

## Case Report

# Reduced-segments V and VIII liver transplantation for an acute liver failure patient with multiple osteochondromas

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**Abstract:** We describe a case of acute liver failure with multiple osteochondromas (MO) which was cured by transplantation of reduced-segments V and VIII liver and the large MO mainly located in the right ribs. A 45 year-old man presented with abdominal distention and jaundice and was confirmed to have acute liver failure, which was caused by hepatitis B associated-cirrhosis. Conservative treatment failed to improve the symptoms, and the general condition of the patient grew worse. As a last resort, liver transplantation was performed. During the operation, because of the abnormal recipient liver fossa caused by MO, reduced-segments V and VIII liver transplantation was performed. The patient survived the procedure and the perioperative period. MO is a benign disease, but it can bring adverse effects through oppressing vital organs. Reduced-segments V and VIII liver transplantation is considered as a highly technical procedure that can be performed by experienced surgeons.

**Keywords:** Reduced-size liver transplantation, multiple osteochondromas, Couinaud's segments V and VIII resection

## Introduction

Liver transplantation (LT) has gradually been accepted as an ordinary option in management of end stage liver failure [1]. However, concurrently combined LT with resection of donor liver is still a surgical challenge, which may result in high complication rate and mortality [2]. The technique of reduced-size liver transplantation has often been applied in pediatric liver transplantation [3]. However, cases regarding adult LT combined with benign mass resection of the donor liver have also been reported [4]. Hereby, we report the first case of liver transplantation after back table resection of Couinaud's segments V and VIII, and also the first case of LT for a patient with multiple osteochondromas (MO).

## Case report

A 45 year-old man with abdominal distention was feeble with yellowing of the skin and urine

for 1-month and was admitted through the Emergency Department. He had a history of hepatitis B virus infection-related cirrhosis for 5 years and MO for 30 years. He had taken herbal medicine to control hepatitis B virus infection without antiviral drugs. Although the vital signs of the patient were stable, laboratory tests showed liver function was abnormal (**Table 1**). He received magnetic resonance (MR) examination, and segments V and VIII of liver atrophy were found oppressed by a large MO (**Figure 1A**). With the examination finished, he was preliminarily diagnosed as acute liver failure, with hepatitis B virus-related cirrhosis, pulmonary insufficiency, and MO.

He received treatment of an artificial liver support system (ALSS) and supportive liver protection therapy. However, all these conventional treatments failed to prevent the general condition from growing worse. Liver transplantation was considered as the last chance. A discussion of the multi-disciplinary team (MDT) includ-

## Special reduced-size liver transplantation

**Table 1.** The laboratory indicators before and after LT

Test	When admitted	Preoperative	POD3	POD7	POD30	POD90	POD210
Albumin (g/L)	28.8	32.7	35.9	40.9	32.9	38.9	38.3
ALT (U/L)	31	45	688	126	49	15	11
AST (U/L)	70	118	470	63	198	31	35
TB (μmol/L)	396	731	244	166	30	9	41
Cr (μmol/L)	80	427	185	151	258	206	331
INR	2.34	3.03	1.32	1.52	1.41	1.17	1.11
PT (s)	26.9	33.1	14.8	17	15.9	13.1	12.3
WBC (10E9/L)	2.4	7.7	3.9	3.6	12.5	1.9	2.3
HGB (g/L)	92	73	50	59	58	44	63
PLT (10E9/L)	80	32	13	10	99	62	94

LT, liver transplantation; POD, post operation day; ALT, alanine aminotransferase; AST, aspartate aminotransferase; TB, total bilirubin; Cr, Creatinine; INR, international normalized ratio; PT, prothrombin time; WBC, white blood cell; HGB, hemoglobin; PLT, platelets.

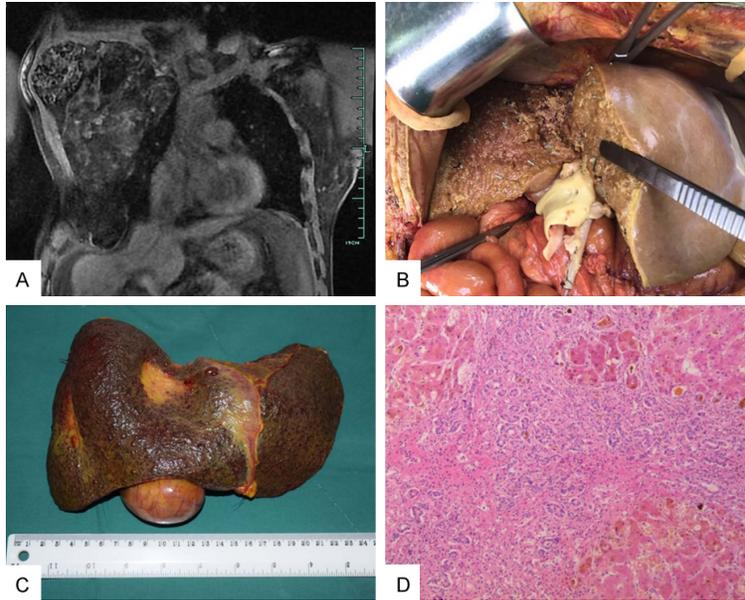
ing experts from Departments of Thoracic Surgery, Respiratory, Orthopedics, Radiology, Liver Transplantation, and Infectious Diseases was carried out. After multi-disciplinary discussion, it was confirmed that reduced-size liver transplantation was the optimal choice of surgical regiment.

Ten days after being listed on the liver transplant waiting list, a cadaveric liver from a donor dying from intracerebral hemorrhage was available. At that time, the patient fell into hepatic coma with extremely abnormal liver and kidney function and needed hemodialysis (**Table 1**). During the surgery, Couinaud's segments V and VIII of the host liver were identified to be squeezed by the giant osteochondromas of right ribs and these two segments became atrophy. The MO was too large for resection. Therefore, the giant osteochondromas occupied the space of V and VIII segments of the donor liver once implanted. Consequently, resection of V and VIII segments of the donor liver was performed on the sterile platform. Using intraoperative ultrasonography, we precisely locate the middle hepatic veins. An incision was performed in the liver parenchyma close to the right of the main trunk of middle hepatic vein, and all the ducts in the cut surface were carefully separated, ligated, and severed. Subsequently, another incision was performed in the liver parenchyma close to the left of the main trunk of the right hepatic vein. With incisions deeper and deeper, the two incisions were confused in the surface of the inferior vena cava. After successfully isolating the V, VIII segments of the donor liver, the main ducts

of V, VIII segments were sutured and cut under adequate exposure. Finally, the remaining liver was weighted at 1857 g, and the graft to recipient weight ratio was 0.025.

At the same time, the liver of the receptor was dissociated and removed to prepare for implanting the graft (**Figure 1B**). Venous anastomosis was performed through using the piggy-back method. Anastomosis of the portal vein and liver artery was end-to-end. To avoid stricture of bile duct, the anastomosis was duct-to-duct with interrupted sutures, which was considered as a criterion [5]. When completing the transplantation, we confirmed that the blood flow index parameter of the donor liver was normal with the help of intraoperative ultrasound. The total operation time was 7 hours. The pathology of the resected liver from the host was confirmed to be liver cirrhosis by final pathological examination (**Figure 1C, 1D**).

After the operation, treatments addressed ascites and slight bile leakage and to reduce portal pressure to curb the ascites. Complete correction of coagulation parameters was achieved within 2 days post-transplantation. There was a dramatic fall in the bilirubin level within 3 days after LT (**Table 1**). However, the kidney function failed to be successfully recovered after the operation and the patient received hemodialysis for a long-term. In addition, the patient suffered pulmonary infection with a result of *Burkholderia cepacia* found in his sputum culture. Additionally, the patient underwent reoperation 34 days after the first operation due to rupture of the incision. Finally,



**Figure 1.** The material of the patient. A. MR sagittal view showed the broad area of MO and the abnormal of liver fossa. B. Reduced-segments V and VIII liver transplantation before reperfusion. C. The V, VIII segments of the recipient's liver was atrophic. D. The pathology of the diseased liver showed disappearance of hepatic lobular structure in this field.

although the renal failure persisted, the patient recovered satisfactorily and was still in good condition 7 months after LT (Table 1). Through follow-up, it was confirmed that MO of the patient had no any change after LT.

### Discussion

LT is a curative treatment for patients with fulminant liver failure, however, it is a complicated technique [6]. Precise hepatectomy of Couinaud's segments V and VIII had come true as the operation skill and instruments improved [7]. However, key points of techniques combining LT with hepatectomy of Couinaud's segments V and VIII were still obscure. In our case, the patient presented a history of MO, and osteochondromas of the right ribs was large. Osteochondromas is a benign lesion that can be treated without operation [8]. In the current case, osteochondromas of ribs was too large to be resected. In addition, according to the results of imaging examination and intraoperative condition, we observed that Couinaud's segments V and VIII of host liver were squeezed by the giant osteochondromas. In order to match the space of hepatic fossa of the receptor best, we had to perform reduced-segments LT.

During the process of reducing segments of the donor liver, the difficult points were the precise hepatectomy along two main hepatic veins and dealing with the main duct of Couinaud's segments V and VIII. In this case, we precisely found the exact locations of the main hepatic vein with the help of intra-operative ultrasonography to confirm the resection margins. The resection margins should not be sutured reluctantly and the needle should not prick into the liver parenchyma too deep to prevent the blood outflow of the remained liver being blocked like Budd-Chiari syndrome. Any procedure close to the main hepatic vein must be carefully and gently performed to avoid rupturing the tiny branch of the hepatic vein. In addition, to

avoid bleeding from the bare inferior vena cava and to reduce the difficulty of the operation, we advocated that it is not necessary to remove the piece of liver which covers the inferior vena cava. Since lacking perfect exposure, it was a tricky business to deal with the main ducts of Couinaud's segments V and VIII at the beginning of the operation. But since the two incisions were performed in the liver parenchyma deeper and deeper, and the V, VIII segments were successfully isolated, the anatomical relationship between the main ducts of right half liver and VI, VII segments was clearly presented. Therefore, we could safely deal with the main ducts of V, VIII segments.

Because of the two huge section planes of the liver and MO existing, the postoperative treatments of the patient were more complicated than those of ordinary LT. Portal hypertension and ascites would appear until regeneration of the remnant liver takes place, but this phenomenon could be controlled by vasopressin. Respiratory dysfunction secondary to infection and chest malformation required prolonged mechanical ventilation and delayed the recovery time. The wound ruptured because of intra-abdominal hypertension and the hacking cough. Intra-abdominal hypertension in our

case was associated with swelling of gut and mesentery, flatus, and constipation caused by portal hypertension [9, 10]. Moreover, we believed that MO also played an important role in intra-abdominal hypertension. Normally abdominal pressure can decrease through the elevated diaphragm and chest expansion. But in this patient, the malformation of chest caused by the MO limited chest expansion which further restricted the raising of the diaphragm. Although the patient was cured after LT in this case with the help of MDT, the recovery process was painstakingly slow. Kidney failure secondary to acute liver failure persisted and required hemodialysis, and renal anemia needed regular blood-transfusion. Fortunately, there were no other serious complications after LT.

### Conclusion

This case shows the feasibility of performing such reduced-size liver transplantation in a patient with abnormal hepatic fossa caused by the giant osteochondromas of right ribs. Though MO is a benign disease, it can result in harmful consequences through oppressing vital organs. In retrospect, it is necessary to attach importance to the influence of giant osteochondromas in the chest wall, and add relaxation suture when sewing up the incision to avoid rupture of incision. This kind of LT is very difficulty and demands superior surgical skill which should be performed by experienced surgeons. Reduced-segments V and VIII liver transplantation could be successfully performed as well. However, the key points of this technique are still obscure, and more related studies should be performed.

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### Disclosure of conflict of interest

None.

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