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LETTER TO THE EDITORS

# Calibrated extra-anatomic hepatic arterial reconstruction in living donor liver transplantation

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Dear Editors,

In LDLT, there exists a limitation in the length of the vascular pedicles and the bile duct stump that can be obtained in the partial hepatic allograft. As a result of this limitation, anatomic arterial reconstruction between the right or left hepatic artery of the partial hepatic allograft and the inflow artery of the recipient may be difficult. This problem is further exacerbated when recipients have compromised arterial walls as a result of previous chemoembolization [1] or neoadjuvant chemoradiation [2]. A few alternative techniques of hepatic arterial reconstruction in LDLT have been described in the literature. Attempts have been made to use the transposed splenic artery [3] or the right gastroepiploic artery [4]. However, transposition of the splenic artery may create splenic infarction, and the gastroepiploic artery may not be able to deliver enough blood flow. In addition, interposition techniques using various interposition grafts have been reported [5,6], and extra-anatomic bypass using a deceased donor iliac arterial graft may become technically difficult to adequately adjust caliber of stumps for anastomosis.

The authors herein describe a novel calibrated anastomotic technique through an aortic conduit using an iliac arterial graft from a deceased donor to reliably reconstruct the hepatic arterial supply to the partial hepatic allograft.

We had a 50-year-old male patient with a history of PSC and ulcerative colitis. On surveillance ERCP with brush cytology, the patient was diagnosed with cholangiocarcinoma. There was no identifiable mass lesion on triphasic intravenous hepatic CT scan, despite diffuse thickening of the biliary tree on intraductal ultrasonography.

Considering the patient's background of PSC through the entire biliary tree with possible multifocality of the tumor, liver transplantation after neoadjuvant chemoradiation was decided as the best therapeutic option. The patient underwent chemoradiation and transcatheter irradiation with Iridium in preparation for liver transplantation, according to the Mayo protocol [7].

The patient's 22-year-old daughter volunteered to donate the right lobe of her liver. Donor evaluations were performed in sequence of blood test, cardiovascular evaluation, abdominal triphasic intravenous contrast CT scan for volume measurement of the prospective right lobe allograft, and MR cholangiography. The donor's anatomy of vasculature and biliary tree was normal. The donor's height and weight were 166 cm and 81 kg, respectively. Abdominal CT scan with IV contrast images of 5-mm thick slice were obtained by a multi-detector Lightspeed$^{R}$ CT scanner (General Electric, Milwaukee, WI, USA) and the measured whole liver volume was 1679 ml and right lobe volume, including the middle hepatic vein, was 883 ml. With the recipient's body weight of 86 kg, the graft versus body weight ratio (GWR) was 1.026. Graft weight after flush with 2 l of HTK solution was 855 g.

In consideration of the perceived higher risk of vascular complication because of pretransplant radiotherapy, extra-anatomic hepatic arterial reconstruction from infrarenal aorta using a deceased donor iliac artery conduit was planned for the recipient operation. To calibrate the diameter of the tip of the extra-anatomic arterial conduit, an iliac artery graft, including the distal branches of the internal iliac artery (superior gluteal, inferior gluteal, and obturator arteries), was recovered from an ABO-identical deceased donor a week before the LDLT.

In the recipient, hilar dissection was initiated from the upper margin of duodenum to isolate the most distal portion of the common bile duct. After dividing the common duct, resection margin was examined through frozen histologic examination. The entire segments of common and proper hepatic arteries were included in the specimen with ligation of proximal common hepatic artery and gastroduodenal artery. Lymphatic and areolar tissue in the hepatic hilum that turned fibrotic was removed en bloc with hepatic artery and common bile duct while skeletonizing the portal vein. The anterior wall of infrarenal aorta was exposed for implantation of the iliac arterial conduit. The rest of native hepatectomy was performed with preservation of the entire length of the vena cava.

On the back table, the internal iliac artery was divided at its origin from the common iliac artery and the opening of the common iliac artery was closed with 6-0 prolene running stitch (Fig. 1a). The inferior gluteal artery in

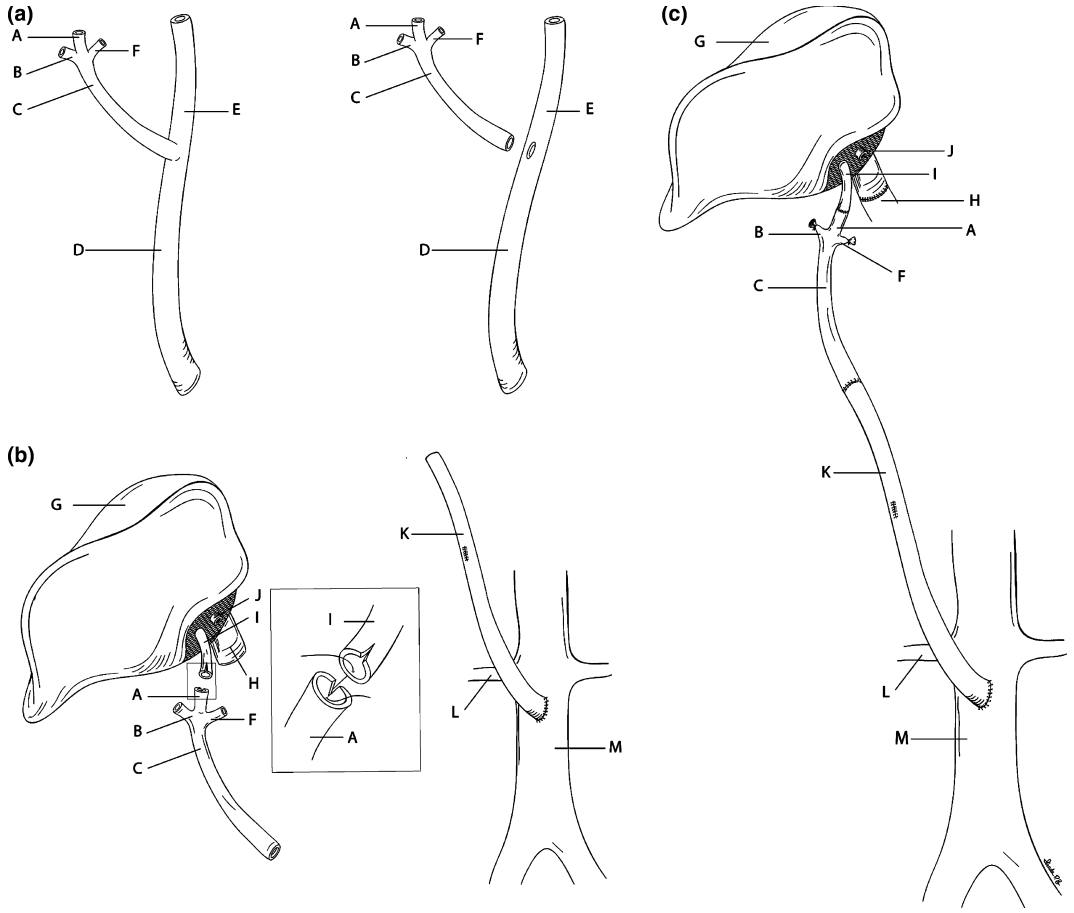


**Figure 1** (a) An iliac artery graft from a deceased donor (A. Inferior gluteal artery, B. Superior gluteal artery, C. Internal iliac artery, D. Common iliac artery, E. External iliac artery, F. Obturator artery). (b) Backtable anastomosis between right hepatic artery of the allograft and the size-matched branch of the internal iliac artery -Inferior gluteal artery in this case (G. Hepatic allograft, H. Right portal vein, I. Right hepatic artery, J. Right hepatic duct) and implantation of iliac arterial conduit to the infrarenal aorta (K. External iliac artery, L. Right renal artery, M. Infrarenal aorta). (c) Overview of the described arterial reconstruction with calibrated anastomoses.

matching caliber was selected for anastomosis to the donor right hepatic artery on the graft (Fig. 1b). The stump of inferior gluteal artery and right hepatic artery of the allograft were trimmed with bevels. Anastomosis was performed with sphenoid technique, using 7-0 polypropylene running suture [8]. In the recipient, the proximal stump of the common iliac artery was anastomosed to the anterior wall of infrarenal aorta using 5-0 polypropylene running suture (Fig. 1c). The iliac arterial conduit was then delivered through retrocolic and retroduodenal location up to the right upper quadrant.

After anastomoses of hepatic venous outflow and portal vein, and reperfusion of the graft, hepatic arterial anastomosis was performed between the distal stump of external iliac artery and the proximal stump of the internal iliac artery, which was attached to the graft using 6-0 prolene running suture.

Postoperative recovery of both the donor and the recipient was uneventful. There has been no evidence of vascular complications or tumor recurrence up to 11 months after transplantation.

Intraoperative encounter with anomalous hepatic arterial anatomy or pathology in recipients of segmental liver transplantation still remains challenging. In particular, delayed hepatic arterial complications become remarkably more common in liver transplantation for cholangiocarcinoma after neoadjuvant chemoradiation [2]. In this situation, it has been recommended to completely avoid the use of an irradiated recipient hepatic artery. En bloc removal of entire hepatic hilar structures including hepatic artery may also offer some oncologic benefit. Despite successful application of iliac arterial conduits in deceased-donor liver transplantations, the use of iliac arterial conduits in LDLT may become very cumbersome

because of severe size mismatch between stumps of the donor's right hepatic artery and the conduit.

With the technique suggested by the authors herein, an iliac arterial conduit from a deceased donor can be more safely used in LDLT.

Hoonbae Jeon, Chandra Bhati, Ivo Tzvetanov, Jose Oberholzer, Kathleen Kinzer and Enrico Benedetti
*Division of Transplantation, Department of Surgery, University of Illinois, Chicago, IL, USA*

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