CLINICAL EXPERIENCE OF EX-SITU HYPOTHERMIC LIVER PERFUSION

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Introduction

Increasing demand for liver transplantation, with a largely static donor pool, has led to increasing use of marginal livers including those from DCD donors [1]. With standard techniques, the outcomes from transplantation of such livers is known to be inferior in terms of allograft dysfunction and biliary complications [2].

We therefore urgently need to find ways of increasing the utilisation of these marginal organs in a safe, systematic and reproducible manner.

Ex-vivo organ perfusion provides a means to recondition livers prior to implantation.

Methods

Hypothermic ex-situ perfusion utilises proprietary cardiopulmonary bypass equipment, a custom-made heparin-bonded circuit, University of Wisconsin solution and a prostaglandin additive. A single centrifugal pump delivers cooled (8-10°C) oxygenated solution via the hepatic artery (25mmHg) and portal vein (4 mmHg) and an IVC cannula maintains a negative transhepatic gradient. Livers from donors after circulatory death (DCD) or organs from donors after brain death (DBD) declined by other centres were perfused and transplanted into recipients after appropriate selection and consent.

Results

6 perfusions of **discarded** livers

8 **clinical** perfusions

- Patient NM – 3rd transplant super-urgent for HAT (DCD out of area)
- Patient JM – DBD out of area (elevated ALT post cardiothoracic surgery)
- Patient MM – DCD poor in situ perfusion
- Patient SB – 2nd transplant for late HAT, DCD, 11hrs CIT
- Patient AM – DBD out of area, declined by other centres for unknown reasons
- Patient JP – DCD out of area, 14.5 hours CIT, declined by all centres
- Patient DO – DCD, moderate steatosis, Top Band, UKELD 71, Failed to reach AT
- Patient GS – DCD out of area, OOH cardiac arrest, Anorexic BMI 17, Recipient DM

Results

To date (February 2016- November 2016) 8 livers (DCD n=6, DBD n=2) have been transplanted after Hypothermic perfusion. All 8 transplants were considered high-risk due to donor and recipient factors. Livers were perfused for an average of 118 minutes (94-176). Median peak post-operative ALT was 667 (298-3020). Longest follow-up is 12 months (3-12) with 100% graft and patient survival and 1 potential case of early ischaemic cholangiopathy. Oxygen tensions in delivery (mean PaO₂ = 29.2kPa, 18.2-22.4) and recovery sides (mean PaO₂ = 4.8kPa, 3.1-5.9) of the circuit demonstrate oxygen consumption (mean = 1.71cm³/Kg/min, 0.62-3.55) in the hepatic parenchyma.

Discussion

We have successfully demonstrated the safe clinical introduction of hypothermic liver perfusion with good recipient outcomes in high-risk cases using a cost-effective setup. Early data suggests possible markers for real-time assessment of donor livers, although further analysis is still ongoing, and correlation to long-term patient outcomes yet to be performed. Further work also includes assessment of alternative means of real-time assessment.

References

1. NHSBT Activity Report. <http://www.odt.nhs.uk/uk-transplant-registry/annual-activity-report/>
2. White SA, Prasad KR. BMJ 2006;332(7538):376-7