

Reconstruction of the Outflow Tract in Cross-Auxiliary Double-Domino Donor Liver Transplantation

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ABSTRACT

Background. Auxiliary liver transplantation is accepted as an effective manner to expand the liver donor pool. A difficult surgical technical challenge of the procedure is hepatic vein reconstruction of the graft.

Methods. To resolve this problem, complex techniques are used to perform an innovative outflow tract reconstruction in the world's first cross-auxiliary double-domino donor liver transplantation with two whole liver grafts. The inferior vena cava-sparing hepatectomy technique was applied at harvest in the two domino liver donors. For each donor, the three major hepatic veins (right, middle, and left) were joined together to create one single orifice, but there was no sufficient tissue to perform a direct anastomosis.

Results. The hepatic vein was reconstructed with the use of a longitudinally opened iliac vein graft from a cadaveric donor to prolong the outflow tract for the piggyback suturing.

Conclusions. This new technique might provide an innovative surgical approach for reconstructing the complex outflow tract of domino transplantation.

AUXILIARY liver transplantation with a living related partial graft or domino liver graft was initially introduced as a temporary or permanent support for patients with potentially reversible fulminant hepatic failure, which can also prevent small-for-size syndrome [1]. The indications of auxiliary liver transplantation have been extended to liver-based metabolic disorders [2] such as Crigler-Najjar syndrome type I, ornithine transcarbamylase deficiency (OTCD), citrullinemia type II, and primary hyperoxaluria [3–8]. In 2000, Ohno et al [9] reported a successful auxiliary partial orthotopic liver transplantation with the use of a small-volume graft (left lateral liver graft from a living donor), followed by re-section of the remnant liver 1 month later in a patient diagnosed with familial amyloid polyneuropathy (FAP) [9]. As a conceptual change in liver transplantation, two different domino donors from patients with liver-based metabolic disease can accomplish metabolic functions complementary to each other in the same recipient, so-called “cross-auxiliary double-domino donor liver transplantation.”

The technical challenge of the procedure is hepatic vein reconstruction of the domino graft anastomosing to the

same recipient by use of the piggyback manner. To resolve this problem, we performed an innovative outflow reconstruction and anastomosis. Approved by the Ethics Committee of Beijing Friendship Hospital, we planned for cross-auxiliary double-domino donor liver transplantation divided into stage 1 and stage 2.

METHODS

Surgical Techniques of Domino Liver-1 Preparation in Stage 1

In the recipient, the left hemi-liver with the middle hepatic vein (MHV) (Couinaud segments 2-4 and left part of segment 1) were preserved and the right hemi-liver (Couinaud segments 5-8 and right part of segment 1) was resected. Domino liver-1 harvesting was performed with preservation of the inferior vena cava (IVC) in the donor. The three major hepatic veins of domino liver-1 lying on different transverse planes should be sutured to the recipient's IVC.

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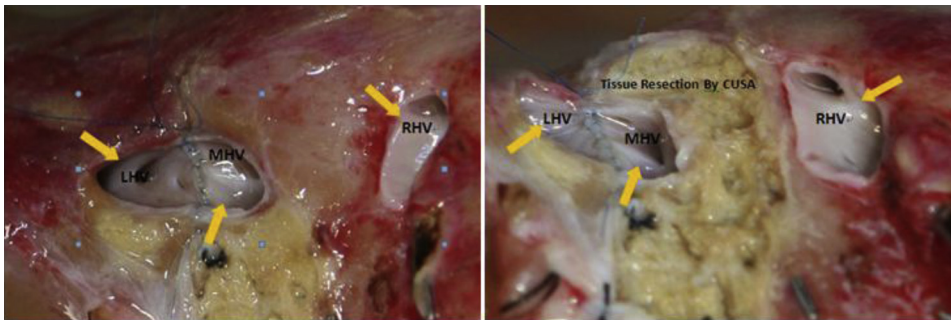


Fig 1. LHV and MHV were joined together and tissue was re-sected by means of CUSA.

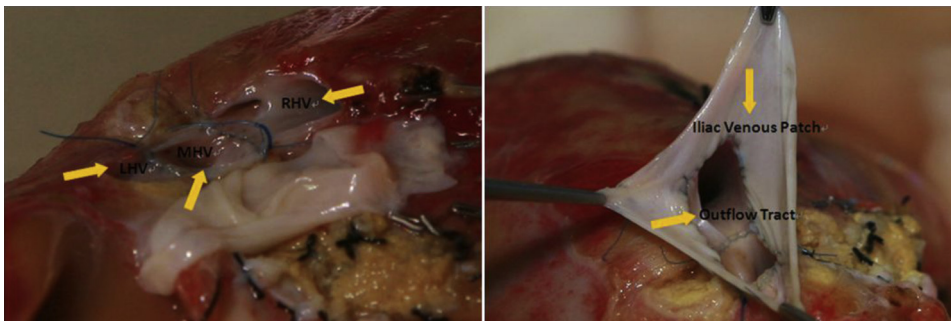


Fig 2. An iliac vein patch graft was sutured circumferentially to the three hepatic veins.

The orifices of the major hepatic veins of the domino livers cannot be performed through a direct anastomosis with the caval cuff of the domino liver transplantation recipient. Venoplasty between the left hepatic vein (LHV) and the MHV was performed first, and the orifices were joined together by suturing the nearby cuff with 6-0 polypropylene sutures. The distance between the common trunk of the MHV-LHV and the right hepatic vein (RHV) was too large to anastomose directly, so we removed the tissue between the vessels with the use of a cavitron ultrasonic surgical aspirator (CUSA) to reconstruct the three hepatic vein orifices into one anastomotic orifice (Fig 1).

The reconstructed outflow tract stump was not long enough to perform a piggyback reconstruction, so we prolonged the cuff with a vascular graft patch, the iliac vein harvested from a deceased donor at the back-table. The iliac vein graft conduit was opened longitudinally and placed on the above-mentioned venous stump with the

long side and anastomosed with a 6-0 polypropylene suture, obtaining a wide, triangular-shaped outflow (Fig 2).

As a result of remnant native left lobe, there was not enough space to transplant the graft horizontally. Also, the distance between the RHV stumps and hepatic hilar of the recipient was larger than that of the domino liver graft, so we designed the outflow tract anastomosis on the right side of the IVC vertically, sutured the stump of the RHV, and incised the right lateral wall of the IVC to obtain an anastomosis in the recipient. The transplantation procedure was carried out with standard techniques, without caval clamping (Fig 3).

Surgical Techniques of Domino Liver-2 Preparation in Stage 2

We removed the recipient remnant native liver 1 month after stage 1. The procedure of harvesting domino liver-2 and the

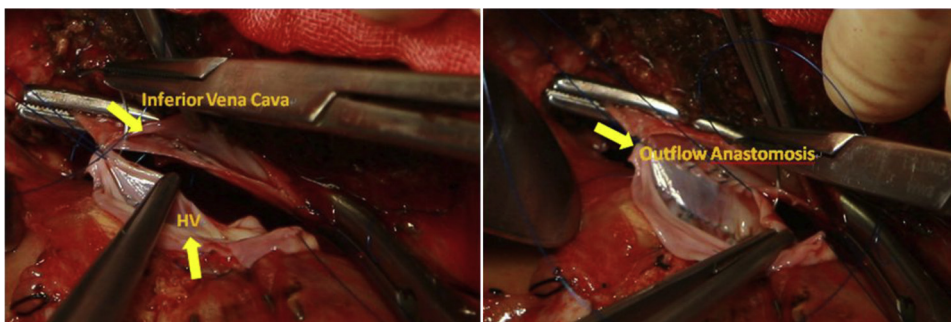


Fig 3. Reconstruction of outflow tract suturing to recipient's IVC of domino liver-1.

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