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Original research

LAPAROSCOPIC HEPATECTOMY FOR HEPATOLITHIASIS - OUTCOMES FROM A SINGLE INSTITUTION IN VIETNAM

Nguyen Thanh Xuan[1], Dang Nhu Thanh[2]

[1]Department of Abdominal Emergency and Pediatric Surgery, Hue Central Hospital

[2]Surgery Department, Hue University of Medicine and Pharmacy, Hue University

ABSTRACT

Background: *Hepatolithiasis is still a common disease in Vietnam and many countries in Asia with high rates of residual stones and recurrence after treatment. Treatment of hepatolithiasis requires a careful selection and combination between surgical, endoscopic, and interventional treatment. The role of laparoscopy, especially in hepatectomy for hepatolithiasis remains unclear and controversial due to technical difficulties.*

Methods: *Between January 2019 to December 2023, 41 patients with hepatolithiasis undergoing laparoscopic hepatectomy were enrolled. The general characteristics, intraoperative, and postoperative data were analyzed.*

Results: *The mean age was 54.7 ± 13.3 (29 - 81) years; the female/male ratio was 2.2. 70.7% of patients had both intra- and extrahepatic duct stones. Left lateral sectionectomy was performed in (29 cases), followed by left hepatectomy (6 cases), right posterior sectionectomy (3 cases), and right hepatectomy (2 cases), and combined resection (1 case). 90.2% of patients underwent common bile duct exploration. Cholangioscopic exploration with/without laser lithotripsy was used in 70.7%. The median surgery time is 152 (70 - 280) minutes. Intraoperative blood transfusion was required in only 6 cases (14.6%). The mean time to bowel movement was 2.3 ± 0.6 days. The mean postoperative hospital stay was 9.1 ± 2.1 days. 14.3% of patients experienced postoperative complications, including wound infection 12.2%, fluid collection 7.3%, pleural effusion (4.9%) and bile leak 4.9%. The complete stone clearance rate was 92.7%.*

Conclusion: *Laparoscopic liver resection, especially left lobectomy, is a safe and effective treatment for patients with hepatolithiasis.*

Keywords: *Hepatolithiasis, laparoscopic hepatectomy.*

I. INTRODUCTION

Hepatolithiasis is defined as the occurrence of stone distal to biliary convergence, most commonly seen in East Asia and characterized by recurrent episodes of infection. While the cause of primary hepatolithiasis is unknown in up to 80% of cases [1], it is associated with multiple factors, including infection, bile content alteration, obstruction, poor hygiene, and parasites. On the other hand, secondary hepatolithiasis results from previous biliary surgery or congenital biliary malformation [2]. Although the incidence has been decreasing compared to the previous era (from 3% to 1.8%) [3], the disease burden is ineligible due to high prevalence in the endemic regions (up to 16%) and high recurrence rate.

Optimal treatment of this disease should ensure complete stone clearance and elimination of biliary stricture and stasis, which are present in 35% - 96% of cases. When these treatment objectives cannot be fulfilled, biliary cirrhosis and cholangiocarcinoma are developed due to longstanding obstruction and inflammation (Uenishi 2009). Among endoscopic, percutaneous, open, and minimally invasive methods, the best treatment should be selected using a multidisciplinary approach considering

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Corresponding author: Nguyen Thanh Xuan. Email: thanhxuanbvh@hotmail.com. Phone: 0945313999

the distribution of stones, the presence of abscess, stricture, atrophy, or the suspicion of cancer.

Hepatectomy is considered the most radical treatment of hepatolithiasis since it permits the removal of the stones and the accompanying strictures and infections. Hepatectomy in hepatolithiasis is technically challenging because of adhesion from repeated cholangitis or previous operations. In addition, chronic liver injury can lead to an increased risk of postoperative hemorrhage, liver failure, or sepsis. However, recent advances in perioperative management and surgical technique have significantly ameliorated the outcomes of the procedure with low complication and residual stone rates [4]. Recently, minimally invasive hepatectomy has emerged as an alternative to open procedures with non-inferiority in terms of morbidity, mortality, and residual stone rate [5]. On the other hand, complications related to laparoscopic hepatectomy were also reported and attributed to technical factors and past surgical history. Hence, there is still uncertainty in the application of laparoscopic hepatectomy in the treatment of hepatolithiasis. This study aims to assess the short-term and mid-term outcomes of laparoscopic hepatectomy in treating hepatolithiasis.

II. MATERIALS AND METHODS

2.1. Study population

From January 2019 to December 2023, 41 patients underwent laparoscopic hepatectomy for hepatolithiasis in Hue Central Hospital. Hepatectomy was indicated for patients who were presented with recurrent cholangitis, liver atrophy, and evidence of biliary stenosis. Exclusion criteria for hepatectomy include septic shock, acute pancreatitis, cirrhosis, cardiovascular or pulmonary diseases with high operative risk,

Exclusion criteria for laparoscopic hepatectomy include (1) extensive open surgery in the upper abdomen, (2) the necessity of a caudate lobectomy, and (3) stones in bilateral hepatic lobes. Bilio-enteric anastomosis is not a contraindication since it can be performed laparoscopically or using a hybrid approach through mini-laparotomy for specimen extraction. Patients with strong suspicion or evidence of cholangiocarcinoma were also excluded from the study.

2.2. Surgical procedures

After general anesthesia, the patient was placed in reverse Trendelenburg position with legs spread apart. The patient was further tilted to the contralateral side of the hepatectomy for better exposure. Five trocars were routinely used for two operators and one scopist (Figure 1). Cholecystectomy was not routinely performed unless indicated by gall bladder stone or when hilar dissection is needed. The to-be-resected lobe was mobilized by dividing round, falciform, and coronary ligaments. Hilar dissection exposing individual components of the Glissonean pedicle was performed in formal left or right hepatectomy, while in other types, the vascular and biliary pedicles were approached intraparenchymally. Inflow control was obtained by Pringle maneuver as needed using a Foley catheter 16F (Figure 2). Superficial parenchymal transection was done using ultrasonic shear by Harmonic Scalpel ® (Ethicon, Cincinnati), or Thunderbeat ® (Olympus, Japan). A deeper transection was carried out using the combination of an energy device and clamp-crush technique to expose the bile duct and vessels. The vessels were divided between Hemolock® while the bile duct was cut open. The hepatic vein was divided using Endo-GIA. If present, stone in the common bile duct was extracted through the stump of the divided bile duct using a flexible choledochoscope and laser lithotripsy as needed. Alternatively, if the stone burden was large, a longitudinal choledochotomy was performed, and stone extraction was done using Randall forceps and choledochoscopy. The choledochotomy was then closed over a T-tube for later cholangiography before removal. A closed suction drain was inserted next to the cut surface. The specimen was extracted through the enlargement of the umbilical port.

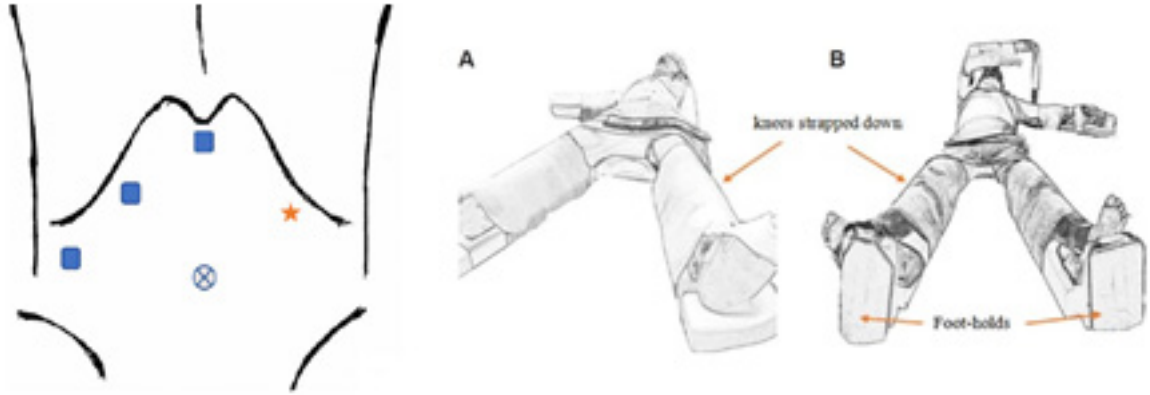

Figure 1: Trocars position and patient positioning for
A. Left-sided hepatectomy and B. Right-sided hepatectomy

2.3. Postoperative care

A liquid diet was allowed on postoperative day (POD) 1 and advanced as tolerated. The drain was removed if drainage volume <50ml/day and there was no evidence of biliary leakage. The T-tube was removed at POD14 at the outpatient clinic after confirmation of stone clearance by cholangiography. A routine CT scan was performed at the one-month follow-up to detect residual stones or postoperative complications.

2.4. Data collection

All patients' preoperative, intraoperative, and postoperative findings and follow-up results were recorded.

III. RESULTS

3.1. Patient's characteristics

From January 2019 to December 2023, 41 patients underwent laparoscopic hepatectomy for hepatolithiasis. The mean age was 54.7 ± 13.3 (29 – 81) years. The male-to-female ratio was 2.2 (28/13). Most patients were admitted with leukocytosis with a mean white blood cell count of 11.5 ± 5.3 (3.9 – 24.2) K/µL. The mean body mass index was 21.4 ± 3 (16.7 – 30.4) kg/m2.

The presenting symptoms and preoperative data are shown in Table 1. Most patients presented with right subcostal or epigastric pain. Clinically apparent jaundice was only presented in 12.2% of patients. 22% of cases had fever on admission. Only a minority of patients had comorbidities (12.2%). A significant number of patients had previous abdominal surgery (31.7%). However, all these previous operations were minimally invasive, leading to a minimal degree of adhesion.

All patients were assessed preoperatively with a CT scan and MRI. Ductal stricture and liver atrophy were presented in most patients (95.1% and 97.6%, respectively). Liver abscess was only detected in 5 patients (12.2%). In addition to intrahepatic stones, gallbladder and extrahepatic bile duct stones were detected in 24.4% and 70.7%, respectively. In two patients, the sphincter of Oddi stricture was suspected since other causes of obstructions were ruled out.

Table 1: Preoperative characteristics

	Characteristics	**N**	**%**
Presentation	Right subcostal/epigastric pain	40	97.6
	Fever	9	22
	Jaundice	5	12.2
	Nausea/vomiting	2	4.9

	Characteristics	N	%
Comorbidities	Stroke	1	2.4
	Parkinson disease	1	2.4
	Deep vein thrombosis	1	2.4
	Chronic anemia	2	4.9
Previous operation	Laparoscopic cholecystectomy	5	12.2
	Laparoscopic appendicitis	3	7.30
	Laparoscopic CBD exploration	4	9.8
	Laparoscopic peptic ulcer perforation repair	1	2.4
Preoperative assessment on imaging	Ductal stricture	39	95.1
	Liver abscess	5	12.2
	Liver atrophy	40	97.6
	Gallbladder stone	10	24.4
	Extrahepatic bile duct stone	29	70.7
	Oddi stricture	2	4.9

Table 2: Operative characteristics

		N	%
Type of operation	Left lateral sectionectomy	29	70.7
	Left hepatectomy	6	14.6
	Right hepatectomy	2	4.9
	Right posterior sectionectomy	3	7.3
	Combined S3 sectionectomy and right posterior sectionectomy	1	2.4
Operative details			
	Operative time (mins)	152 ± 52.6 (70 - 280)	
	Intraoperative cholangioscopy	29	70.7
	Total laparoscopic	21	51.2
	T-tube drainage	37	90.2
	Hepaticojejunostomy	5	12.2
	Blood transfusion required	6	14.6
	Blood loss (ml)	67.1 ± 36.4 (50 - 250)	
	Pringle maneuver time used	1.9 ± 0.9 (1 - 4)	

Among 41 operations performed, left lateral sectionectomy and left hepatectomy were the most common, accounting for 70.7% and 14.6%, respectively. Right-sided hepatectomy (right hepatectomy, right posterior sectionectomy) was used in only a limited number of cases (12.2%). Combined resection of S3 and the right posterior section was done in one case.

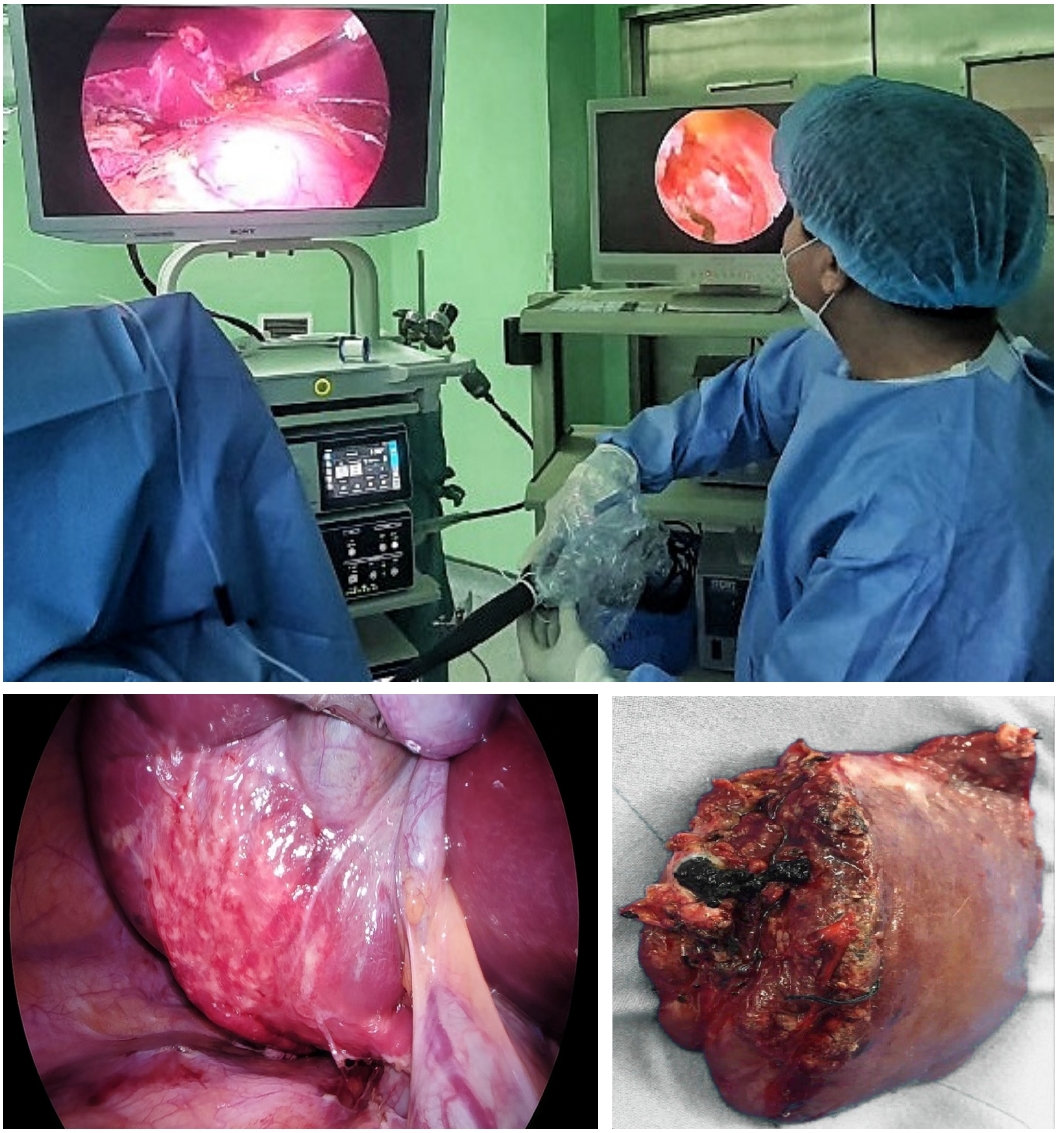

Figure 2: Positions of the operator during cholangioscopy (upper row)

Intraoperative images of fibrotic change of the resected liver (lower row)

The operative details are listed in Table 2. The mean operative time was 152 (70 - 280) mins. Cholangioscopy with or without lithotripsy was used in 70.7% of cases to confirm stone clearance and manage residual stones. In half of the cases, the procedure was performed totally laparoscopic, while in the rest of the cases, a mini-laparotomy was used for specimen extraction, choledochotomy, and T-tube insertion. Blood transfusion was required in only 6 patients (14.6%).

3.2. Postoperative course

The mean postoperative hospital stay was 9.1 days, and the mean time to the first bowel movement was 2.3 days. There was no perioperative mortality. Ten patients (24.4%) had postoperative complications, including wound infection (12.2%), bile leakage (4.9%), fluid collection (7.3%), and pleural effusion (4.9%).

Table 3: Postoperative characteristics

	N	%
Postoperative hospital stay (days)	9.1 ± 2.1(7 - 15)	
Mean time to first bowel movement (days)	2.3 ± 0.6 (2 - 4)	
Perioperative mortality	0	0
Number of patients with complications	10	24.4
Type of complications		
Wound infection	5	12.2
Bile leakage	2	4.9
Fluid collection	3	7.3
Pleural effusion	2	4.9

Postoperative choledochoscopy via T-tube tract was required in 5 patients (12.2%). The initial number of patients with residual stones was 7 (17.1%). Additional lithotripsy resulted in 4 more patients with complete stone clearance. Hence, the final stone clearance rate was 92.7%. Patients were follow-up during a median duration of 18 (12 - 24) months. Recurrent stone was detected in 5 (12.2%) cases.

IV. DISCUSSIONS

The safety of hepatectomy for hepatolithiasis, including both laparoscopic and open procedures, has significantly improved in recent years. However, complications following hepatectomy were still reported. In some reports, complication rates, including wound infection, hemobilia, biliary fistula, were as high as 38.5% [6]. Recent cholangitis (within one month) is considered one of the risk factors for bile leak after hepatectomy [7]. With the widespread use of laparoscopic surgery in multiple procedures, laparoscopic hepatectomy for hepatolithiasis has been increasingly performed with comparable short-term and long-term outcomes [8,9]. However, technical challenges still exist since adhesions and inflammation are related to recurrent cholangitis and multiple operations. In addition, the distribution of hepatolithiasis and the anatomy of the biliary tree are important factors that guide the choice of operations among the available armamentarium. In our study, laparoscopic hepatectomy was indicated only for localized hepatolithiasis associated with liver atrophy or recurrent abscess.

Cholangioscopic with lithotripsy (laser or electrohydraulic) was frequently used further to enhance the stone clearance rates in open surgery. However, when the stone burden is high, the time required for maximal stone lithotripsy and retrieval is prolonged and is associated with increased costs due to the fragility of the instruments [10]. Therefore, careful selection and combination use of multiple approaches is crucial to maximize therapeutic effects. In our study, intraoperative cholangioscopy was used in 70.7% of cases, most of the time to confirm stone clearance and exclude Sphincter of Oddi stricture. In addition, using flexible cholangioscopy in totally laparoscopic is not without difficulties. Since the movement of the cholangioscope is restricted by the trocart and scope damage can be caused by hyperflexion of the scope. In our series, only more than half of the procedures were done in a totally laparoscopic manner. Through a small laparotomy of approximately 5 cm in length, we can perform specimen extraction, cholangioscopy, and T-tube insertion with ease. Our initial stone clearance rate is 82.9%, which is high compared to other authors.

In all patients, we used an ultrasonic scalpel for parenchymal transections, and CUSA was used in no cases. Not only for superficial transection, the Harmonic can also be used for deep parenchymal transection using the CUSA-mimic technique with

the active blade of the instrument. This technique has also been mentioned in other papers. In our study, the mean blood loss volume was 67.1± 36.4 (50 - 250), and only 6 patients required blood transfusions.

The complication rate in our study was 24.4%. However, most complications were self-limited, and no additional intervention was required. Two patients (4.9%) had bile leakage, suspected by the greenish drainage production, and later confirmed by bilirubin dosage. These two patients were treated conservatively with prolonged drain placement and gradual withdrawal of the drain. Both cases were presented with cholangitis on admission. It is well-recognized that recent cholangitis is one of the most important risk factors for biliary leakage after liver resection [11].

Table 4: Stone clearance and recurrence rates

	N	%
Postoperative choledochoscopy for residual stone extraction	5	12.2
Residual stones	7	17.1
Final stone clearance rate	38/41	92.7
Follow-up (months)	18 (12 - 24)	
Recurrent stone	5	12.2

All patients were followed up for a median of 18 months. Stone clearance was confirmed by cholangiography and postoperative CT scan. Stone recurrence was seen in only 5 patients (12.2%). The stone recurrence rates after hepatectomy for hepatolithiasis were 11.8 - 34.1%. Aggressive liver resection to remove the diseased part of the liver with recurrent infection and biliary stenosis was believed to reduce the incidence of recurrence and later development of intrahepatic cholangiocarcinoma [11,12].

V. CONCLUSIONS

Laparoscopic liver resection, especially left lobectomy, is a safe and effective treatment for patients with hepatolithiasis. Further studies are required to prove the long-term efficacy and help better select patients for laparoscopic surgery.

REFERENCES

1. Balasegaram M. Hepatic Calculi. Annals of Surgery. 1972; 175(2): 149-154
2. Pan SB, Wu CL, Zhou DC, Xiong QR, Geng XP, Hou H. Total laparoscopic partial hepatectomy versus open partial hepatectomy for primary left-sided hepatolithiasis: study protocol for a randomized controlled trial. Trials. 2024;25(1):137.
3. Li H, Zheng J, Cai JY, et al. Laparoscopic VS open hepatectomy for hepatolithiasis: An updated systematic review and meta-analysis. World J Gastroenterol. 2021;23(43):7791-7806.
4. García D, Marino C, Ferreira Coelho F, et al. Liver resection for hepatolithiasis: A multicenter experience in Latin America. Surgery (United States). 2023;173(2):299-304.
5. Ardito F, Mele C, Vellone M, Giuliante F. Laparoscopic left hepatectomy for primary intrahepatic lithiasis: surgical technique. Laparosc Surg. 2020;4.
6. Fang C, Dong Y, Liu S, Wei W, Tan J, Chen W. Laparoscopy for Hepatolithiasis: Biliary Duct Exploration with Primary Closure Versus T-Tube Drainage. Journal of Laparoendoscopic and Advanced Surgical Techniques. 2020;30(10):1102-1105.
7. Li H, Zheng J, Cai JY, et al. Laparoscopic VS open hepatectomy for hepatolithiasis: An updated systematic review and meta-analysis. World J Gastroenterol. 2021;23(43):7791-7806.
8. Jiang O, Yang K, Cai CX, Liu Y, Zhou RX, Cheng NS. Negative short-term impact of intraoperative biliary lavage in patients with hepatolithiasis. World J Gastroenterol. 2016;22(11):3234-3241.
9. Jin RA, Wang Y, Yu H, Liang X, Cai XJ. Total laparoscopic left hepatectomy for primary hepatolithiasis: Eight-year experience in a single center. Surgery (United States). 2016;159(3):834-841.
10. Oh CH, Dong SH. Recent advances in the management of difficult bile-duct stones: A focus on single-operator cholangioscopy-guided lithotripsy. Korean Journal of Internal Medicine. 2021;36(2):235-246.
11. Kwan KEL, Shelat VG, Tan CH. Recurrent pyogenic cholangitis: a review of imaging findings and clinical management. Abdominal Radiology. 2017;42(1):46-56.
12. Pu Q, Zhang C, Ren R, et al. Choledochoscopic lithotripsy is a useful adjunct to laparoscopic common bile duct exploration for hepatolithiasis: A cohort study. Am J Surg. 2016;211(6):1058-1063.