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LETTER TO THE EDITOR

The use of autologous vena cava patch graft for reconstructing multiple outflow orifices in right hemiliver living donor graft

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The major issue in the use of right hemiliver (RL) graft in living donor liver transplantation (LDLT) is the increased frequency of anatomical variations, especially in the venous drainage system [1]. Moreover, the availability of vascular grafts for reconstructing those vessels is usually very limited in LDLT settings [2–5]. We have previously reported the feasible usage of an explanted portal vein (EPV) graft for the reconstruction of middle hepatic vein (MHV) tributaries [3]. However, the presence of a major inferior right hepatic vein (IRHV) further complicates the reconstruction procedure [2,4]. This report describes the use of an autologous hepatic inferior vena cava (IVC) graft and EPV for facilitating one-step venous reconstruction in RL-LDLT with multiple venous orifices.

The recipient was a 46-year-old male patient with end-stage liver disease caused by hepatitis C. The donor was a 46-year-old female subject with blood type (O+) identical to the recipient. The estimated graft volume (GV) of her RL was 593 ml, corresponding to 43% of the recipient's standard liver volume (SLV). Preoperative enhanced multidetector helical CT images were made with 2-mm-thick slices. Three-dimensional reconstruction of the liver and graft was obtained from the CT data with Zio M900 (Zio Software Inc., Tokyo, Japan). The RL graft had five major outflows, including outflows through the right hepatic vein (RHV), two large IRHVs, and two major MHV tributaries (Fig. 1). The calculated total drainage area of the four outflows, calculated by the regional three-dimensional volume calculating software (Region Growing® software; Hitachi medical, Tokyo, Japan), excluding the RHV, was 351 ml, representing 59.2% of the GV. Therefore, it was necessary to reconstruct all of the hepatic veins [6].

In the recipient, a total hepatectomy was performed with the clamping of the upper and lower hepatic vena cava, after creation of a venovenous bypass. A square-shaped anterior wall of the IVC was procured for patch reconstruction *ex situ* (Fig. 2). The EPV was also procured from the explanted liver, and was used for connecting V5, V8 and the RHV on the bench, as reported previously [3]. Then, the procured autologous IVC patch graft was connected with the conduit of the EPV-RHV and the two IRHVs, as in a bridge (Fig. 3). The graft was put in the recipient's body, and the venous conduit of the RL graft was anastomosed in a face-to-face fashion to the posterior wall of the hepatic IVC using 5-0 PDS (Ethicon, Somerville, NJ) continuous sutures in a four-corner stitch method. During suturing of the side or caudal edges of the conduit to the vena cava in an intra-luminal over-and-over method, special care was taken to bite edges of the vessels so as not to cause caval stenosis. The cranial edge was sutured using over-and-over sutures for the graft side and horizontal mattress sutures for the caval side, to adjust the size gap for approximation. The operative time, blood loss, anhepatic time and the time for bench surgery were 985 min, 13,735 ml, 251 min and 221 min respectively. No antithrombotic agent was used postoperatively. The patency of all graft venous outflow was confirmed on the CT scan, performed 1 month after LDLT.

One-step reconstruction method has been applied for reconstructing IRHV since 2007 at Kyushu University Hospital, because the reconstruction of IRHV *in situ* after

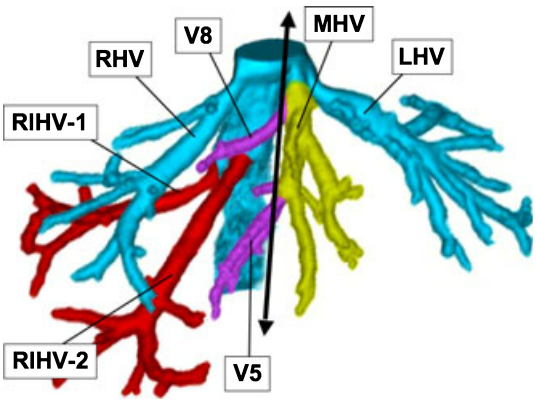

Figure 1 The 3-D image of the venous anatomy of the donor is shown. There are five major hepatic veins draining the right hemiliver. RHV, Right hepatic vein; RIHV, right inferior hepatic vein; V5, segment 5 vein; V8, segment 8 vein; MHV, middle hepatic vein; LHV, left hepatic vein.

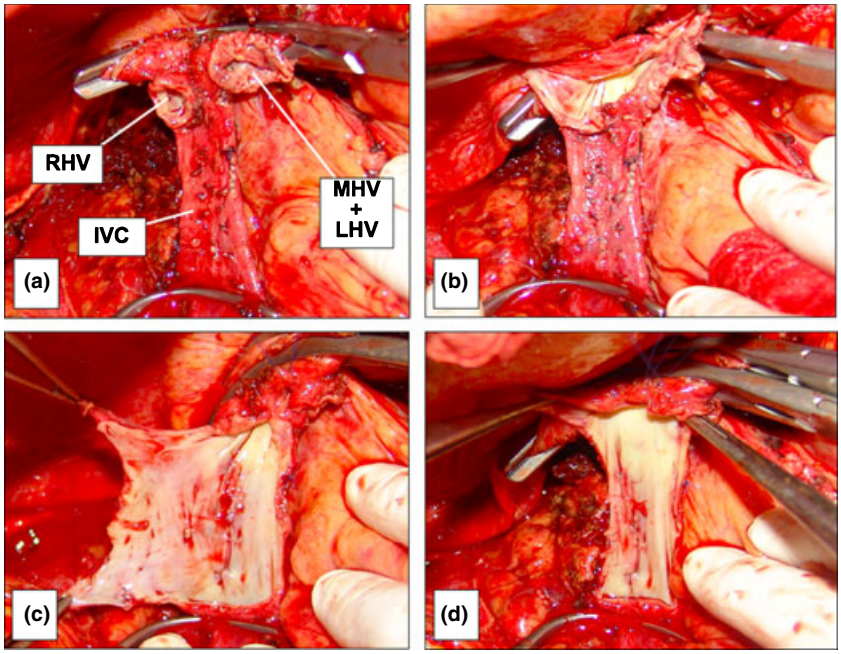

Figure 2 The anterior wall of the hepatic IVC was procured for the *ex situ* surgical procedure. After a total hepatectomy with clamping of the upper and lower hepatic IVC (a), a venotomy was created between the RHV and MHV+LHV (b), extended on the left side and caudal side (c). Note only the posterior wall of the IVC after procurement of the IVC patch graft (d). RHV, Right hepatic vein; MHV, middle hepatic vein; LHV, left hepatic vein; IVC, inferior vena cava.

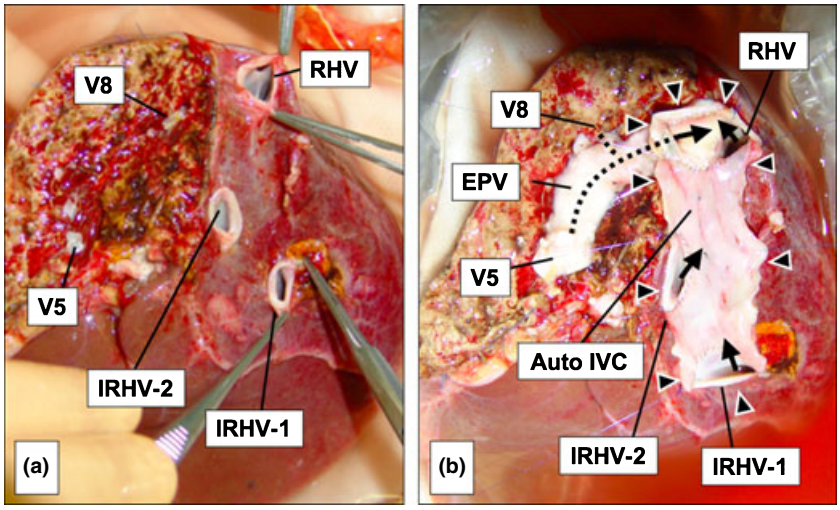

Figure 3 *Ex-situ* procedure for reconstructing five major drainage veins is shown. The five major hepatic veins on the graft (a) were co-joined together using an IVC patch graft (b). The patch graft is shown with endothelial surface facing out (b). The arrows with bold lines or dotted lines indicate the direction from the reconstructed vessels. The arrowheads indicate the exact line of anastomosis of the patch to the sidewalls of the vena cava. EPV, Explanted portal vein; RHV, right hepatic vein; IRHV, right inferior hepatic vein; V5, segment 5 vein; V8, segment 8 vein; MHV, middle hepatic vein.

anastomosis of the other major hepatic veins is usually performed in a deep, narrow and possibly bloody surgical field [4]. These IRHVs are usually small or short and the outflow of these vessels can be impaired or troublesome if they are anastomosed directly to the sidewall of the IVC. In the current case, there was no appropriate shunt vessel and the patient had a very short and obese neck for procuring jugular vein. If applicable, an internal jugular

vein, a saphenous vein, a superficial femoral vein, an inferior mesenteric vein, or an external iliac vein could also be procured and used for the same purpose. The use of anterior wall of the autologous IVC is one of the back-up strategies for enabling one-step venous reconstruction in RL living donor liver transplantation.

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