Superextended Hepatectomy for Resection of Multiple Giant Hemangiomas: Report of a Case

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Abstract
Most liver hemangiomas are small, asymptomatic, and require no treatment. Symptoms such as right upper quadrant abdominal pain and fullness are associated only with liver hemangiomas larger than 4 cm in diameter. Serious complications such as jaundice, Kasabach–Merritt syndrome, and rupture are rare. Surgical resection is the only effective treatment, but it is advocated only for patients with incapacitating symptoms or complications. We report a case of successful superextended hepatectomy with resection of segments III–VIII for multiple, bilobar hemangiomas. A 45-year-old woman, who had undergone transcatheter arterial embolization (TAE) for inoperable multiple giant liver hemangiomas 4 years earlier, was referred to our hospital for investigation of abdominal distension and consumption coagulopathy. Because of her severe and progressive symptoms despite treatment, the other hospital had considered her as a candidate for liver transplantation, which she had refused. After careful preoperative assessment of the future liver remnant volume and function, we considered that resection was possible. Based on our review of large surgical series in the literature from 1970, this is the first report of a superextended hepatectomy for a benign liver tumor.

Key words Liver hemangioma · Kasabach–Merritt syndrome · Consumption coagulopathy · Liver benign neoplasm · Giant hemangioma of the liver · Extended liver resection

Introduction
A range of treatment options exists for liver hemangiomas, from observation to various radiological and surgical procedures. When treatment is needed, surgical excision of the hemangioma is most effective, and associated with low morbidity and mortality. Other treatments, including transcatheter arterial embolization (TAE), arterial ligation, radiotherapy, corticosteroid therapy, and liver transplantation, have been employed for large unresectable lesions. Apart from liver transplantation, however, the long term effect of these methods usually cannot be anticipated. We report a case of multiple giant hemangiomas, treated by superextended resection, of segments III–VIII, after careful evaluation of predicted remnant liver function. Before referral, this patient had been offered liver transplantation because of her severe symptoms and extensive tumors.

Case Report
A 45-year-old woman was admitted to our hospital with severe abdominal bloating. About 4 years earlier multiple giant hepatic hemangiomas had been diagnosed, the largest lesion measuring 16 cm in diameter, and involving the right lobe and the medial segment of the left lobe. Otherwise her medical and family histories were unremarkable. She had never used contraceptives. She had been treated by transcatheter arterial embolization (TAE) to decrease the size of the tumors and alleviate her symptoms, since complete resection of the lesions had been considered impossible because of their large size and bilobar location. About 1 year after diagnosis, superselective embolization of subsegmental arterial branches in segment III had been performed twice, and 1 year later, the right hepatic artery had been embolized. However, there was no reduction in the size
of the hemangiomas and her symptoms persisted. Thus, liver transplantation had been recommended, but she had refused this treatment option. The patient was then referred to our hospital for further assessment and possible surgery.

On examination, her abdomen was distended by massive hepatomegaly, with the liver extending below the umbilicus. Biochemistry tests were normal, except for mild “asymptomatic” Kasabach–Merritt syndrome, and liver function was preserved. Routine blood tests revealed a prothrombin time of 87.6%, a platelet count of 108,000/μl, and a γ-glutamyltranspeptidase level of 99 U/l. More detailed hematologic evaluation revealed a low fibrinogen level of 155 mg/dl with an elevated D-dimer level of 12.9 μg/dl and fibrin degradation products of 41 μg/ml.

Computed tomography (CT) revealed a central hilar mass involving segments III, IV, V, VI, VII, and VIII. The segment VI bile duct was also dilated as a result of compression by the hemangioma (Fig. 1). Portography and angiography, reconstructed from multidetector-CT scans, revealed compression of the portal vein and hepatic artery at the hilum. The right hepatic artery and the portal vein were displaced and stretched by the tumors. There was no aberrant arterial supply to the liver. The middle and right hepatic vein were compressed between two hemangiomas, but the left portal vein and left hepatic vein were patent. Intravenous cholangiography-CT revealed severe compression of the bile ducts at the hepatic hilum.

The plasma disappearance rate of indocyanine green (KICG) was 0.178. Comprehensive preoperative imaging and assessment of liver function suggested that extended liver resection was feasible. The right-sided hemangiomas occupied segments VII and VIII. The tumor compressed the right and middle hepatic veins and the bile duct of segment VI, which was dilated on the CT scan (Fig. 1). As preservation of segments V and VI did not seem feasible, we decided to perform right trisectionectomy with resection of segment III. A volumetric study using CT revealed the total volume of the functioning liver, apart from the tumor, to be 767 ml. The volume of segments I and II was 17 ml (2.2% of the functioning liver) and 312 ml (39.8% of the functioning liver), respectively. The KICG for the predicted functional remnant liver (FRL) was calculated (KICG×% volume of the predicted FRL/100) as 0.075.

We performed en-bloc resection of segments III–VIII with preservation of the left hepatic duct. The operating time and blood loss were 488 min and 2447 ml, respectively (Fig. 2). Macroscopically, the tumors were partly spongy with a central zone of fibrotic scar tissue. Micro-