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INTRA-OPERATIVE OUTCOMES IN DONATION AFTER CIRCULATORY DEATH LIVER TRANSPLANTATION USING NORMOTHERMIC MACHINE PERFUSION, OR NORMOTHERMIC REGIONAL PERFUSION VERSUS SUPER RAPID RECOVERY WITH STATIC COLD STORAGE

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Background: Donation after circulatory death (DCD) is an increasingly prevalent practice in liver transplantation to address the persistent organ shortage. However, DCD liver transplantations procured with a super rapid recovery technique with static cold storage (SRR+CS) is associated with an increase in adverse outcomes including higher rates of early allograft dysfunction (EAD) and biliary complications when compared to transplants using donation after brain death. Regional perfusion (NRP) and normothermic machine perfusion (NMP) aim to reduce these complications. Outcomes related to long term graft function, patient survival, and allograft dysfunction when NRP and NMP are used in clinical transplant have been published recently. However, intra-operative hemodynamic outcomes and post-reperfusion syndrome between NMP and NRP are not well described nor compared directly.

Methods: We performed a single-center retrospective clinical study of 50 DCD liver transplants in adult recipients using three techniques for DCD organ recovery and preservation (SRR+CS, NRP+CS, and SRR+NMP). Donor, recipient, and transplant characteristics were recorded and evaluated. Primary outcome measure was rate of post-reperfusion syndrome (as defined by Hilmi et. al.). Categorical variables were compared between groups using chi-square, and continuous variables compared using a non-parametric ANOVA. Additionally, donor and recipient variables were used to construct a binary logistic regression model for PRS.

Results: Intra-operative outcomes demonstrated lower epinephrine dose needed on reperfusion in the SRR+NMP group (0 mcg) compared to SRR + CS (40 mcg) and NRP+CS (20 mcg), $p=0.010$. There was a lower rate of post-reperfusion syndrome in both the NMP and NRP groups compared to the SRR + CS (33.3% in SRR+NMP, 37.5% in NRP+CS and 75% in SRR+CS, $p=0.025$). 70.8% of the SRR+CS group and 66.7% of the NRP+CS group were noted to have severe PRS, versus 33.3% of the SR+NMP group ($p=0.430$). Post-transplant liver enzymes were significantly higher in the SRR+CS arm compared to NMP and NRP. Incidence of EAD and primary non-function (PNF) was not significantly different between groups. There was no difference in graft nor patient survival between groups.

Conclusion: Machine perfusion in LT continues to demonstrate good outcomes in DCD liver grafts. Despite a growing number of publications supporting their use to lower EAD, improve biliary outcomes, and overall graft and patient survival, little has been shown on intra-operative outcomes. This study demonstrates for the first time NMP and to a certain extent, NRP, mitigates early reperfusion injury as measured by post-reperfusion syndrome when compared to SRR+CS. The lower incidence of PRS suggests a smoother

hemodynamic profile and potentially improved outcomes for patients. In addition to increasing the available grafts for transplantation, NMP may also allow for higher risk patients to undergo LT.

Table 1. Donor & Recipient Characteristics, and Transplant Outcomes

		SRR + CS (n = 33)	NRP + CS (n = 8)	SRR + NMP (n = 9)	P value
Donor Characteristics					
Median Age		36.0 (22.0 to 45.0)	23.5 (21.8 to 28.5)	40.0 (32.0 to 57.0)	
Sex (N)	Female	9	0	3	
	Male	24	8	6	
Median BMI		29.0 (26.5 to 32.1)	29.2 (22.8 to 29.4)	26.4 (22.5 to 37.1)	
Recipient Characteristics					
Median Age		55.0 (47.0 to 59.0)	56.0 (51.2 to 59.2)	58.0 (52.0 to 63.0)	
Median MELD at Tx		22.0 (20.0 to 24.0)	18.0 (15.8 to 22.5)	21.0 (14.0 to 24.0)	
Sex (N)	Female	10	2	3	
	Male	23	6	6	
Transplant Outcomes					
Epinephrine bolus dose (mcg)		40.0 (10.0 to 100.0)	20.0 (7.5 to 100.0)	0.0 (0.0 to 0.0)	0.010
PRS	No	8 (25%)	5 (62.5%)	6 (66.7%)	0.025
	Yes	24 (75%)	3 (37.5%)	3 (33.3%)	
PRS- Severity	Mild	7 (29.2%)	1 (33.3%)	2 (66.7%)	0.430
	Severe	17 (70.8%)	2 (66.7)	1 (33.3%)	
EAD	No	14 (42.4%)	6 (75%)	7 (77.8%)	0.072
	Yes	19 (57.6%)	2 (25%)	2 (22.2%)	
PNF	No	31 (93.9%)	8 (100%)	9 (100%)	0.585
	Yes	2 (6.1%)	0	0	