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Case Report

A Left-Sided Approach for Resection of Hepatic Caudate Lobe Hemangioma: Two Case Reports and a Literature Review

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Resection of the hemangioma located in the caudate lobe is a major challenge in current liver surgery. This study aimed to present our surgical technique for this condition. Two consecutive patients with symptomatic hepatic hemangioma undergoing caudate lobectomy were investigated retrospectively. First, all the blood inflow of hemangioma from the portal vein and the hepatic artery at the base of the umbilical fissure was dissected. After the tumors became soft and tender, the short hepatic veins and the ligaments between the secondary porta hepatis were severed. At last the tumors were resected from the right lobe of the liver. The whole process was finished by a left-sided approach. Blood lost in Case 1 was 1650 mL because of ligature failing in one short hepatic vein, and in the other case, 210 mL. Operation time was 236 minutes and 130 minutes, respectively. Postoperative hospital stays were 11 and 5 days, respectively. The diameter of tumors was 9.0 cm and 6.5 cm. Case 1 required blood transfusion during surgery. No complications such as biliary fistula, postoperative bleeding, and liver failure occurred. The left-sided approach produced the best results for caudate lobe resection in our cases. The patients who recovered are living well and asymptomatic. Caudate lobectomy can be performed safely and quickly by a left-sided approach, which is carried out with optimized perioperative management and innovative surgical technique.

Key words: Caudate lobe – Hemangioma – Left-sided approach hepatectomy – Surgical technique

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The caudate lobe is considered to be a separate and distinct liver lobe with its own vascularization and biliary drainage. It is generally divided into 3 portions: the left Spiegel lobe (Couinaud's segment 1), the process portion, and the paracaval portion (Couinaud's segment 9).[1–3] The caudate lobe is an autonomous segment of the liver and is surgically difficult to approach because of its deep location in the hepatic parenchyma beneath the confluence of the main hepatic (left and middle) veins and its adjacency to the porta hepatis, the ligamentum venosum, and the inferior vena cava. The unique anatomic location and specific anatomic features of the caudate lobe render resection technically challenging.[3–5] Surgeons have emphasized caudate lobectomy since the report written by Nimura *et al* in 1990.[6] Isolated or combined caudate lobectomy is a selective method for a mass originating from the caudate lobe or hepatobiliary cancer invading the porta hepatis.[7–10] Among various types of caudate lobectomy, isolated complete resection of the caudate lobe is the most technically difficult and always a challenge, even to accomplished hepatobiliary surgeons.[10] Caudate lobectomy is now considered to be the most appropriate surgical treatment for benign tumors in the caudate lobe and is increasingly performed. However, how to resect the caudate lobe safely is still a major challenge to the hepatobiliary surgeon. Currently, hepatic hemangioma is the most frequently diagnosed benign liver tumor.[11,12] From November 2012 to December 2013, 2 patients underwent caudate lobectomy due to hemangiomas at our hospital. In these 2 cases, a left-sided approach was performed successfully and the patients recovered well.

Case Report

From December 2012 to December 2013, 2 female patients underwent caudate lobectomy for symptomatic hemangiomas. The patient in the first case was 48 years old (Case 1) and the second one was 36 years old (Case 2). Preoperative Child-Pugh classification of liver function was grade A. The main complaint was distending pain in the upper abdomen. The diagnosis of hemangioma of the caudate lobe was confirmed by abdominal computed tomography (CT) scan in the 2 patients (Figs. 1 and 2).

The resection chose a right sub-rib margin incision. At the initiation of the operation in Case 1, we tried to dissect the short hepatic veins as we did in the hepatic cancer of caudate lobe.[12]

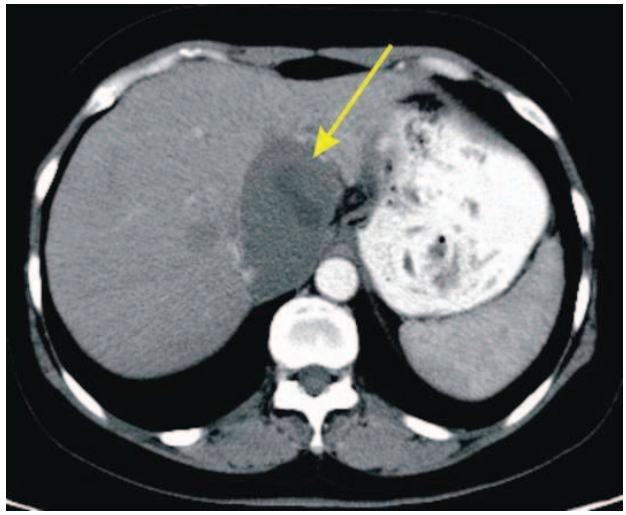

Fig. 1 A low-density hemangioma (arrow), 6.5 cm in diameter, in paracaval portion and Spiegal's lobe is demonstrated in CT scan of case 1.

However, it was difficult without the blockade of blood inflowing to the liver, and bleeding was not easy to control. Therefore, we changed the method to the left-sided approach. And we used this approach in Case 2 as well. This procedure involved the following steps:

Step 1. Mobilization of the liver: First, we cut off the ligamentum teres hepatis and the falciform ligament. Second, the lesser omentum, the left and right coronary ligaments and triangular ligaments

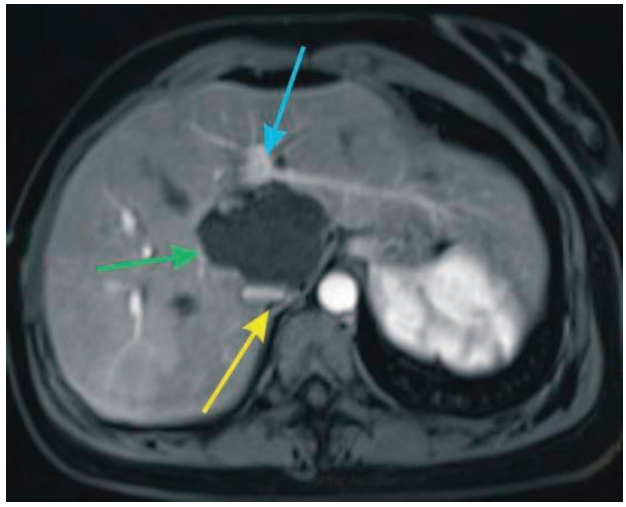

Fig. 2 A low-density hemangioma (green arrow), 9.0 cm in diameter, in caudate lobe is demonstrated in CT scan of case 2. The yellow arrow shows the compressed inferior vena. The blue arrow shows the first porta hepatis.

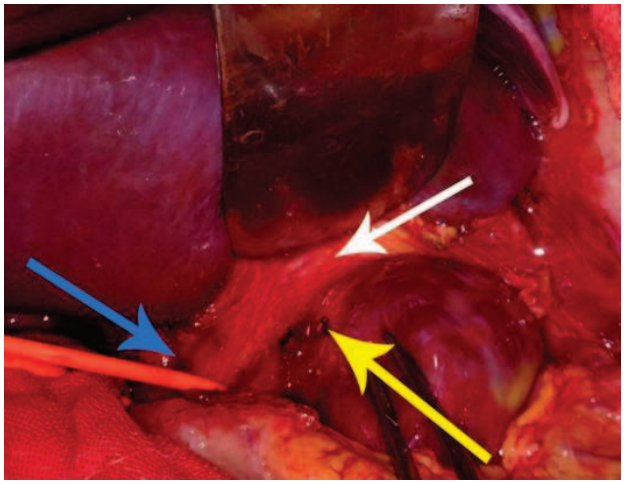

Fig. 3 The portal triads to the caudate lobe were divided (yellow arrow), and the adhesion between the hemangioma and ligamentum venosum (white arrow) was dissected up to its junction with the left hepatic vein. The blue arrow shows the hepatoduodenal ligament.

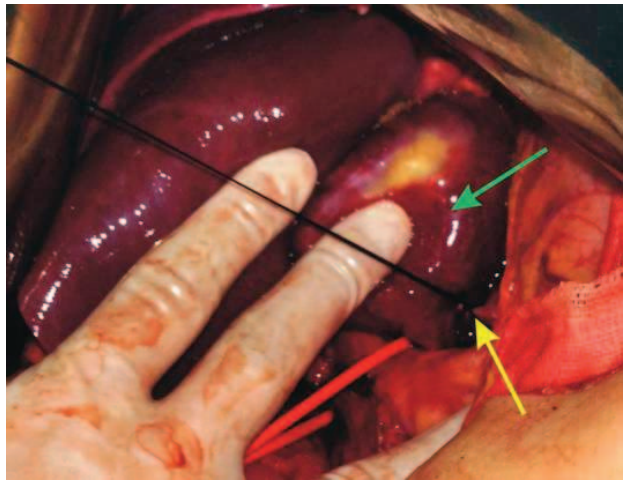

Fig. 4 The compressed hemangioma (green arrow) was drawn to the rightward; the short hepatic veins were dissected. The yellow arrow shows the posteroinferior hepatic vein.

as well as the hepatorenal ligament were also cut off. The suprahepatic inferior vena cava (SIVC) was dissected, and the major hepatic veins were exposed so that they could be blocked in case of massive bleeding

Step 2. Devascularization of the caudate lobe: The inflow blood supply of the caudate lobe from the portal vein and the hepatic artery at the base of the umbilical fissure were dissected and divided after isolating the hepatoduodenal ligament and drawing it anteriorly and rightward (Fig. 3). The adhesion between the hemangioma and ligamentum venosum to its junction with the left hepatic vein was dissected. Next, the caudate hepatic ducts were divided. The hemangioma became smaller and softer after the blockade of its blood supply and being compressed.

Step 3. Bent up the left lateral lobe, drew the left liver rightward and anteriorly. After compressing the hemangioma tenderly and drawing the hemangioma slightly to the right and anteriorly, the short hepatic veins could be cut off in direct viewing. We cut off the short hepatic veins on the left anterior of the inferior vena cava and then the right part (Fig. 4).

Step 4. Drew the hemangioma downward slightly and dissected the upper pole of the caudate lobe from the undersurface of the middle and the left hepatic veins. Usually, there was no vessel between them, just some connective tissues.

Step 5. Drew the hemangioma leftward, severed the caudate lobe from the right lobe with ultrasound scalpels. Then the hemangioma was entirely taken off (Fig. 5).

The operative time was 236 minutes in Case 1 and 130 minutes in Case 2. Case 1 required transfusion of 1200 mL red blood cells and 400 mL plasma during surgery because ligature silks of 1 short hepatic vein fell off. And there was no transfusion in Case 2 as only 210 mL blood lost during the operation. The drainage of the 2 patients was minimal after operation; no complication such as biliary fistula, postoperative bleeding, and liver failure was observed. No complaints of discomfort

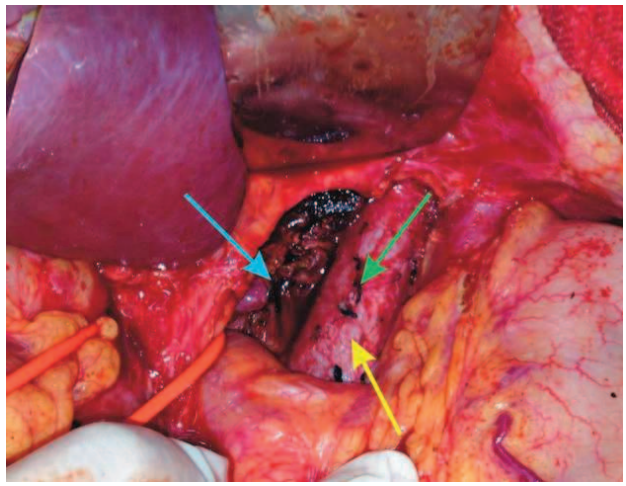

Fig. 5 The hemangioma was entirely taken off. The yellow arrow shows the inferior vena cava; the green arrow shows the ligature of the stump of short hepatic vein. The blue arrow shows the stub of hemangioma to the right posterior lobe.

were heard from these 2 patients. The postoperative hospital stay was 11 days in Case 1 and 5 days in Case 2. Postoperative histologic examination of the specimen demonstrated cavernous hemangioma. The tumor size was 9.0 × 7.5 × 6 cm and 6.5 × 6 × 5 cm respectively.

Discussion

Caudate lobectomy is a technique-demanding procedure that entails the surgeon's judgment and knowledge of liver anatomy. Therefore, it has been considered a very difficult and dangerous operation.[13] The caudate lobe is not only deeply embedded between the hilar structures of the liver and the inferior vena cava but also has its own independent blood supply and biliary drainage. Although that resection of caudate lobe hemangioma is not a common operation, caudate lobe hemangioma is increasingly reported in the literature.

Cavernous hemangioma is the most common benign lesion of the liver, with an incidence varying from 0.4% to 20%.[14] Generally, hemangioma is asymptomatic unless it is very huge. The clinical manifestations are usually nonspecific and chronic. The frequently seen symptoms include abdominal pain, nausea, vomiting, obstructive jaundice, and hemorrhage. Occasionally, external compression of inferior vena cava may lead to edema and or deep vein thrombosis of the lower limbs.[15] Because caudate lobe is located between the inferior vena cava, porta hepatis, stomach, and duodenum, caudate hemangioma often presents more evident symptoms than those located in the other part of the liver. The patients with caudate hemangioma might complain about epigastric discomfort just like our patients. Therefore, hemangioma in caudate lobe needs more active resection to avoid adding difficulty and danger during the resection of bigger hemangioma of caudate lobe. Unfortunately, literatures on this topic are rare. We searched PubMed using the key words "caudate lobe" and "hemangioma" until March 2014, and only 9 papers describing caudate lobectomy for hemangioma were found.

Resection of the caudate lobe with a large hemangioma is a difficult and dangerous operation. It is difficult to perform because of its location beneath the liver and adjacency to the inferior vena cava, porta hepatis and major hepatic veins. In any case, preserving the hepatic function reserve and decreasing the adverse damage is one of the main objects of our operation. There are 3 approaches to access and resect the tumor of the caudate lobe, including the right, left, and anterior approaches.[16] However, which approach should be chosen in resection of the caudate lobe is determined by the location and size of the tumor as well as the hepatic functional reserve.[17,18] The characteristic of the tumor is another factor that we should take into account when we choose the approach. As we resected the hepatic cancer of the caudate lobe,[12] the right approach was chosen. Some authors recommended right approach for a tumor in the process portion or left approach for a tumor in the Spiegel's lobe.[18] As for some huge tumors of the caudate lobe, especially tumors located in the paracaval portion, some authors recommended anterior transhepatic approach.[10,19,20] This technique requires splitting the liver from the interlobar plane, which needs more time and might damage the liver tissue,[21] some abnormal vessels, and bile ducts. In some cases of major vessels or duct damage, hemihepatic resection might be carried out, which would be more challenging and dangerous.

Herein, we resected the hemangiomas by the left-sided approach in our cases. We used this method because the hemangioma was a benign tumor. As to the hepatocellular cancer of caudate lobe, the short hepatic veins were severed firstly to avoid the metastasis of cancer through them when we resected the hepatocellular cancer of caudate lobe.

During the operation, the inflow blood control was the first critical step. At the initial of resection, we severed the inflow caudate blood supply from the portal vein and the hepatic artery at the base of the umbilical fissure. After all the blood inflow was blockaded, the tumor became soft and tender with the oppression of the hemangioma, which would make the operation easier. Then we could draw it rightward and sever the short hepatic veins, which was the second critical procedure. At this time, we could sever the hepatic tissue along the ischemic line and divide the caudate lobe from the posterior surface of the second porta hepatis.

The short hepatic veins were prone to bleeding. Actually, in Case 1, 1500 mL of blood was lost just because of the failing of ligature of 1 short hepatic vein, so blood transfusion was required. In this case, the operator suppressed the spot of bleeding by the finger immediately and sutured it with 5-0 Prolene (Johnson & Johnson, Shanghai, China). We came to the conclusion that the veins should be ligated and sutured with 5-0 Prolene carefully. Although the

interface between the caudate lobe and the middle and left hepatic veins has no vessel generally, injury to the veins and inferior vena cava may lead to massive bleeding and the danger of air embolism. Therefore, controlling tapes encircling the suprahepatic and infrahepatic inferior vena cava were regularly placed at the beginning of the operation to control hemorrhage even though these were rarely used.

The left-sided approach had no blockade of blood inflow of reserved liver. Since blockade and reperfusion of blood may cause ischemia-reperfusion injury to the liver, no blockade is the simplest method to avoid ischemia-reperfusion injury to the liver.[17] So this technique has little injury to the liver function. Although resection of hepatocellular cancer arising from the caudate lobe with a left-sided approach might be lengthy and bloody,[21] we resected the caudate hemangioma with this approach safely and quickly because the hemangioma is benign tumor, which can be compressed and become much smaller after the blood is squeezed out.

In summary, this technique is low-invasive and has no additional damage to the liver tissue, whereas less technique is challenging and much safer. But this can only be used in the resection of hemangioma of caudate lobe without severe cirrhosis.

Acknowledgments

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