Comparison of laparoscopic and open surgery for pyogenic liver abscess with biliary pathology

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Abstract

AIM: To investigate the feasibility and therapeutic effect of laparoscopic surgery for pyogenic liver abscess (PLA) with biliary pathology.

METHODS: From January 2004 to October 2010, 31 patients with PLA combined with biliary pathology meeting entry criteria received surgical management in our hospital. Of the 31 patients, 13 underwent laparoscopic surgery (LS group) and 18 underwent open surgery (OS group). Clinical data including operation time, intraoperative blood loss, postoperative complication rate, length of postoperative hospital stay, and abscess recurrence rate were retrospectively analyzed and compared between the two groups.

RESULTS: All patients received systemic antibiotic therapy. Four patients underwent ultrasound-guided percutaneous catheter drainage before operation. Postoperative complications occurred in 5 patients (16.1%, 5/31) including 2 in the LS group and 3 in the OS group. One patient had retained calculus in the common bile duct and another had liver abscess recurrence in the OS group. No retained calculus and liver abscess recurrence occurred in the LS group. In the two groups, there was no mortality during the perioperative period. There were no significant differences in operation time, intraoperative blood loss and transfusion, postoperative complication rate and abscess recurrence rate between the two groups. Oral intake was earlier (1.9 ± 0.4 d vs 3.1 ± 0.7 d, P < 0.05) and length of postoperative hospital stay was shorter (11.3 ± 2.9 d vs 14.5 ± 3.7 d, P < 0.05) in the LS group than in the OS group.

CONCLUSION: Laparoscopic surgery for simultaneous treatment of PLA and biliary pathology is feasible in selected patients and the therapeutic effect is similar to that of open surgery.

INTRODUCTION

Pyogenic liver abscess (PLA) is a potentially fatal disease. Before the 1970s open surgical drainage was often adopted for the treatment of PLA. With the development of imaging techniques, ultrasound or computed tomography (CT)-guided percutaneous catheter drainage combined with systemic antibiotics has become the preferred treatment, and mortality has significantly decreased. In
some conditions such as percutaneous drainage failure or underlying biliary pathology, surgery is still required[4-11]. With the development of laparoscopic instruments and techniques, laparoscopic liver abscess drainage has become popular[7-11]. Compared with conventional open liver abscess drainage, laparoscopic drainage has some advantages in operation time, postoperative recovery and length of hospital stay[10,11]. However, little research has been done on laparoscopic surgery (LS) for simultaneous treatment of both PLA and biliary pathology. The purpose of this study was to explore the safety and feasibility of laparoscopic or open surgery (OS) for simultaneous treatment of both PLA and biliary pathology, and to compare the therapeutic effects of the two methods through retrospective analysis of 31 patients with PLA meeting entry criteria.

MATERIALS AND METHODS

Patients

From January 2004 to October 2010, 348 patients with PLA were treated in our hospital. Of the 348 patients, 31 met entry criteria. The entry criteria included (1) ultrasound, CT, surgery or pathogen culture-diagnosed PLA combined with biliary pathology including gallstone, choledocholith, hepatolithus, biliary stricture and biliary tract neoplasms; (2) simultaneous surgical treatment for both PLA and underlying biliary pathology. Patients undergoing drainage of liver abscess alone were excluded. Of the 31 patients with PLA, 13 underwent LS (LS group) and 18 OS (OS group). In the 13 patients in the LS group, 5 patients were men and 8 women, with a mean age of 57.5 years (range 35-73). In the 18 patients in the OS group, 8 patients were men and 10 women, with a mean age of 55.8 years (range 35-73). Fever and/or chills were common, then abdominal pain. Most patients had right upper quadrant tenderness. Symptoms and signs of patients are shown in Table 1.

Routine blood analysis, liver function tests and blood coagulation assays were performed in all patients. Increased white blood cell count was the most common laboratory abnormality in these patients (Table 2). Abdominal ultrasound examination was performed in 31 patients, and indicated liver abscess in 30 patients and biliary pathology in 28 patients. CT scan and contrast-enhanced CT scan were performed in 30 patients, and indicated liver abscess in 30 patients and biliary pathology in 26 patients. Magnetic resonance imaging (MRI) was performed in 5 patients, and indicated liver abscess in 5 patients, choledocholith in 3 patients and cholecystolithiasis in 2 patients. In the 13 patients from the LS group, 5 patients had right liver abscess, 7 left liver abscess and one both right and left liver abscess; 11 patients had single liver abscess and 2 multiple liver abscesses; and 5 patients had > 5 cm diameter liver abscess. In the 18 patients from the OS group, 9 patients had right liver abscess, 7 left liver abscess and 2 both right and left liver abscess; 15 patients had single liver abscess and 3 multiple liver abscesses; and 10 patients had > 5 cm-diameter liver abscess. In the 13 patients from the LS group, 6 patients had cholecystolithiasis combined with acute cholecystitis; 3 patients had choledocholith cholangitis (2 also had cholecystolithiasis); 3 patients had left multiple hepatolithiasis (one also had choledocholith); one patient had left intrahepatic biliary stricture. In the 18 patients from the OS group, 7 patients had cholecystolithiasis combined with acute cholecystitis (one also had primary gallbladder cancer); 5 patients had choledocholith cholangitis (2 also had cholecystolithiasis and one right hepatolithiasis); 4 patients had left multiple hepatolithiasis (one also had choledocholith); one patient had left intrahepatic biliary stricture; and another one had intrahepatic bile duct cystadenoma combined with hepatolithiasis (Table 3). Among the 31 patients, aerobic bacterium culture was positive in 21 patients. The common bacteria were colibacillus, then Klebsiella pneumoniae. Three of the 13 patients in the LS group had diabetes mellitus. Of the 18 patients in the OS group had diabetes mellitus, 2 patients had hypertensive disease, one patient had a history of biliary surgery and another patient had a history of two-time biliary surgery. There were no statistic differences in age, sex, clinical manifestations, characteristics of liver abscess and underlying biliary pathology between the two groups.

Operative techniques

Laparoscopic liver abscess drainage: After general anesthesia, a small cut below the umbilicus was made followed by establishing pneumoperitoneum and placing a laparoscope into the peritoneal cavity. The pore site positions were determined according to the size and position of liver abscess. Under laparoscopy, the adhesions of the liver with the abdominal wall or diaphragm were separated using electrocautery. In large and superficial liver abscess, the surface of the liver was locally elevated with gray-and-white or yellowish-white color. After aspirating pus from the liver abscess through paracentesis, a small hole was made on the elevated or thinnest surface of the liver abscess. The abscess cavity was then unroofed using electrocautery, and samples were routinely obtained for bacterial culture and drug sensitivity testing. Debridement and irrigation of the abscess cavity were performed. Laparoscopic cholecystectomy or common bile duct exploration for calculus removed was routinely carried out. Laparoscopic left hepatobectomy was performed as previously described[13]. Thick latex drainage tubes were left in the abscess cavity and subhepatic space, respectively. When B-ultrasonic image or CT confirmed abscess cavity collapse or closure 6-9 d after operation, and 24-hour drainage liquid was less than 20 mL, drainage tubes might be removed.

Open surgery: A right subcostal incision or a superior median abdominal incision was made to explore abdominal lesions. The position of the liver abscess was determined through paracentesis, and then hemostatic forceps entered the abscess cavity along the paracentetic needle to remove pus and separate fibrous septa. A latex drainage tube was left. At the same time, biliary pathology was also treated.

Clinical data including operation time, intraoperative...
Table 1 Clinical manifestation of patients with pyogenic liver abscesses

| Variables           | LS group (n = 13) | OS group (n = 18) |
|---------------------|-------------------|-------------------|
| Fever/chills        | 11                | 17                |
| Abdominal pain      | 10                | 14                |
| Vomiting            | 8                 | 10                |
| Jaundice            | 5                 | 8                 |
| Septic shock        | 1                 | 1                 |
| RUQ tenderness      | 10                | 15                |
| Murphy’s sign       | 6                 | 7                 |
| Hepatomegaly        | 4                 | 6                 |

LS: Laparoscopic surgery; OS: Open surgery; RUQ: Right upper quadrant.

Table 2 Initial laboratory values for pyogenic liver abscesses

| Parameter                        | LS group (n = 13) | OS group (n = 18) |
|----------------------------------|-------------------|-------------------|
| WBC count (> 10 000/mL)          | 12                | 18                |
| Serum albumin (< 35 g/L)         | 8                 | 11                |
| Total bilirubin (> 20 µmol/L)    | 7                 | 10                |
| AST (> 60 U/L)                   | 6                 | 9                 |
| Serum creatinine (> 80 µmol/L)   | 2                 | 3                 |
| PT (> 14.8 s)                    | 2                 | 2                 |

LS: Laparoscopic surgery; OS: Open surgery; WBC: White blood cell; AST: Aspartate aminotransferase; PT: Prothrombin time.

Table 3 Origin of pyogenic liver abscesses

| Variables            | LS group (n = 13) | OS group (n = 18) |
|----------------------|-------------------|-------------------|
| Cholelithiasis       | 6                 | 7                 |
| Choledocholithiasis  | 3                 | 5                 |
| Hepatolithiasis      | 3                 | 4                 |
| Intrahepatic biliary stricture | 1             | 1                 |
| Biliary cystadenoma  | 0                 | 1                 |

LS: Laparoscopic surgery; OS: Open surgery.

Table 4 Operative procedures performed on the patients

| Operative procedures                                      | LS group (n = 13) | OS group (n = 18) |
|----------------------------------------------------------|-------------------|-------------------|
| Drainage of abscess with cholecystectomy                  | 6                 | 7                 |
| Drainage of abscess with CBD                              | 3                 | 5                 |
| exploration and cholecystectomy                            |                   |                   |
| Left lateral segmentectomy                                 | 2                 | 4                 |
| Left hemihepatectomy                                      | 2                 | 2                 |

LS: Laparoscopic surgery; OS: Open surgery; CBD: Common bile duct.

Liver abscess was unchanged due to inadequate drainage. In 7 patients with diabetes mellitus, blood glucose levels were all controlled under 10 mmol/L by administration of insulin. General anesthesia was performed in 31 patients through endotracheal intubation. In the LS group, 6/13 patients received laparoscopic liver abscess drainage and cholecystectomy; 3 patients received liver abscess drainage, cholecystectomy, common bile duct exploration and T tube drainage; 2 patients with hepatolithiasis limited to the left lateral segment combined with liver abscess received left lateral segmentectomy, and of these 2 patients, one also received cholecystectomy, common bile duct exploration and T tube drainage; one patient with left hepatic duct stenostomia and another patient with hepatolithiasis limited to left hepatic lobe received laparoscopic left hemihepatectomy. In the OS group, 7/18 patients received laparoscopic liver abscess drainage and cholecystectomy, and of these 7 patients, one with gallbladder cancer also received radical cholecystectomy; 5 patients received liver abscess drainage and common bile duct exploration, and of these 5 patients, primary closure of the bile duct was performed in 2 patients and T tube drainage in 3 patients, and 4 patients also received cholecystectomy; 4 patients received left lateral segmentectomy, and of these 4 patients, two also received cholecystectomy, common bile duct exploration and T tube drainage; 2 patients received hemihepatectomy, and one of these patients also received cholecystectomy, common bile duct exploration and T tube drainage (Table 4).

Postoperative complications occurred in 5 patients (2 patients in the LS group and 3 in the OS group, 16.1%). In the LS group, one patient had biliary leakage (100-200 mL of bile per day), and it automatically healed 7 d after drainage; another patient had right hydrothorax, and it was relieved 4 d after closed drainage. In the OS group, early postoperative inflammatory ileus occurred in one patient who recovered 10 d after conservative treatment; subphrenic abscess occurred in one patient and was relieved 8 d after ultrasound-guided puncture; and incision infection occurred in one patient who showed second-class healing after changing dressings. In the OS group, one patient had retained calculus in the common bile duct and left hospital with T tube, the retained calculus were removed using fibercholedochoscope 58 d after operation; liver abscess recurrence occurred in one patient 20 d after surgery and were relieved a week after systemic use of antibiotics and ultrasound-guided percutaneous catheter drainage before surgery. Preoperative drain tubes were inserted in 3 patients, while in another patient, the diameter of the abscess was unchanged due to inadequate drainage.

RESULTS

All patients received systemic antibiotic therapy. Four patients (one patient in the LS group and 3 patients in the OS group) underwent ultrasound-guided percutaneous catheter drainage before surgery. Preoperative drainage lasted 2-8 d. After percutaneous catheter drainage, diameters of liver abscesses were decreased by 2-5 cm in 3 patients, while in another patient, the diameter of liver abscesses were decreased by 2-5 cm.
Tu JF et al. Laparoscopic and pyogenic liver abscess

In this study, 7 patients with hepatolithiasis combined with PLA underwent left lateral segmentectomy or left hemihepatectomy. Hepatolobectomy can achieve radical treatment results, because of removal of not only the abscess but also biliary stones, biliary stricture and hepatic lesions. Moreover, hepatolobectomy for treatment of hepatolithiasis combined with PLA is conducive to long-term prevention of biliary carcinogenesis.

With the development of laparoscopic techniques, laparoscopic drainage may replace traditional open drainage in the treatment of PLA. A laparoscopic drainage group was better than an open drainage group in operation time, blood loss and length of hospital stay, and laparoscopic drainage is safe and feasible in patients who have no response to conservative treatment. In this study, LS or OS were used to treat PLA combined with biliary pathology in 31 patients with a postoperative complication rate of 16.1%. In the two groups, there was no mortality during the perioperative period. There were no significant differences in operation time, intraoperative blood loss and transfusion, postoperative complication rate and abscess recurrence rate between the two groups. Oral intake was earlier (1.9 ± 0.4 d vs 3.1 ± 0.7 d, \( P < 0.05 \)) and length of postoperative hospital stay was shorter (11.3 ± 2.9 d vs 14.5 ± 3.7 d, \( P < 0.05 \)) in the LS group than in the OS group (Table 5).

Table 5  Comparison of results in laparoscopic surgery group and open surgery group

| Variables                        | LS group (\( n = 13 \)) | OS group (\( n = 18 \)) |
|----------------------------------|-------------------------|--------------------------|
| Operating time (min)             | 117 ± 27                | 112 ± 31                 |
| Intraoperative blood loss (mL)   | 139 ± 51                | 146 ± 47                 |
| Intraoperative blood transfusion (%) | 1 (7.7)                | 1 (5.6)                  |
| Commencement of oral intake (d)  | 1.9 ± 0.4               | 3.1 ± 0.7                |
| Postoperative complications (%)  | 2 (15.4)                | 3 (16.7)                 |
| Postoperative hospital stay (d)  | 11.3 ± 2.9              | 14.5 ± 3.7               |
| Intermediate residual stone (%)  | 0 (0)                   | 1 (5.6)                  |
| Abscess recurrence (%)           | 0 (0)                   | 1 (5.6)                  |
| Perioperative mortality (%)      | 0 (0)                   | 0 (0)                    |

LS: Laparoscopic surgery; OS: Open surgery.

DISCUSSION

In the early 20th century, PLA was commonly secondary to pyodilhlebitis caused by acute appendicitis. Since the mid 20th century, PLA has been mainly due to benign or malignant biliary pathology, accounting for about 40%-65%.[1,3,14] These common biliary lesions include cholecystolithiasis, intrahepatic and extrahepatic cholangiolithiasis, ascariasis of the biliary tract, biliary stricture and biliary tumor. When these biliary lesions lead to acute supplicative cholecystitis, acute suppurative cholangitis, and intrahepatic and extrahepatic cholangitis, bacteria may enter intrahepatic bile ducts and cholangioles to cause PLA. Perforation of gallbladder may also result in PLA.[10,11] Mezhir et al. have reported that 88% of patients with PLA have a history of malignant tumor including pancreatic cancer (36%), cholangiocarcinoma (17%), colon carcinoma (12%) and gallbladder cancer (10%) in 58 patients between 1998 and 2009. However, in India[14] and China[11,17], the main cause of PLA is still biliary calculi. Since the 1980s, the incidence of hepatolithiasis has been decreased and the incidence of cholecystolithiasis has been significantly increased. In China, cholecystolithiasis is increasingly becoming a main cause of PLA. In this study, the main causes of PLA were cholecystolithiasis and cholangiolithiasis.

Before the 1970s, conservative treatment or open surgical drainage was mainly adopted for the treatment of PLA, but the mortality rate was as high as 65%.[1]. With the development of imaging techniques and effective broad-spectrum antibiotics, image-guided percutaneous catheter drainage combined with systemic antibiotics have become preferred for the treatment of PLA, and the mortality rate is under 10%.[1,3,17] Image-guided percutaneous catheter drainage is suitable not only to unilocular abscess, but also to multiple unilocular abscesses and multiloculated abscesses[4], and has some advantages including simple procedures, low cost and good therapeutic effect. However, percutaneous catheter drainage has some disadvantages. For example, multiple percutaneous drainages are required due to drainage tube block or inadequate drainage; it has the possibility of hepatic hemorrhea or pneumothorax; and it cannot simultaneously treat PLA with underlying hepatobiliary pathology.

Liver abscess surgical drainage and percutaneous drainage are complementary techniques. In this study, 4 patients received percutaneous drainage before operation, and following improvement of pathogenetic condition, underwent surgical management. Liver abscess open surgical drainage is suitable after percutaneous drainage failure or for patients having primary diseases such as biliary PLA, abscess rupture and so on[14,17]. Surgical drainage has some advantages including positioning accuracy, and simultaneous treatment of both abscess and primary diseases[1,4,14,17]. In this study, as well as liver abscess drainage laparoscopic cholecystectomy was also performed in 6 patients, open cholecystectomy was performed in 7 patients, laparoscopic common bile duct exploration for calculus removed was performed in 3 patients and open common bile duct exploration for calculus removed was performed in 5 patients. Hepatolobectomy is suitable for hepatolithiasis or hepatobiliary tumor combined with PLA.[6,19]. In this study, 7 patients with hepatolithiasis combined with PLA underwent left lateral segmentectomy or left hemihepatectomy. Hepatolobectomy can achieve radical treatment results, because of removal of not only the abscess but also biliary stones, biliary stricture and hepatic lesions. Moreover, hepatolobectomy for treatment of hepatolithiasis combined with PLA is conducive to long-term prevention of biliary carcinogenesis.

With the development of laparoscopic techniques, laparoscopic drainage may replace traditional open drainage in the treatment of PLA. A laparoscopic drainage group was better than an open drainage group in operation time, blood loss and length of hospital stay, and laparoscopic drainage is safe and feasible in patients who have no response to conservative treatment.[10,11] In this study, LS or OS were used to treat PLA combined with biliary pathology in 31 patients with a postoperative complication rate of 16.1%. In the two groups, there was no mortality during the perioperative period. There were no significant differences in operation time, intraoperative blood loss and transfusion, postoperative complication rate and abscess recurrence rate between the two groups. Oral intake was earlier and length of postoperative hospital stay was shorter in the LS group than in the OS group.

LS or OS for the concomitant treatment of both PLA and biliary pathology is suitable for (1) cholecystolithiasis, common bile duct calculi, ascariasis of biliary...
surgery has advantages in postoperative recovery of gastrointestinal function and length of postoperative hospital stay.

**Terminology**

PLA is the result of bacterial infection of the liver parenchyma, with subsequent infiltration by inflammatory cells and formation of a collection of pus.

**Peer review**

This is a nice case series. The numbers of patients are obviously small, and meaningful comparisons between the 2 groups are difficult.

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**COMMENTS**

**Background**

Pyogenic liver abscess (PLA) is a potentially fatal disease. Before the 1970s, open surgical drainage was often adopted for the treatment of PLA. With the development of imaging techniques, ultrasound or computed tomography-guided percutaneous catheter drainage combined with systemic antibiotics is preferred. In selected patients with biliary PLA, laparoscopic or open surgery for simultaneous treatment of PLA with underlying biliary pathology is safe and feasible. Laparoscopic surgery has advantages in postoperative recovery of gastrointestinal function and length of postoperative hospital stay.

**Research frontiers**

The feasibility and therapeutic effect of laparoscopic surgery for simultaneous treatment of both PLA and biliary pathology is a hotspot.

**Innovations and breakthroughs**

This study was performed to explore the safety and feasibility of laparoscopic or open surgery for simultaneous treatment of both PLA and biliary pathology, and to compare the therapeutic effects of the two methods through retrospective analysis of 31 patients with PLA meeting entry criteria.

**Applications**

In selected patients with biliary PLA, laparoscopic or open surgery for simultaneous treatment of PLA and biliary pathology is safe and feasible. Laparoscopic surgery has advantages in postoperative recovery of gastrointestinal function and length of postoperative hospital stay.

**Tu JF et al. Laparoscopic and pyogenic liver abscess**