

LETTER TO THE EDITOR

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# The first case of heterotopic auxiliary liver transplantation of discarded right hemiliver allograft with intrahepatic bile duct stones

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## To the editor:

Due to the shortage of donor organs for transplantation, liver transplantation from marginal donors has been accepted as a treatment option [1]. Technical advances in transplantation, such as auxiliary liver transplantation, reduced size transplantation, split liver transplantation and the use of living donors for partial liver transplantation, as well as changes in immunosuppression and improvements in prophylaxis, have led to improved survival rates [2, 3].

In this paper, we present the first successful case of heterotopic auxiliary liver transplantation using a discarded liver from intrahepatic bile duct stones. The procedure was modified by performing a splenectomy and implanting the graft into the splenic fossa. The patient recovered well after transplantation.

## Case presentation

A morbidly 54-year-old male presented to the emergency department with acute portal hypertension-related gastrointestinal hemorrhage. Vital signs were within the normal range. Upon admission, a physical examination revealed splenomegaly and mild ascites. Abdominal ultrasonography and computed tomography demonstrated marked liver cirrhosis and splenomegaly. He had severe cirrhosis and was on the liver transplantation waiting list in the China Organ Transplant Response

System (blood group, O+). Given his critical clinical condition, emergent liver transplantation was indicated.

Thankfully, a 24-year-old female with intrahepatic bile duct stones in the right lobe had blood group O+. The patient planned to undergo a right hemi-hepatectomy and volunteered to donate her resected right lobe, which would otherwise be discarded. The calculated volume of the right lobe on computed tomography (CT) volumetry was 286 ml, resulting in a predicted graft-to-recipient weight ratio (GRWR) of 0.49%, which is insufficient for orthotopic liver transplantation [4]. Prior to the surgical procedure, a three-dimensional reconstruction of the donor liver was created (Fig. 1A) in order to facilitate a more comprehensive evaluation of the anatomical structure.

In the surgical procedure, the porta hepatis was first exposed, followed by the right hepatic artery and right portal vein. In close proximity to the posthepatic inferior vena cava, a thick right posterior inferior vein is observed (Fig. 1B). Following the dissection of the right hepatic duct, the right anterior and posterior lobe bile ducts were clipped separately (Fig. 1C), and stones were extracted using a choledochoscope. The liver was then split along the right edge of the middle hepatic vein up to the second porta hepatis, revealing the thick right posterior inferior vein and the right hepatic vein.

After heparinization, the proximal part of vessels was clipped successively via laparoscopy. The liver graft was quickly transferred and infused with enough cold UW (University of Wisconsin) solution through the portal vein until clear solution flowed out. We then reconstructed the hepatic vein, using an artificial vessel to

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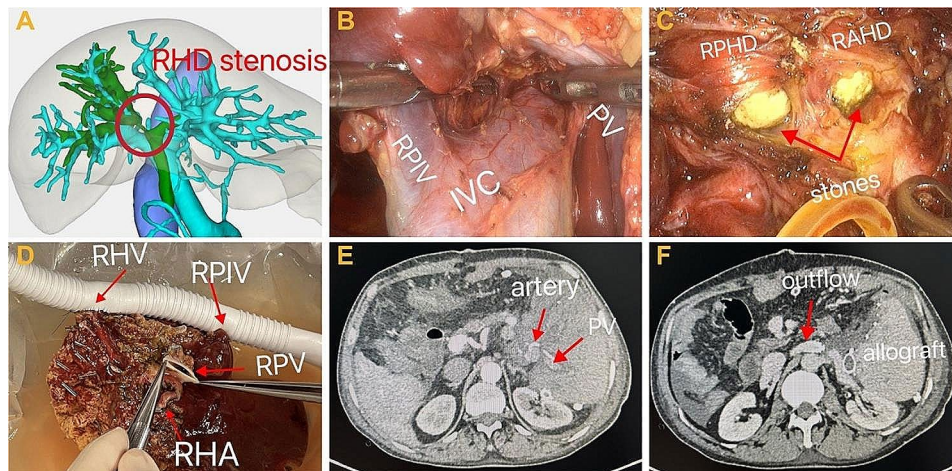
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**Fig. 1** Figure A, preoperative three-dimensional reconstruction of the patient's hepatic ducts reveals the presence of a stenosis in the right hepatic duct. Figure B, the patient exhibited a markedly enlarged right posterior inferior vein, which exerted a considerable influence on subsequent venous outflow tract reconstruction. Figure C, the intraoperative situation revealed the presence of stones within the right anterior and right posterior hepatic ducts following the incision of the stenotic right hepatic duct. Figure D, the excised right half of the liver was trimmed, the outflow tract was reconstructed, and the complete removal of the stone was confirmed. Figure E-F, postoperative enhanced CT imaging demonstrated the satisfactory condition of the grafts and vessels. RHD, right hepatic duct; RPIV, right posterior inferior vein; IVC, inferior vena cava; PV, portal vein; RPHD, right posterior hepatic duct; RAHD, right anterior hepatic duct; RHV, right hepatic vein; RHA, right hepatic artery

bring the two thick veins together (Fig. 1D). Furthermore, the complete removal of the stone was confirmed.

At the same time as the donor surgery, the recipient underwent splenectomy with excellent preservation of the splenic vessels. The absence of tumor and hepatic fibrosis was confirmed by a rapid intraoperative biopsy before transplantation to the recipient. The graft was then implanted into the recipient's splenic fossa. Anastomosis of the vessels was then performed. The reconstruction of the hepatic biliary duct was performed by Roux-en-Y biliary-jejunal anastomosis.

Recipients underwent standard thromboprophylaxis and immunosuppression were administered in the postoperative period. And the postoperative enhanced CT scan demonstrated satisfactory graft hematopoiesis (Fig. 1E-F). The postoperative recovery of the donor and recipient was uncomplicated, and they were discharged home on the 8th and 17th postoperative days, respectively. The volume of the liver increased from 286 g at the time of surgery to a predicted 642 ml (post-operative day 8), and 731 ml (post-operative day 16).

## Discussion

In this case, the patient required a splenectomy due to portal hypertension, splenomegaly, and hypersplenism. We successfully preserved the splenic vasculature and used the discarded liver with intrahepatic bile duct stones (which had been drained of stones) as a heterotopic auxiliary liver graft. This was an initial exploration, which we felt was safer compared to traditional living donor liver transplantation. The ligation of the left renal vein did not result in any impairment of renal function. In fact, the

size of the left renal vein was found to be within the normal range following the ligation of the left renal vein [5].

One potential drawback of heterotopic auxiliary partial liver transplantation for cirrhotic liver disease is the risk of carcinogenesis in the residual native liver. This issue remains to be discussed. However, as the size of the auxiliary liver increases, it can be evaluated for a second-stage resection of the native liver.

Both operations were successfully completed in the donors and recipients. The findings of our study indicate that the discarded right half of the liver following laparoscopic resection for intrahepatic bile duct stones may be utilized as an auxiliary transplanted liver for the treatment of patients with portal hypertension and need emergent liver transplantation.

## Author contributions

(I) Conception and design: Bangyou Zuo, Yu Zhang and Xinyu You; (II) Administrative support: Bangyou Zuo, Tao Liu and Yu Zhang (III) Provision of study materials or patients: Bangyou Zuo and Chong Yang (IV) Collection and assembly of data: Donghui Cheng, Jipeng Jiang and Peng Li (V) Data analysis and interpretation: (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

## Funding

The Natural Science Foundation of China (82373189), the Youth Talent Fund of Sichuan Provincial People's Hospital (2022QN53), and the Science and Technology Department of Sichuan Province (2024NSFSC1935).

## Data availability

Data are available upon request.

## Declarations

## Ethics and informed consent

The procurement of the graft from the discarded liver (living donor) were approved by the Medical Affairs Department and the Ethics Committee of the

Sichuan Provincial People's Hospital, and informed consent was obtained from the patient.

#### Disclosures

The authors of this manuscript have no conflicts of interest to disclose.

Received: 30 July 2024 / Accepted: 4 August 2024

Published online: 14 August 2024

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