating patients with febrile illness.
Methods: All pediatric liver transplant (PLT) recipients who underwent an abdominal CT scan in the post-LT period over a period of 36 months (November 2018 to October 2021) were evaluated. The patients' CT scans were compared with their abdominal USG. We calculated the sensitivity and specificity of USG in detecting a fluid collection and its efficacy in quantifying it.
Results: Of 169 PLT recipients, 36 (21.3%) patients with a median age of 12(19-39) months, who had both USG and CT to look for intraabdominal collections were enrolled. The primary etiology was biliary atresia in 20 (55.5%) patients and all were living donor transplantation. Of the patients who underwent both imaging modalities, 32 (89%) patients were detected to have a collection. Only 1 (2.7%) patient had a collection in CT which was not detected in USG. USG abdomen had a sensitivity of 97% and specificity of 100% in identifying intra-abdominal fluid collections. The fluid volume quantified correlated significantly (r 0.93, P<0.0001) with the volume quantified by CT.
Conclusions: In children with febrile illness in the post-LT period, USG abdomen is a sensitive and specific tool to identify & quantify intra-abdominal collections. This would hence obviate the need of an expensive (10 times more expensive) and potentially deleterious imaging modality like CT, especially in the pediatric age group.

P-252

Delayed biliary reconstruction in liver transplantation: pediatric case series

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Background: Pediatric liver transplantation can be a complex procedure in highly technically demanding cases and in critically ill patients resulting in prolonged ischemia time, hemodynamic instability, and loss of graft quality. The aim of this study is to evaluate the utility of delayed biliary reconstruction in a complex case series of pediatric liver transplants.
Methods: Pediatric liver transplantation cases with delayed biliary reconstruction from January 2015 to July 2021 in a single center are reported.
Results: A staged biliary reconstruction procedure was needed in 4 out of 100 patients due to hemodynamic instability or intraoperative vascularization complications requiring transfer for endovascular treatment by interventional radiology during liver transplantation. Biliary reconstruction was performed after a median of 5 days (2-17 days) using an hepaticojejunostomy in all cases. There were no major postoperative biliary complications requiring percutaneous management or reintervention. Graft and patient survival were 100% in a median of 50.5-month follow-up period.
Conclusions: Delayed biliary reconstruction in pediatric liver transplantation is a strategy to consider in complex situations where intraoperative hemodynamic instability or incidences in graft patency occur

Poster Presentations: Transplant Oncology

P-253

Gemcitabine plus Cisplatin versus non-gemcitabine and Cisplatin as neo-adjuvant for cholangiocarcinoma patients prior to liver transplantation

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Background: Cholangiocarcinoma management is constantly updated in view of existing evidence in order to establish practice guidelines and consensus statements. However, the standardized treatment guidelines for cholangiocarcinoma patients who have received a liver transplant are still controversial.
Methods: In this prospective study, patients with locally advanced, unresectable, hilar, or intrahepatic cholangiocarcinoma with no evidence of extrahepatic disease or vascular involvement were treated with either combination of Gemcitabine plus Cisplatin or other standard options of treatment as neo-adjuvant with no radiation involved before listed for liver transplantation according to an open labeled. The primary endpoints were the overall survival and recurrence-free survival after liver transplantation.
Results: In these 18 patients (11 males and 7 female) with median age of 61.83 [interquartile range (IQR): 58.27-68.74] were confirmed with diagnosis of cholangiocarcinoma and all of whom had undergone for liver transplantation. Of 18 patients enrolled, 10 received Gemcitabine/Cisplatin, while 8 patients received either Capecitabine or FOLFIRI alone or with Cetuximab. Days for recurrence after transplantation were 603 (IRQ: 603-603) in Gemcitabine/Cisplatin group and 285 (267-374) days for non-Gemcitabine/ Cisplatin group (p-value=0.18).Median days of follow-up in Gemcitabine/Cisplatin patients were 753 (621-885), versus 1050 (618-1489) days in non-Gemcitabine/ Cisplatin patients (p-value=0.25). In non-Gemcitabine/ Cisplatin patients, overall survival was 75% (95% CI 31-93%) at both years 1 and 2; 63% (95% CI 23-86%) at both years 3 and 4. In Gemcitabine/ Cisplatin patients, overall survival was 100% (95% CI 100-100%) at both years 1 and 2; 67% (95% CI 5-95%) at both years 3 and 4. Three non-Gemcitabine/ Cisplatin patients died at 328 days, 340 days, and 896 days, respectively. One Gemcitabine/ Cisplatin patient died at 885 days.
Conclusions: Our finding illustrated that, Gemcitabine plus Cisplatin as neo-adjuvant with no radiation involved have shown better results than non-Gemcitabine/ Cisplatin in patients with cholangiocarcinoma prior to live transplantation.

P-254

Outcomes of mixed hepatocellular carcinoma-cholangiocarcinoma tumors: a single-center experience

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Background: Mixed tumors with combined features of hepatocellular carcinoma (HCC) and cholangiocarcinoma (CCA; mixed HCC-CCA) are rare tumors and carry poor prognosis. Liver transplantation (LT) is usually not considered an option for these patients given high rates of recurrence and poor outcomes.
Methods: We reviewed our prospectively maintained institutional database for LT patients diagnosed with HCC-CCA. Between January 2000 and October 2020, we performed 13 LTs on patients with mixed tumors. All patients were diagnosed with presumed HCC pre-LT without biopsy and were diagnosed with mixed HCC-CCA via explant pathology.
Results: Mixed pathology was diagnosed in all after LT in all cases. 10 patients had recurrence after LT. Median survival after LT was 2.3 years. Median largest and total tumor diameters were 2.8 cm and 4.5 cm, respectively, with 92% of patients having multiple tumors. One- and 3-year overall survival rates were 77% and 23%. Patients receiving locoregional therapy (LRT) did not survive significantly longer than those without LRT (median survival 2.9 vs. 1.4 years; p=0.31). Only one patient received Nexavar chemotherapy pre-LT for presumed HCC. Interestingly, the only patients (n=3) alive 3 years post-LT had elevated CA19-9 levels (>35 U/mL), which can indicate more aggressive tumor biology, although survival rates between patients with normal and elevated CA19-9 were not significantly different (p=0.13). All but one patient had normal alpha fetoprotein (AFP) levels (≤20 ng/mL) at the time of LT.
Conclusions: The overall experience with HCC-CCA at our center shows no post-LT survival advantage based on tumor size, as other centers have shown. Early pre-LT diagnosis and adequate tumor control may improve outcomes in patients with mixed tumors. CA19-9 and AFP levels may not be reliable markers of tumor biology in HCC-CCA and did not have any prognostic value in our patients.

P-255

Liver transplantation for fibrolamellar hepatocellular carcinoma: an analysis of the European Liver Transplant Registry

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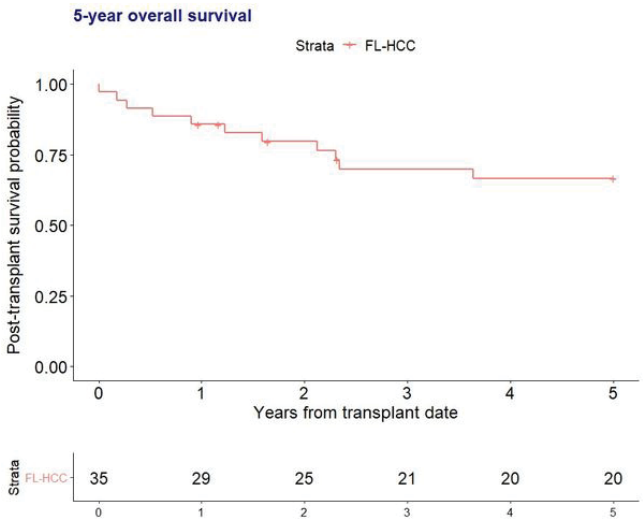
Background: Liver transplantation (LT) for fibrolamellar hepatocellular carcinoma (FL-HCC) remains under debate. We sought to evaluate the oncological outcomes after LT for FL-HCC by analyzing data from the European Liver Transplant Registry (ELTR).
Methods: All ELTR-registered cases of LT before Jul-2021 were considered, but only those for patients with a confirmed diagnosis of FL-HCC were included. Overall survival (OS) and recurrence-free survival (RFS) rates were estimated using the Kaplan-Meier method. For cumulative incidence of recurrence, death without recurrence was considered a competing event.
Results: Thirty-five FL-HCC patients from 25 centers were included, all transplanted between 1985 and 2020. The median age was 30 years (interquartile range [IQR] 23-46). At listing, 46% of patients had already been diagnosed with FL-HCC, 43% were listed for HCC, and for 11% the listing reason was unknown. Only three patients (9%) had an underlying liver disease: alcoholic liver disease (two), non-alcoholic steatohepatitis (one). The median tumor number at listing was one (IQR:1-2) with a largest lesion size of 55mm (IQR:20-140). Pre-LT tumor marker levels were on median: AFP 6 (IQR:3-118), CA19.9 14.8 (IQR:2.7-13.0), CEA 1.25 (IQR:0.25-2.15). At explant pathology, the median tumor number was one (IQR:1-2) with a median maximum lesion size of 60mm (IQR:32-150). Vascular invasion was present in 37%. Recurrence occurred in 40% of the patients, most frequently extrahepatic (75%). Oncological outcomes at 1, 3, 5-years were: OS 86%, 70%, 67%; RFS 77%, 62%, 52%; cumulative incidence of recurrence 17%, 30%, 39%. Patients with a single tumor at explant pathology (median size 90mm, IQR:40-150) showed a 5-years OS of 81%, 5-years RFS of 57%, and 5-years cumulative incidence of recurrence of 43%.



Conclusions: Liver transplantation for FL-HCC yields acceptable long-term survival outcomes, especially for patients with a single lesion. However, recurrence rates remain high in all groups.

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international multi-institutional comparison of liver transplantation for hepatocellular carcinoma: United States, United Kingdom and Canada

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Background: Hepatocellular carcinoma (HCC) has become a leading indication for liver transplantation (LT) globally. Given the scarcity of organs, the general consensus has been that liver transplantation should be reserved for HCC patients who have a predicted 5-year survival similar to non-HCC patients. In the new era of transplant oncology, we sought to perform a multi-national comparison of donor and recipient characteristics, trends in LTs performed for HCC, and post-LT long-term survival.
Methods: We studied consecutive adults (≥18-years) who underwent

first-time LT for HCC between Jan-2008 and Dec-2018 from three national liver transplantation registries (United Network for Organ Sharing STAR [United States (US)], National Health Service Blood and Transplant [United Kingdom (UK)], and Canadian Organ Replacement Registry [Canada]).

Results: A total of 22,404 LTs performed for HCC were identified (US n=19,776, Canada n=1,005, UK n=1,623) (**Figure 1**). The UK had the shortest waitlist time but longest cold ischemia times, highest donor ages, and the highest proportion of deceased after circulatory death donor use. Canada had the highest proportion of living donor liver transplant donor use. 5- and 10-year post-transplant survival exceeded 72% and 58% in all countries (**Figure 2**). Relative to the US, the overall adjusted mortality hazard was equivalent for Canada but lower in the UK (Canada:HR 0.90, 95% CI 0.76-1.07; UK:HR 0.87, 95% CI 0.77-0.99).

Figure 1. Temporal trends in proportion of liver transplants for hepatocellular carcinoma in Canada, United Kingdom, and United States

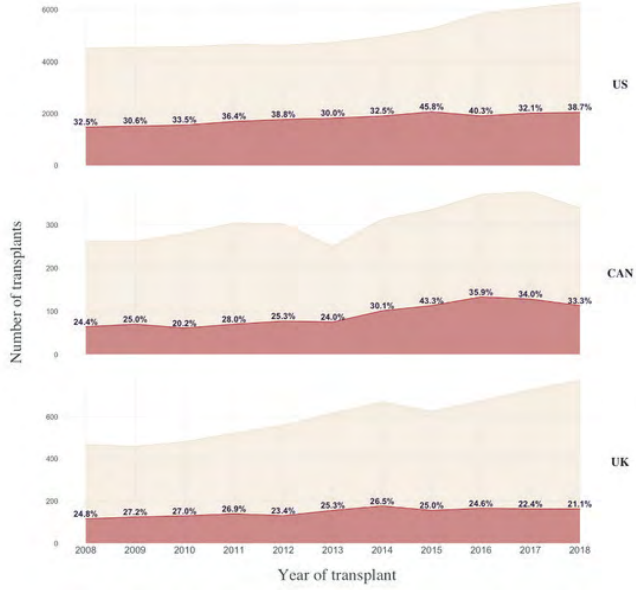
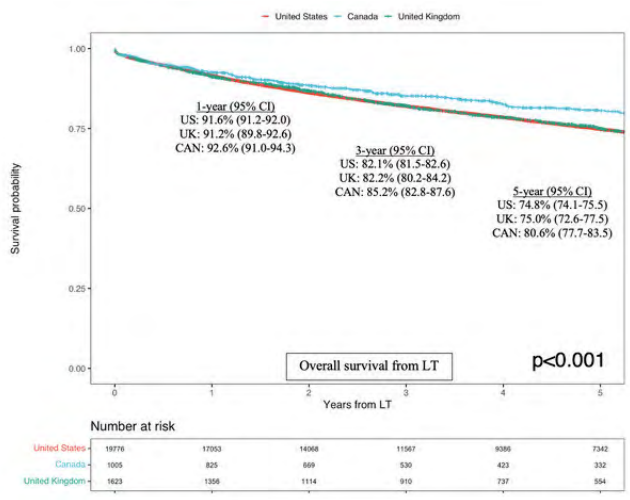


Figure 2. Kaplan-Meier survival analysis of overall survival



Conclusions: This represents the largest and only population-based multi-national analysis of LT for HCC. Identifying differences in recipient, donor, and transplant characteristics between countries offers opportunities for benchmarking, optimization of transplant practices, and ultimately improved post-transplant outcomes.

P-257

Robotic liver resection for HCC as a bridge to transplantation

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Background: Minimally invasive approach to the liver reduces the risks of intraoperative complications and is linked to lower incidence of post-hepatectomy liver failure (PHLF), compared to the traditional open approach. We report our experience with patients affected by hepatocellular carcinoma (HCC) treated at our Institution with robotic liver resection (RLR) before liver transplantation.

Methods: 221 RLR were performed at University of Modena and Reggio Emilia between May 2014 and November 2021. Clinical data of patients underwent RLR for HCC were prospectively collected.

Results: 108 patients underwent RLR for HCC in the study period and, 22 underwent LT. Median MELD score at RLR was 8 (range 6-14) and 50% of the patients had a clinically significant portal hypertension (CSPH), by the mean of a hepatic venous pressure gradient (HVPG) higher than 10 mmHg or presence of esophageal varices (table 1). Median in-hospital stay was 4 days (range 2-23 days), without any 30-days readmission, 0% 90-days mortality, no PHLF (table 2). Median tumor size was 30 mm (range 12-85 mm), and median resection margin was 10 mm (range 1-20 mm) (figure 1). Mean interval between RLR and LT was 11.5 months (±9.5). All patients are alive and only one developed pulmonary HCC recurrence after LT, and is currently alive under Sorafenib treatment 16 months after LT.

Conclusions: Robotic liver resection is a safe alternative for cirrhotic patients affected by HCC that are not suitable for radiological bridging and downstaging. Also patients with CSPH can be safely resected while waiting for LT adjusting the extension of the resection according to the portal vein pressure gradient and future liver remnant.

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Comparison of transplantability of hepatocellular carcinoma before and after surgical resection

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Background: To evaluate the survival and recurrence outcomes of patients who underwent curative resection for hepatocellular carcinoma (HCC) and compare the transplantability at the time of initial presentation and at the time of last follow-up or in the event of recurrence.

Methods: Consecutive patients with HCC who received curative resection (n = 3229) between 2001 and 2019 were studied. The transplantability was evaluated at the time of initial surgery with UCSF criteria. Patients with recurrence were evaluated again for transplantability. Overall survival (OS) and disease-free survival (DFS) were assessed and predictors of survival and transplantability were analyzed.

Results: After a median follow-up of 74.3 months, 5-year OS rate was 82.5%. Among them, 52.3% patients developed recurrence after a median DFS of 74.0 months. Age > 60, HCV infection, multiple tumors, Tumor diameter > 3cm, major resection, microvascular invasion, and liver cirrhosis were predictors of poor survival. For initially transplantable patients with recurrence (n = 1124), 25.8% became non-transplantable. Multiple tumors, tumor diameter > 3cm, microvascular invasion, liver cirrhosis, and DFS< 1yr were predictors of non-transplantability. For initially non-transplantable patients with recurrence (n = 560), 37.5% patients became transplantable. Major resection, microvascular invasion, and DFS > 1yr were predictors of transplantability. Eventually, 72.2% of patient were transplantable at the time of HCC diagnosis, while 80.2% patients were still transplantable at the time of last follow-up or recurrence. (p < 0.001) Even more, 47.8% of patient had no recurrence and did not require liver transplant due to oncologic factor.

Conclusions: The present study revealed that both transplantability and non-transplantability were affected by certain oncologic factors. Total percentage of transplantability rates were comparable before and after index HCC resection. Furthermore, nearly half of the patients did not develop recurrence and do not require liver transplantation for oncologic reason.

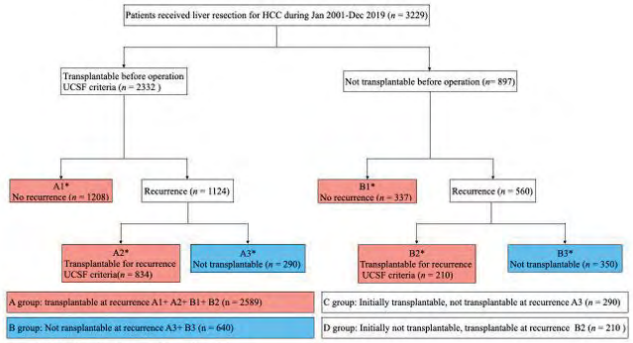

Figure 1. CONSORT flow diagram of the study participants

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Feasibility of personalized and tumor informed ctdna testing for recurrence monitoring in post-transplantation hepatocellular carcinoma

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Background: Hepatocellular carcinoma (HCC) is an aggressive malignancy for which liver transplantation can be curative. Unfortunately, ~8-20% of HCC patients will go on to relapse post-transplantation. Personalized and tumor-informed circulating tumor DNA (ctDNA) testing (SignateraTM, bespoke mPCR NGS assay) has been validated to accurately predict relapse across solid tumors, ahead of radiological imaging. Here, we demonstrate the feasibility of ctDNA testing for monitoring relapse in HCC patients who underwent liver transplantation with curative intent.

Methods: In this cohort, 10 HCC patients, stage I-IV, who underwent curative liver transplantation with longitudinal ctDNA monitoring were included in the analysis. Alpha-fetoprotein (AFP) levels were measured during surveillance in a subset of patients.

Results: Of 10 patients, 2 (20%) tested ctDNA positive during surveillance, both of whom relapsed. Of these, one tested ctDNA positive two months prior to imaging. Of the 8 patients who did not test ctDNA positive during surveillance, all remained disease free by imaging. Two patients had elevated AFP, neither of whom relapsed. Of the 2 patients who relapsed, AFP levels were available for one patient, and fell within the normal range.

Conclusions: We demonstrate the feasibility of performing longitudinal ctDNA assessment in patients with HCC (post-transplantation) during surveillance. ctDNA status but not AFP was

associated with recurrence, and was able to inform disease status ahead of imaging. In order to facilitate clinical decision making, specifically with immunosuppression management, additional studies with larger patient cohorts will be needed to validate the clinical utility of ctDNA testing in HCC.

P-260

Hepatoblastoma outcomes in two tertiary UK centres: a 20-year retrospective analysis

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Background: Hepatoblastoma although rare, is the most common form of childhood liver cancer. Despite the advances in chemotherapy, surgical resection or transplantation are the mainstay of treatment. The study aims to examine outcomes of hepatoblastoma patients treated at two tertiary UK centres.
Methods: All patients aged <18 years with hepatoblastoma from January 2001 to January 2021 were included in the study. A retrospective analysis of prospectively managed databases was undertaken. The primary outcome was overall survival. Secondary outcomes included: recurrence and recurrence-free survival.
Results: 221 patients were diagnosed with hepatoblastoma over a 20-year period. 125 (56.6%) were male and the median age of diagnosis was 20 months (3 days to 13 years). Data on primary management was available for 190 patients of which: 130 (68.4%) underwent surgical resection, 51 (26.8%) were transplanted, 3 (1.6%) received chemotherapy only and 6 (3.2%) received best supportive treatment. Patients that underwent transplantation compared to resection were more likely to have PRETEXT stage IV disease at presentation (n=40 *vs.* n=14, P<0.001). Overall survival at 1-, 5- and 10-years was 97%, 87%, 87% in those undergoing transplantation *versus* 96%, 92% and 90% surgical resection (log-rank P=0.120) (figure 1). Three patients (5.9%) had recurrence following transplantation, at a median of 20 months. Eighteen patients (13.8%) had recurrence following resection at a median of 10 months, of which 9 had a further resection (5 local, 4 distant recurrences) and 5 had a salvage transplant (4 local, 1 distant recurrence). There was no difference in recurrence-free survival between those undergoing resection *versus* transplantation (log-rank P=0.190) (figure 2).

Figure 1. Kaplan Meier curve showing overall survival of surgical resection versus transplant for hepatoblastoma

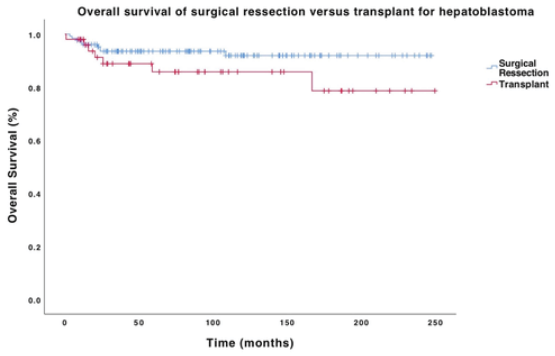
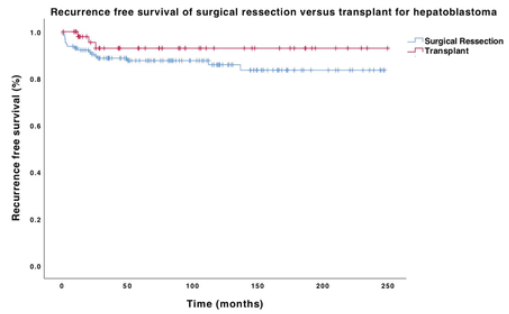


Figure 2. Kaplan Meier curve showing recurrence free survival of surgical resection versus transplant for hepatoblastoma



Conclusions: Hepatoblastoma outcomes from two large tertiary centres in the UK are comparable to worldwide published data. The excellent outcomes emphasise the importance of multidisciplinary approach with expertise in paediatric oncology, liver resection and liver transplantation.

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Stereotactic body radiation therapy (SBRT) as a bridge-to-liver transplantation (LT) for hepatocellular carcinoma (HCC)

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Background: An increasing number of LT teams have added SBRT to their bridge-to-LT strategies, although robust data are still lacking. The aim of this study was to analyze SBRT as part of LT waitlist treatment for HCC.
Methods: All patients who underwent LT in two tertiary referral French centers were retrospectively analyzed. Patients treated with SBRT (n=40) were compared with those who received other treatments (Trans arterial chemoembolization (TACE), ablative therapy, surgery, n=145). Propensity score matching (1 vs. 1) was performed (using MELD and Child-Pugh scores, tumors' number and size and alphafoetoprotein levels).
Results: Overall, 185 patients were included (SBRT=40, other treatments (OT)=145), with median wait-list time before LT of 11 (0-46) months, Child-Pugh of 5 (5-10), MELD of 10 (6-35), number of tumors of 2 (1-7), maximal tumor size of 26 (3-80) mm, Alphafoetoprotein levels of 7(1-1974), follow-up of 49(6-122) months, with no statistically significant differences between SBRT and OT groups. In OT group, 11 patients have previously had TIPS placement (vs. 7/40 in SBRT group, p=0.055). Overall, one patient presented with post-waitlist treatment complication. In SBRT group, median tumor size decreased by 28% at 6 months (16.5 (0 – 47) vs. 23 (10-55) mm). Median tumor necrosis reached 70 (0 – 100)% with a complete histological response rate observed in 13/40 patients. After propensity score matching, median necrosis rate in SBRT group was 65 (0 – 100) % vs. 40 (0 – 100)% in OT group, p=0.061. No differences were found between both groups in terms of overall and recurrence-free survivals (p=0.294 and p=0.426).
Conclusions: SBRT was not associated with post-procedure or post-LT complications. Long-term oncologic outcomes were similar between SBRT and OT groups.

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Impact of pre-liver transplant treatments on imaging accuracy of HCC staging and their influence on outcome

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Background: Outcome after liver transplantation (LT) for candidates with hepatocellular carcinoma (HCC) is affected by various factors. The accuracy of pre-LT imaging is crucial for the decision-making process, but lesions' size and number do not often match with histopathological staging. The aim of this study was to evaluate imaging data, bridging treatments, and their impact on LT outcome.
Methods: All primary LT in HCC patients performed between 01/2012 and 06/2018 were included in this single-center observational study. The primary endpoint was the concordance between imaging before LT and HCC staging based on LT hepatectomy specimens. Other endpoints included the impact of the bridging treatment modality before LT on post-transplant outcomes. Images (computed tomography and magnetic resonance) were compared with hepatectomy specimens. Concordance was defined in case of comparable number of HCC nodules between the last pre-LT imaging and histopathological findings.
Results: 134 patients were included (median follow-up 4.3 [IQR 2.0-5.1] years) (Table 1). At LT, 23% of the recipients were Milan-out and 11% Up-to-7-out. Non-concordance rate was significantly higher in patients receiving > 3 downstaging/bridging treatments (p=0.014). Non-concordance did not impact on disease and overall survival. Conversely, patients with >3 bridging treatments had a significantly reduced median disease-free survival (57 (CI-95% 49-65) months), compared to liver recipients with a lower number of treatments (70 (CI-95% 63-77) months, p=0.019) (Figure 1). Patients who achieved/maintained Milan criteria with less than 3 downstaging treatments had higher disease-free survival rates (p=0.015). Expectedly, HCC candidates outside Milan criteria showed inferior survival rates (p=0.023).

	Concordance (n= 32)	Non-Concordance (n= 102)	*p value*
Patients characterisitcs			
Age, yr	59.5 (49-71)	59 (36-71)	*0.581*
	26 (81.2)	87 (85.3)	0.584
MELD at listing	11 (6-26)	11 (2-31)	0.297
AFP at listing, ng/ml	9 (1-864)	11.5 (1-3721)	0.581
MELD at LT	10 (6-30)	11 (3-31)	0.899
AFP at LT, ng/ml	9.5 (2-755)	9 (1-60500)	0.581
Donor age, yr	60 (18-80)	65 (17-88)	0.074
Time from listing to LT, days	73 (6-1328)	73 (2-1170)	0.512
Treatment n>3, n (%)	13 (40.6)	66 (64.7)	***0.014***
Time from diagnosis to LT, days	455.5 (63-1572)	591.5 (4-5769)	0.062
Pathological characteristics			
N° nodules	2 [1-4]	3 [1-29]	***0.004***
Total nodules diameter, mm	35 [8-61]	59 [8-271]	***<0.0001***
Diameter largest nodule, mm	22 [8-45]	25 [8-78]	0.066
N° active nodules	2 [1-3]	2 [1-22]	***0.019***
Total diameter active nodules, mm	32 [8-61]	40.5 [8-239]	***0.026***
Max diameter active nodules, mm	21 [8-45]	22.5 (6-78]	0.348
Metroticket, %	73.8 (48.7-78.4)	70.4 (41.1-78.4)	0.081
TNM, n (%)			
- ≤ 1	10 (37.0)	20 (23.8)	0.108
- > 1	17 (63.0)	64 (76.2)	
Grading, n (%)			
- ≤ 2	7 (25.9)	32 (38.1)	0.149
- > 2	20 (74.1)	52 (61.9)	
Microsatellites, n (%)	2 (6.3)	19 (18.6)	0.054
Microvascular invasion, n (%)	6 (18.8)	23 (22.5)	0.427
HCC staging at LT, n (%)			
- Milan IN	31 (96.9)	72 (70.5)	***0.002***
- Up-to-7 IN	1 (3.1)	15 (14.7)	
- Up-to-7 OUT	0 (0.0)	15 (14.7)	

Table 1. Patients with and without concordance and their characteristics of HCC nodules before LT (imaging) and at histopathological examination. Data expressed as median [IQR] for continuous variables, absolute value (percentage) for categorical ones.

Conclusions: With a high number of nodules, there is a low rate of concordance between pre-LT imaging and histopathological results. In the era of extended HCC-criteria, multiple bridging treatments reduce the accuracy of pre-LT imaging to predict the HCC-stages and negatively impact outcome after LT.

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Disparities in liver transplantation in patients with HCC diagnosis

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Background: Disparities in outcomes of hepatocellular carcinoma (HCC) have not been adequately studied, especially in the context of liver transplantation (LT). We sought to identify disparities in racial/ethnic groups in this patient population with the goal to find ways to mitigate them.
Methods: We obtained patient and tumor characteristics from the National UNOS STAR files from April 12, 2012 to June 6, 2021. One-way ANOVA and Chi-square tests were conducted looking for differences among racial/ethnic groups, utilizing non-Hispanic White (NHW) patients as the comparator. A p-value of ≤.05 was deemed significant. All statistical analysis was performed using SAS 9.4.

Table 1: HCC Liver Transplant Recipient Characteristic Data by Race/Ethnicity

Characteristics	Non-Hispanic White (N=8,400)	Non-Hispanic Black (N=1,176)	NHW vs NHB p-value	Hispanic (N=2,092)	NHW vs. Hispanic p-value	Asian (N=976)	NHW vs. Asian p-value
Mean (S.D.)							
Age	61.5 (6.9)	61.2 (7.5)	0.1426	60.6 (7.3)	<.0001*	59.9 (8.8)	<.0001*
BMI	29.8 (21.0)	28.8 (5.1)	0.0002*	29.8 (5.1)	0.9324	25.5 (3.9)	<.0001*
MELD at Listing	10.5 (3.8)	10.3 (3.9)	0.0343*	11.0 (3.9)	<.0001*	9.2 (3.8)	<.0001*
MELD at Transplant	12.0 (5.0)	11.5 (5.0)	0.0034*	12.5 (5.3)	<.0001*	10.5 (5.1)	<.0001*
Graft survival Time (Days)	1322.7 (898.0)	1298.9 (882.6)	0.3944	1182.7 (889.3)	<.0001*	1327.3 (943.5)	0.8807
Patient survival Time (Days)	1324.2 (897.8)	1300.4 (882.7)	0.3945	1182.4 (888.6)	<.0001*	1328.8 (942.1)	0.8846
Frequency (%)							
Sex			<.0001*		<.0001*		0.0107*
Female	1,663 (19.8)	317 (27.0)		562 (26.9)		227 (23.3)	
Male	6,737 (80.2)	859 (73.0)		1,530 (73.1)		749 (76.7)	
Number of tumors			0.2340		0.9001		0.2289
1	4,162 (49.6)	592 (50.3)		1,012 (48.4)		512 (52.5)	
2	1,962 (23.4)	291 (24.7)		507 (24.2)		222 (22.8)	
3	1,026 (12.2)	144 (12.2)		257 (12.3)		122 (12.5)	
4	549 (6.5)	55 (4.7)		144 (6.9)		52 (5.3)	
5	299 (3.6)	39 (3.3)		77 (3.7)		24 (2.5)	
>5	402 (4.8)	55 (4.7)		95 (4.5)		44 (4.5)	
Vascular Invasion			0.3522		0.2313		0.0173*
Macrovascular	174 (2.1)	17 (1.5)		34 (1.6)		15 (1.5)	
Microvascular	1,131 (13.5)	161 (13.7)		264 (12.6)		103 (10.6)	
None	7,092 (84.5)	998 (84.9)		1,794 (85.8)		858 (87.9)	
Treatment for HCC	400 (4.8)	44 (3.7)	0.1189	99 (4.7)	0.9572	34 (3.5)	0.0719
No	7999 (95.2)	1132 (96.3)		1992 (95.3)		942 (96.5)	
Yes							
Tumor Necrosis			0.6669		0.0006*		<.0001*
Complete	2,870 (34.2)	399 (33.9)		700 (33.5)		401 (41.1)	
Incomplete	3,878 (46.2)	557 (47.4)		1,047 (50.1)		438 (44.9)	
None	1,651 (19.6)	220 (18.7)		344 (16.4)		137 (14.0)	
Worst Tumor Differentiation			0.3237		0.1563		<.0001*
Complete necrosis	1,814 (21.6)	278 (23.6)		469 (22.4)		271 (27.8)	
Moderate	4,122 (49.1)	570 (48.5)		1,022 (48.9)		397 (40.7)	
Poor	592 (7.1)	86 (7.3)		169 (8.1)		72 (7.4)	
Well	1,870 (22.3)	242 (20.6)		430 (20.6)		236 (24.2)	
Patient graft Status			0.0084		0.1284		0.0004*
Dead	1,544 (18.4)	256 (21.8)		338 (16.2)		128 (13.1)	
Living	6,450 (78.1)	884 (75.3)		1,674 (80.3)		812 (83.4)	
Lost to Follow up	111 (1.3)	7 (0.6)		29 (1.4)		9 (0.9)	
Re-transplanted	183 (2.2)	27 (2.3)		45 (2.2)		25 (2.6)	

*=Significant p-value

Results: Mean graft and patient survival times were the lowest in Hispanics among all groups. Hispanics also had the highest MELD at listing in the recipient and waitlist groups. Among LT recipients, Non-Hispanic Blacks (NHBs) had significantly lower MELDs at listing and transplant compared to NHW. Hispanics were significantly different than NHW with lower age, patient and graft survival times and had higher MELD at listing and MELD at transplant. Tumor necrosis was also significantly different in Hispanics. In the Asian population significant differences were seen in lower age, BMI, MELD at listing and transplant when compared to NHW. Sex, graft status, tumor necrosis, tumor differentiation, and vascular invasion were also significantly different from NHW. For patients dropped from the waitlist, Hispanics constituted higher proportions of death on the list and worsened condition.
Conclusions: There are significant disparities in the Hispanic population compared to NHW with regard to waitlist and transplant outcomes in HCC in the United States. Whether these are a result of the recognized increased proportion of NASH diagnosis among Hispanics or the effect of socioeconomic factors will need closer evaluation.

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Spectrum of denovo malignancies and their predictors after liver transplantation

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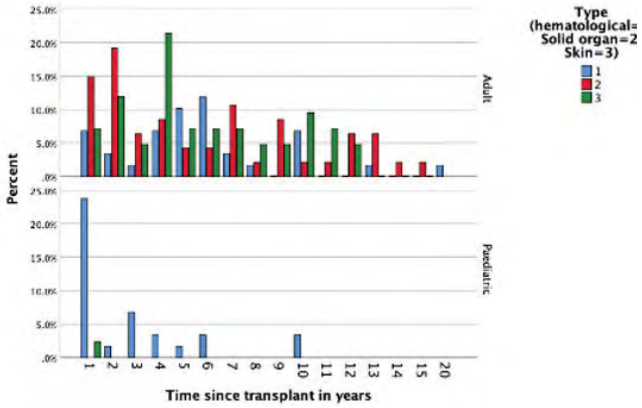
Background: De-novo malignancy (DNM) has become an important cause of death after long term survival following liver transplantation (LT). We share our experience of identifying and managing LT patients with DNM and our analysis of possible risk factors.
Methods: We retrospectively studied 2249 consecutive liver transplant recipients between 2005 and 2015 who were followed up for a minimum period of 5 years. The incidence and types of DNM and possible risk factors were studied in detail.
Results: The incidence of DNM was 8.2% (n=185 patients) and they were broadly classified into hematological, solid organ and skin malignancies. Some patients developed more than one type of DNM. The various types of DNM observed are given in the table below. Hematological malignancy was frequently observed in pediatric age group and was common in the first year following transplant (picture). Solid organ malignancy was more common in adults and showed a biphasic peak between 1-3 years and 7-10 years. Skin malignancy was also more common among adults and occurred commonly 4-5 years following transplant. Among various risk factors analyzed, the significant risk factors for individual types of DNM are summarized in the table. Interestingly, the type of immunosuppression used did not co-relate with the development of DNM in our study. The median survival following diagnosis of DNM was 56 months (IQR 80.3).

Table: DNM following LT

Hematological (n=74, 37.8%)			
Types:		**Risk factors:**	
PTLD	70	Blood group	p 0.51
Leukemia	2	Pediatric age	p 0.0001
Multiple myeloma	2		
		Etiology	
		Alcoholic liver disease	p 0.004
		Chronic viral hepatitis	p 0.042
		Redo liver transplant	p 0.05
		Metabolic liver disease	p 0.044
		EBV mismatch	p 0.0001
		Post-Tx high EBV load	p 0.0001
		Treatment for Acute cellular rejection	p 0.12
		Type of immunosuppression	p 0.91
Cutaneous malignancy (n=53, 27%)			
Types:		**Risk factors:**	
BCC	32	Time since Tx <18 months	p .038
SCC	20	Blood group	p 0.39
Melanoma	1	Alcoholic liver disease	p 0.0001
		Treatment for Acute cellular rejection	p 0.54
		Age group (adult/paediatric)	p 0.82
		Fitz Patrick Skin type	p 0.87
		Type of immunosuppression	p 0.72
Solid Organ Malignancy (n=69, 35.2%)			
Types:		**Risk factors:**	
Oropharynx	7	Time since Tx <18 months	p 0.75
Larynx	2	Blood group	p 0.44
Esophagus	3	Treatment for Acute cellular rejection	p 0.072
Parotid	1	Etiology	
Lung	8	Primary sclerosing cholangitis	p 0.473
Thyroid	1	Alcoholic liver disease	p 0.0001
Breast	7	Inflammatory bowel disease	p 0.31
Hepato-biliary	2	Smoking	p 0.045
Pancreas	5		
Small intestine	2		
Colorectal	9		
Anal canal	3		
Renal and urinary tract	6		
Female genital tract	3		
Male genital tract	10		



Conclusions: LT patients are at a significant risk of developing DNM. Hence, early identification of risk factors and appropriate surveillance protocols for monitoring high risk groups should be the sine qua non for reduction of DNM associated mortality.

P-265

Prediction of hepatocellular carcinoma recurrence after liver transplantation with hepatitis B virus DNA levels

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Background: High serum load of hepatitis B virus (HBV) deoxyribonucleic acid (DNA) is known to be a strong risk factor of hepatocellular carcinoma (HCC) development. The aim of study was to investigate the predictive role of HBV DNA levels in recurrence of HCC after liver transplantation (LT).
Methods: From June 2006 to May 2020, 729 recipients underwent LT for HBV-related HCC in Seoul National University Hospital. The risk factors for HCC recurrence after LT were analyzed including serum HBV DNA load.
Results: Recurrence-free survival at 1, 3, 5, and 10 years were 99.6%, 98%, 95.1%, and 87.8%, respectively. Detectable HBV DNA level (higher than 10 IU/mL) before transplant was significant predictors of HCC recurrence in univariate analysis (P=0.027). Further subgroup analysis was performed to demonstrate the significance of HBV DNA level according to the risk of HCC recurrence. Based on the score of the predicted survival after liver transplantation for HCC (SALT), patients were divided in three groups. In high risk group of recurrence with SALT score more than 2.44, detectable HBV DNA level were significantly associated with recurrence free survival (57.9 % vs. 78.7 %, P<0.0001).
Conclusions: There is a close relationship between HBV DNA level and HCC recurrence after transplant. High HBV DNA levels before transplant are associated with HCC recurrence after transplant, especially in high recurrence risk group.

P-266

While tumour [^{18}F] FDG PET avidity is a prognostic marker for recurrence post-LDLT in NAFLD/NASH patients with HCC, AFP is not

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Background: With a dramatic increase in the obesity epidemic worldwide, non alcoholic fatty liver disease (NAFLD) and non alcoholic steatohepatitis (NASH) have emerged as the commonest underlying aetiology for cirrhosis in patients with hepatocellular carcinoma (HCC).
Methods: Recipients undergoing LDLT for HCC were labeled as having NAFLD/NASH based on presence of steatosis/steatohepatitis on histopathology, or presence of ≥3 of: serum triglycerides>150 mg/dl,HDL <40 mg/dL(males)/<50 mg/dl (females),diabetes mellitus

(DM) or FBSL>100 mg/dl,hypertension (HT), BMI >25 kg/m^2. We accept patients with HCC and cirrhosis for upfront LDLT irrespective of tumour size or number, provided there is no extrahepatic disease or macrovascular invasion
Results: From 2004-19, of the 3203 LDLT's performed, 60 patients with NAFLD/NASH cirrhosis had pathology proven HCC. Fifty-seven were males, mean age was 59±7 years, 41 had DM, 18 had HT. 42% had tumours beyond UCSF criteria. Mean pre-LT AFP was 155±574 mg/dl (only 25 [42%] had raised AFP). The 5-yr OS/RFS post LDLT were 75%/71%, respectively. Sixteen patients developed HCC recurrence (26.6%, similar to our overall series recurrence rate of 17.6%, p=0.09). In our overall series, pre-LT AFP ≥100 ng/ml, tumour beyond UCSF criteria, and [^{18}F] FDG-18 PET avidity predicted recurrence. In this cohort however, tumour [^{18}F] FDG PET avidity was the only adverse prognostic factor for both, OS (p=0.008,CI 1.45-13.25,HR 4.39) and RFS (p=0.01,CI 2.5-35.0,HR 9.56). Of 16 patients with HCC recurrence, 13 had FDG-avid tumours, 10 had HCC beyond UCSF criteria. Only 5 had pre-LDLT AFP >100 ng/ml. The commonest site of HCC recurrence was the grafted liver (as opposed to lungs in our overall series).
Conclusions: Tumour [^{18}F] FDG PET avidity predicts adverse outcomes post LT in HCC patients with NAFLD/NASH cirrhosis, while contrary to other aetiologies, pre-LT AFP level is not. Post-transplant recurrence rates are similar to the non-NAFLD population, and recurrences are more often hepatic.

P-267

Influence of postoperative complications on long-term survival in liver transplantations for HCC: a competitive risk analysis

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Background: Postoperative complications have been associated with poorer outcomes in several branches of surgical oncology, although this relationship in liver transplant (LT) setting for HCC is still unexplored. The study aim was to analyse the impact of postoperative complications on recurrence-free survival (RFS), (OS) and cancer-specific survival (CSS) of transplanted HCC patients.
Methods: We retrospectively evaluated 254 LTs for HCC from 2015 to 2019. Postoperative complications were classified according to Comprehensive Complication Index (CCI) and the postLT CSS assessed through Metroticket 2.0 calculator. The population was stratified in a high-risk and a low-risk cohort based on the predicted CSS of 80% according to M2.0 calculator. In a second step, we re-evaluated the RFS, OS and CSS of both high-risk and low-risk cohort according to a further stratification based on a 47 points CCI cutoff.
Results: In the low-risk cohort (Cohort A, 226 pts), we observed a significantly better recurrence-free (92% vs 26%, p<0.001), cancer-specific (2% vs 26%, p<0.001) and overall survival (89% vs 53%, p<0.001) in the group with CCI < 47. In the high-risk cohort (Cohort B, 26 pts), there was no significant difference between two groups.
Conclusions: Our study suggested a negative influence of postoperative complications on RFS, OS and CSS in low-risk cohort. These results emphasized the importance of minimizing risks of a complicated postoperative course, beginning with a careful donor-recipient matching and ending with an effective postLT management.

P-269

Milan criteria in patients with hepatocellular carcinoma who are candidates for liver transplantation. Discordance between radiology and histopathological analysis of explanted liver

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Background: Patients with hepatocellular carcinoma (HCC) who exceed Milan criteria (MC) on explant pathology have an increased risk of recurrence and death. Discordance between radiological studies (CT or MRI), explant pathology, and preoperative characteristics predictive of discordance are not well understood.
Methods: Patients who underwent orthotopic liver transplantation (OLT) for HCC after preoperative CT or MRI between January 2011 to November 2017 were dichotomized to „within" or „outside" MC into two groups histological analysis of the explanted liver from a 100 cases institutional prospective database. We performed Univariate and survival analyses using the Kaplan-Meyer test to identify independent factors that could predict discordance between pretransplant imaging findings, explant histology, and the impact on overall (OS), Graft (GS), and Recurrence-free survival (RFS).
Results: Of 71 patients with HCC who met the CM by CT/MRI at the time of OLT, 49 patients (69%) remained within a pathological correlate of Milan criteria on explant examination. We observed a higher rate of HBV and HCV infection and larger diameter of the dominant nodule, higher incidence of tumor recurrence in the graft and larger size of the larger nodule, worse histological grade, microscopic vascular invasion, and worse response to TACE in the recipients among the histological variables (p<0.05). There was no association with pretransplant AFP levels (p=ns). Although clinically relevant OS, GS, and RFS differences between both groups were not statistically significant (p=ns).
Conclusions: Underestimation of HCC burden prior to LT remains common despite current imaging technologies. The graft's higher rate of tumor recurrence should guide studies to avoid transplanting patients who do not benefit from this treatment.

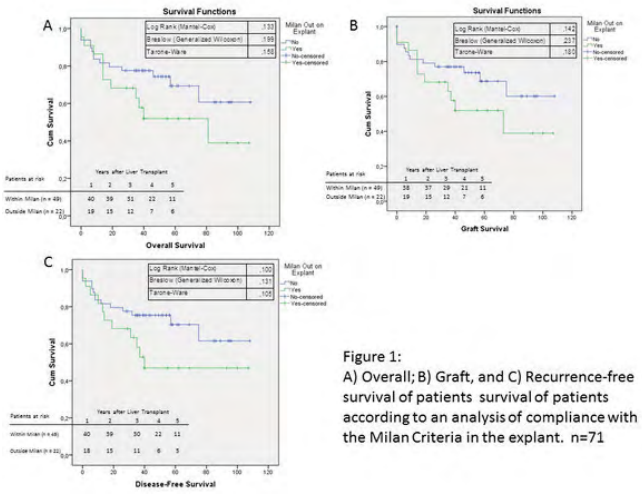

Figure 1:
A) Overall; B) Graft, and C) Recurrence-free survival of patients survival of patients according to an analysis of compliance with the Milan Criteria in the explant. n=71

Table 1: Descriptive analysis of pre, post-transplant and explant variables according to study groups based on compliance with the Milan Criteria. (n=71)

Variables		Within Milan (n = 49)	Outside Milan (n = 22)	p
		Mean ± SD	Mean ± SD	
Pretransplant characteristics				
Recipient age (years)		60 ± 5,6	57,9 ± 9	ns
Recipient gender	Male	37	20	ns
	Female	12	2	ns
HBV infection		4	8	**<0,05**
HCV infection		25	5	**<0,05**
Sustained Viral Response (SVR)		16	2	ns
Child - Pugh	A	29	16	ns
	B	18	6	
	C	2	0	
MELD		9,8 ± 3	9,6 ± 5,3	ns
Last pretransplant alpha-fetoprotein *		34,70	35,60	ns
Number of radiological tumors		1,2 ± 0,5	1,5 ± 0,7	ns
Largest lesion (in mm)		24,6 ± 9,8	32,6 ± 12	**<0,05**
Locorregional therapies		41	17	ns
TACE		35	15	ns
Number of TACE sessions		1 ± 0,8	1,1 ± 1	ns
Waiting List Time (in months)		6 ± 5,2	4,5 ± 4	ns
Postransplant characteristics				
HCV recurrence		4	1	ns
Tumor Graft Recurrence		1	4	**<0,05**
Explant histopathological characteristics				
Number of histopathological tumors		1,3 ± 0,7	1,9 ± 1,4	ns
Largest lesion (in mm)		19,9 ± 10,7	36,4 ± 18	**<0,05**
Edmondson-Steiner Degree of Differentiation	Grade 1	7	3	**<0,05**
	Grade 2	26	12	
	Grade 3	2	7	
Microvascular Invasion		0	17	**<0,05**
Portal vein thrombosis		1	3	ns
Pathologic response to treatment (%)		71,7 ± 36,5	40,5 ± 35,5	**<0,05**
Pathologic response to treatment	Absent	7	5	**<0,05**
	Partial	8	8	
	Complete	27	4	

Abbreviations: *HBV:* Hepatitis B Virus; *HCV:* Hepatitis C Virus; *MELD:* Model for End-Stage Liver Dissease; *TACE:* Transarterial Chemoembolization; *AFP:* Alfapheto-protein.

*Obs: * U de Mann-Whittney*

P-270

Transarterial chemoembolization (TACE) plus Sorafenib compared to TACE alone in transplant recipients with hepatocellular carcinoma

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Background: Hepatocellular carcinoma (HCC) is the sixth most common malignancy and the third most common cause of cancer-related mortality worldwide. Trials assessing the combination of TACE plus Sorafenib in patients with unresectable HCC have yielded inconsistent results. The purpose of this study is to compare the outcome of HCC patients treated with TACE combined with sorafenib versus TACE monotherapy.

Methods: Hepatocellular carcinoma (HCC) is the sixth most common malignancy and the third most common cause of cancer-related mortality worldwide. Trials assessing the combination of TACE plus Sorafenib in patients with unresectable HCC have yielded inconsistent results. The purpose of this study is to compare the outcome of HCC patients treated with TACE combined with sorafenib versus TACE monotherapy.

Results: A total of 128 patients received LT with median (IQR) age of 61.4 (57.0, 66.3) years; most were males (77%). Within the TA group, 79 (77%) patients met Milan criteria and 24 (23%) were beyond Milan criteria, while the TandS group had a higher proportion of patients beyond Milan: 16 (64%) vs 9 (36%); p=0.01. The five-year disease-free survival (DFS) between treatment groups approached significance, with 100% DFS in the TandS group vs 67.2% in the TAne group, p=0.07. Five-year patient survival was 77.8% in the TandS group compared to 61.5% in the TA group (p=0.51). However, beyond Milan criteria had an average amount of percent tumor necrosis on explant pathology of 43.8% ± 32% for those who received TA compared to 69.6% ± 32.8% for patients who received TandS, p=0.03.

Conclusions: This study found that using TandS is generally well tolerated and demonstrated improved the OS compared to TA in patients with unresectable HCC. A multi-center, prospective randomized controlled trial is needed to substantiate these findings.

P-271

Is salvage LDLT for 'all comers' among previously resected HCC in cirrhotics justified?

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Background: In patients with early hepatocellular carcinoma (HCC) and compensated cirrhosis,upfront liver resection (LR) followed by salvage liver transplantation (SLT) in case of recurrence is proposed, as opposed to upfront primary LT. In addition to the difficulties of a re-operation in a patient with cirrhosis and previous LR, a living donor SLT is further complicated by short vascular stumps and small caliber vessels.Short and long term outcomes of salvage LDLT have seldom been reported.
Methods: We accept 'all comers' with HCC irrespective of tumour size or number for upfront or salvage LDLT, provided there is no extrahepatic disease or macrovascular invasion. We analysed outcomes of salvage LDLT at our centre.
Results: From 2014-2019, of the 3203 LT's performed, 553 LDLT's were performed in patients with HCC (pathology proven). Of these,16 patients had a salvage LDLT. Nine were males, mean age was 48±12 years, majority (8) had underlying hepatitis B. Five patients had also undergone 1 or 2 local ablation(s) of the HCC before LDLT with RFA or MWA (5), or TACE (2). Fourteen (87.5%) had tumours beyond Milan, 13 (81%) beyond UCSF criteria. Ten patients had [^{18}F] FDG PET avid tumours. Mean and median pre-LT AFP levels were 1077±2935 mg/dl and 23.4 mg/dl (range 2.2-11,200), respectively. After salvage LDLT, there were no postoperative deaths; 1-year survival was 100%. After a mean follow-up of 48 months (median 28 months), the 3-yr OS/RFS were 77%/65%, respectively. Seven patients (44%) had HCC recurrence;5 in lungs, one each in liver and bone, of whom four died. The recurrence rate in our series of upfront primary LDLT was 17.6%.
Conclusions: Most patients undergoing salvage LDLT had locally advanced, [^{18}F] FDG PET avid tumours, and high AFP levels at presentation. Short and long term survival outcomes were good, but recurrence was much higher compared to upfront LDLT.

P-272

Clinical significance of PIVKA-II levels after liver transplantation for hepatocellular carcinoma

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Background: Measurement of α-fetoprotein (AFP) level is already used widely for routine surveillance and noninvasive HCC diagnosis and to evaluate prognosis and monitor recurrence. Serum prothrombin induced by the absence of vitamin K or antagonist-II (PIVKA-II) measurement more specifically differentiates HCC from other hepatic diseases. The objective of the current study was to assess clinical utility of PIVKA-II in patients with HCC.
Methods: Peripheral blood was obtained from 46 patients with HCC before transplantation (LT), at 6 months and 1 year post-LT. Serum PIVKA-II-levels were determined by Lumipulse G1200 (Fujirebio®) and serum AFP levels were obtained in Cobase601 (Roche Diagnostics®). The main clinicopathological variables were collected. Tumor size refers to the diameter in centimeters of the largest lesion at diagnosis as determined by pre-LT imaging. Spearman's rho, Mann-Whitney amd Wilcoxon test were used.
Results: Regarding the association between PIVKA-II and the other parameters, we found a statistically significant association with tumor size (rho=0,423; p=0,003). We also found significant differences in PIVKA-II levels between patients with tumor size ≤3 cm (median=74,50 mAU/mL; IR 37,50-155) and >3 cm (median=372,50 mAU/mL; IR 45,25-1422), such that median levels in patients with tumor size >3 cm were significantly higher (U=92; p=0,003). Finally, we found that PIVKA-II levels decreased significantly both at 6 months (Z= -2,814; p=0,005) and 1 year (Z= -2,315; p=0,021) after-LT.
Conclusions: PIVKA-II-levels were positively correlated with the the tumor size, suggesting that PIVKA-II may play a role in predicting the severity of the disease. A higher concentration of PIVKA-II may suggest a larger tumor volumen and a higher clinical stage. Also we found that the serum levels of PIVKA-II in HCC patients before and after LT had a significant difference, suggesting that PIVKA-II may be used as an indicator in evaluating curative effects of liver cancer surgery.

P-274

Transarterial chemoembolization (TACE) with radiotherapy for solitary HCC bone metastasis after living donor liver transplantation

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Background: Hepatocelluar carcinoma (HCC) represents one of the most common causes of cancer-related deaths worldwide. Bone metastasis (BM) is a typical metastatic pattern in HCC patients. Although the treatment of HCC has improved in recent years, the prognosis of bone metastasis is poor, a median survival of HCC with bone metastasis is 1-2 months. However, the management of bone metastasis is palliative radiotherapy only. We present the cases, TACE with radiotherapy for solitary bone metastasis lesion.
Methods: Among 94 recipients who received living donor liver

transplantation due to HCC between December 2014 and July 2021, we had 3 cases of bone metastasis from HCC. They had solitary lesion and we performed the TACE with radiotherapy for curative treatment.

Results: Metastatic lesion was decreased or disappeared in radiologic finding after TACE, tumor marker was decreased in all cases. In spite of extremely poor prognosis of bone metastasis from HCC, patients have survived more than six months after the first recurrence event. There is no recurrence in other organ, except primary bone metastasis lesion.

Conclusions: Bone metastasis in HCC is typical metastatic pattern, but the prognosis is poor. TACE with radiotherapy for solitary bone metastasis lesion could be a treatment option for the purpose of curative intend, compared to palliative radiotherapy.

Poster Presentations: Surgical Videos for Technical Innovation

vP-004

Liver transection: the Achilles heel in robotic donor hepatectomy

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Robotic donor hepatectomy is still in its infancy and evolving gradually. Many experienced live donor liver transplant (LDLT) centres have started robotic donor hepatectomies. Out of 3423 LDLT from 2004-21, 41 were robotic donor hepatectomies (RDH) since 2019 – first 5 hybrid and last 36 intended as total RDH. There were 4 conversions, while 32 were total RDH. Donors were excluded from RDH in case of graft size >1000gm, GRWR < 0.8, remnant < 35%, multiple RIHV, >2 hepatic ducts, and Type C /D portal vein.

Liver transection technique in right lobe RDH

The transection line is marked on the liver surface after clamping right hepatic artery and right portal vein, and confirmed by ICG injection. The salient points in liver transection are: 1. Placement of prolene suture traction slings for the right and left lobes on either side of the cutting plane, brought out through separate holes, to open the liver like a book, 2. Harmonic scalpel for transection and dissection around the V5, V8 veins with the active blade. Both are aided by bipolar forceps. Major bleeding points are suture ligated and /or clipped. 3. Ensuring the correct transection plane using the four point technique – first the surface transection line, second the MHV, third the hepatic duct confluence, and fourth the Ryle's tube superiorly, 4. The hanging manoeuvre for the final part of transection, avoiding injury to both the RHV and MHV.

vP-006

Total right lobe robotic donor hepatectomy: replicating the open technique

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We embarked on right lobe (RL) robotic donor hepatectomy (RDH) in 2019. Of 3423 LDLT, 41 were RDH– the first 5 hybrid and 36 intended as total RDH. There were 4 conversion (2 due to less operating space, 1 bleeding during transection, and 1 complex RIHVs), while 31 were total RL and 1 left lateral sector RDH. Graft size >1000gm, GRWR < 0.8%, remnant < 35%, multiple RIHV, >2 hepatic ducts, and Type C/D portal vein were excluded.

Mean first and second warm ischemia times: 7 and 38 min, and cold ischemia time: 104mins.

Technique Steps: Five ports (4 robotic and 1 umbilical-laparoscopic; two 12mm and three 8mm) in a 'smiley' fashion at umbilicus level. Falciform divided and RL mobilized. RIHV <3mm divided with harmonic. RIHV >3mm clipped and divided for later reconstruction. Hepato-caval ligament divided with harmonic/hem-o-clipped. RHV looped and silicon Foley catheter passed between it and MHV for later hanging maneuver. Retrograde cholecystectomy done. RPV and RHA are dissected and temporarily clamped to mark liver transection line. Stay sutures taken on right and left lobes for lateral retraction. Liver transection is planned on specially reconstructed MHV films and done with harmonic aided by bipolar forceps, suture ligation and clips. V5 and V8 hepatic veins are dissected, clipped and divided for later reconstruction. After 60-70% liver transection, RHD along with hilar plate divided and stump closed with 6-0 PDS continuous suture. Caudate divided. Remaining transection is completed with hanging manoeuvre. Pfannenstiel incision (10-12cm) made and 15cm endo bag placed. After placing RL in endobag, RHA is clipped and divided. RPV followed by RHV are divided with 45mm endo GIA stapler. Graft is retrieved via the Pfannenstiel incision. Hilar plate is closed with 6-0 PDS suture. Methylene blue leak test for HD stump is done via the cystic duct.

vP-007

Right lobe mobilisation and anterior IVC dissection in the total robotic donor hepatectomy

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Introduction: Out of 3423 LDLT from 2004-21, we have performed 41 robotic donor hepatectomies (RDH) in the past 2 years. The first 5 were hybrid by intent, whereas the last 36 were intended as total RDH. Four of the 36 were converted to open, while 32 were total RDH. We exclude right lobe donors from RDH in case of graft size >1000gm, GRWR < 0.8, remnant < 35%, multiple significant RIHV, >2 hepatic ducts, and Type C or D portal vein anomaly. Here, we demonstrate our technique of right lobe (RL) mobilization and anterior IVC dissection in a total RDH.

Technique: Four robotic and one laparoscopic assistant ports are used. Falciform ligament is divided with harmonic scalpel. Superior leaf of the right coronary ligament is divided with hook diathermy to expose the groove between the RHV and MHV, which is then scored up to the anterior surface. The gallbladder is retracted towards the left shoulder with Maryland forceps by the laparoscopic assistant, and the RL is mobilized by dividing its attachments to the diaphragm and the right triangular ligament with hook diathermy while it is retracted medially by the Prograsp via the third robotic arm, until the retrohepatic IVC is identified. The RL is mobilized off the anterior

surface of the IVC by dividing the short hepatic veins with a combination of hook diathermy, bipolar Maryland forceps, suture ligation and hem-o-lok clips. The hepatocaval ligament is divided with harmonic scalpel and/or beween hem-o-lok clips. The RHV is defined, and a silicon foley's tube is passed between the RHV and MHV for later hanging maneuver.

vP-008

Liver transplantation for Budd-Chiari syndrome caused by advanced alveolar echinococcosis

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Alveolar echinococcosis is a rare parasitic disease caused by the fox tapeworm Echinococcus multilocularis. Endemic regions in Russia include Western Siberia, Russian Far East, Yakutia. Features of development of the tapeworm in the human body: predominantly infiltrative growth with extensive invasion to adjoining organs; ability to metastasize; asymptomatic course.
We present the case of 36 y.o. male experienced IVC occlusion, Budd-Chiari syndrome. The patient suffered from severe portal hypertension and encephalopathy. Diagnosis of alveolar echinococcosis of the liver has been confirmed. The partial prolapse of echinococcus mass into the right atrium and diaphragm invasion were revealed on CT scans.
Bisubcostal incision with sternotomy was performed. After full liver mobilization, IVC was circled Above the diaphragm. After the hepatectomy, a vascular graft was sewed up to the atrium to replace the suprahepatic part of IVC. After the repairing of the diaphragm defect, the DDLT in the bicaval technique was applied. Postoperative course uneventful was uneventful, follow up for 1.5 without recurrence.

vP-009

Double biliary ducts anastomoses of a right lobe living donor transplantation: trans-papillary biliary free stenting of the cystic and common bile ducts

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We report a case of adult-to-adult right lobe living donor liver transplantation (LDLT) performed for a recipient affected by alcohol-related cirrhosis with MELD score of 17. End-stage liver disease was complicated by refractory ascites, portal hypertension, small esophageal varices and portal gastropathy, hypersplenism, and abundant right pleural effusion. Here in the attached video we described the adult-to-adult LDLT procedures, where a right lobe with two biliary ducts draining respectively the right anterior and the right posterior segments has been transplanted. LDLT required a biliary reconstruction using the native cystic and common bile ducts stented trans-papillary with two 5- French 6 cm long soft silastic catheter. None major complications were detected during post-operative clinical courses. Actually, the donor and the recipient are alive and well. The technique we describe in the video, allow to keep the biliary anastomoses protected and patent without having the risk of creating cholestasis and the need of invasive additional procedure. No living donor right lobe transplantation should be refused because of the presence of multiple biliary ducts.
One of the major issues related to the living donor liver transplantation recipient outcome is still the high rate of biliary complication, especially when multiple biliary ducts are present and multiple anastomoses have to be performed.

vP-010

In vivo in situ extended right hepatectomy with portal vein resection for advanced alveolar echinococcosis

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16 yo patient with advanced alveolar echinococcosis involving right lobe, hilum, caudal lobe, abutted the left portal triad structures and partly S3.
Procedure: in vivo in situ extended right hepatectomy with portal vein resection. Roux-en-Y jejunostomy.
IVC has been narrowed during the hepatectomy which is required cavaplasty after all.
The postoperative period was uneventful.

Poster Presentations: Late Breaking Abstracts

LB-P-01

Safe Right Lobe donation equivalent to Left Lobe donation: Mebrofenin Uptake Rate (MUR) a surrogate marker of functional liver capacity

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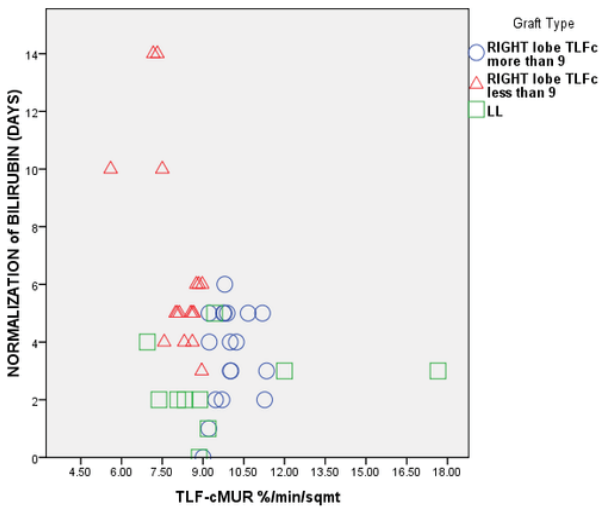
Background: Current imaging modalities and liver biopsy in donors cannot assess functional capacity of liver, and hence regenerative potential of future liver remnant (FLR). Hepatobiliary Scintigraphy (HBS) can benefit in this regard.
Methods: On HBS, donor total liver function (TLF) expressed as TLF-cMUR %/min/sqmt, Blood Pool Clearance % (BPC%), Liver uptake ratio/min (LUR/min). Right lobe (RL) donors with TLFcMUR > 9%/min/sqmt (Group B) are compared to RL donors with TLFcMUR < 9%/min/sqmt (Group A), and left lobe (LL) donors (Group C). End Points: Post hepatectomy liver failure (PHLF) defined by ISGLS, remnant liver function in terms of peak and day of normalization of Serum Bilirubin and INR.
Results: Post donation, liver function recovery of Group B donors is similar to Group C, whereas Group A had delayed recovery (Table&figure). Group A had 4 donors with grade I PHLF. All donors with PHLF had TLFcMUR < 7.53%/min/sqmt.

	Group A RL TLFcMUR < 9%/min/sqmt (n=17)	Group B RL TLFcMUR > 9%/min/sqmt (n=18)	Group C LL (n=10)	Group B Vs Group A p	Group B Vs Group C p
Donor Age (Years) Mean ± SD	35.7 ± 11.8	37.5 ± 9.6	32.1 ± 4.5	0.637	0.110
Donor Liver Biopsy Normal 10-20%steatosis	16 01	17 01	10 00	0.967	0.821
FLR % CT Mean ± SD	37.7 ± 4.3	37.6 ± 5.5	65.6 ± 4.5	0.976	0.000
TLFcMUR %/min/sqmt Mean ± SD	8.0 ± 0.8	9.9 ± 0.7	9.6 ± 3.1	**0.000**	0.685
BPC % Mean ± SD	35.0 ± 4.2	38.4 ± 3.4	38.3 ± 5.6	**0.013**	0.958
LUR/min Mean ± SD	1.89 ± 0.18	2.0 ± 0.12	1.96 ± 0.15	**0.038**	0.433
Peak Bilirubin(mg/dl) Mean ± SD	3.7 ± 1.7	2.3 ± 0.9	2.3 ± 1.4	**0.007**	0.932
Normalization Bilirubin (Days) Mean ± SD	6.5 ± 3.3	3.5 ± 1.6	2.4 ± 1.4	**0.002**	0.075
Normalization INR (Days) Mean ± SD	4.4 ± 0.9	4.1 ± 1.0	3.3 ± 0.6	0.359	0.034
PHLF	04	00	00	**0.029**	NS



Conclusions: RL donors with high TLFcMUR >9%/min/sqmt, BPC% and LUR/min had enhanced recovery of liver function equivalent to LL donors. This emphasizes the important role of Functional Liver Capacity over FLR CT volumes or histology and donor age.

LB-P-02

Pre-ischemic hypothermic oxygenated perfusion alleviates protective molecular markers of ischemia-reperfusion injury in rat liver

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Background: As the pool of donors decreases and the patients' waiting for liver transplants is becoming longer, clinicians have investigated the use of grafts coming from extended criteria donors (ECD). As a result, *ex vivo* machine perfusion has become of major interest to optimize the use of ECD grafts. Hypothermic Oxygenated Perfusion (HOPE), one of the most promising perfusion protocols, is currently performed **after** cold storage (CS) at transplant centers (HOPE-END). As HOPE-END protocol was mainly adopted for logistical reasons (no transportable perfusion system available), we investigated a new timing for HOPE, hypothesizing that performing HOPE **before** CS (HOPE-PRE) could boost mitochondrial protection allowing the graft to better cope with the accumulation of oxidative stress during CS.
Methods: We designed three experimental groups: CS only (CTRL), HOPE-PRE, and HOPE-END in which rat liver injuries were investigated after two hours of normothermic perfusion. We analyzed common biomarkers used in the clinical setting and measured the expression level of forty genes involved in ischemia-reperfusion injuries (IRI) using qPCR.

Results: Histological analysis demonstrated that, compared to CTRL, the HOPE-PRE group showed significantly less ischemic necrosis compared to CTRL vs. HOPE-END. From a biochemical standpoint, transaminases were lower in the HOPE-PRE group vs. CTRL, which marked decreased liver injury. Gene expression analysis revealed that the protection in HOPE-PRE and HOPE-END compared to CTRL was mediated through similar pathways (mitochondria protection, glycocalyx preservation). However, HOPE-PRE seems to confer a higher level of protection than HOPE-END when compared to the CTRL, demonstrated through a higher increase transcriptional level for protective genes in this group.
Conclusions: This study on HOPE protocol timing, using a large set of genes not only opens the door for pursuing real-time transcriptomic analysis helping surgeons for liver graft allocation but also serves as preliminary proof-of-concept supporting the use of portable perfusion devices.

LB-P-03

Endosopic treatment of biliary complications after living donor liver transplantation

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Background: Endosopic treatment of biliary complications after living donor liver transplantation (LDLT) is challenging. We aim to present our endoscopic treatment outcomes in patients with biliary complications after living donor liver transplantation.
Methods: Patients who underwent endoscopic retrograd cholangiopancreatography (ERCP) for biliary complications after LDLT between 2015 and 2021 were included in the study. Demographic data of the patients, ERCP findings, whether PTC (percutaneous transhepatic cholangiography) and surgical treatment were applied, and frequency of recurrence were investigated.
Results: ERCP was applied to 283 patients, 198 men (70%), 85 women (30%) after LDLT.
Biliary complications were successfully treated with endoscopic therapy in 71% of the patients. While the highest success rate was 76.4% in patients with strictures, the success rate was 57.1% only in those with leakage (Table 1). 97.5% of the patients were successfully treated with endoscopic therapy and PTC. Recurrence was detected in 53 (18.7%) of the patients.While 185 patients (65.4%) were followed without stent, endoscopic treatment of the remaining 95 patients continued.

Table 1. ERCP findings and PTC and surgery rates.

ERCP results	PTC		Surgery		Total
	No	Yes	No	Yes	
Stricture	159 (76.4%)	49 (23.6%)	206 (99%)	2 (1%)	208 (73.5%
Leak	8 (57.1%)	6 (42.9%)	13 (92.8%)	1 (7.2%)	14 (4.9%)
Stricture + leak	24 (61.5%)	15 (31.5%)	35 (89.7%)	4 (10.3%)	39 (13.8%)
Stone	1 (33.3%)	2 (66.7%)	3 (100%)	0	3 (1.1%)
Normal	7 (87.5%)	1 (12.5%)	8 (100%)	0	8 (2.8%)
Fistula	1 (50%)	1 (50%)	2 (100%)	0	2 (0.8%)
Fail to pass due to duodenal ulcer	1 (25%)	3 (75%)	4 (100%)	0	4 (1.4)
No cannulation	0	5 (100%)	5 (100%)	0	5 (1.8%)
Total	201 (71%)	82 (29%)	276(97.5)	7(2.5)	283 (100%)

Conclusions: Our results suggest that endoscopic treatments are very effective in the treatment of biliary complications after LDLT.

LB-P-04

Distinctive methylation patterns on circulating DNA as a novel non-invasive biomarker of graft pathology in liver transplant recipients

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Background: Liver biopsy is the gold standard for diagnosis of graft pathology in Liver Transplant Recipients (LTRs). However, it is invasive and often performed with delay, preventing time-sensitive implementation of appropriate therapy. Circulating donor-derived DNA has been examined as a non-invasive biomarker of graft pathology, however it is not specific for the cause. A recently developed assay called Cell-free methylated DNA-seq (cfMeDIP-seq) requires only minute amount of DNA to identify distinctive methylation patterns. The goal of our study was to determine if cfmeDIP-seq could serve as a non-invasive marker of graft injury in LTRs.
Methods: We retrieved frozen plasma samples preserved at -80°C from our Transplant program biobank. CfDNA was extracted and library prepared as previously described. Sequencing was performed on an Illumina HiSeq 2500. Raw data analysis was performed with a combination of bioinformatics tools, e.g. SAMtools and QSEA package. Ingenuity Pathway Analysis was employed to perform pathway analysis of differentially methylated genes.
Results: We analyzed DNA methylation patterns on circulating DNA in a pilot study of 8 LT recipients with TCMR (n=5) and recurrent NASH (n=3) confirmed on liver biopsy compared to 3 control LT recipients with no graft pathology. Methylation patterns on genes involved in inhibition of Fc epsilon RI signaling and activation of TGF-beta signaling were distinctive of TCMR (Figure 1). Methylation

patterns on genes regulating fatty acid and sphingolipid metabolism, such as GAL3ST1, SPTLC3, and CERK, were distinctive for recurrent NASH post-transplant (Figure 2).

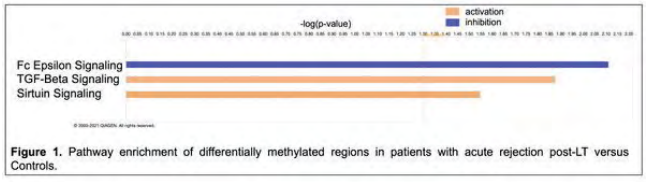

Figure 1. Pathway enrichment of differentially methylated regions in patients with acute rejection post-LT versus Controls.

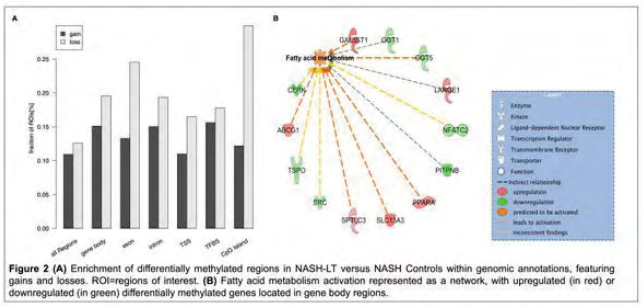

Figure 2 (A) Enrichment of differentially methylated regions in NASH-LT versus NASH Controls within genomic annotations, featuring gains and losses. ROI=regions of interest. **(B)** Fatty acid metabolism activation represented as a network, with upregulated (in red) or downregulated (in green) differentially methylated genes located in gene body regions.

Conclusions: Our preliminary results suggest that cfMeDIP-seq is promising as a specific non-invasive biomarker by identifying TCMR and recurrent NASH via distinctive methylation patterns on circulating DNA. We are proceeding with further studies on larger cohorts to validate the use ofcfMeDIP-seq as non-invasive biomarker for graft pathology.

LB-P-05

living donor liver transplantation for secondary HLH-ALF: a case report

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Background: Hemophagocytic lymphohistiocytosis (HLH) is a life-threatening syndrome characterized by pathologic macrophage activation. Clinical features include fever, cytopenia, hepatosplenomegaly, and coagulopathy. Liver dysfunction is often seen in HLH patients and occasionally leads to acute liver failure (ALF). There is limited data using liver transplantation (LT) to treat HLH associated ALF (HLH-ALF).
Methods: We present a pediatric HLH-ALF case treated with living donor liver transplantation from her mother and summarize the diagnosis and treatment.
Results: A 4-year-old girl was admitted to the hospital with intermittent fever for more than two months. Although the patient was diagnosed with Idiopathic thrombocytopenic purpura two years ago, work-up for infectious and autoimmune causes was negative. Differential diagnosis of lymphoma was considered but was eventually ruled out by lymph node biopsy. After antibiotic treatment, the patient's temperature dropped to normal, and was discharged.
The patient had repeated illness outside the hospital and presented for recurrent high fever(40°C) with hepatosplenomegaly and superficial lymphadenopathy. The Symptomatic treatment was ineffective; the patient deteriorated rapidly with highly elevated transaminases and serum bilirubin, cytopenias, highly elevated ferritin and sCD25. Bone marrow biopsy revealed foamy macrophages engulfing mature, consistent with HLH. The patient's total bilirubin was continually increased and diagnosed secondary HLH-ALF, PELD scored 38. The patient was referred to our center for preparing liver transplantation.
Considering the patient's critical condition, she received living donor liver transplantation from her mother (left lobe). The patient recovered well, the liver function improved and the jaundice gradually disappeared after LT. The postoperative immunosuppression regimen consisted of tacrolimus, mycophenolate mofetil and prednisolone.
Conclusions: The experience demonstrates the effect of LT treating HLH-ALF. Early investigation and treatment should be taken in HLH patients presenting with ALF. LT combined with immunosuppressive therapy offers the potential for improved survival.

LB-P-06

Impact and consequences of recipient Gastroduodenal Artery (GDA) ligation prior to Hepatic Artery (HA) anastomosis during Orthotopic Liver Transplantation (OLT)

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Background: The recipient GDA is often ligated before the HA anastomosis during OLT either to gain mobility, length on recipient HA and with hypothesis that it would prevent "Steal syndrome" protecting the anastomosis. The aim of study is to evaluate its impact on prevention of HA thrombosis (HAT) and consequences of such ligation.
Methods: A retrospective analysis of cadaveric OLT (n=210) with recipient GDA ligated (Group 1) or not (Group 2). Impact was evaluated by occurrence of HAT and consequences by post-operative hyperamylasemia (POHA), nausea and vomiting and delayed feeding.
Results: Group 1 included 78 (37%) cases where common HA was used for anastomosis, Group 2 had 132 (63%) cases where right HA or the proper HA was used for anastomosis.

	Group 1 N = 78(37.1%)	Group 2 N = 132(62.9%)	Total N = 210	p-value
Replaced vessels	18(23.1)	30(22.7)	48(22.9)	1.0
Right	11(14.1)	17(12.9)	28(13.3)	
Left	6(7.7)	12(9.1)	18(8.6	
Hyperamylasemia	31(47.0)	30(25.4)	61(33.2)	0.003
Tube Feeds	19(24.4)	14(10.6)	33(15.7)	0.01
Nausea/Vomiting	38(48.7)	17(12.9)	55(26.2)	<0.001
Delayed Feeding	23(29.5)	9(6.8)	32(15.2)	<0.

There was no incidence of hepatic artery thrombosis(HAT) reported in either group. In Group1, 31 out of 78(39.7%) patients were reported to have post-operative hyperamylasemia(POHA) ranging between 200 and 4700 Units/liter accompanied by delayed feeding, whereas in Group 2, 16 out of 132(12%) patients had POHA ranging between 200-1400 Units/liter (p value of <0.01 using Fisher's exact test).
Conclusions: Ligation of recipient GDA is not associated with decreased risk of HAT as compared to non-ligation. However, it does have consequences in the form of possible POHA leading to delayed feeding due to decreased oral tolerance.

LB-P-07

Fibroprogression and cirrhosis in living liver donor

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Background: Living liver donation has served to bridge the gap between transplant waitlist and dead donation rate. Although the short term outcomes of living donation have been described in literature, the long term health consequences, especially those pertaining to remnant liver are yet to be fully understood. The current study is done to assess the prevalence of fatty liver disease and to non-invasively assess liver health in liver donors using serological markers and sonological evaluation.
Methods: This is a retrospective observational hospital based study focusing on "long term remnant liver health" of those liver donors who attended liver clinic between March 2021 and October 2021 . All of them were subjected to sonographic evaluation using multi parametric ultrasound machine (Super Sonic Imagine), and Shear wave elastography (2D-SWE), Sound speed (SSp.PLUS), Attenuation (Att.PLUS) and Viscosity (Vi.PLUS) were assessed.
Results: A total of 36 liver donors were included in our study with a mean age of 41.5 years. The mean APRI & FIB-4 in total study population was 0.275 & 0.936 respectively. The mean values of 2D SWE, Vi.PLUS, Ssp. PLUS & Att.PLUS in total study cohort were 7.31 kPa, 2.3 Pa.s, 1535 m/s and 0.49 dB/cm/MHz respectively. Significant fibrosis(>F2) was found in 11 donors, of which 7 had severe fibrosis(>F3) with 2 donors having 2D SWE values in cirrhotic range. One donor with 2D SWE value >13kPa was extensively evaluated and was found to have biopsy proven cirrhosis.
Conclusions: The prevalence of fatty liver disease in our study group was 50%. Significant fibrosis was noted in around 30% of donors. We report the first case in published literature of cirrhosis occurring in a liver donor. Our donor cohort with a significant proportion having steatosis, inflammation and fibroprogression underscores the importance of regular follow up and evaluation of remnant liver.

LB-P-08

Choledochoduodenostomy is an excellent alternative to Roux y choledochojejunostomy or choledochocholedochostomy

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Background: We have previously reported that choledochoduodenostomy (CD) is an excellent alternative to Roux Y choledochojejunostomy (CJ) and have preferentially used CD for patients requiring bilioenteric anastomoses since 2005. Our excellent results with CD led us to wonder whether CD would be an appropriate alternative for patients that undergo choledochocholedochostomy (CC) during liver transplantation. We reviewed our experience since 2005 with specific **AIMS** to compare complications and outcomes between patients that underwent CD versus CJ and CC biliary reconstruction.
Methods: We reviewed medical records for all patients that underwent CD biliary reconstruction between 2005 and 2021.

We chose control patients by selecting the CJ and CC recipients transplanted immediately before each CD patient. They were well matched by age, gender and MELD score.We excluded patients that underwent retransplantation, pediatric patients, recipients of split and reduced grafts, and recipients of livers procured after circulatory death. Comparisons were made with the chi square test (or Fisher's exact test) for categorical outcomes and Mann Whitney U test for continuous outcomes.

Results: We identified 74 patients in each group that satisfied our inclusion criteria. Most of the patients in the CD and CJ groups had PSC and cholangiocarcinoma respectively. There were no differences in median duration of hospitalization between the groups. Biliary complications (strictures, leaks) requiring operative, endoscopic or percutaneous intervention were less common in the CD group than the CJ and CC groups: 9.5% for the CD group versus 20% for the CC (p=0.1) and 36% for the CJ groups, p<0.001).Median operative time was significantly shorter for the CD group than the CJ and CC groups.

Conclusions: CD is associated with fewer complications requiring operative, endoscopic or percutaneous intervention and shorter operative time than CJ and CC.CD is an excellent alternative to CJ or CC biliary reconstruction during liver transplantation.

	Choledochoduodenostomy (CD)	Choledochocholedochostomy (CC)	Choledochojejunostomy (CJ)	P*	P#
Anastomotic Stricture (%)	5 (6.75)	13 (17.56)	14 (18.91)	0.078	0.049
Bile leak (%)	2 (2.70)	6 (8.10)	8 (10.81)	0.25	0.09
Cholangitis (%)	4 (5.40)	3 (4.05)	13 (17.56)	1	0.037
Stone, sludge (%)	0 (0)	5 (6.75)	4 (5.40)	0.058	0.12
Papillary stenosis (%)	0 (0)	2 (2.70)	0 (0)	0.5	-
Total number of patients with biliary complication (%)	8 (10.81)	19 (25.57)	22 (29.72)	0.030	0.008
Reoperation for biliary complications (%)	2 (2.70)	0 (0)	5 (6.75)	0.5	0.4
Endoscopic treatment (%)	5 (6.75)	15 (20.27)	15 (20.27)	0.030	0.030
PTC (%)	0 (0)	0 (0)	7 (9.45)	-	0.013
Total number of any biliary procedural intervention (ERCP, PTC, Surgery) (%)	7 (9.45)	15 (20.27)	27 (36.48)	0.1	0.000
Operative time (min) (Median, IQR)	210 (180-240)	240 (200-280)	300 (240-340)	0.007	0.000

*Comparison between CD and CC
#Comparison between CD and CJ
PTC: Percutaneous transhepatic catheter, ERCP: Endoscopic retrograde cholangiopancreatography.

LB-P-09

Implementation of a patient-reported outcome measure called PeLTQL into clinical practice following pediatric liver transplantation: the Starzl Network experience

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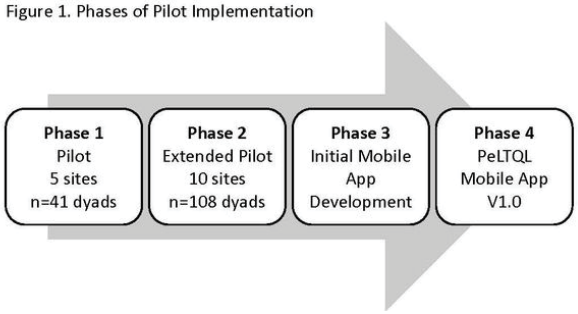
Background: Patient-reported outcome measures (PROMs) are not routinely used in pediatric post-liver transplant clinical care. The Starzl Network for Excellence in Pediatric Transplantation (SNEPT) implemented the Pediatric Liver Transplant Quality of Life (PeLTQL) questionnaire as an inaugural initiative.

Methods: A mixed methods feasibility and implementation project was conducted across ten centers to assess administration processes, barriers, and user experiences related to the integration of the PeLTQL into ambulatory clinic visits. The project involved four phases: initial pilot PeLTQL implementation at five SNEPT sites, extended pilot PeLTQL implementation at all ten SNEPT sites, initial PeLTQL mobile app development and testing, and mobile app implementation at two sites (see Figure 1). User experience surveys, developed based on phase-specific outcomes, were administered at each phase. Strategies were modified based on an iterative process that involved stakeholder feedback.

Figure 1. Phases of Pilot Implementation



Results: 149 patient-parent dyads completed the PeLTQL during outpatient Liver Transplant clinic visits across phases I and II. Clinicians, parents, and patients reported that implementation was feasible. However, most (8/10) sites stopped administering the PROM within one year after the pilot phase, due to concerns about limited clinical time, available personnel, and administration during virtual clinic visits. In response to stakeholder feedback, the PeLTQL was adapted from the originally created pen-paper version to a mobile app version on the RealTime Clinic platform. Feedback from parents and clinicians on the mobile app was overwhelmingly positive, with 96% (22/23) of parents indicating that it was "very easy" or "easy" to complete PeLTQL responses electronically.

Conclusions: Implementation of a PROM into pediatric post-liver transplant care was feasible during the pilot, but sustained implementation was stalled due to logistical challenges, including lack of time during clinic visits. Uncoupling PROM assessments from clinic visit times using a mobile app is preferable and may be sustainable.

LB-P-10

Derivation of a mortality prediction model in critical care patients with cirrhosis and sepsis

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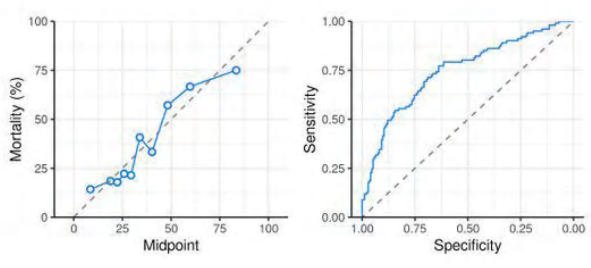
Background: Patients with liver cirrhosis present an impaired immune response, increasing the likelihood of developing infections and related complications. Sepsis in these patients is associated with high mortality. This study aimed to develop a predictive model for in-hospital mortality in critically ill patients with cirrhosis and sepsis, using clinical and laboratory data.
Methods: Cirrhotic adults admitted with sepsis to the medical and mixed ICUs of a tertiary medical center from January of 2007 to May of 2017. A retrospective cohort study in which ten-fold cross-validation was used to estimate best parameter values and model performance and the final model was chosen as the model maximizing area under the receiver-operating characteristic curve.
Results: Out of 2595 ICU admissions of patients with cirrhosis, 277 patients with first ICU admission for sepsis were included in the analysis, and 37% of the patients died in the hospital. We considered for the predictive model, patients who stayed in the ICU for at least 6 hours (n=275). Variables in order of impact were APACHE III score, initial serum lactate, conjugated bilirubin, serum creatinine, MELD score, age, BMI, and serum hemoglobin. Sex was not a contributory factor for outcome. The final best model from cross-validation presented an AUC of 0.75, using a cut-point of 50% estimated probability, sensitivity and specificity were 0.46 and 0.90, respectively, with PPV of 0.72 and NPV of 0.74.



Calibration and receiver operator characteristic curve for the predictive model

Conclusions: The combination of initial serum lactate level, conjugated bilirubin, initial serum creatinine, MELD score, age, BMI, and serum hemoglobin did not yield meaningful improvement in the AUC and did not provide advantage over the APACHE III score for the prediction of in-hospital mortality in critically ill patients with cirrhosis and sepsis.

LB-P-11

Procalcitonin as a biomarker for bacterial infections in the immediate post-operative course of liver transplantation

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Background: Orthotopic liver transplantation (OLT) has evolved as a life-saving procedure for the treatment of end-stage liver diseases. However, infectious complications such as bacteraemia still represent a significant cause of morbidity and mortality. Early diagnosis and appropriate treatment of infection and sepsis in the immediate post-transplant period remains challenging. This study observes procalcitonin (PCT) levels in the early postoperative period after liver transplantation and determines whether it is a reliable tool for the diagnosis of bacteraemia.
Methods: Postoperative serum PCT levels were retrospectively assessed in forty-one consecutive adult patients who underwent OLT between March 2019 and August 2020. PCT levels on postoperative days 2, 5 and 10 were recorded. The study evaluated the trend of PCT and also the correlation between PCT and bacteremia episodes during the first ten postoperative days. PCT at different time periods in predicting outcome was assessed by receiver operative curve analysis (ROC).
Results: The median PCT values on POD 2, 5 and 10 were 9.70ng/ml (*IQR*5.31-23.34), 4.2ng/ml (*IQR*1.55 – 9.10) and 0.92ng/ml (*IQR*0.44 – 2.87) respectively. Thirteen of the forty-one patients (31.1%) had culture-positive bacteremia. Median PCT values were higher in those with with bacteremia - POD 2 (20.94ng/ml vs 8.8ng/ml; p-value 0.288), POD 5 (7.63ng/ml vs 2.68ng/ml; p-value 0.025), and POD 10 (3.05ng/ml vs 0.66ng/ml; p-value <0.001). The area under ROC for predictive validity of procalcitonin on POD 5 in predicting bacteremia was 0.721 with a p-value of 0.025. Using a PCT cutoff of 5.31ng/ml for bacteremia allowed a negative predictive value = 87%, positive predictive value = 58.8%, sensitivity =76.9% and specificity = 74.1%.
Conclusions: PCT can be a reliable biomarker for ruling out bacteremia following OLT with a high negative predictive value.

LB-P-12

Carbapenems are not superior to cephalosporin or piperacillin-tazobactam as perioperative antibiotic prophylaxis in liver transplantation recipients with MELD ≥ 30

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Background: Perioperative prophylaxis, commonly a third-generation cephalosporin plus ampicillin or piperacillin-tazobactam, is usually employed to prevent infections in liver transplantation (LT). Patients with high Model for End-Stage Liver Disease (MELD) score have an increased risk of infection. It remains inconclusive whether we could use carbapenems as surgical prophylaxis for those high-risk patients.
Methods: It is a retrospective study involving all adult patients with MELD score≥30 who underwent LT between May 2018 and September 2020 in our center. We analyzed the infection rate between patients using cefoperazone-sulbactam or piperacillin-tazobactam vs those using carbapenems as surgical prophylaxis.
Results: This study consisted 105 patients who underwent their first liver only transplantation. Seventy-eight patients were used non-carbapenem antibiotics, while 27 patients were used carbapenems as surgical prophylaxis. The incidence of infections within 30 days after LT was 66.7% in carbapenem group and 38.5% in non-carbapenem group (p=0.011). In the view of that the difference might not directly associate with antibiotic prophylaxis regimens because clinicians tend to prescribe carbapenems to patients with worse clinical conditions, we did multivariate analyses and identified that only re-operation (odds ratio [OR], 3.942; 95% confidence interval [CI], 1.004-15.468; p=0.049) and Child-Pugh score (OR, 1.726; 95% CI, 1.183-2.519; p=0.005) were independent risk factors for infections within 30 days after LT. Prophylaxis with or without carbapenems was not associated with the incidences of infection
(OR, 1.940, 95% CI, 0.638-5.898. p=0.243).
Conclusions: The use of carbapenems as surgical prophylaxis was not associated with decreased infection incidences within 30 days after LT. Therefore, carbapenems should be avoided as surgical prophylaxis even if patients had MELD score ≥ 30 because of the potential of causing the dissemination of multi-drug resistance.

LB-P-13

A convolutional neural network-based Innovative donor grafts evaluation model for liver transplantation

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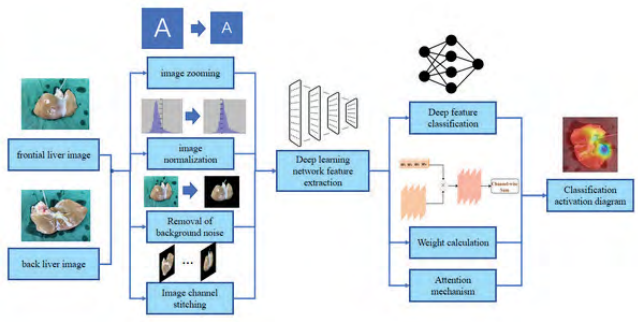
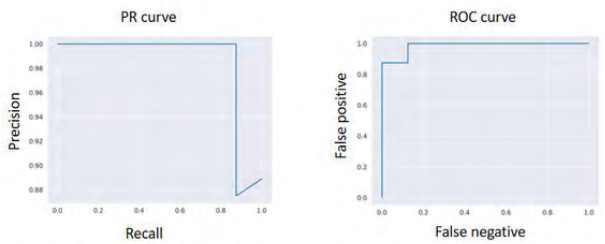
Background: In order to meet the growing demand for liver grafts, the use of marginal donorshas gradually become the norm, but structural changes such as bullous steatosis or severe fibrosis is still associated with high risk of poor graft survival rate to split/whole liver transplantation.The present research aimed to utilize the value of convolutional neural network(CNN) in the assessment of mild liver steatosis compared with liver biopsy data.
Methods: A total of 103 consecutive liver grafts from DBD/DCD were included and classified into 2 cohorts: ≥10(19 cases) versus <10%(84 cases) hepatic steatosis. CNN analysis required the presence of 2 sides of liver images as well as the graft biopsy data. A novel standardise-training feature set is arising from smartphone images including image zooming, image normalization, Removal of background noise and mage channel stitching. Then, a fully automated Classification activation diagram of the liver graft was performed by the Deep feature classification and Attention mechanism.



Results: With the standardise-training feature set and Classification activation diagram, the achieved precision rate, recall rate and accuracy were 100, 87.5, and 93.75%, respectively(≥10 versus <10%). The AUC value is 0.984.



Conclusions: Inthefaceofchallengeof organ shortage,this research prepresents apotential and strongconvolutional neural network strategyto assist surgeons in graft utilization forclinical liver transplantation.

LB-P-14

The cost of procuring deceased donor livers: evidence from OPO cost reports 2013-2018

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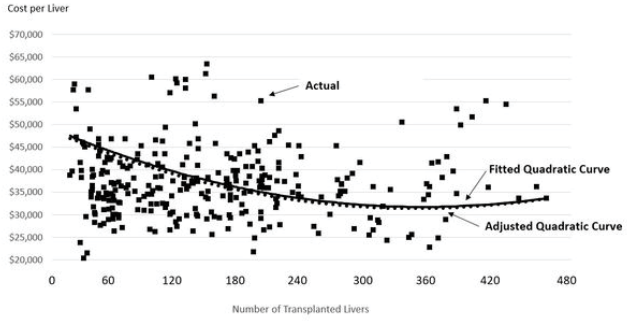
Background: The cost of procuring deceased donor organ for transplantation include costs for the assessment of potential organ donors, maintenance of the donor while waiting organ recovery, the surgical recovery of the viable organs and the cost of transportation. Organ Procurement Organizations (OPOs) have defined geographic service area for which they have exclusive responsibility for organ recovery. By examining the variations in reported organ acquisition charges from the CMS OPO Cost Reports, we may aim to elucidate policy issues affecting the OPOs.
Methods: Using six years of US OPO data (2013-2018), we determined the cost of recovering a viable (i.e., transplanted) liver for each of the 51 independent OPOs. We examined predictors of these costs, which included number livers procured, percent nonviable livers, direct costs of procurement, professional education, procurement coordinators salaries, and local cost of living. A quadratic liver cost curve estimated the relationship between the cost of livers and the number of viable livers recovered.
Results: During the study period, 50,991 livers were recovered (44,513 viable and 6,373 nonviable). The cost of transplanted livers at individual OPOs varied widely from $19,285 to $63,444 over the six years with an average cost of $37,166. The cost of a viable liver tended to decline with the number of livers procured up to 350 livers per year and then increased slightly. Cost increases were 3% per year (+$932/year).



Conclusions: The cost function demonstrates that the number of livers recovered by the OPO is associated with the cost per viable liver, suggesting there may be an optimal number of livers recovered for an OPO.

LB-P-15

Ultra low Graft-to-recipient Weight Ratio (GRWR) graft in living donor liver transplant: role of Mebrofenin Uptake Rate (MUR) in predicting the safety

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Background: Recipient outcomes in LDLT depends on graft functional capacity and adequate volume. Accepted GRWR is 0.8%. Current imaging and liver biopsy cannot assess functional capacity. Hepatobiliary scintigraphy (HBS) can benefit.
Methods: Between October 2019-December 2021, in addition to CT, HBS was performed in 56 donors, of which 11 transplants performed with GRWR between 0.6% to 0.7%. On HBS, Total liver function (TLF) of donor liver (TLF-MUR %/min), Blood pool clearance (BPC %) and Liver uptake ratio (LUR/min) calculated. End points: Small for Size Syndrome (SFSS) and Early Allograft Dysfunction (EAD) in recipients.
Results: Liver biopsies of all donors were normal. Of 11 recipients with ultra-low GRWR grafts, 2 had EAD (Table). In non-EAD group 2 required portal inflow modulation, whereas one in EAD group. SFSS noticed in one in each group. HBS parameters in EAD group were low. No mortality in either group.

		Recipient 1	Recipient 2	Recipient 3	Recipient 4
	Donor age (Years)	28	29	44	30
Donor HBS Parameters	TLF-MUR %/min	17.1	13.1	15.9	16.8
	BPC %	39.8	33.8	38.7	38.6
	LUR/min	2.01	1.82	1.99	2.02
Recipient Factors	Na MELD	23	16	24	15
	GRWR%	0.63	0.7	0.69	0.69
	ECOG	2	2	4	3
Perioperative Data	CIT (min)	70	100	130	90
	WIT (min)	35	35	83	45
Outcome	Normalization Bilirubin (Days)	7	10	45	46
	SFSS	No	No	**Yes**	No
	EAD	No	No	No	No

		Recipient 5	Recipient 6	Recipient 7	Recipient 8
	Donor age (Years)	34	46	39	34
Donor HBS Parameters	TLF-MUR %/min	18.3	15.5	15.7	15.5
	BPC %	42.5	35.6	37.6	36.7
	LUR/min	2.20	1.89	2.05	1.99
Recipient Factors	Na MELD	25	31	17	21
	GRWR%	0.69	0.7	0.63	0.65
	ECOG	2	3	2	3
Perioperative Data	CIT (min)	90	88	90	100
	WIT (min)	35	35	50	38
Outcome	Normalization Bilirubin (Days)	7	20	10	5
	SFSS	No	No	No	No
	EAD	No	No	No	No

		Recipient 9	Recipient 10	Recipient 11
	Donor age (Years)	39	43	23
Donor HBS Parameters	TLF-MUR %/min	17.8	**11.3**	**10.5**
	BPC %	40.2	**33.3**	**29.8**
	LUR/min	2.21	**1.61**	**1.43**
Recipient Factors	Na MELD	32	14	15
	GRWR%	0.68	0.7	0.67
	ECOG	2	2	2
Perioperative Data	CIT (min)	100	90	155
	WIT (min)	40	45	45
Outcome	Normalization Bilirubin (Days)	9	14	45
	SFSS	No	**Yes**	No
	EAD	No	**Yes**	**Yes**

Conclusions: Inspite of normal donor liver biopsies, higher donor HBS parameters reflecting good functional capacity are important in preventing EAD or SFSS and achieving good outcomes in ultra-low GRWR grafts.

LB-P-16

Liver transplant and global surgery: experience establishing a global liver transplantation mentoring program

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Background: Two million adults and children die each year of liver disease. Liver transplantation (LT) is the second most common solid organ transplantation, however, less than 10% of global transplantation needs are achieved. Low- and Middle-income Countries (LMIC's) are the most affected. A University based Center for Global Surgery and our LT team, started collaborations with counterparts in LMIC's over a decade ago and joined efforts in 2017 to create an international alliance that allows clinical care, education and research endeavors. We aim to describe our experience establishing a LT mentoring group within an academic Center for Global Surgery.

Methods: This is a retrospective observational study. We evaluated the number of clinical, research and educational activities that our program did in collaboration with LMIC's for more than a decade (2009 -2022).Surgeries, patient evaluation and follow-up were done in a multidisciplinary fashion with protocols and guidelines from our LT program in partnership with LMIC's LT teams and via telehealth. Most educational and research activities were done online.

Results: We performed 15 surgeries in pediatric and adult patients, including cadaveric and living donor LT, portosystemic shunts and resections and evaluated 27 patients from LMIC's. We published 1 article, presented 5 abstracts and obtained 1 grant. Our group received support to sponsor one research scholar per year and we had 15 bilateral exchange visits and organized 27 online multidisciplinary education sessions in collaboration with centers from LMIC'S.

Conclusions: Our data shows that global efforts with a multidisciplinary model supported by international societies can have clinical and academic impact. It is feasible to partner and mentor the academic and clinical development of LT programs in LMIC's through telehealth and exchange programs. Funding of these efforts remains challenging, and COVID-19 has limited academic and clinical activities.

LB-P-18

Expansion of liver transplantation criteria for hepatocellular carcinoma from Milan to UCSF criteria in Australia and New Zealand and justification for using Metroticket 2.0

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Background: Liver transplant (LT) is the recommended treatment for early-stage HCC in patients with chronic liver disease who are unsuitable for resection. Modest expansion in criteria for transplantation for HCC has not adversely impacted overall survival. This has prompted an expansion in the criteria from Milan to UCSF in 2007, and now towards Metroticket 2.0 (MT2). This study aimed to: a) Compare patient survival post-transplant before and after 2007, b) Compare long-term outcomes for LT within Milan versus UCSF criteria to determine the true benefit of expansion of criteria, and c) Retrospectively validate the MT2 criteria.
Methods: A retrospective analysis of the ANZ Liver and Intestinal Transplant Registry to include all patients who underwent LT for HCC in ANZ since July 1997. The entire cohort was divided into two eras based on the criteria used at the time of listing, namely, *Milan Criteria era* (1997 - 2006) and the *UCSF era* (2007 – July 2015).
Results: Overall 5- and 10-year cumulative survival rates for the entire cohort of 691 patients were 78% and 69%, respectively. Patients transplanted in *UCSF era* had significantly higher 5- and 10-year survival rates than the *Milan era* (80% vs 73% and 72% vs 65%, respectively; p=0.016). In the*UCSF era*, 5- year survival rate for patients transplanted within Milan criteria was significantly better than those transplanted outside Milan, but within UCSF criteria (83% vs 73%; p<0.024). Patients transplanted within the MT2 criteria had a significantly better 5- and 10-year survival rate as compared to those outside criteria (81% vs 64% and 73% vs 50%, respectively; p=0.001).
Conclusions: Overall survival following LT for HCC has significantly improved over time despite expanding the criteria from Milan to UCSF. Patients fulfilling the MT2 criteria have a survival comparable to the UCSF cohort. Thus, expansion of the LT criteria to MT2 is justifiable.

LB-P-20

Clinical outcomes of intra-operative fluid therapy based on transpulmonary thermodilution incorporated vs regular pulse contour analysis in orthotopic liver transplant: a retrospective analysis

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Background: The ideal hemodynamic monitoring to optimise fluid therapy during orthotopic liver transplant (OLT) has been ever-evolving. Despite being invasive, the pulmonary artery catheter is still the gold standard. Pulse wave contour analysis monitors (Flow Trac) that compute cardiac output (CO), stroke volume variation (SVV) and stroke volume index (SVI), being minimally invasive, are preferred in this aspect. The recent bedside transpulmonary thermodilution (TPTD) integrated pulse contour analysis gives additional values like the Extravascular Lung Water Index (ELWI) and alveolar permeability indicated by the PVPI (pulmonary vascular permeability index). Our study attempts to determine whether TPTD integrated devices provide better clinical outcomes than Flow Trac.
Methods: We retrospectively reviewed the outcomes in fifty-six consecutive patients who underwent OLT. These patients' intraoperative fluid therapy and hemodynamics were guided by TPTD (Volumeview) or Flow Trac measurements. Postoperatively the duration of mechanical ventilation, reintubation, weight gain, bacteremia and length of hospital and ICU stay were recorded. Statistical analyses of the patients' variables were compared using Mann-Whitney U tests and Fisher's exact test.
Results: Of the fifty-six patients, twenty-five were managed with Flow Trac and thirty-one with TPTD technique. The median duration of postoperative ventilation was higher in the Flow Trac group (2.00days vs 1day, p-value = 0.034). Similarly, the median length of ICU stay was also higher in the Flow Trac group (9days vs 8days, p-value = 0.041). There were four reintubations in the Flow Trac group and none in the TPTD group (p-value = 0.034). The average weight gain, incidence of bacteremia and duration of hospital stay were also higher in the Flow Trac group (p-value >0.05). The volume of crystalloids administered was comparable in both groups.
Conclusions: OLT recipients managed with the TPTD technique demonstrated lesser morbidity with significant reductions in the duration of postoperative ventilation, reintubation and length of ICU stay.

LB-P-21

Low-grade dysplastic nodules developed in alcoholic liver disease present mutational heterogeneity - early study

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Background: Hepatocarcinogenesis is a complex stepwise process where low-grade dysplastic nodules (LGDN) evolve to high-grade dysplastic nodules and subsequently to early hepatocellular carcinoma (eHCC). Progenitor cells (PC) activated at early stages of carcinogenesis are believed to shape tumour cell behaviour through distinct mechanisms, where epithelial-mesenchymal (EM) plasticity may play an important role.
We aimed to investigate molecular-phenotypic associations in a preliminary study of LGDN, by applying a next-generation sequencing (NGS) panel.
Methods: A series of 4 LGDN was selected concerning 4 patients with alcoholic liver disease (3 cirhhotic) undergoing liver transplantation or resection. WHO 2019 histopathological criteria, PC/cholangiocytic markers (CK7, CK19, EpCAM/BerEp4) and

mesenchymal markers (alpha-smooth muscle actin - ASMA - and vimentin) expression was evaluated. Gene expression profiling and sequencing was performed by NGS (Ion Torrent; Oncomine panel).
Results: The following mutations were identified: NRAS (n=2/4), KRAS (n=2/4), MET (n=2/4), BRAF (n=2/4), DDR2(n=2/4); ALK (n=2/4), FGFR1 (n=2/4), FGFR2 (n=3/4), FGFR3 (n=2/4), EGFR (n=2/4), ERBB2 (n=2/4), ERBB4 (n=3/4); PIK3CA (n=4/4), NOTCH1 (n=1/4); PTEN (n=4/4), FBXW7 (n=3/4), SMAD4 (n=3/4), CTNNB1 (n=1/4), TP53 (n=2/4), SKT11 (n=2/4). A higher number of mutations was observed in SMAD4 (18%), ERBB4 (14%), TP53 (14%), DDR2 (12%), FGFR2 (12%) and FGFR1 (10%) genes. Considering the association between gene mutations and PC/cholangiocytic/mesenchymal markers, NOTCH1 mutations associated ($p<0.05$) with CK7 and ASMA tumor expression; PTEN mutations associated ($p<0.05$) with EpCAM/BerEp4, ASMA and vimentin tumour expression and FBXW7 mutations associated ($p<0.05$) with CK7, EpCAM/BerEp4, ASMA and vimentin expression in tumour cells.
Conclusions: These preliminary results indicate a mutational landscape where EM and stemness plasticity at the early key steps of hepatocarcinogenesis might be intermingled, probably dependent from the underlying liver disease.
Personalized care of patients with eHCC will benefit from effective knowledge on the early phases of hepatocarcinogenesis. Its clinical translation will help to develop preventive strategies, adjust treatment and improve patients follow-up.

LB-P-22

Nanodiamond-Doxorubicin complexes improve hepatic ischemia/reperfusion injury

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Background: Oxidative stress is a major mediator of hepatic ischemia-reperfusion injury (IRI) in liver transplantation (LT). Doxorubicin (DOX) can mitigate oxidative stress, but its clinical use is hampered by significant systemic toxicity. Nanodiamonds (ND) are carbon nanoparticles with the potential to be high-affinity carriers for the selective delivery of anthracyclines, such as DOX, and thus reduce the negative effects of systemic delivery. Here we aim to characterize ND-adsorbed DOX (NDX) uptake and evaluate its efficacy in a mouse model of hepatic IRI.
Methods: ND solution was mixed with aqueous DOX and filtered to produce NDX complexes. Uptake of DOX, ND-FITC, and NDX were tested on THLE-3 hepatocytes. Balb/c mice were divided in to 6 groups and treated i.v. with high (1mg/kg) and low (0.5mg/kg) DOX, high (eq. 0.5 mg/kg DOX) and low (eq. 1mg/kg DOX) NDX, ND and PBS for 48 hours prior to our model of 90min partial (70%) warm hepatic IRI.
Results: ND/NDX uptake in hepatocytes was localized to the cytoplasm without reducing cell viability. In contrast, DOX located to the nucleus of hepatocytes and significantly reduced cell viability. NDX therapy mitigated hepatic IRI with only half the required dose of DOX. Plasma ALT levels after 6h of IRI were significantly lower in mice treated with high DOX, low NDX, and high NDX when compared to mice treated with low DOX, ND, and PBS. NDX therapy reduced the extensive liver damage, the upregulated inflammatory cytokine expression, and the increased leukocyte infiltration present in livers of ND, PBS, and low DOX treated mice.
Conclusions: We establish that NDs form efficient NDX complexes with DOX that are readily taken up by hepatocytes with minimal toxicity. Moreover, NDX complexes enhance the physiological impact of DOX, protecting mice from hepatic IRI with half the DOX, providing a rationale for more effective use of DOX in LT.

LB-P-24

The prevalence of frailty in end-stage liver disease and the impact it has on liver transplantation outcomes

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Background: Frailty is prevalent in patients with Chronic Liver Disease (CLD). Frail patients with CLD have been demonstrated to experience an increased incidence of poor clinical outcomes associated with liver transplantation (LT). This study aimed to determine the prevalence of frailty in 240 patients with CLD assessed for transplantation at St James University Hospital (SJUH) Leeds between 2018-2021 and evaluate the relationship between frailty and poor LT outcomes including waitlist mortality, 90-day post-transplant mortality and length of hospitalisation and ICU stay.
Methods: 240 patients were included in this single centre retrospective observational cohort study at SJUH in Leeds. Frailty status was assessed using the Liver Frailty Index (LFI) and data relating to transplantation outcomes and patient demographics was collected using PPM+.
Results: Of the 226 patients analysed, 15.9% were defined as frail, 70.4% as pre-frail and 13.7% as robust. The incidence of 90-day post-transplant mortality and waitlist mortality was significantly increased in frail patients in comparison to robust (9.10%, 6.67% and 7.69%, 0% respectively, $p<0.001$). Differences in length of hospital stay were not found to be statistically significant ($p=0.12$). Participants with a MELDNa $\geq$15 who were frail had the higher incidence of poor clinical outcomes in comparison to those defined as robust with a MELDNa $\geq$15 (57% vs 7% respectively).
Conclusions: Frail patients were found to have an increased risk of waitlist mortality and 90-day post-transplant mortality. Additionally, the combined use of MELDNa and LFI scores may enhance identification of high risk patients. Frailty evaluation should be routinely performed for patients undergoing assessment for LT as this could help identify patients who would benefit from prehabilitation interventions including physiotherapy and nutritionist input, with a view to improve transplantation outcomes.

LB-P-25

A systematic review of the use of Patient-Reported Outcome Measures (PROMs) in adults undergoing liver transplantation

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Background: Improved survival rates of liver transplantation (LT) (~80% 5-year survival) has shifted the focus towards reducing symptom burden and improving quality of life, which can be assessed using patient-reported outcome measures (PROMs). This study systematically reviewed measurement properties of PROMs to serve as an evidence base for the selection of suitable PROMs and offer new benchmarks for value-based health-care in LT.
Methods: MEDLINE, EMBASE, PubMed and COCHRANE databases were searched for relevant articles. Studies were included if they reported PROMs in LT candidates and/or recipients. Articles including patients <16 years only and clinician-assessed instruments were excluded. The COnsensus-based Standards for the selection of health Measurement INstruments (COSMIN) checklist was used to asses methodological quality of included studies and measurement properties.
Results: The full-texts of 185 out of 2040 studies were reviewed. The Short-Form-36 (SF-36) (n=86 studies) and Hospital Anxiety and Depression Scale (HADS) (n=16 studies) were the most commonly reported generic instruments in this population. Only 15 studies provided original measurement properties for 24 PROMs. Both SF-36 (n=2 studies) and HADS (n=2 studies) showed high quality evidence for sufficient internal consistency (Cronbach's alpha >7.8 and >7.3, respectively), but indeterminate reliability. The Liver Disease Quality of Life Questionnaire and its short version ((SF-)LDQOL) were the most used disease-specific PROMs reported in LT candidates (n=8 studies), and showed moderate quality evidence for sufficient internal consistency and construct validity in 2 studies. Five individual studies reported newly developed PROMs for LT recipients, often incorporating questions from existing instruments. These showed generally high quality evidence and sufficient internal consistency.
Conclusions: In addition to well-established PROMs (SF-36 and HADS), we conclude that the (SF-)LDQOL is the most promising for the detection of disease-specific changes in LT candidates. However, this instrument should be evaluated further for LT recipients.

LB-P-26

Mesenterico-portal axis recanalization with combined tranjugular and transileal approach for extensive mesentericoportal thrombosis

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Background: Diffuse splanchnic venous thrombosis is a potential life threatening condition. Sometimes it can be clinically silent but patients can experience massive variceal bleeding with limited endoscopic treatment, as varices can be ectopic. Anticoagulation medication and esopageal and gastric variceal ligation are the first line of treatment, but in case of recurrent bleeding, multi-visceral transplantation is considered the only definitive solution. We present an endovascular procedure, combining trans-jugular and trans-mesenteric access to portal system.
Methods: From 2013 to 2018, 6 patients (age 19 to 63 years) had combined trans-jugular and trans-mesenteric procedures for diffuse porto-mesenteric thrombosis associated with several pro-thrombotic conditions: PIK3CA mutation, JAK2 - related thrombocythemia, TT MTHFR homozygote condition, chronic myeloid leukemia and after complicated obesity surgery. In all but one case we were able to get access to superior mesenteric vein and to recanalize mesenterico-portal axis. After balloon dilatation we used endovenous stents and TIPS in order to obtain patency of the main axis. All patients had long-course anticoagulation therapy after the procedure.
Results: We obtained immediate patency of the mesenterico-portal in 5 out of 6 patients. 2 of them required reinterventions (one early and one late) for partial dysfunction / re-thormbosis. All 5 patients have a patent portal vein with a minimum 3 years of follow-up. There were no recurrence of bleeding.
Conclusions: Combined trans-jugular and trans-mesenteric endovascular recanalization of the splanchnic venous system might offer a long - term alternative to multi-visceral transplantation in cases of diffuse portomesenteric thrombosis.

LB-P-29

Outcome of urgent liver transplantation in COVID-19 era

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Background: Liver transplant is a proven management method for end-stage cirrhosis and is estimated to have increased life expectancy by 15 years. The COVID-19 pandemic posed a challenge in patients who were candidate for a solid organ transplant. It has been suggested that the outcomes of liver transplants could be adversely affected by the infection, as immunosuppression makes liver transplant recipients more susceptible to adverse effects.
Methods: The outcome of the patients who underwent urgent liver transplantation from April 2020 to February 2022 (COVID-19 era) were assessed regarding mortality rate with and without COVID-19 infection. Our study included 45 patients who were diagnosed with COVID-19 infection as cases and our previous urgent liver transplant patients' database in non-COVID era.

Results: This study shows that the mortality rate for liver transplants carried out in acute and acute on chronic cases are markedly higher in comparison to elective ones. Meanwhile, the patients with COVID-19 infection had a 41.9% early mortality rates in comparison to 26.0% in those without COVID-19 infection. Furthermore, acute and acute on chronic cases with and without COVID infection had 46.2% and 34.4% mortality rates, respectively. Our data also shows that post-surgical COVID-19 pneumonia findings are directly related to mortality rates, albeit marginally.
Conclusions: This study shows that the survival rates for urgent liver transplant cases with concurrent COVID-19 infections are not greatly affected; hence, it is presumed that the benefits of transplantation outweigh the risks.

LB-P-30

Does technique of hepatic arterial anastomosis and heparinization at graft recovery really matter in Living Donor Liver Transplants?

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[1]Gleneagles Global Hospital, Liver Transplant and Hepatobiliary Surgery, Hyderabad, India, [2]AIG Hospitals & Leeds Teaching Hospital NHS Trust, Liver Transplant & Hepatobiliary Surgery, Hyderabad, India, [3]AIG Hospitals, Liver Transplant & Hepatobiliary Surgery, Hyderabad, India, [4]Gleneagles Global Hospital, GI and Hepatobiliary Surgery, Hyderabad, India

Background: Hepatic artery (HA) anastomosis in Living Donor Liver Transplantation (LDLT) is technically difficult due to short length and small calibre of graft arteries. There is a continuous debate regarding method of arterial anastomosis, need for heparinization at graft recovery and role of post-transplant anticoagulation.
Methods: November 2018 to December 2021, 151 liver transplants performed, of which 134 were LDLTs. 7 (5.2%) early mortalities excluded from analysis, though mortality was not related to HA thrombosis (HAT). End points were incidence of HAT at 6 weeks and hepatic artery stenosis.
Results: Graft types were right lobe (RL,n=88), Right posterior (RP,n=1), left lobe (LL,n=18), left lateral segment (LLS,n=18) and mono segment (MS,n=2). Continuous method of anastomosis performed in 49 patients(38.5%), of which 38 were RL, 1 RP, 6 LL and 4 LLS grafts. Of the 4 LLS grafts, one had 2 arteries anastomosed to two recipient arteries. Interrupted method of anastomosis performed in 78 patients(61.5%) of which 50 were RL , 12 LL, 14 LLS and 2 MS grafts. 1 out of 50 RL grafts and 4 out of 14 LLS had two graft arteries anastomosed to two recipient arteries. Heparin was given in 67 (52.7%) of 127 donors immediately before graft recovery. All recipients received once daily dose subcutaneous enoxaparin for 2 weeks and oral aspirin for 3 months. 5 recipients developed postoperative bleeding, of which one required laparotomy, and there was no mortality related to bleeding. There was no HAT in this series, but one with interrupted method had HA stenosis at 4 months detected on CT with stable graft function at 18 months follow up, no intervention needed.
Conclusions: Both continuous and interrupted suture techniques of HA anastomosis are safe in experienced hands who perform LDLTs regularly. Heparinization at graft recovery is not mandatory and routine posttransplant prophylactic LMWH and aspirin are safe.

LB-P-31

Hybrid approach in living donor hepatectomy: safe and secure method in the era of minimally invasive surgery

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Background: Safe and less-invasive approach is ideal for living donor hepatectomy. As pure laparoscopic donor hepatectomies are not covered by Japanese health insurance now, to minimize the wound of the living donor while ensuring donor safety, we perform the hybrid approach for living donor right hepatectomy and left hepatectomy.
Methods: In a spine position, liver mobilization is performed with a hand-assisted laparoscopic approach. With an 8 cm upper midline incision, Gelport® is attached. Two 5 mm trocars are inserted from the umbilicus and right side of the abdomen. After the mobilization of the liver, midline incision is extended to 12-14 cm. Cholecystectomy is performed, and hepatic artery and portal vein of the graft side are identified and dissected. Liver transection is performed directly from the midline incision with the same procedure as an open approach without Pringle's maneuver using CUSA or Hydrojet (recent cases). Hepatic duct is divided after confirming the proper cutting point with an intraoperative cholangiography. Glissonean branches of the caudate lobe are securely ligated to prevent bile leakage. More recently, glissonean pedicle approach is often applied, and hepatic artery and portal vein are separated from the glissonean pedicle after the completion of the liver transection.
Results: Between 2013 and 2021, 105 right hepatectomies and 108 left hepatectomies were safely performed with this hybrid approach without severe complications.
Conclusions: The hybrid approach for living donor hepatectomy is safe and feasible with less invasiveness compared to the conventional open approach. This approach is reasonable to achieve both safety and reduction of invasiveness of the living donor hepatectomy.

LB-P-33

Liver transplantation for liver metastasis of pseudopapillary pancreatic neoplasm in a male patient

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Background: Solid pseudopapillary neoplasm (SPN) of the pancreas is a rare entity with low malignant potential primarily affecting young women. In contrast to other pancreatic tumors, it has low metastatic rate and a good prognosis. Liver metastasis occurs in 15% of SPNs. Complete surgical resection is the treatment of choice in metastatic recurrent disease.
Methods: We present a case of a 60-year-old male patient with recurrence of multiple liver metastasis after previous pancreas surgery, repeated liver surgery and chemotherapy for SPN. Metastatic liver disease was considered unresectable. After multidisciplinary evaluation the patient underwent orthotopic liver transplantation from a deceased donor.
Results: With 2 years follow up the patient is alive and recurrence free.
Conclusions: This is the first case of liver transplantation due to SPN metastasis in a male patient described in literature. Our case suggests that liver transplantation should be further explored for selected cases of SPN liver metastatic disease.

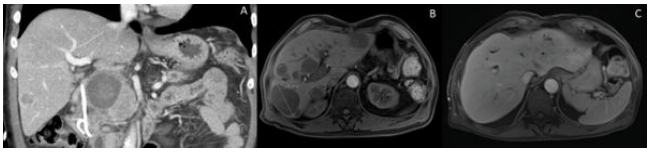

Figure 1
A Preoperative computer tomography showing both the primary SPN and liver metastasis in segment 6
B Magnetic resonance imaging before liver transplantation showing recurrence of multiple liver metastasis
C Magnetic resonance imaging 2 years after liver transplantation

LB-P-35

Ionized magnesium monitoring during pediatric liver transplantation

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[1]Hospital Universitario La Paz, Laboratory Medicine, Madrid, Spain, [2]Hospital Universitario La Paz, Madrid, Spain

Background: Liver transplantation (LT) is a complex surgical procedure with significant intraoperative physiological alterations. Citrate infused by massive transfusions contributes to a significant electrolytic imbalance by chelating cations such us magnesium and leading to hypomagnesemia, associated with intraoperative cardiac alterations. Ionized magnesium (iMg) is the physiologically active form (67%) of total serum magnesium (tMg) but is rarely available as a laboratory test in any clinical setting. According to previous studies, iMg and tMg do not correlate well in critically ill patients, therefore, the aim of the present study is to monitor tMg and iMg in pediatric LT hoping to identify more accurately hypomagnesemia states during surgery.
Methods: After the approval of our Clinical Research Ethics Committee, 14 pediatric patients who underwent LT have been studied. iMg measurements were performed in a Stat Profile Prime+ POC analyzer (Nova Biomedical®). Samples were classified according to the different phases of surgery: dissection, anhepatic, reperfusion, neohepatic, and end of surgery.
Results: Patients' data are summarized in a descriptive table. iMg and tMg showed statistically significant changes (p<0,001) in concentration at the reperfusion stage compared to dissection. However, while iMg concentrations decreased leading to reperfusion and increased at the last stage, tMg showed the opposite behavior, rising until reperfusion to decline at the neohepatic stage. Additionally, iMg concentrations were below the reference interval (RI) in middle stages whereas tMg concentrations remained within the RI in all stages.

Characteristics	Total (N = 14)
Male (%)	50
Female (%)	50
Age (years)	
Median	0,93
IQR	0,57 – 7,25

Table. Description of patients' data. Abbreviations: IQR, interquartile range.

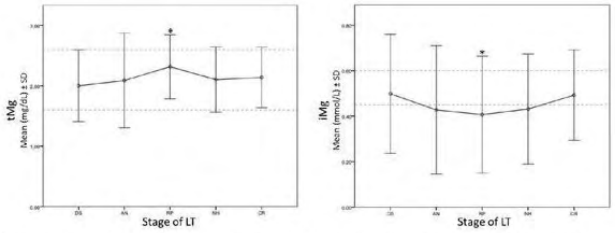

Figure. Evolution of tMg and iMg concentrations during the different phases of LT. *p<0,001 compared to the DS stage. Abbreviations: DS, dissection; AN, anhepatic; RP, reperfusion; NH, neohepatic; and CR, end of surgery. Dotted lines: reference intervals

Conclusions: The present study suggests that iMg could be a more precise magnitude for assessing hypomagnesemia during LT. These are preliminary results from a larger study, carried out by a multidisciplinary team, which will include other clinical and biochemical variables to further evaluate the usefulness of iMg measurement during LT surgery.

LB-P-36

Effect of combined supportive extracorporeal therapy in patients with acute liver failure or liver transplant recipients

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Background: Recently in Acute Liver Failure; Combined application of V-V hemodiafiltration (CVVHDF) and plasma exchange (PEX), which are supportive extracorporeal therapy (SECT) options, is recommended.
The aim of this study is to retrospectively analyze the effects of supportive extracorporeal therapy (SECT) in patients with acute liver failure (ALF) or liver transplant recipients who develop acute liver failure (ACLF).
Methods: Approximately 100 liver transplants pear year have been performed in the last 10 years, followed in the Liver Transplant ICU. The number of patients with(ALF) or Liver TX recipients who developed ALF and received combined supportive extracorporeal therapy is 114. These patients who admissed in the Liver Transplantation ICU were analyzed retrospectively. Central and hemodialysis catheterization and invasive artery monitoring with PICCO were performed on the patients. PEX application was made with Fresh Frozen Plasma without anticoagulant application by calculating 50cc x kg volume. Citrat-Ca anticoagulant was applied locally to the circuit, with hemodiafiltration continuous for 24 hours. Biochemical and hemodynamic values were compared before and after PEX and blood gases, which were measured 2 hours apart.
Results: The number of patients who are ALF or Liver TX recipients and develop ALF, who underwent conventional treatment and Combined SECT in Liver transplant ICU is 114. This group consisted of patients (64 women, 50 men; median age 8,3 (0,6-62,9) years; 34 transplant recipients. A median of 8 days and a mean of 7.96 PEX courses were administered to the patients. The number of PEX courses was minimum 3 and maximum 14. Median CVVHDF was 199 hours (8.29 /day). CVVHDF was Minimum 79 hours and Maximum 343 hours. Serum bilirubin and Ammonia,PT/INR levels were lower in 34 patients who received Liver TX after the Combined SECT was terminated compared to baseline levels (p<0.01 and p<0.05 respectively). However, there was partial improvement in encephalopathy and hemodynamics. Liver transplantation was performed in these patients, whose need for hemodynamic support decreased. 14 patients whose ammonia, PT/INR levels and bilirubin levels decreased compared to the baseline levels, but whose hemodynamic values did not improve with encephalopathy or who developed multi-organ failure, who could not be transplanted or who were considered out of indication, became EX. Encephalopathy and acute liver failure of 64 patients whose ammonia, PT/INR, bilirubin levels decreased significantly compared to the baseline levels after combined SECT application and did not increase again in the follow-up, and whose hemodynamic values improved. PT/INR was shorter in all surviving patients.(p<0.01) . Further analysis revealed that surviving patients had lower ammonia levels (p<0.01).

Tablo 1 .Laboratory values of patients at admission

	Liver Transplant*	**Non-Liver Transplant***	**p value**
AST (U/L)	1635(1108)	2645(1817)	<0,01
ALT (U/L)	1715(1142)	2755(1947)	<0,01
Laktat (mmol/L)	5,75(1,15)	6(2,8)	0,027
Ammonia (µmol/L)	128(28,5)	132(46,5)	0,401
Total bilirubin (mg/dL)	19,25(8,18)	8,2(3,97)	<0,01
INR**	3,35(0,7)	3,4(0,77)	0,156
	Liver Transplant*	**Non-Liver Transplant***	**p value**
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Tablo 2. Laboratory values of patients after liver transplant or ekstracorpareal treatment

	Liver Transplant*	Non-Liver Transplant*	p value
AST (U/L)	187(84)	184(120,5)	0,660
ALT (U/L)	199,5(83,25)	195(108,5)	0,265
Lactat (mmol/L)	1,7(0,2)	1,25()	<0,01
Ammonia (µmol/L)	78(16)	54(16)	<0,01
Total bilirubin (mg/dL)	6,1(3,92)	2,3(0,8)	<0,01
INR**	1,8(0,1)	1,3(0,2)	<0,01

Laboratory values of the transplant free patients at admission and after treatment

	Initial values*	Last values*	p value
AST (U/L)	2317(1426)	184(111,25)	<0,01
ALT (U/L)	2357(1331,75)	198(103,75)	<0,01
Lactat (mmol/L)	5,9(1,47)	1,5(0,7)	<0,01
Ammonia (mol/L)	132(37)	59(24)	<0,01
Total bilirubin (mg/dL)	9,55(8,75)	2,7(2,2)	<0,01
INR**	3,4(0,72)	1,35(0,5)	<0,01

Conclusions: Combined SECT application in patients with ALF or liver transplant recipients who develop ALF; ALF can reduce biochemical findings, ammonia and PT/INR elevation, as well as bilirubin compared to baseline levels.
This biochemical decrease is beneficial in groups with permanent hemodynamics and encephalopathy recovery.
Biochemical and hemodynamic recovery in liver transplant recipients creates elective conditions and acts as a bridge to enter Liver TX.
Combined supportive CVVHDF and PEX therapy can be used as an option in patients who are ALF or Liver TX recipients and develop ALF.

LB-P-37

Models to predict the prognosis of liver transplant patients

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Background: MELD have been applicated in organ allocation but had deficiencies in screening sickest patients, especially who supported with mechanical ventilation and vasoactive drugs. In recent years, several models had been proposed to predict the prognosis of liver transplant patients, including Survival Outcomes Following Liver Transplantation (SOFT score), Balanced Risk (BAR score), Transplantation for ACLF-3 Model (TAM score) and Chronic Liver Failure Consortium - acute on chronic liver failure score (CLIFC-ACLF score). The aim of our study was to compare these proposed scores, hoping to propose a mortality prediction model for Chinese population in the future.
Methods: 255 benign liver transplants during 2015-2017 were enrolled in the study cohort. The major endpoint was 90-day survival. Risk factors were compared between survival group and died group.
Results: A total of 255 patients was enrolled in the study, 199 patients survived and 56 patients died within 90 days. In univariate analysis, fever (p=0.000), ABO incompatible transplant (p=0.003), CLIF-OF (sum of CLIF organ failure score) (p=0.000), cold ischemia time (p=0.001), DRI (donor risk index) (p=0.019), blood lactate level (p=0.000) and log-transferred WBC (p=0.000) were associated with 90-day survival. All models showed significant discrimination between survival group and died group with F=23.82 for MELD, F=33.18 for TAM, F=31.10 BAR, F=46.35 for CLIFC-ACLF and F=29.65 for SOFT (p=0.000 for all). C-static for these models were 0.696 for MELD, 0.701 for SOFT, 0.732 for BAR, 0.691 for TAM and 0.749 for CLIFC-ACLF.
Conclusions: All models including MELD, SOFT, BAR, TAM and CLIFC-ACLF showed significant power in predicting short-time survival after LT. New model were needed for better organ allocation policy.

LB-P-38

Has COVID-19 pandemic pushed the frontiers of organ utilisation in liver transplantation? Perspective from a high-volume liver transplant unit in the United Kingdom

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Background: As the world recovers from the aftermath of devastating waves of an outbreak, the ongoing COVID-19 pandemic has presented a unique perspective to the transplantation community of "organ utilisation" in liver transplantation, a poorly defined term and ongoing hurdle in the field. To this end, we report key metrics of transplantation activity from a high-volume liver transplantation centre in the United Kingdom over the past two years.
Methods: Between March 2019 and February 2021, details of deceased donor liver offers received by our centre from National Health Service Blood & Transplant (NHSBT), and of liver transplantation were reviewed. Differences in the activity before and after the outbreak of COVID, including early post- transplant survival were reported.

Results: The pandemic year at our centre witnessed a higher utilisation of DCD livers (80.4% vs 58.3%, p=0.016) with preserved UK donor liver indices and median donor age (2.12 vs 2.02, p=0.638; 55 vs 57 years, p=0.541) when compared to the previous year. The six-month patient survival rates for recipients in both the periods were comparable.

	Mar 2019-Feb 2020	Mar 2019-Feb 2020	p- value
Overall offers received DBD DCD	1803 929 (51.3%) 874 (48.4%)	1208 739 (61.1%) 469 (38.8%)	0.000
DCD offers Accepted Proceeded Transplanted	 195 94 42	 95 58 33	 0.382 0.039 0.016
DBD Acceptance rate Utilisation rate	 34.8%(324) 76.1%(201)	 35.3% (261) 73.4% (166)	 0.851 0.448
DCD Acceptance rate Utilisation rate	 22.3% (195) 58.3% (42)	 20.4% (95) 80.4% (33)	 0.382 0.016
Survival (adult) 6m Graft Patient	 96.6% 98.5%	 97.5% 98.7%	0.508

Conclusions: The pressures of the pandemic have pushed transplant surgeons at our centre to better utilise certain liver organs to meet the needs of patients, with apparently preserved early post-transplant survival. Optimum organ utilisation is a balancing act between risk and benefit for the potential recipient, and technologies like machine perfusion may allow surgeons to increase utilisation without compromising patient outcomes.

LB-P-39

SARs-CoV-2 infection among vaccinated and unvaccinated liver recipients – Georgian experience

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Background: COVID-19 appeared to be main problem for the world. Patients with liver transplants are at increased risk of outcomes from COVID-19 because of Immunosuppressive therapy or other comorbidity. Now is fact that vaccination dramatically reduces risks of coronavirus, complications and deaths.
The aim of the paper is to describe cases of SARS-CoV-2 infection among liver recipients in Georgia and compare the manifestation, severity and outcomes of SARs-CoV-2 infection between vaccinated and unvaccinated liver recipients.
Methods: The study used secondary data analysis to answer the research question. Information on interested variables were obtained from the medical documentations of patients medical history in Batumi Referral Hospital. Study subjects were adult liver recipients who had liver transplantation at our center (Batumi, Referral Hospital) since 2015, totally 70 patients and were under regular follow-up. Data were recorded related to symptoms and laboratory-confirmed SARS-CoV-2, need for hospitalisation, need for ICU stay and mortality.
Results: According to secondary analysis of Medical cards of liver transplant recipients in our center show that out of 70 recipients 25 (36%) had laboratory confirmed Covid-19, one of them was infected twice, among 25 patients 7 (28%) were vaccinated twice, 5 (20%) with one dose. From the beginning of Pandemic, 13 (52%) recipients were infected before first vaccine dose came to Georgia, there is 5 (38,4%) hospital and zero ICU admition and zero death among them. From fully vaccinated 7 patients, there was 3 (43%) hospital admition, from one dose vaccinated recipients, there is 1 (33,3%) ICU admition with lethal outcome.
Conclusions: More than half of the patients got infected by SARS-CoV-2 before vaccine was distributed to the country.
There is no significant difference in clinical manifestation, severity and complications of COVID-19 between vaccinated and unvaccinated liver transplant recipients.
Ongoing research in these population on post vaccine immune response, comorbid status and strategies such as booster doses is in process.

LB-P-41

Liver transplantation for hepatocarcinoma. Survival and recurrence in two time periods within a transplant program

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Background: Liver transplantation is a therapeutic option for patients with hepatocarcinoma. Over the last few years its management both in the pre- and post-transplantation period has changed, which could have influenced the results.
Methods: Single-center retrospective study of patients transplanted for hepatocarcinoma between December 1997 and July 2020. We will describe the demographic characteristics of the patients (sex, age at transplantation, etiology of cirrhosis), calculate patient survival, the percentage of overall recurrence of hepatocarcinoma and a comparative analysis will be made between two periods (1997-2010 and 2011-2020).
Results: We obtained 269 patients, 79% male and 21% female. The mean age at the time of transplantation was 58 years ± 7.5 years. The main etiologies of cirrhosis were: 41% HCV, 23% alcohol and 11% HBV. The overall survival of the patients was 68% at 5 years; 58% at 10 years; 45% at 15 years and 34% at 20 years, Figure 1.

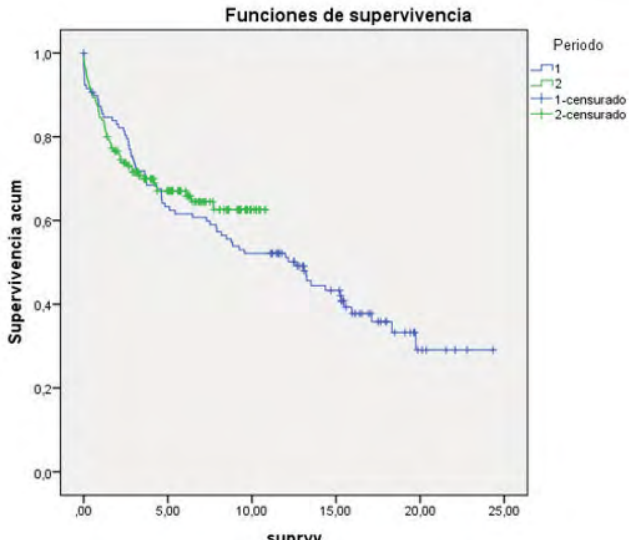

Figure 2 shows the comparison of survival for both periods. A Long Rank test was performed with a result of p = 0.46, indicating no significant difference in survival in both periods. The overall percentage of recurrence of hepatocarcinoma was 14.5% (47% presented recurrence at the extrahepatic level, 20.5% at the intrahepatic level, and 32.5% in both locations). The recurrence rate was 13.4% in the first period and 15.3% in the second period, no significant differences were found between both periods (p = 0.6).

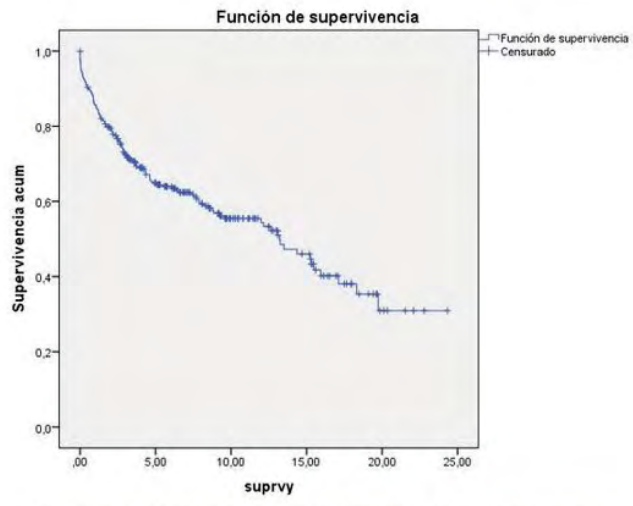

Table 1. Kaplan-Meier plot of overall survival of patients transplanted for hepatocarcinoma in our center.

Conclusions: There are no differences in the survival of transplanted patients if we compare the two established time periods. There are no significant differences in the percentage of recurrences. In spite of having broadened the transplant criteria, the improvement of pre-transplant strategies and greater experience in immunosuppression has allowed the percentage of recurrences not to have increased.

LB-P-42

Hungry for change? Challenges in minimising fasting times prior to orthotopic liver transplantation

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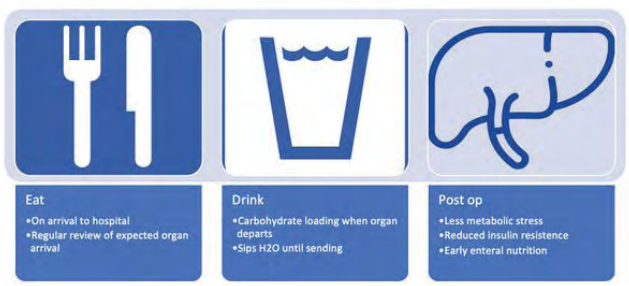
Background: Patients with end-stage liver disease are at risk of malnutrition. Prolonged fasting induces metabolic stress and insulin-resistance, which are associated with increased postoperative morbidity and mortality. Whilst patients have traditionally been nil by mouth for >6hours to minimise aspiration risk, it is recognised shortened pre-operative fasting times for fluids (1-2 hours) are preferable and safe.

Methods: We conducted a retrospective audit of electronic notes for all liver transplants performed during a 2-year period in a single UK centre. Super-urgent and multi-organ transplants were excluded. Data points included patient age, UKELD score, indication for transplant, time of hospital admission and theatre check-listing, and fasting times for food and fluids. Audit standards were that no patient should be fasted for fluids >6hours, or for food >12hours. Pearson correlation coefficient was calculated for the time of admission and wait to check-listing.

Results: Seventy-seven transplants were performed during a two-year period, eight super-urgent and three multi-organ transplants were excluded. Nine patients did not have fasting times documented in their electronic medical records. Of the remaining 57 patients, 45 (79%) fasted for fluids for >6 hours, the mean fasting time was 594 minutes (range 170-1611). For food, 35 patients (63%) fasted >12 hours, the mean fasting time was 923 minutes (range 320-1671). The mean wait from admission to check-listing was 765 minutes (range 74-2518). There was no correlation between time of admission and wait to check-listing. (Pearson coefficent= -0.01)

Conclusions: Our data shows the challenges in minimising pre-operative fasting in liver transplant, with variable wait times between admission check-listing, making necessary fasting times difficult to predict. Since only six patients were check-listed for theatre within six hours of admission, we propose a new pathway to reduce fasting times. Incorporation of pre-operative carbohydrate-loading may offer additional metabolic benefits postoperatively.



LB-P-43

Native whole blood (TRUE-NATEM) and recalcified citrated blood (NATEM) reference value validation with ROTEM delta

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Background: Thromboelastography (TEG) was originally designed as a test for native whole blood. The ROTEM system is a further development of classical TEG and has been used widely in liver transplantation for coagulation management. Currently, no reference value exists for native whole blood and recalcified citrated blood without activators. The aim of this study was to establish a native whole blood and recalcified citrated blood reference value with ROTEM-Delta®.
Methods: This study was registered onwww.clinicaltrials.gov (NCT04282889). Inclusion criteria were healthy adult volunteers (age 18-65 years) who meet the ASA 1 criteria. Exclusion criteria were refusal, any medical condition or medication affecting coagulation. For native whole blood testing the definition of "TRUE-NATEM-test" was established. For recalcified citrated blood testing the NATEM function was used on ROTEM.
Results: The reference value for TRUE-NATEM was CT: 872-1595s, A10: 14-34mm, A20: 26-48mm, CFT: 314 -839s, MCF: 34-55mm, alpha angle: 17-40°. The reference value for NATEM was CT: 757-1327s, A10:19-43mm, A20: 33-55mm, CFT: 219-615s, MCF: 37-61mm, alpha angle: 24-51°, ML: 0-3%. NATEM showed decreased CT and CFT values and increased MCF and alpha angle compared to TRUE-NATEM indicating that the recalcification process of citrated blood activates coagulation. Female had shorter CFT, prolonged A10, and higher MCF and alpha angle indicating enhanced coagulation. This difference was not seen in TRUE-NATEM. Age-related statistical difference was seen in EXTEN, INTEM, FIBTEM, APTEM, and HEPTEM but not on NATEM and TRUE-NATEM. The ethnicity (African American, Asian [southeast], Asian [Indian], Hispanic, white) did not show any statistical difference.
Conclusions: We determined the reference value for native whole blood and recalcified whole blood using ROTEM. We demonstrated a significant discrepancy in native whole blood and recalcified citrated blood coagulation and considered both techniques not comparable. Our study underlines the importance of native whole blood as the gold standard reference value in coagulation.

LB-P-44

Detection of early-stage hepatosteatosis after liver transplantation with MRI-PDFF

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Background: Metabolic syndrome and accompanying hepatosteatosis have become an increasing problem in the world. It is an important cause of cirrhosis, hepatocellular cancer, and liver transplantation. However, it is an important problem due to drugs used in liver recipients, their accompanying diseases, and weight gain.
Methods: It was planned to evaluate hepatosteatosis with MRI-PDFF in patients who were followed up for at least 6 months after liver transplantation, concomitant BMI (body mass index), serum lipid profile, comorbid diseases, and medications were evaluated in the study group. The steatosis detected in the fat fraction MRIs was classified as grade 0-1-2-3 according to the specified references (An Tang et al. Radiology, 2015).
Results: The mean age of the 40 patients included in our ongoing study so far is 59.4 ± 8.4 years old. Seventy percent (16/28) of the patients are males. The period of follow-up after transplant is 74 months (min-max: 8-156 months), mean BMI is 28.5±4.8 kg/m2. Twenty seven percent (n = 11) of all patients had diabetes, 25% (n = 10) had hypertension, and 7.5% (n=3) had CAD. Ninety-two percent of patients were receiving tacrolimus treatment. While there were 22 patients with at least grade 1 hepatosteatosis, only 1 patient had grade 3 hepatosteatosis. The relationship between DM, HT, BMI (overweight, obese), lipid profile, tacrolimus use, insulin use, period of follow-up after transplant, and steatosis was examined, and it was observed that the frequency of hepatosteatosis increased significantly only in those with DM (p: 0.03).
Conclusions: When MRI-PDFF is performed in patients with liver transplantation, early-stage hepatosteatosis can be detected before complications of metabolic syndrome occur.

LB-P-46

Preservation solutions for static cold storage in DCD and DBD liver transplantation in the United States

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Background: Static cold preservation remains the cornerstone for storing donor livers following procurement, however, the choice between University of Wisconsin (UW) and histidine-tryptophan-ketoglutarate (HTK) solutions remains controversial. Recent ILTS guidelines have recommended avoiding HTK solution for donation after circulatory death (DCD) grafts based on older reports.
Methods: We studied the latest US adult graft outcomes in 3 recent eras (2006-2010; 2011-2015; 2016-2020) comparing HTK and UW solutions among 5,956 DCD LTs: 3,873 (65.0%) used UW and 1,944 (32.7%) used HTK; and 82,679 donation after brain death (DBD) liver transplantations (LTs): 63,511 (76.8%) used UW and 15,855 (19.2%) used HTK.

Results: The HTK group had higher 1- and 5-year graft survival rates of 89.7% and 74.3%, respectively, compared with 85.9% and 70.8% in the UW group in the 2016-2020 era (p=0.005). This difference remained when adjusted for important potential confounders (HR 0.78, 95% CI: 0.60, 0.99). There were no differences between groups among DCD LTs in the earlier eras, and among DBD LTs in all eras (all p-values>0.05).
Conclusions: The latest US data suggests that HTK is at least non-inferior to UW for preserving DCD livers. These data support HTK use in DCD LT and contradict ILTS guidance.

LB-P-48

Fibrinogen concentration a predictor for transfusion requirement in liver transplant recipients

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Background: To assess the effect of preoperative fibrinogen levels on transfusion requirement in liver transplant recipients.
Methods: In this retrospective study we studied the fibrinogen levels of all patients who underwent liver transplant in the last 5 years. Pediatric, acute liver failure or re-transplant recipients were excluded. 416 adult patients with complete data were included in this analysis. All adult recipients (age >18yrs) undergoing elective transplant who hadn't received cryoprecipitate pre or intra operatively were analyzed. For study purposes they were divided into 3 groups – Group A – <100mg%, Group B – 100-250mg%, Group C – >250mg%.The amount of blood and products transfused (Packed Red Blood Cells -PRBC and Fresh Frozen Plasma – FFP) intra operatively in each group was reviewed and analyzed. The requirement of blood products was largely guided by point of care viscoelastic tests.
Results: The need for transfusion of fresh frozen plasma was found to be significantly higher in low fibrinogen Group (A) as against Group C (p value – 0.0001). Similarly blood transfusion requirement also correlated to fibrinogen levels at the start of the transplant procedure (p value – 0.05).
Conclusions: Fibrinogen levels less than 100 mg% at the start of liver transplantation is associated with higher blood loss and requirement of blood and blood products. Optimization of pre-operative fibrinogen levels at the start of surgery could reduce the requirement of blood and blood products.

LB-P-49

Superiority of two-layer rectus sheath closure compared to single-layer closure in recipients undergoing liver transplantation and live donors undergoing donor hepatectomy

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Background: Various recipient risk factors leading to wound complications in the post-transplant period are non-modifiable and therefore a superior technique of rectus sheath closure may benefit in preventing these problems, especially in living donors as their safety is of paramount importance.
Methods: November 2018 to October 2021, 125 Living donor liver transplants and 16 deceased donor transplants were performed, of which 19 were pediatric recipients under 20 kg and excluded from the analysis. 7 (5.7%) out of 122 had early mortality and were excluded. All living donors (n=125) were included. All donors and recipients had reverse 'L" incision in upper abdomen. End points were incidence of wound related problems at 6 weeks in recipients and live donors, and incisional hernia in late post-operative period.
Results: 34 (29.5%) out of 115 recipients had single layer (SL) closure, 81(70.5%) had two- layer (TL) closure. 6 (17.6%) had wound complications in SL group, significant ascitic leak from wound in 2, burst abdomen in 1 and wound dehiscence in 3. Laparotomy and sheath re-closure performed in 2, and the remaining 4 were managed non-operatively. In TL group, one had minor ascitic leak and managed non-operatively. Risk factors in recipients were diabetes mellitus (p-0.263), gross ascites in pre-transplant period (p-0.101), SL versus TL closure (p-0.001), age (p-0.111), performance status ECOG (p-0.130), blood transfusions (p-0.618), NaMELD score (p-0.841), BMI (p-0.775). 2 patients had incisional hernia in SL group, while 1 had in TL group. 35 (28%) out of 125 donors had SL closure, of which one had burst abdomen requiring laparotomy, one had wound infection and one developed incisional hernia. 90 (72%) donors had TL closure with zero wound related complications.
Conclusions: In our series, two-layer (TL) rectus sheath closure showed clear benefit over single-layer (SL) closure in both living donors and all transplant recipients enhancing their post operative recovery.

LB-P-50

The role of static and dynamic evaluation of sarcopenia in liver transplant candidates – is it worth?

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Background: We focused on the impact of sarcopenia on cardio-pulmonary performance of liver transplant (LT) candidates in term of their prolonged ICU stay after grafting.

Methods: The study group consisted of well characterized 54 (M/F 22/32) liver graft recipients from single liver transplant center in median age 53.5 year; 17 (31.5%) with alcohol-related liver disease (ALD) (M/F 3/14) in median age 56 (IQR 8.1) year, 25 (46.3%) with autoimmune liver disease (M/F 12/13) in median age 42 (13.5) year. The median MELD was 14.4 points, twenty individuals (37%) were in Child-Pugh class (CPC) C. Median BMI (kg/m^2) in females was 23.95 and in males 27,65. Median L3SMI (cm^2/m^2) was 46.1 for females and 44.55 for males, median 6-minute walking test (6MWT) was 431 meters, and median cardiac output (CO) (L/min) was 4.9 for females and 6.5 for males. 42 (77.8%) of liver graft recipients spent more than 3 days in ICU, and four (9.5%) of them more than six days.
Results: There were 32 (60.4%) liver grafted patients with sarcopenia in respect to L3SMI-based definition. There were no correlations between L3SMI and age (50 vs >50 year) (p=0.95), gender (p=0.62), origin of the chronic liver disease (all p>0.05), BMI (p=0.16) and blood ammonia levels (p=0.69). Sarcopenia did not correlate with 6MWT (p=0.0556), CO (p=0.0066), MELD (p=0.73) and prolonged ICU stay (p=0.94).Ammonia levels did not correlate with L3SMI (p=0.69), 6MWT (p=0,16) and CO (p=0,58). Although, the lowest results in 6MWT were achieved by patients with ALD, and with the most severe liver insufficiency as judged by CPC, no clear risk factors of prolonged ICU stay were identified.
Conclusions: The results of these study showed neither the correlation between sarcopenia and cardiac sarcopenia in particular, in term of morbidity and mortality after grafting, nor prioritizing factors to avoid short time LT futility.

LB-P-51

Normothermic machine perfusion of the liver. Initial results and development of a multiinstitutional recovery center

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Background: The well known issue of organ shortage is experiencing a major shift with the appearance of isolated organ machine perfusion sistems that permit the evaluation of extended criteria donors without endangering the recipient, having proved their capability of improving the yield of the donor pool and even the recovery of previously discarded organs.
Methods: With these premises in mind, we initiated our machine perfusion program in a clinical setting.
We are one of four transplant groups operating in the Madrid area of Spain, one of the most densely populated areas in the country, servicing an aproximate population of 6,5 million people.
Due to the expenses and logistical challenges inherent to such an endeavour, we proposed to centralize the procedure in our center after establishing the feasibility.
Results: It took one year to address all the logistical and bureaucratic aspects to initiate the program.
After 4 initial procedures, two of which resulted in succesful transplants, we offered to share the technology and resources with the other three grous in the region. Since then we have performed 4 procedures more, three of which were implanted, with two organs corresponding to another center.
We will present a brief resume of each case discussing the indications and learning tips of each one, including the logistical challenge particular to a multiinstitutional endeavour.
Conclusions: The machine technology for normothermic perfusion is capable of recovering more than 50 % of the livers previously considered unsuitable for transplantation in our experience. The capability of transporting the device opens up the possibility of establishing regional collaboration networks aimed at optimizing the cost and results.

LB-P-52

Does really ‚age" matter?

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Background: Average human life span has increased in recent decades. The need for liver transplant (LT) in elderly patients has become more frequent.
Methods: Between July 2018 and February 2022, 196 LTs were performed for 192 recipients in our institution. Of these, 15 were older than 65 years old at their operation dates (12 males and 3 females). The oldest recipient was 73.5 years old at the time of transplant. 5 of the LTs were from deceased donors and the remaining 10 were living related. Mean clinic Model for End Stage Liver Disease with Sodium (MELDNa) score was 15.4 (range, 8-24). Co-morbidity was recorded in 5 patients (4 of them were cardio-vascular and 1 was pulmonary related). Kaplan Meier method was used to estimate the 1 year and 3 year survival.
Results: The median post transplant ICU stay was 2 days (range, 1-61). The median total hospital stay was 15 days (range, 8-61). Both 1 year and 3 year survivals were 93.3 % in this elderly group but there were no significant difference wth regards to the other age groups in our series.
Conclusions: Our results suggest that LT can safely be performed in patients over 65 years old. Careful pre-operative evaluation including adequate cardiac assessment and optimal graft and recipient matching is crucial for good results.

LB-P-55

Retrospective analysis of liver transplant patients for autoimmune hepatitis

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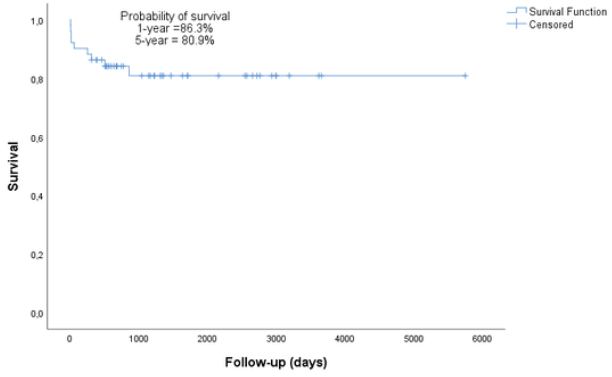
Background: Liver transplantation (CN) is a life-saving treatment that can provide 80% survival at 5 years for patients with decompensated autoimmune hepatitis (AIH). In our study, we aimed to present a retrospective analysis of this patient group followed in our center.
Methods: The data of adult patients who underwent transplantation due to AIH at İnönü University Liver Transplant Institute between 2002-2021 were reviewed retrospectively from the file.
Results: The mean age of 51 patients, 20 male (mean age 28.65±7.60) and 31 female (mean age 30.90±9.78), was 30.02±9.00. One patient was transplanted for acute liver failure and 50 patients for chronic liver failure. 3 patients were transplanted from cadaveric 48 patients from a living donor. The mean survival time of the patients was 4703±319.4 days, and the 1-year and 5-year survival rates were 86.3% and 80.9%, respectively. Only 6 patients had recurrence, 28 patients had biliary tract complications and 11 patients had rejection. Table 1 shows the frequency of the complications after transplantation.



Survival analysis by Kaplan-Meier method

Table 1. Frequencies of complications after transplantation

Post-transplant complications	Number of patients	Average occurence time (days)
Rejection	11 (%21.5)	387.9 ± 203.2
Reccurence of AIH	6 (%11.7)	848.5 ± 444.4
Rejection+Reccurence of AIH	3 (5.88%)	99,5±103.9
Cirrhosis	1 (%1.96)	3437
Biliary complications	28 (%56)	117.8±160

Conclusions: In patients with AIH, CN is a life-saving treatment with survival rates of up to 80%. Since biliary complications after transplantation are seen more frequently than recurrence and rejection, it is necessary to be alert for biliary complications in the follow-up of patients.

LB-P-56

Long-term outcomes of liver transplantation for primary sclerosing cholangitis

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Background: The number of studies reporting long-term outcomes after liver transplantation in primary sclerosing cholangitis (PSC) patients is very few. In this study, we aimed to present the complications and outcomes of PSC patients after liver transplantation in our high-volume transplant center.
Methods: Adult patients who underwent liver transplantation for PSC between February 2008 and October 2020 were included in the study. Post-transplant survival, biliary complications, rejection and PSC recurrence rates were retrospectively investigated.
Results: A total of 30 patients, 18 (60%) male and 12 (40%) female, who underwent liver transplantation for PSC were included in the study. Twenty-seven (90%) of the patients were living donor transplants and 3 (10%) were cadaveric transplants. A total of 3 patients died in the first 10 days. Two of them were due to sepsis, and one of them was acute kidney failure. Biliary complications were seen in 15 patients (55.5%). Stricture was found in 5 (33.3%) of the patients, leak in 3 (20%), and stricture and leak in 7 (46.7%) patients. The success rate of ERCP was 85.7% None of the 15 patients with biliary complications underwent surgical treatment. With ERCP and PTC, the success rate was 100% in patients with biliary complications. Chronic rejection was seen in 3 patients (11.1%), PSC recurrence developed in 4 patients (14.8%). Four of the patients were transplanted for the second time (12.9%). One of the patients had a third transplant (3.3%). The 1, 3, and 5-year survival rates of the patients were 75.9%, 74.9%, and 74.9%, respectively. The cause of death in all patients was biliary sepsis.
Conclusions: In conclusion, the long-term outcomes of patients with PSK after liver transplantation are satisfactory. These patients should be followed closely, especially in terms of biliary complications.

LB-P-58

Call for a new International Prospective Non-Competitive, Observational study to validate-optimize kinetic models to predict allograft failure at 90 and 365 days following liver transplantation. Improvement.

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Background: Allograft failure (AF) at 90 days after LT has been recently predicted by externally validated kinetic models based on graft performance during early post-operative days (North-American L-GrAFT-score, European EASE-score), which identify patients at high risk of AF who benefit from early retransplantation (C-statistic >85%). However, with increasing utilization of ECD or DCD allografts, a higher incidence of ischemic cholangiopathy has been reported at 12 months, which is not captured when evaluating short-term outcomes. Furthermore, other factors not routinely evaluated (e.g., frailty, sarcopenia, nutritional status, other organ failure, infections) often contribute. Finally, role of graft steatosis and protective effect of perfusion machines are yet to be analyzed in a large multicentric prospective study. These factors may hamper or contraindicate a timely and efficacious re-transplantation.

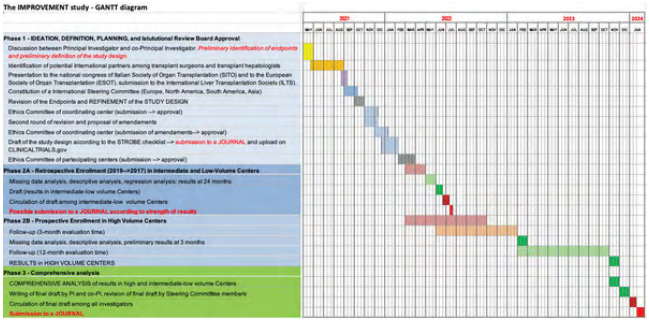
Methods: We call for an International, Prospective, Non-competitive, Observational study to validate-optimize prediction models of AF at 90-days and 1-year after LT by collecting data on current practice, various donor types (DBD, DCD, living donors[LD]) with balanced international enrollment, homogeneous center volume, and evaluation of various mitigation strategies (perfusion machines). The study protocol has been defined by an International *Steering Committee and includes both a prospective cohort (high-volume centers with >65 LT per year, 50 pts each) to develop new predictive models, and a retrospective cohort (intermediate and low-volume centers, 75 pts each) to validate them. The retrospective enrollment will be also allowed to high-volume centers that participate in the prospective cohort. Secondary objectives include: -developing a novel time-based dynamic algorithm, with increasing accuracy from day 3 to 7; -identifying an optimal re-transplant time; -investigating AF-differences among DBD, DCD, LD grafts; -evaluating strategies that mitigate AF; -evaluating ability to predict complications (AKI, ischemic cholangiopathy) and mortality (futility threshold).

Results:

	RETROSPECTIVE cohort low-VOLUME & intermediate-VOLUME (≤ 65 LTx per year)	PROSPECTIVE cohort high-VOLUME Centers (> 65 LTx per year)
Consecutive pts to be included	75	50
Sample size	3000	2000
N of Centers to be involved	40	40
Enrollment period	December 2019 → January 2017	April 2022 → November 2022
AIMs	Validation of PREVIOUS kinetic algorithms Possible Validation (?) of NEW ONE(S)	Validation of PREVIOUS kinetic algorithms DEVELOPENT of NEW ONE(S)
main KINETIC PARAMETERS	AST, PLT, BIL, INR	AST, PLT, BIL, INR
OUTCOME DATA and follow-up	Incidence of AF at 90 and 365 days Length of stay, 90d and 365d Graft Survival, 90d and 365d Patient Survival, Actuarial data at 36 months	Incidence of AF at 90 and 365 days Length of stay, 90d and 365d Graft Survival, 90d and 365d Patient Survival, Actuarial data at 12 months
PRE-OP. ASSESSMENT of FRAILTY, SARCOPENIA, MALNUTRITION, CARDIAC, RENAL RISK	NO	YES
BIOPSY of the graft (back-table, donor-hepatectomy for LD)	only when available	ALWAYS in DBD, DCD, LD
POST-OPERATIVE ASSESSMENT of FACTORS that favour or contraindicate RE-TRANSPLANT	NO	YES
Numeric parameters to be recorded	165	97

https://gemelligenerator.it/projects/the-improvement-study-2/

Conclusions:



Poster Presentations: Late Breaking Surgical Videos for Technical Innovation

LB-vP-01

Using O-Arm™ cholangiography in living donor liver transplantation

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Objectives: One of the important challenging factors in living donor liver transplantation is the biliary tract anatomy of the donor. When it comes to cutting the bile duct, getting the least number of anastomosis becomes one of the important factors that directly affect the morbidity and even mortality of the recipient, and also for donor safety. We aimed to use the O-arm™ device so that the bile ducts can be seen better and from all aspects.
Methods: The cystic duct is cannulated to deliver opaque material after cholecystectomy. The installation of the O-arm™ device is completed. After the opaque material is given to the bile ducts, imaging is completed with the O-arm™ device. The captured images are evaluated in 3-dimensions (3D) from every angle.
Results: With this method, we had cholangiography of 3 liver donors. With the images we obtained, we had the opportunity to examine the bile ducts from all aspects in 3D and determined the bile duct division point accordingly.
Conclusions: With the existing methods, it is not possible to view the bile ducts in 3D during surgery. In addition, since the images are 2D in the fluoroscopy method, which is frequently used, the route of the bile ducts cannot be fully understood. With this method, even small branches can be seen and an unwanted division can be prevented.
Advances in knowledge: In our study, we describe the details of the use of the O-arm™ device, in intraoperative cholangiography in order to better understand the biliary tract anatomy. We called this new method "O-Arm Cholangiography", and we suggest this method for selected patients.

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