Laparoscopic donor right hepatectomy with reconstruction of segment V and VIII tributaries of the middle hepatic vein using a cadaveric iliac artery allograft

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To the Editor: Living donor liver transplantation (LDLT) has effectively expanded the donor pool. However, up to 40% of living donors suffer from postoperative complications, which are mostly associated with a right subcostal laparotomy wound.[1] A pure laparoscopic technique has been employed in living donor right hepatectomy since 2013.[2,3] In the interest of the donor's safety, pure laparoscopic living donor right hepatectomy (PLDRH) is recommended for selected donors with normal anatomy. To overcome the hepatic venous variation limitation, we present a case of PLRDH with reconstruction of segment V and VIII tributaries of the middle hepatic vein (MHV) using a cadaveric iliac artery allograft.

A 46-year-old woman, with a weight of 48 kg, height of 160 cm and body mass index (BMI) of 18.8 kg/m^2, volunteered to donate her right liver to her 40-year-old younger brother, with a weight of 52 kg, height of 165 cm and BMI of 19.1 kg/m^2. The recipient was diagnosed with decompensated biliary cirrhosis and severe portal hypertension with esophageal and gastric variceal bleeding. His Child-Pugh class was B-9, and his model for end-stage liver disease score was 14.

The donor was evaluated by enhanced computed tomography (CT) and magnetic resonance cholangiopancreatography (MRCP) before the operation. The CT showed that the donor's estimated right liver volume, excluding the MHV, was 512 g with a graft to recipient weight ratio (GRWR) of 0.98% and a remnant liver volume of 50%. The CT also showed that the MHV had two main tributaries of segments V and VIII [Figure 1A]. The anatomy of the right hepatic artery (RHA), right portal vein (RPV), right hepatic vein (RHV) and bile duct was normal.

Written informed consent about the risks of PLDRH was obtained from both the donor and the recipient before operation. All the procedures performed in this study were in accordance with the ethical guidelines of the *Helsinki Declaration* and were approved by the Ethics Committee of the West China Hospital of Sichuan University.

The donor was put in a 30° reverse Trendelenburg position with the arms abducted. Five laparoscopic trocars were inserted [Figure 1B]. The gallbladder was resected first. The right ligaments and short veins were divided, and the right liver was completely mobilized. The right hepatic vein was dissected, and a tube was inserted through the tunnel among the RHV, MHV and retrohepatic inferior vena cava (IVC) for a hanging maneuver. Then, the RHA and RPV were encircled by dissecting the right porta hepatis.

The ischemic demarcation line on the liver surface was marked as the transection line, which was induced by transiently clamping the right inflow vessels. A Thunderbeat scalpel (© Olympus, Tokyo, Japan) and an ultrasonic aspirator (CUSA Excel+, Integra, NJ, USA) were used for the parenchymal transection. The segment V and VIII tributaries of the MHV were identified and divided between Hem-o-Lok clips [Figures 1C and 1D]. A laparoscopic hanging maneuver was used for the transection of the deep parenchyma [Figure 1E]. Then, the right hepatic duct was dissected and divided after rechecking the MRCP images and performing intraoperative C-arm-shaped roentgenographic cholangiography. After preparation of the subumbilical incision and injection of heparin, the RHA and RPV were clamped and transected. The RHV was transected using a vascular stapler. The right liver was extracted from the incision.

The graft was perfused with 2 L of HTK solution immediately, and the clips on the segment V and VIII

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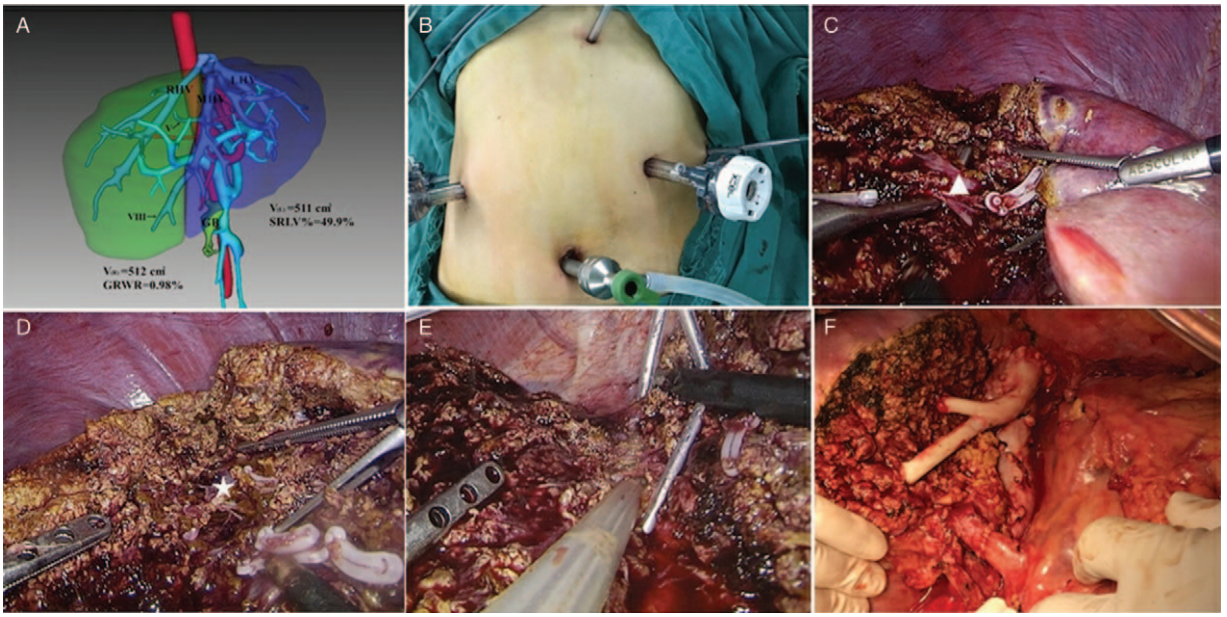

Figure 1: (A) Liver volumetry and anatomy of the donor according to a three-dimensional CT scan. (B) Trocar positions. (C) Dissection of the segment V tributary of the middle hepatic vein (▲). (D) Dissection of the segment VIII tributary of middle hepatic vein (★). (E) Laparoscopic hanging maneuver for deep parenchymal transection. (F) Implanted liver with reconstruction of segment V and VIII tributaries of the middle hepatic vein using a deceased donor's iliac artery graft. LHV: Left hepatic vein; MHV: Middle hepatic vein; RHV: Right hepatic vein; GB: Gall bladder; V: Segment V tributary of the MHV; VIII: Segment VIII tributary of the middle hepatic vein; GRWR: Graft to recipient weight ratio; SRLV: Standard remnant liver volume.

tributaries of the MHV were removed. The openings of segment V and VIII tributaries of the MHV were 0.8 cm and 0.5 cm in diameter, respectively. A preserved iliac artery allograft from a deceased donor was used to bridge the gap between the segment V and VIII tributaries of the MHV with 5–0 polypropylene sutures. The openings of the external and internal iliac arteries were anastomosed with the segment V and VIII tributaries of the MHV, respectively, on the back table. Then, the opening of the common iliac artery was anastomosed with the IVC of the recipient [Figure 1F].

The donor's operation time was 515 min. The warm ischemia time was approximately 5 min. The blood loss was less than 300 mL, with no transfusion. The actual graft weight was 500 g, with a GRWR of 0.96%. The donor was discharged on the seventh postoperative day without any complications. The postoperative course of the recipient was uneventful, with a hospital stay of 23 days.

Laparoscopic procedures have been widely used for liver resection because they can minimize surgical wounds, improve the quality of life, reduce hospital stays and decrease postoperative morbidity compared with open operations. Laparoscopic procedures were first used for left lateral hepatectomy in pediatric LDLT by Cherqui *et al* in 2002.[4] However, complex laparoscopic donor major hepatectomy remains challenging because right liver mobilization, right hilar dissection, deep parenchymal transection, and vascular vessel reconstruction are much more difficult than left donor hepatectomy for LDLT. Laparoscopic donor major hepatectomy is classified as being in the development phase of IDEAL of the Balliol classification for surgical procedure innovation, which was recommended for select donors with normal anatomy in highly specialized centers.[5] Actually, PLDRHs have only been reported sporadically in limited centers since 2013.[2,3]

Another controversial issue regarding LDLT is whether to harvest the MHV with the graft. In the interest of the donor's safety, the MHV is usually kept with the donor in our experience. Therefore, venous outflow reconstruction is necessary for the right liver graft without the MHV to prevent congestion of segments V and VIII. From January 2001 to August 2018, 299 right lobe adult-to-adult LDLTs were performed in West China Hospital. Of these, 285 (95.3%) right grafts did not contain the MHV, and 46 (15.4%) right grafts needed reconstruction of segment V and VIII tributaries of the MHV with frozen iliac vessels. In this case, we overcame the hepatic venous variation limitation to expand the donor criteria for PLDRH.

In conclusion, PLRDH with reconstruction of segment V and VIII tributaries of the MHV is a safe and feasible procedure in highly specialized centers.

Declatation of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patients have given their consent for their images and other clinical information to be reported in the article. The patients understand that their names and initials will not be published and due efforts will be made to conceal the identity of the patient, although anonymity cannot be guaranteed.

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Conflicts of interest

None.

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