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LETTER TO THE EDITORS

Technique for *in situ* liver splitting liver associated with modified-multivisceral graft recovery

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Intestinal transplantation is a well-established treatment in the management of children with intestinal failure [1]. In some cases, the recipient does not need a liver transplantation and a "modified multivisceral graft" (MMV) (stomach, duodenopancreas, small bowel +/− colon) is performed, usually for motility disorders representing up to 25% of children listed for intestinal transplantation [2]. The recovery of an MMV graft should not compromise the recovery of other organs, in particular, the liver. Most of these donors are young and haemodynamically stable, and their livers are suitable for liver splitting. This paper describes what the authors believe is the first report detailing the technique of combining an *in situ* splitting liver with an MMV recovery procedure.

A 36-year-old woman was admitted with an intracranial haemorrhage. She was declared brain stem dead after 2 days of care. The recovery was performed by two consultant surgeons starting with a midline sterno-laparotomy, initially using standard techniques of abdominal organ recovery. The modified multivisceral graft was mobilized and prepared as follows: the pancreatoduodenal unit was mobilized en bloc, the gastrocolic ligament was divided with preservation of the left gastric artery. The spleen was mobilized to permit an en bloc removal of the pancreas and gastroduodenum, preserving part of the short gastric arcade along the greater omentum. Maximal preservation of terminal ileum with the ileocolic vessels was emphasized. The *in situ* split started with the mobilization of the left lateral segment (LLS) and parenchymal phase was performed using Cavitron Ultrasonic Surgical Aspiration (CUSA®, Tyco Healthcare, Mansfield, MA, USA) dissection to divide the parenchymal bridge between the LLS and the left median segment. When the dissection was completed, the two future liver grafts were separated, each with its own vascular pedicle and venous drainage. During the cold dissection phase, the inferior vena cava was divided above the renal vein orifices. The arteries were divided as shown on Fig. 1. The main portal vein trunk was transected 1 cm above the pancreas for the MMV graft. The main portal vein was allocated to the right liver graft and the left portal vein was divided at its origin for the LLS graft. Venous outflow for the liver grafts was as per protocol: the left hepatic vein for the LLS graft and the IVC for the right liver graft. Duration for the procedure was around 6 hours. Ex vivo preparation of the MMV graft consisted of a splenectomy. An external iliac artery graft was anastomosed to the SMA/coeliac trunk aortic patch.

Recipient 1 (MMV): The patient was a 12-year-old boy with an irreversible intestinal failure due to Hirschsprung's disease. The MMV graft was implanted anastomosing the portal vein to the IVC with an iliac vein interposition; followed by anastomosing the arterial graft conduit to the recipient infrarenal aorta.

Recipient 2 (left lateral segment): The patient was a 6-month-old boy with end stage biliary atresia. The graft was implanted using standard split liver transplant without any interposition grafts.

Recipient 3 (Right lobe): The patient was a 30-year-old woman with acute intermittent porphyria. The right lobe graft was implanted using standard venous anastomosis techniques. The proper hepatic artery had a small calibre and was reconstructed using an interposition donor iliac conduit anastomosed to the junction of the GDA and CHA of the recipient. The patient was discharged home at day 10. She developed pruritis and jaundice 6 months post-LT. Investigations revealed a biliary stricture at the hilum associated with a late arterial thrombosis.

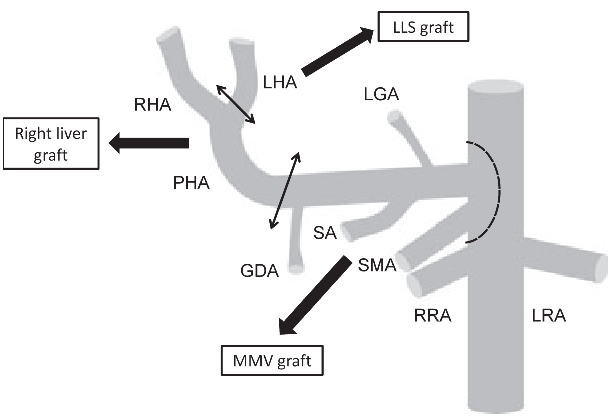

Figure 1 Schematic view of the arterial allocation. RHA, right hepatic artery; LHA, left hepatic artery; PHA, proper hepatic artery; GDA, gastroduodenal artery; SA, splenic artery; LGA, left gastric artery; SMA, superior mesenteric artery; RRA, right renal artery; LRA, left renal artery.

Discussion

Organ scarcity requires transplant surgeons to make maximal use of every donor to provide as many transplantable organs as required. The simultaneous recovery of the intestine, pancreas and liver from the same donor was shown to be routinely feasible and that recovery of an MMV graft can be associated with the recovery of a liver [3]. Furthermore, it has been established that *in situ* splitting of liver grafts can be accomplished in stable donors without significant negative effects on other organs [3,4]. The left gastric, splenic and superior mesenteric arteries should be preserved for the MMV graft, in conjunction with retrieving a sufficient length and calibre of hepatic artery for the liver graft. Multiple arterial reconstruction in multivisceral transplantation is possible [5] and some authors [6] have described a procedure, which enables adequate vessel length and calibre for the liver and reconstructable anatomy for the MMV graft. They described the transection of the splenic artery at his origin and coeliac axis at origin of left gastric. The revascularization of the MMV graft was made by anastomosing the divided vessels end-to-end. In this method, the GDA could not be revascularized. Recently, others (Somasundaram *et al* [7]) have proposed to anastomose a Y-graft (full iliac axis) to the divided splenic artery and coeliac axis distally and the GDA proximally. This technique reduced tension of the coeliac axis at implantation and enabled revascularization of the GDA. On the other hand, it required a prolonged bench work and a possible increased risk of thrombosis due to multiples arterial anastomosis [8]. Our technique had permitted an implantation of the three grafts without any complex arterial reconstruction, but has the disadvantage of potentially shortening or reducing the calibre of the vessels for liver transplantation. Conversely, it has been [9] demonstrated that left split grafts can be safely transplanted with the small and short left vascular supply only, provided that division is guided by careful anatomical evaluation and that vascular reconstructions are adequate. Several series of living-donor liver transplants have shown these improvements with the use of high magnification and micro-vascular techniques [10].

We have demonstrated that *in situ* liver recovery can be combined with safe recovery of a modified-multivisceral graft. In case of a normal anatomy distribution, the hepatic artery can be transected just above the GDA providing a sufficient arterial length for a whole liver graft or a split liver graft. The different grafts obtained with this technique were of good quality and implantation of these organs was performed without using complex vascular reconstruction.

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Conflict of Interests

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