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Transport and Preservation of Liver in a Revolutionary Medical Device

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Background and Aims: The injury of the graft during the period in which the donor organ is transported until it is implanted in the recipient negatively affect the quality of liver grafts from extended criteria donors and the post-operative outcomes after transplant. Herein, we evaluated whether a new medical device based on the combination of ultrasounds and hypothermic conditions increases the viability of liver grafts during cold ischemia before being implanted in the recipient, in comparison to what could be obtained with known devices
Methods: Pig livers grafts were perfused with preservation solution and kept in the cooler with or without ultrasound for 8h. Liver and perfusate samples were collected to assess liver damage induced by ischemia. Transaminases and lactate dehydrogenase were measured in the perfusate and caspase 3 activity in liver. MDA levels were determined in liver an oxidative stress index, and hepatic ATP levels were determined as an energy metabolism preservation index.
Results: The protection of liver grafts (confirmed by the reduction in transaminases, lactate dehydrogenase, caspase 3 and MDA as well as ATP preservation) conferred by UW solution under cold conditions (2-6°C) is higher than that obtained with Celsior or Ringer solution. Our results indicated a synergistic effect when both cold conditions (2-6°C) and ultrasound treatment (at low frequency and intensity) are combined because the protection obtained when both treatments are combined is much better than the sum of protections obtained when both treatments are applied separately. The protection conferred by ultrasound was independently of the preservation solution used.
Conclusions: We provide a revolutionary method and medical device for transporting and storing liver grafts under better conditions than those currently available. All this allows reducing the harmful effects of cold ischemia and increasing viability of grafts before they are implanted in the recipient.

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Normothermic Machine Perfusion of Ischaemically Damaged Porcine Kidneys with Autologous, Allogeneic and Human Red Blood Cells

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An increasing amount of research is being done to investigate normothermic machine perfusion (NMP) as a preservation method to bridge the period between organ retrieval and transplantation. In porcine kidney auto-transplant models red blood cells (RBCs) are required for ex-vivo NMP. As large quantities of RBCs are needed, utilising autologous RBCs would imply lethal exsanguination of the pig that is donor and recipient-to-be in the same experiment. The purpose of this study was to determine if an isolated porcine kidney can also be perfused with allogeneic or human RBCs instead.

Porcine kidneys, autologous and allogeneic blood were obtained from a local slaughterhouse. Human RBCs (Opos), were provided by our transfusion laboratory. Warm ischaemia time was standardised at 20 min and subsequent hypothermic machine perfusion with UW-MP lasted 1,5-2,5 hrs. Next, kidneys underwent NMP at 37°C during 7 hrs in a recirculating circuit with either washed, leukocyte depleted autologous, allogeneic, or human RBCs (n=5 per group). Other components of the perfusate were Williams' Medium E, albumin, creatinine and Augmentin.

During perfusion kidneys were functional and produced urine. No macroscopic adverse reactions were observed). ASAT was significantly higher in the xeno group (p=0.01). LDH release, peripheral renal resistance and fractional excretion of sodium did not differ significantly between groups. Creatinine clearance was significantly higher in the xeno group in comparison with the other groups (p= 0.02), but not in comparison with the autologous group alone. The concentration of albumin in the urine was significantly and substantially higher in the xeno group (p<0.005). Renal histology revealed acute tubular necrosis in all groups. There were signs of glomerular hyperfiltration in the xeno group.

In conclusion, perfusion of porcine kidneys with RBCs of different origin proved feasible. However, laboratory analysis and histology revealed more damage in the xeno group compared to the other two groups. These results indicate that the use of allogeneic RBCs is preferable to human RBCs in a situation where autologous RBCs cannot be used for NMP.

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