Laparoscopic caudate lobe resection for the treatment of hepatolithiasis

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Abstract

Background: To explore the safety and feasibility of laparoscopic caudate lobe (CL) resection for the treatment of hepatolithiasis.

Methods: A retrospective study of nine patients who received laparoscopic CL resection for treatment of hepatolithiasis in our hospital from January 2013 to April 2017. Of these cases, we studied the patients' demographic data, the operation time, blood loss, post-operative hospital stay, post-operative complications and prognosis.

Results: All the nine cases are performed successfully; the post-operative recovery was symptom free except for one case of post-operative bile leakage. Among them, there were six cases of CL resection in combination with other lobe, three cases of separate CL resection, and three cases of whole CL resection. The average operative time was 310 min (Range: 180–450 min), the average intraoperative blood loss was 530 ml (Range: 100–1000 ml), average post-operative hospital stay was 9 days (Range: 6–13 days), average total hospital stay was 10 days (Range: 9–19 days). Intraoperative calculi exhaustion rate was 66.7% (6/9), which at the end of treatment was 88.9% (8/9). No cases had calculi recurrence.

Conclusion: The application of laparoscopic CL resection is feasible and safe.

Keywords: Caudate lobe, hepectomy, hepatolithiasis, laparoscopy

INTRODUCTION

The occurrence of hepatolith in the East and Southeast Asian countries is much higher than that in the Western countries, the liver resection is a major treatment of hepatolith.¹,² With the development of laparoscopic hepectomy technique, the evidence of post-operative complications is decreased while surgical effects are enhanced unceasingly.¹⁻⁵ Caudate lobe (CL) is located in the middle of the liver, there are much difficulty and the risks for an open-CL resection surgery and many more challenges for laparoscopic approach.⁶⁻⁸ There were little literature reports for a laparoscopic CL resection, in this article, we shared our initial experience of laparoscopic CL resection for the treatment of hepatolithiasis.

This was a retrospective study in patients from January 2013 to April 2017, a total of nine patients had undertaken laparoscopic
CL. resection for the treatment of hepatolithiasis in our department. There were four male and five female patients with a mean age of 63.7 (Range: 58–73) years. Pre-operative hepatolithiasis was diagnosed by computed tomography or magnetic resonance cholangiopancreatography. Among nine cases, the stone was located in one case of the left lobe (LL) + Spiegel lobe (SL), two cases of LL and caudate process (CP) and common bile duct (CBD) and SL, one case of CP + CBD, two cases of CP and SL and CBD and paracaval portion (PP), one case of the right lobe and CP and SL and PP and CBD, one case of LL and CP and anterior segment and one case of the left lateral segment and CP and CBD [Table 1]. Pre-operative jaundice had a mean total bilirubin level of 49.7 umol/L (Range: 21.1–234.3 umol/L, 5.1–19.0 umol/L normal range in our hospital), and a mean direct bilirubin level of 39.2 umol/L (Range: 8.6–215.4 umol/L, 0–7.1 umol/L normal range in our hospital).

METHODS

All operations were performed by the same surgeon. Patients who received hemihepatectomy with caudate resection will get preoperative 3D reconstruction, which was of great significance for us to understand the distribution of biliary calculi and the volume of residual liver. The patient was intubated in a supine position with a 20° head-up tilt. After undergoing tracheal intubation and induction of general anesthesia, a CO₂ pneumoperitoneum was created through an open Veress-assisted technique. A 30° telescope was used to inspect the peritoneal cavity. Five trocars were used: a 10-mm telescope trocar in the midline above the umbilical scar; two 5-mm ports were placed cranially in the left/right anterior axillary line, respectively. Another two were placed cranially in the lateral to the rectus muscles of umbilical horizontal, 5-mm at left and 10-mm at right [Figure 1]. An intraoperative liver ultrasound is performed to identify the localisation of stone and major blood vessels.

Left liver lobe with SL resection is shown in Figure 2A. First, dissection of the porta hepatis dividing artery and portal vein of the left hepatic and SL, respectively. Then, dissection of the left vena cava ligament and dividing the left-short hepatic vein. Finally, resection of the left liver and SL lobe, respectively.

Right liver lobe with the CL resection is shown in Figure 2B. First, dissection of the first porta hepatis, dividing the right hepatic artery and portal vein before arteriovenous of CP, dissection of the short vein of right hepatic, open the vena cava on the right side ligament, dissected the right hepatic vein and which was prepared for stamping then, divide the left vena cava ligament at the left side of hepatoduodenal ligament, left-hepatic short veins, the artery and portal vein of SL. Then, divide the hepatic vein ligament, exposing common trunk of the middle and left hepatic vein, divide the SL and push it to the right side of hepatoduodenal ligament. Finally, resection of the right liver and CP and PP, respectively.

A single total caudate resection [Figure 3]: first, the CP arteriovenous vein was dissected from the right hepatic

Table 1: Perioperative data for nine patients

| Gender | Female | Female | Male | Male | Female | Male | Female | Male | Female |
|--------|--------|--------|------|------|--------|------|--------|------|--------|
| Age    | 63     | 73     | 64   | 61   | 60     | 58   | 67     | 70   | 68     |
| Bile duct surgery history | No | No | LH | LC | No | OC | No | No | No |
| Location of stone | LL + SL | LL + CP | SL + CBD | CP + SL | LL + SL | LL + CP | SL + CBD | CP + SL | LL + SL | LL + CP | SL + CBD | CP + SL | LL + SL | CP + SL |
| Removed parts | LL + SL | LL + SL | CP | CP + SL | LL + SL | LL + SL | CP | CP + SL | LL + SL | CP + SL | LL + SL | CP + SL | LL + SL | CP + SL |
| Operation time (min) | 260 | 450 | 300 | 200 | 420 | 250 | 290 | 440 | 180 |
| Bleeding (ml) | 300 | 1000 | 850 | 100 | 1000 | 200 | 400 | 800 | 100 |
| Post-operative hospital stay (days) | 11 | 13 | 10 | 7 | 8 | 7 | 8 | 10 | 6 |
| Intra-operative residual stone | No | Yes | No | No | No | Yes | No | No | No |
| Residual stone after treatment | No | No | No | No | No | No | No | No | No |
| Stone recurrence | No | No | No | No | No | No | No | No | No |

LH: Left hepatectomy, LC: Laparoscopic cholecystectomy, OC: Open cholecystectomy, LL: Left lobe, RL: Right lobe, CP: Caudate process, AS: Anterior segment, LLS: Left lateral segment, SL: Spiegel lobe, PP: Para caval portion, CBD: Common bile duct.

Figure 1: Placement of the four ports
pedicle, and then the ligament of the right vena cava and the right-hepatic short vein were dissected. Then, turn to the left hepatoduodenal ligament, dissecting from the left hepatic pedicle to vena cava, cut the left-hepatic short vein, continue dissecting upward to the co-trunks of the left and middle hepatic vein. Finally, PP and CP were removed on the right side of the hepatic duodenal ligament and the SL lobe was removed on the left side of the hepatic duodenal ligament.

Parenchymal transection was performed cephalad using an ultrasonic scalpel, combined with Hemo-lok or absorbable clips to clip the blood vessels and bile ducts with diameter of >3 mm. The resection surface was checked carefully for biliary leaks, bleeding was controlled with the argon beam coagulator and keep the pressure was <14 mmHg, macrovascular was sutured with a 4–0 prolene nesis to stop the bleeding, bile ducts and CBD were explored by choledochoscope, placing a T-tube in CBD if it is not clear whether the stone was totally removed or not, then a continuous single-layer suture of the resected bile duct surface with a 3–0 absorbable nesis. A total of 1 or 2 small suction drains were inserted and positioned at the resection site through the right 5-mm trocar.

RESULTS

All the perioperative data are shown in Table 1, and no cases transformed to an open surgery. About three of nine cases had a history of bile duct surgery. Among the nine cases, there were six cases of CL resection in combination with other lobe, three cases of separate CL resection and three cases of whole CL resection. The average operative time was 310 min (Range: 180–450 min), average intraoperative blood loss was 530 ml (Range: 100–1000 ml), average post-operative hospital stay was 9 days (Range: 6–13 days) and average total hospital stay was 10 days (Range: 9–19 days). Intraoperative calculi exhaustion rate was 66.7% (6/9), which at the end of treatment was 88.9% (8/9).

All the cases were followed up to June 2018, no cases had calculi recurrence. Post-operative complication was bile leakage in one case, there were no incision infection, abdominal cavity infection, abdominal bleeding or liver failure cases. Our date compared with the former reported CL resection data is shown in Table 2.

DISCUSSION

Due to improved laparoscopic instruments and increasing experience with laparoscopic and liver surgery, the technical difficulty of laparoscopic liver resection (LLR) is slowly being overcome, more and more centres could perform a variety of LLR such as laparoscopic left, right, middle or even expand the right and left liver resection.[9–11] More recently, LLR for lesions located in the post-erosuperior segments (Couinaud segments 1, 4a, 7 and 8) has been reported on by some surgeons who have great experience in the field.[12–14] A recent systematic review indicated that laparoscopic hepatectomy is associated with less blood loss, less narcotic dose requirements and shorter length of hospital stay, with no difference in the complication rates or oncological outcomes as compared with open hepatectomy.[19] While the hepatic CL has generally not been considered amenable to laparoscopic treatment because its anatomic position between the hilar plate and inferior vena cava (IVC) technically interferes with the application of the
usual laparoscopic approach to the treatment of primary and metastatic lesions in this liver segment.

Conventionally, open CL resection including the left-sided, right-sided and anterior transhepatic approaches. It is generally believed that Pringle manoeuvre would cause liver warm ischaemia reperfusion during the operation and blocking IVC for a long time could cause abdominal viscera and lower limb extravasated blood. Furthermore, haemostasis under laparoscopy is more difficult than laparotomy, so we emphasise the vascular occlusion of the hepatic segments (lobes) which need to be resection is the first important steps must be carried out.

The liver will lose the normal anatomical structures due to repeated inflammation of the bile duct caused by hepatolith and hepatolith cases often had a history of biliary tract surgery which increased the complexity of the vascular anatomy. On the other hand, comparing to the CL tumour, in addition to hepatectomy, also bile duct exploration, stone crushing and removing and bile duct suture were needed, which require a lot of time. While the operation time in our study was similar to the open surgery, to our experience, the method of former approach is not suitable for laparoscopic surgery because that needed to resect too much liver parenchymal,[14] we adopt the method of first dividing the left caudate and then the right caudate. Another that needs to be highlighted is when resecting the SL, we resected parenchymal from an upward angle which created by common trunk of the left and middle hepatic vein and IVC to downwards; and in case of resecting CP and PP, we first found the joint point created by CP and right liver and resected the parenchymal from downwards to upwards. If connecting the two points into line, which can be used as the resection boundaries of the CL.

No Pringle manoeuvre and IVC blocking were applied during the parenchymal transection, the results of intraoperative bleeding was almost in accordance with Chen's study, which was better than open surgery.[17] Hepatolith relative to the tumour, in addition to hepatectomy, also bile duct exploration, stone crushing and removing and bile duct suture were needed, which require a lot of time. While the operation time in our study was similar to the former laparoscopic and open surgery [Table 2], that means we need less time to liver resection. Preoperative 3D reconstruction was of great significance for us to understand the distribution of biliary calculi and the volume of residual liver.

**CONCLUSION**

Through liver blood flow control and choosing a proper order of liver resection, the laparoscopic CL resection for the treatment of hepatolith is safe and feasible.

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Conflicts of interest
There are no conflicts of interest.

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