Abscess of ligamentum teres hepatis post-endoscopic retrograde cholangiopancreatography: A case report and a literature review

Zixiang Ji, Zhenyu Wang and Hao Li

Abstract
Abscess of the ligamentum teres hepatis has been described in the medical literature as an extremely rare clinical entity, which often presents a diagnostic dilemma. A 68-year-old man was hospitalized for upper abdominal pain and obstructive jaundice. The patient presented with low-grade intermittent fever. Laboratory investigations showed a white blood cell count of 32.38 × 10⁹/L, a C-reactive protein level of 247.86 mg/L, abnormal liver enzyme and bilirubin levels, and elevated serum levels of amylase and lipase. He was first diagnosed with acute biliary pancreatitis. A computational tomography scan and magnetic resonance cholangiopancreatography revealed obstructive choledocholithiasis and cholecystolithiasis. The patient received preoperative antibiotics and symptomatic treatments for 5 days, followed by endoscopic retrograde cholangiopancreatography and a subsequent duodenal papilla incision to extract pigment and cholesterol gallstones. The patient recovered and was discharged on the fifth day after surgery. However, 10 days later, the patient was readmitted for the recurrence of acute calculous cholecystitis. Laboratory tests showed increases in total and direct bilirubin, γ-glutamyltransferase, and alkaline phosphatase, but not inflammatory parameters. After the patient's nutritional status improved on the 11th day after admission, a laparoscopic cholecystectomy was performed. Intraoperative exploration revealed extensive abdominal adhesions; a thickened edematous gallbladder wall; and an unexpected abscess of the ligamentum teres hepatitis. Pus aspiration was performed laparoscopically after laparoscopic cholecystectomy, and to ensure elimination of the abscess, ultrasound-guided pus aspiration was also performed 1 week later. Fortunately, the patient made an uneventful recovery and was discharged with a drain tube on the 16th day after surgery. Doppler ultrasound indicated that the abscess had completely disappeared 2 weeks after discharge. This case highlights an unusual presentation of a ligamentum teres hepatitis abscess caused by obstructive cholangitis but that appeared after the choledocholithiasis was resolved. However, the mechanism of abscess formation remained uncertain.

Keywords
Ligamentum teres hepatitis, abscess, obstructive choledocholithiasis, calculous cholecystitis, acute biliary pancreatitis

Date received: 20 April 2022; accepted: 15 June 2022

Introduction
An abscess of the ligamentum teres hepatitis (LTH) is an infrequent clinical entity. Although the etiology remained unclear, the LTH abscess is supposedly induced by acute calculous cholecystitis, cholangitis, and pancreatitis in adults, as well as omphalitis and infected ventriculoperitoneal shunts in newborns/infants.¹⁻⁶ The most common symptoms of the disease are fever, abdominal pain, and vomiting, which make clinicians often confused with clinical manifestations that are primarily associated with pancreatitis, biliary tract infection, and other conditions, leading to missed or delayed diagnosis.

As for the treatment options, aspiration of the pus followed by surgical excision of the abscess is recommended to prevent septic shock with severe peritonitis.⁷⁻⁸ However, conservative treatment with endoscopic biliary drainage and broad-spectrum antibiotics has also been effective in
improving condition. The latter can be considered the primary choice when the patient’s general conditions allow.

**Case presentation**

A 68-year-old man was admitted to treat abdominal pain and notable jaundice of the skin and sclerae. The pain had started 1 month earlier and was significant in the upper right quadrant without radiation to the back. It was associated with nausea and vomiting. He was treated with cephalosporins at a local clinic before admission to our hospital, but did not improve symptoms. On physical examination, his abdomen appeared flat and soft with palpable tenderness. No abdominal mass was palpable. Murphy’s sign was negative. The lesion appeared to show mixed signals on the T2-weighted imaging (T2WI) that extended from the median fissure of the liver to the lower abdomen (Figure 1(d) and (e)). The combined diffusion-weighted imaging (DWI) sequence showed high signal intensity and restricted diffusion (Figure 1(f) and (g)), representing the LTH abscess.

After cholecystectomy, a 1-cm parallel incision was made in the LTH and 40 mL of thick gray-yellow pus containing necrotic tissue was aspirated. The pus and blood culture were tested twice to be negative for bacteria. Twenty-two French drainage tubes were placed individually in the abscess incision and below the liver. The volumes of pus draining gradually decreased in a week.

However, a subsequent CT scan detected the persistent abscess, which appeared to be a draining tube attached to the wall, suggesting that the drainage of the pus was insufficient (Figure 1(h)). Ultrasound-guided pus aspiration was followed immediately (Figure 1(i)). A total of 100 mL of pus was initially obtained, followed by a steadily reduced volume each day, and the color of the pus gradually turned light yellow. The tube was constantly flushed. The patient was discharged 16 days after surgery. Doppler ultrasound showed that the abscess cavity had completely disappeared 2 weeks after discharge (Figure 1(g)). The patient remained without radiation to the back. It was associated with acute pancreatitis and mild peritonitis. A thorough retrospective examination on CT scans was conducted, although this LTH abscess was absent in the imaging at the first admission (Figure 1(c)).

We then reevaluated the MRCP results before surgery. The lesion appeared to show mixed signals on the T2-weighted imaging (T2WI) that extended from the median fissure of the liver to the lower abdomen (Figure 1(d) and (e)). The combined diffusion-weighted imaging (DWI) sequence showed high signal intensity and restricted diffusion (Figure 1(f) and (g)), representing the LTH abscess.

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asymptomatic with normal laboratory biochemistry and the abscess had not recurred at the 1-year follow-up.

Discussion

The LTH, also known as the “round ligament of the liver,” is a structure that makes up the falciform ligament (FL). Due to the rarity of LTH abscess, limited literature is available. We extensively reviewed the English literature (with abstract available) using PubMed, Google Scholar, and manual cross-referencing that covers abscess of LTH or FL up to 2021. To better compare with our case, only those reported in adults were included. A total of 18 reports containing the present one are listed (Table 2). As is known, the leading
| Reference          | Age | Sex | Main presentation                              | Concomitant disease                                             | Microbiology                                                                            | Treatment                                      |
|--------------------|-----|-----|-----------------------------------------------|----------------------------------------------------------------|----------------------------------------------------------------------------------------|-----------------------------------------------|
| Charuzi and Freund | 75  | F   | Abdominal pain, high fever                    | Not significant                                                 | (−)                                                                                     | Surgical resection                            |
| Sones et al.       | 71  | M   | Abdominal pain and distension, palpable gastric mass | Cholecystitis, rupture of gangrenous gallbladder                  | Not described                                                                          | Surgical resection                            |
| Watson et al.      | 84  | F   | Abdominal pain, vomiting                       | Cholecystolithiasis                                             | Not described                                                                          | Surgical resection                            |
| Losanoff and Kjossev | 18 | M   | Abdominal pain, nausea, vomiting               | Not significant                                                 | Blood (−), peritoneal pus (+ Escherichia coli)                                         | Surgical resection                            |
| De Melo et al.     | 65  | M   | Abdominal pain, fever                          | Calculous cholecystitis                                         | Not described                                                                          | Laparoscopic abscess drainage (recur), cholecystectomy                                |
| Martin             | 52  | F   | Light abdominal pain, epigastric burning pain, nausea, vomiting | Cholecystolithiasis, cholecystitis                              | Not described                                                                          | Surgical resection                            |
| Tsukuda et al.     | 70  | F   | Abdominal pain, high fever                     | Cholecystolithiasis, cholecystitis                              | Not described                                                                          | Antibiotics, ERCP, cholecystectomy, surgical resection                                  |
| Arakura et al.     | 63  | M   | Epigastralgia, high fever                      | Cholecystolithiasis, portal thrombosis                         | Bile and blood (+ Streptococcus anginosus)                                              | Antibiotics, thrombolytic therapy            |
| Czymek et al.      | 44  | F   | Epigastralgia                                  | Cholecystolithiasis                                             | Resected specimen (+ Staphylococcus epidermidis)                                       | Surgical resection                            |
| Warren et al.      | 73  | M   | Extreme tenderness in upper abdomen, jaundice, anorexia, nausea | Cholangitis, obstructive ampullary carcinoma, portal pyemia   | Not described                                                                          | Antibiotics, ERCP, pancreaticoduodenectomy, surgical resection                          |
| Atif and Khaliq     | 40  | M   | Epigastralgia, anorexia, vomiting, a noticeable mass in epigastrium | Pancreatitis                                                  | Not described                                                                          | Excision of falciform ligament and para-duodenal abscess                              |
| Sen et al.         | 40  | M   | Acute abdomen, palpable sausage-shaped, suprambificlal mass | Obstructive choledocholithiasis, cholangitis, portal thrombosis | Pus (+ Escherichia coli)                                                               | Pus aspiration, ERCP, cholecystectomy, surgical resection                              |
| Jain et al.        | 65  | F   | Epigastralgia, vomiting                        | Cholecystitis, choledolithiasian                                | Not described                                                                          | Pus aspiration, antibiotics, cholecystectomy                                          |
| Fujikawa and Araki  | 86  | F   | Hypochondralgia, fever                         | None                                                          | Pus (+ Serratia marcescens)                                                           | Pus aspiration, antibiotics                  |
| Bhattacharya et al. | 69 | F   | Abdominal pain, palpable epigastric lump       | Calculus cholecystitis                                          | Not described                                                                          | Antibiotics, upcoming cholecystectomy                                                   |
| Zorgdrager et al.  | 66  | M   | Periumbilical painful swelling, loss of appetite, fever | Abdominal wall abscess, partial portal thrombosis, liver atrophy | Pus (+ Enterobacter aerogenes, Enterobacter cloacae, Streptococcus milleri)        | Surgical resection                          |
| Fang and Huang     | 33  | M   | Epigastralgia                                  | Calculous cholecystitis                                         | Not described                                                                          | Surgical resection of the gallbladder and round ligament                              |
| **Current case**   | 68  | M   | Abdominal pain, jaundice, nausea, vomiting, low-grade fever | Pancreatitis, obstructive choledocholithiasis, cholecystolithiasis, calculous cholecystis | Blood (−), pus (−)                                                                     | Antibiotics, ERCP, cholecystectomy, laparoscopic pus drainage/US-guided aspiration |

ERCP: endoscopic retrograde cholangiopancreatography.
presentation of LTH abscesses is abdominal pain (epigastralgia), fever, and vomiting. Of the 18 cases, 4 presented palpable/noticeable mass in the epigastrum.9,12,19,21 The majority of cases are accompanied by at least one of these complications, pancreatitis, obstructive choledocholithiasis, cholangitis, and portal thrombosis. An LTH or FL abscess was first suspected in most cases by imaging and confirmed by intraoperative exploration followed by treatments. There are only two cases, the current case and the other reported by Tsukuda et al.,16 that presented abscess in a delay after ERCP was conducted. Six patients were cured with conservative therapy,7,10,14,20,21 while the rest underwent surgical resection, including some who received conventional treatment primarily but recurrent or did not shrink the abscess.8,9,11–13,15–19,22,23

As such, scholars classify LTH abscess as a complication of biliary tract obstruction interpreted as retrograde infection of the portal venous system.18,19,23 When bacteria invade the hepatic sinusoids and systemic circulation, they can cause abscesses in the round ligament of the liver. However, some cases develop an LTH abscess without a history of pancreatitis or biliary tract infection, particularly in children.1–4 Others have proposed that the lymphatic spread of infection could be another cause of abscess formation.14 Because the superficial lymphatics of the liver drain the lymph from the FL, it could spread infections and malignancies to the FL through blood or lymphatics. It could also collect infections or malignancies from surrounding structures and seed them in the FL.18

Our patient presented with severe infection and was initially treated with ERCP for obstructive cholangitis. However, when he was readmitted for laparoscopic cholecystectomy, an LTH abscess was incidentally identified during surgery. A detailed retrospective investigation in imaging revealed that this abscess appeared on the second visit but not on the first, raising a causal inference dilemma. Here, we discuss some potential causes that could link to this abscess formation.

First, we suspect that due to obstructive choledocholithiasis, the retrograde spread of the infection from the biliary tree to the liver sinusoids could have led to an abscess of the LTH.18 However, since the patient had a low intermittent fever and aspirated pus and blood cultures were negative for bacteria, the antibiotics were assumed to be effective. Therefore, the hematogenous spread of the infection does not appear to have directly triggered this abscess. Second, could this LTH abscess be an ERCP complication? Tsukuda et al.18 described a case of the round ligament abscess that occurred after an endoscopic papillotomy for choledocholithiasis, similar to our case, although the mechanism was unclear. In general, injection of contrast dye and biliary flush during ERCP could temporarily increase pressure in the biliary duct, leading to the retrograde spread of bacteria through the biliary tract to the hepatic sinusoids and blood circulation. It can also cause liver damage and LTH abscess.

Nevertheless, this route of infection is consistent with the first. Given the clinical manifestations and treatments provided, it is difficult to infer that sinusoidal infection or hematogenous spread of infection led to this abscess of LTH. Besides, the patient received antibiotics before and after the operation and endoscopic nasobiliary drainage (ENBD) was also performed. Thus, it is unlikely that ERCP directly resulted in an abscess of the LTH.

Next, the round ligament of the liver is a degenerative cord of tissue that extends from the umbilicus to the transverse fissure of the liver. Increased pressure in the portal vein could recanalize the FL to allow blood flow. Yet, no evidence from laboratory tests or associated examinations suggested that the patient had cirrhosis or portal hypertension.

Then, would the lymphatic spread of the infection be the route? Due to its close association with the liver, when there is severe inflammation in the bile duct, it is likely that the LTH is infected by the retrograde lymphatic route to form an abscess. Finally, given that extensive adhesion was observed in the abdomen, direct infection by peritonitis cannot be ruled out as the source of this abscess formation.

Here, we elaborate on the “likely” and “unlikely” routes to spread the infection in this case, but the mechanism of LTH abscess formation remains controversial. It is also interesting to note that no abscess was detected at the initial admission but found at the second. We assume that our patient was on antibiotics before (cephalosporin) and after entry (meropenem, piperacillin, and levomizamide), which slowed but could not stop the development of the abscess.

Regarding the treatment option, surgical excision is recommended to completely resolve the abscess.5 However, quite a few show that conservative treatment with endoscopic biliary drainage and broad-spectrum antibiotics has improved the condition. We assume that the primary cause of LTH abscess was biliary tract infection due to obstructive cholangitis, which was managed by ERCP and antibiotics. An isolated LTH abscess was discovered coincidently during laparoscopic cholecystectomy (LC); however, his general condition was not sustainable for surgical excision of the LTH immediately after LC because it could have spread the infection and cause diffuse peritonitis or even septic shock. In addition, intraoperative examination revealed that the patient had extensive intra-abdominal adhesions.

Therefore, considering that the patient’s inflammatory parameters improved significantly, we believed that the conservative approach using laparoscopic pus aspiration and drainage was the best option for the patient at the time the abscess was confirmed after LC. An ultrasound-guided pus aspiration was also performed to ensure thorough removal of the abscess. Fortunately, drainage of the pus and antibiotic treatment diminished the abscess. Our patient showed improved clinical symptoms and remained asymptomatic with normal biochemical parameters at follow-up.
Conclusion

Imaging techniques are an essential means of inspecting round ligament abscesses. However, exploratory laparotomy or intraoperative diagnosis is often used for confirmation. In the present case, the mechanism of the formation of LTH abscesses is not fully understood. However, in patients with severe infection due to obstructive cholangitis and cholecystitis, although it is not necessarily related to the ERCP procedure, an abscess of LTH can occur as a rare complication afterward. Furthermore, when the infectious states of the patients allow, it is feasible to simultaneously address predisposing conditions, such as laparoscopic cholecystectomy, intraoperative diagnosis, and subsequent conservative treatment with endoscopic biliary drainage and antibiotics.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethical approval

The study is approved by the Ethics Committee of Yanbian University Hospital (No. 2021165).

Informed consent

Written informed consent was obtained from the patient for his anonymized information to be published in this article.

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