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Does Normothermic Regional Perfusion Modify the Relationship Between UK DCD Risk Score and Graft Failure?

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Background and Aims: The UK DCD Risk Score is a validated tool to stratify graft failure risk in donation after circulatory death (DCD) donors. However, the score was developed before widespread use of normothermic regional perfusion (NRP). The analysis aimed to identify if the association between graft survival and UK DCD risk score differs between NRP and direct procurement (DP) recoveries.

Methods: Using UNOS data, we analyzed adults who received DCD liver grafts between June 2021 and September 2024 ($n = 1371$) using a logistic regression model for one-year graft failure and a Cox model for overall graft failure. Covariates for both models were continuous UK DCD score, recovery type, and an interaction between the two to test if relationship between UK DCD risk score and graft failure differs by procurement type. Recovery type was identified via the bimodal distribution of death-to-clamp times, with exclusion of ex-vivo machine-perfused grafts. We used multiple imputation to address missingness in UK DCD score.

Results: NRP and DP grafts had similar UK DCD scores, and NRP grafts had longer survival than DP grafts (log-rank test, $p = 0.003$). For DP grafts, a one-point increase in UK DCD score was associated with an 10% increased odds of one-year graft failure (OR: 1.10, 95% CI: 1.03-1.18, $p = 0.004$), but UK DCD score was not significantly associated with increased hazard of graft failure (HR: 1.04, 95% CI: 0.99-1.10, $p = 0.16$). For NRP grafts no association was identified between UK DCD score and odds of one-year graft failure (OR: 0.94, 95% CI: 0.69- 1.48, $p = 0.70$) or hazard of graft failure (HR: 0.96, 95% CI: 0.76-1.22, $p=0.75$). However, interaction between risk score and procurement type was not statistically significant in either model (Cox model, $p = 0.53$; logistic model, $p = 0.32$).

Conclusions: A higher UK DCD score was associated with greater odds of one- year graft failure in DP, but not NRP liver grafts. The lack of significant association in the NRP group may be attributed to small n . Further clinical experience may allow a better understanding of how NRP procurement may modify graft failure risk.

Table 1. Summary of cohort by procurement type (DP or NRP)

	DP (N = 1193)	NRP (N = 178)	P-value
UK DCD score			
Median [IQR]	5 [4]	5 [5]	0.59
Missing	120 (10.1%)	37 (20.8%)	
UK DCD score group			
Low (0 - 6 points)	619 (51.9%)	77 (43.3%)	0.68
High (6 - 10 points)	407 (34.1%)	56 (31.5%)	
Futile (>10 points)	47 (3.9%)	8 (4.5%)	
Missing	120 (10.1%)	37 (20.8%)	
Donor age (years)			
Mean $\pm$ SD	40.9 $\pm$ 12.2	36.0 $\pm$ 12.1	<0.001
Missing	0 (0%)	0 (0%)	
Donor BMI (kg/m²)			
Mean $\pm$ SD	27.5 $\pm$ 5.9	28.0 $\pm$ 6.7	0.31
Missing	1 (0.1%)	0 (0%)	
Functional warm ischemia time (min)			
Mean $\pm$ SD	16.7 $\pm$ 6.0	18.7 $\pm$ 8.7	0.01
Missing	116 (9.7%)	37 (20.8%)	
Cold ischemia time (hours)			
Mean $\pm$ SD	7.0 $\pm$ 4.3	5.4 $\pm$ 2.5	<0.001
Missing	3 (0.3%)	1 (0.6%)	
Recipient age (years)			
Mean $\pm$ SD	56.9 $\pm$ 10.2	57.2 $\pm$ 9.4	0.79
Missing	0 (0%)	0 (0%)	
Recipient final lab MELD			
Mean $\pm$ SD	18.6 $\pm$ 6.9	19.4 $\pm$ 6.8	0.13
Missing	1 (0.1%)	0 (0%)	
Previous liver transplant			
No	1188 (99.6%)	177 (99.4%)	0.28
Yes	5 (0.4%)	1 (0.6%)	
Missing	0 (0%)	0 (0%)	
Graft failure			
One-year	135 (11.3%)	7 (3.9%)	

Table note: P-values were obtained via Fisher exact test (previous liver transplant), chi-square test (UK DCD score group), Mann-Whitney test (UK DCD score), and two-sided unpaired t-tests with unequal variance (all other numeric variables). UK DCD risk score is calculated using donor age, body mass index, functional warm ischemia time, cold ischemia time; and recipient age, laboratory model for end-stage liver disease, and history of prior liver transplant.

Figure 1. Distribution of UK DCD risk score by recovery type

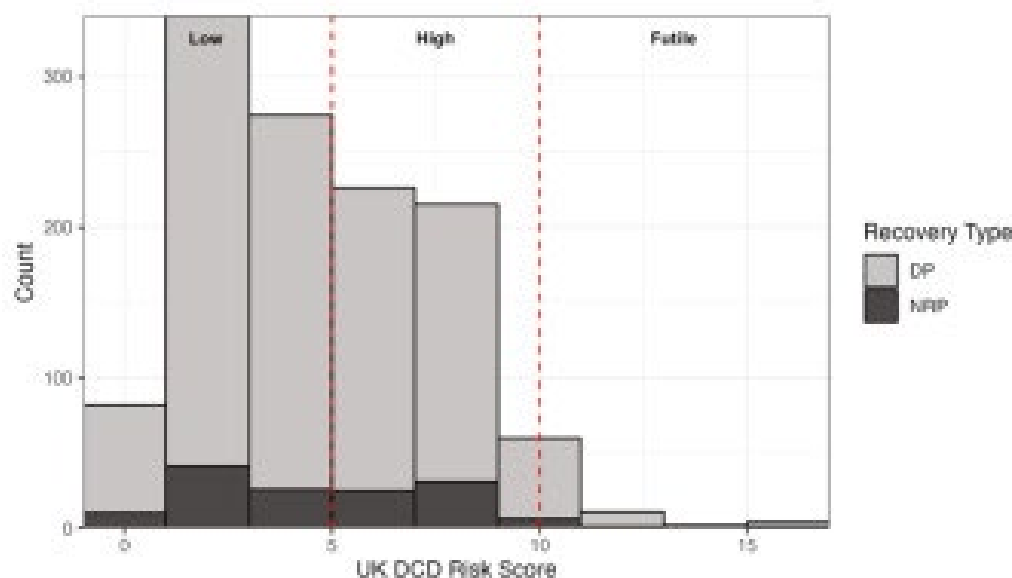


Figure note: Vertical dotted lines indicate the UK DCD risk score cutoffs for low, high, and futile risk categories.

Figure 2. Kaplan-Meier (KM) survival curves with 95% confidence intervals by procurement type (DP or NRP)

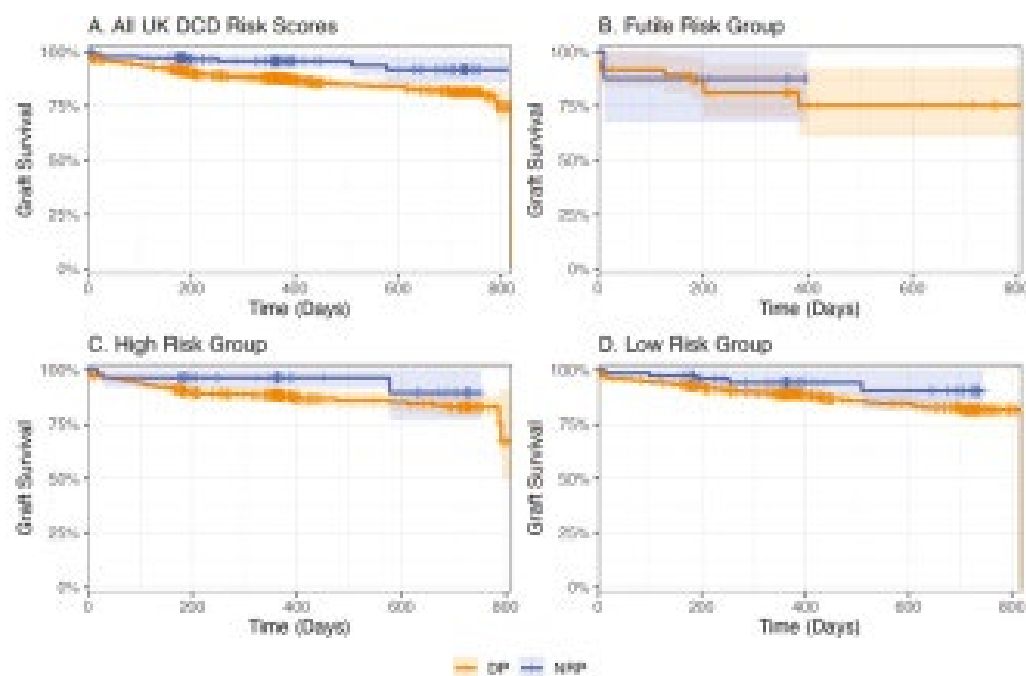


Figure note: **A** Overall KM curve DP and NRP procured livers; **B-D** KM curves stratified by risk category.