Viability testing and transplantation of marginal donor livers (VITTAL) trial outcomes: bile duct injury assessment during the normothermic machine perfusion of discarded livers

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Background

Histological evidence of donor bile duct injury (BDI) prior to transplantation is known to correlate with development of post-transplant biliary complications. We aimed to analyse BDI on discarded donor livers that were transplanted following viability testing by normothermic machine perfusion (NMP) in the VITTAL clinical trial.

Method

31 extended criteria livers discarded by all UK transplant centres were offered for research and underwent viability testing using the OrganOx *metra* normothermic machine perfusion device within the VITTAL trial. Viability criteria involved lactate metabolism, bile production, pH maintenance, flow rates, glucose metabolism and adequate macroscopic perfusion.

22 livers met viability criteria and were transplanted into consented recipients. Bile duct (BD) biopsies from all livers were obtained before NMP and post-reperfusion prior to abdominal closure. The assessment consisted of grading the injury to the deep peribiliary glands, stromal and arterial necrosis, thrombi and haemorrhage (Op den Dries 2014, Hansen 2012) and the overall score (0 no injury, 1 minimal, 2 mild, 3 mild to moderate, 4 moderate, 5 moderate to severe, 6 severe;) was correlated with development of post-transplant biliary strictures.

Figure 1. Macroscopic appearance of all 31 livers that underwent viability testing using the OrganOx *metra.*

Results

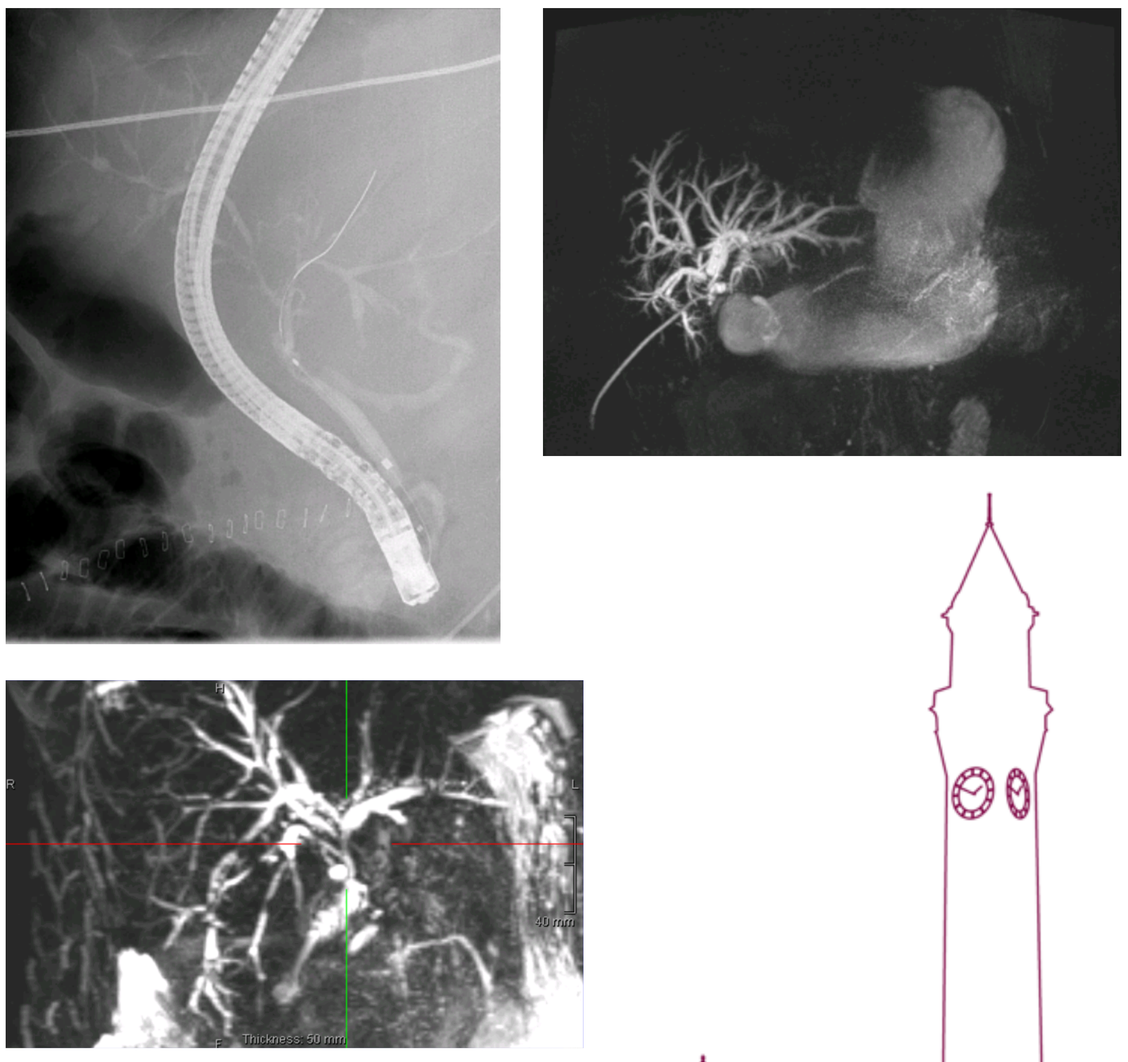
The 22 transplants consisted of 12 livers from donors after brainstem death (DBD) and 10 from donors after circulatory death (DCD). Ten recipients (45%) developed BD irregularities seen on magnetic resonance cholangiogram performed 6 months following transplantation. Over a 297-day median study follow-up period, 5 (23%) patients remained clinically asymptomatic, 1 (5%) patient developed an anastomotic stricture successfully managed by stenting and 4 (18%) patients developed non-anastomotic strictures (NAS) requiring re-transplantation. Of these, three were in recipients of DCD livers (n=3) and one in a DBD recipient who developed early hepatic artery thrombosis. Pre-NMP and post-reperfusion BDI correlated with the development of biliary strictures ($p < 0.001$) and BDI increased significantly in post-reperfusion biopsies in those patients who subsequently developed strictures ($p=0.003$).

	BDI score Pre-NMP	BDI score Post-transplant
Normal bile duct imaging	2 (0-4)	3 (1-5)
Non-anastomotic BD stricture	3 (1-6)	6 (3-6)

Conclusions

Current BDI scores apply to livers undergoing viability assessment and the degree of injury during NMP could predict grafts at risks for development of NAS. Analysis of perfusate and bile samples may yield biomarkers related to BDI.

Figure 2. Representative MRCP images of patients' biliary trees who developed NAS.



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