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LETTER TO THE EDITORS

Successful adult-to-adult liver transplantation of an otherwise discarded partial liver allograft with a cavernous hemangioma: new strategy for expanding liver donor pool

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Dear Sirs,

With improvement of perfusion techniques [1], the use of marginal or expanded pool donors, is increasingly common as liver donor acceptance criteria are relaxed [2], which palliates the shortage of the liver graft and was shown to have outcome similar to ideal graft [3]. We present here the first report of adult-to-adult liver transplantation of an otherwise discarded partial liver allograft containing a cavernous hemangioma (hepatic venous malformation).

A 41-year-old male, with 2-year history of hepatic hemangioma diagnosed by computerized tomography (CT), was admitted to our hospital on November 19, 2012 because of fullness and discomfort of the right upper abdomen. This time, our CT imaging analyzed by a quantitative imaging analysis system (IQQA-Liver, EDDA technology Inc., Princeton, NJ, USA) revealed a cavernous hemangioma approximately 6 × 5.8 cm^2 in size in the left lobe of the liver (Fig. 1a). The size and location of the hemangioma mandated complete left hepatic lobectomy. To expand the liver donor pool, we considered using the to-be-resected hepatic lobe as an allograft for liver transplant. We consulted the donor and his family, and obtained their informed consent to donating the to-be-resected hepatic lobe as liver graft.

A 27-year-old male patient with hepatitis B virus (HBV)-associated hepatocellular carcinoma (HCC) was considered as a candidate recipient for the to-be resected partial liver allograft. The patient was beyond the Milan criteria in terms of the giant lesion about 8 cm in diameter in cirrhotic liver from CT scans of the abdomen (Fig. 1b). The poor liver function and hepatic functional reserve from both blood test and indocyanine green (ICG) test ruled out hepatectomy. The patient has blood group A^+, which was compatible with that of the prospective donor. He was in the highest risk waiting-list because of unbearable right upper quadrant pain. Given the shortage of liver grafts and his progressing symptoms, we counseled the patient and his family, who agreed to this liver transplant and provided

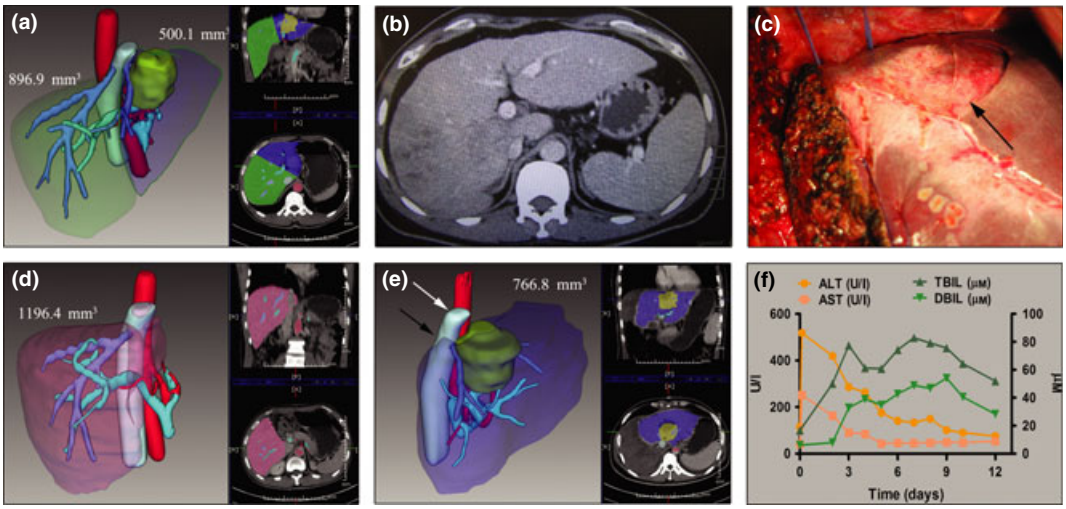

Figure 1 (a) Re-evaluated CT image of cavernous hemangioma in the donor. (b) CT showing a giant lesion in the right lobe of liver in the recipient. (c) Intraoperative view of cavernous hemangioma (black arrow). (d) Re-evaluated 11-day postoperative CT image of the remnant liver of the hemagioma patient. (e) Re-evaluated 11-day postoperative CT of the graft in the recipient (white arrow indicates the original outflow site of hepatic vein; black arrow the modified one). (f) The recipient's liver function curve during 12 days after transplant.

informed consent for liver transplant from an expanded criteria liver donor. The therapeutic decision was reviewed and approved by the Institutional Ethics Committee at the First Affiliated Hospital of Nanjing Medical University.

The graft was excised by standard partial hepatectomy. Intraoperatively, a mass 7.8 cm in diameter was found in the left hepatic lobe (Fig. 1c). The duration of the donor operation was 5 h and the blood loss was about 100 ml. The liver allograft weighed 500 g and the body weight of the recipient was 60 kg with a graft-to-recipient weight ratio (GRWR) of 0.83%. Considering the giant lesion, the transplant was considered to be a small-for-size graft with GRWR below 0.8% [4]. Hepatic graft without resection of hemangioma underwent hepatic vein reconstruction via joining the left and middle hepatic veins together, and was flushed via the portal vein with 1 l of the University of Wisconsin (UW) solution.

A modified piggyback orthotopic liver transplant procedure was performed. For veno-venous anastomosis, the hepatic venous orifices in the recipient were closed (Fig. 1e, white arrow) and a new latitudinal incision was made 3–4 cm below the closed orifices (Fig. 1e, black arrow). The reconstructed orifice in the donor graft was then anastomosed to the incision. The new incision enlarged the hepatic venous outflow to avoid the obstruction [5] and the move-down of the orifice facilitated anastomoses of the portal vein, hepatic artery, and bile duct. Total cold ischemia time was about 6 h.

On the 11th day, CT scans were performed postoperatively, showing that the graft had grown from 500.1 to 766.8 mm^3 with no observation of increase in hemangioma (66.5–66.6 mm^3), and the remnant liver from 896.9 to 1196.4 mm^3 (Fig. 1a, d and e). Blood test results demonstrated the recipient's improving liver function (Fig. 1f). When seen in January 2013, the recipient was well with normal liver function and α fetal protein of 8.9 ng/ml (normal <20 ng/ml).

Hepatic cavernous hemangioma, accurately characterized as hepatic venous malformation other than vascular tumor [6], persists throughout life without regression according to the International Society of the Study of Vascular Anomalies (ISSVA). Hepatic venous malformation can cause abdominal pain, discomfort, fullness, nausea, vomiting, and even hemorrhage from accidental rupture during trauma[7,8], which may occur in retained hemangioma within the liver graft. However, one previous report showed that retained hemangioma in liver graft was observed to shrink 6 months after transplantation [9]. In our case, a CT scan was performed 11 days after transplantation, showing increase in the graft but not hemangioma within it. The patient was still being followed up.

Our approach offers a novel strategy in expanding the donor pool by using otherwise discarded livers to bridge the patients who face grave prognosis and a long liver transplantation waiting list. Other benign hepatic tumors including hepatocellular adenoma and focal nodular hyperplasia, with the exclusion of malignancy, could be considered as donor grafts if resection of these benign lesions is strictly surgically indicated.

Conflicts of interest

The authors have declared no conflicts of interest.

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