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Multivisceral cluster transplantation in the rat

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Transplantation of multivisceral grafts has evolved recently as a new therapeutic modality for hepatopancreatobiliary malignancies [1, 2]. The mutual interactions between the liver, pancreas, small bowel and the recipient organism after cluster grafting are not clearly understood and deserve further experimental evaluation. We present a technique for combined hepatopancreaticoduodenal cluster transplantation in the rat. The cluster grafts consisted of a pancreaticoduodenal graft and an orthotopic arterialized liver graft. A separate arterial anastomosis of the liver and a bile duct anastomosis were not necessary. Bile and exocrine pancreas secretions drained over the duodenal conduit of the graft into the recipients jejunum via an end-to-side anastomosis.

Key words: Multivisceral grafts – Hepatopancreaticoduodenal cluster transplantation – Rat

Materials and methods

Outbred male Wistar rats of 250–300 g body weight were used as donors and recipients. All operations were performed under ether anesthesia using a clean, non-sterile technique. Surviving animals were sacrified 72 h post-transplant and underwent autopsy. In the donor, the pancreaticoduodenal part of the cluster was prepared following mainly the original pancreaticoduodenal grafting described by Lee [3]. The pancreas was freed from its attachments to the omentum and the colon. The splenic vessels and the left gastric artery were ligated and the liver was mobilized. Before starting an in situ hypothermic perfusion, an aortic segment giving off the celiac axis and the superior mesenteric artery were prepared and the infrahepatic vena cava and the aorta were crossclamped. The whole cluster was perfused with 40 ml saline at 4 °C using a 16-gauge i.v. catheter. The graft was removed and stored in saline at 4 °C.

In the recipient, hepatectomy was performed as for liver transplantation. The cluster graft was placed orthotopically with regard to the liver into the recipient. After completion of the suprahepatic vena cava anastomosis, the anhepatic phase was finished by restoration of the venous blood flow through the hepatic part of the graft. The infrahepatic vena cava was anastomosed end-to-end and the arterial pedicle was sutured end-to-side to the infrarenal recipient aorta. Then the arterial perfusion of the pancreaticoduodenal part and the liver was reestablished. Finally, the exocrine drainage was reestablished by suturing the open end of the distal duodenum to the first jejunal log of the recipient in end-to-side technique with 6-0 running nylon sutures.

Results

A total of 25 transplants were performed establishing the technique. The portal clamping time averaged 16 min; the mean cold storage time was 25 min. While no problems were encountered in the donor, 6 recipients died during the procedure, the reasons being failure of the end-to-side portoportal anastomosis due to hemorrhage or stenosis with resulting splanchnic congestion and irreversible shock. Eight animals died 4–24 h post-transplantation without signs of hemorrhage and with patent anastomoses. One animal died after 2 days of peritonitis caused by intestinal perforation. Ten recipients were well at 72 h and all anastomoses were patent at autopsy.

Discussion

Four demanding vascular anastomoses can be performed with an acceptable operation time, and the anhepatic time of less than 20 min allows the recipient to recover from splanchnic congestion after clamping of the portal vein. Functional impairment of the rat pancreas does not occur by warm ischemia at 37 °C prolonged up to 90 min [4]. In our experiments revascularization of the pancreaticoduodenal part of the cluster occurred after 40 min and was therefore within safe limits. This model represents a new technique for multivisceral grafting in the rat with a simultaneous retrieval of liver, pancreas and duodenum en bloc.

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The immunology and preservation of composite grafts can be studied with this experimental procedure.

References

1. Starzl TE, Rowe MI, Todo S, Jaffe R, Tzakis A, Hoffman AL, Esquivel C, Porter KA, Venkataramanan N, Makowka L, Duquesnoy R (1989) Transplantation of multiple abdominal viscera. Jama 261: 1449–1457
2. Starzl TE, Todo S, Tzakis A, Podesta L, Mieles L, Demetris A, Teperman L, Selby R, Stevenson W, Stieber A, Gordon R, Iwatsuki S (1989) Abdominal organ cluster transplantation for the treatment of upper abdominal malignancies. Ann Surg 210: 374–386
3. Lee S, Tung KSK, Koopman SH, Chandler JG, Orloff MJ (1972) Pancreaticoduodenal transplantation in the rat. Transplantation 13: 421–425
4. Schulak JA, Franklin WA, Stuart FP, Reckard CR (1983) Effect of warm ischemia on segmental pancreas transplantation in the rat. Transplantation 35: 7–11