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Case Report

Laparoscopic treatment of Mirizzi syndrome with subtotal cholecystectomy and electrohydraulic lithotripsy: A case report ☆

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ABSTRACT

Mirizzi syndrome is a rare chronic cholecystitis complication. However, the current consensus on managing this condition remains controversial, especially through laparoscopic surgery. This report describes the feasibility of treating type I Mirizzi syndrome with laparoscopic subtotal cholecystectomy and electrohydraulic lithotripsic gallstone removal. A 53-year-old woman presented with dark urine and right upper quadrant pain for 1 month. On examination, she was jaundiced. Blood tests showed highly elevated liver and biliary enzyme levels. Abdominal ultrasound showed a slightly dilated common bile duct with suspicion of choledocholithiasis. However, endoscopic retrograde cholangiopancreatography showed a narrowed common bile duct extrinsically compressed by a gallstone in the cystic duct, establishing a Mirizzi syndrome diagnosis. Elective laparoscopic cholecystectomy was planned. At operation, the trans-infundibulum approach was used since dissection around the cystic duct was difficult due to severe local inflammation of Calot's triangle. The gallbladder's neck was opened, and the stone was removed by lithotripsy via a flexible choledochoscope. Common bile duct exploration through the cystic duct was normal. The fundus and body of the gallbladder were resected, followed by T-tube drainage and suturing of the gallbladder's neck. The patient's postoperative clinical course was uneventful. Treating Mirizzi syndrome remains a major challenge for hepatobiliary specialists even with open surgery due to high complication rates, including bile duct injuries. Treatment is primarily to clear out the responsible stone and necrotic tissue. Due to advances in endoscopic surgery and

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equipment, subtotal cholecystectomy with laparoscopic gallstone extraction provides a safe and effective option for patients with Mirizzi syndrome. Laparoscopic subtotal cholecystectomy with electrohydraulic lithotripsy is a feasible and useful approach for treating Mirizzi syndrome that avoids iatrogenic bile duct injury.

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Introduction

Mirizzi syndrome (MS) is a rare gallstone disease complication. It is named after Pablo Luis Mirizzi, an Argentine surgeon who described it in 1948 [1]. While many MS classifications exist, those of McSherry and Csendes' are currently widely used. According to their classification, MS is divided into 2 types. Type I is characterized by the extrinsic compression of the main bile duct by a stone impacted in the infundibulum of the gallbladder or cystic duct. Type II is associated with the formation of a cholecystocholedochal fistula [2]. The incidence of MS in patients undergoing cholecystectomy ranges between 0.06% and 2.7% [3]. At present, the standard treatment for MS remains controversial. Due to the high conversion rate and high risk of bile duct injury, open surgery is usually preferred over laparoscopic surgery [1]. However, we believe that advances in preoperative diagnostic tools and endoscopic surgery, including devices and techniques, make laparoscopic surgery suitable for MS with good outcomes [4,5]. Here, we report a case of MS successfully treated with laparoscopic subtotal cholecystectomy combined with electrohydraulic lithotripsy (EHL) to demonstrate the feasibility and utility of laparoscopic surgery in managing MS. This work has been reported in line with the SCARE criteria [6].

Case report

A 50-year-old woman was admitted to our hospital with vague epigastric pain and dark urine for 1 month. The patient's medical history was normal. On examination, she had mild jaundice and slight right upper quadrant tenderness. Laboratory findings on admission are shown in Table 1, with blood tests showing elevated inflammatory findings (white blood cells = 23,500/μL), high liver and biliary enzymes (total bilirubin = 24.8 mg/dL). Abdominal ultrasound showed a thick-walled and depleted gallbladder with slight dilatation of the intrahepatic bile duct and common hepatic duct (about 12 mm in diameter), suggesting choledocholithiasis (Fig. 1). She then developed acute cholangitis signs with severe abdominal pain and high fever (38.5°C). Emergency endoscopic retrograde cholangiopancreatography (ERCP) was performed. It showed a dilated common hepatic duct extrinsically compressed by a large gallstone (Fig. 2), establishing the MS diagnosis.

After biliary drainage by ERCP, conventional laparoscopic cholecystectomy was performed. The operation started with 4 ports. Due to severe inflammation in the hepatobiliary triangle, the gallbladder's neck could not be dissected clearly, and the critical safety view could not be archived. Therefore, a longitudinal incision was made in the gallbladder's infundibulum, and an intraoperative cholangiogram confirmed a stone obstructed in the cystic duct (Figs. 3 and 4). Subtotal cholecystectomy was performed to remove the gallbladder's fundus. Then, a flexible cholangioscope was inserted via the infundibulum. EHL was performed using a 4.5 Fr flexible probe connected to a shock-wave generator unit - Storz Calcutript 27080 (Karl Storz Gmbh & Co. Kg, Tuttlingen, Germany), and stone fragments were removed with a basket. Transcystic common bile duct (CBD) exploration was performed using a flexible choledochoscope to confirm complete ductal clearance. Finally, a T-tube was inserted through the cystic duct foramen, and the cystic duct was sutured from the inside of the gallbladder using 4.0 Vicryl. The operation time was 380 minutes, and blood loss was slight. The patient's postoperative course was uneventful, and they were discharged 7 days postoperation. Cholangiography performed 14 days postoperation showed good passage with a normal bile duct (Fig. 5). The T-tube was removed 1 month later without postoperative complications.

Table 1 – Laboratory findings.

Complete blood count		
Variable	Range	On admission
WBC (/μL)	4600-10.000	23.500
RBC (/μL)	404-613	342×10^4
Hb (g/dL)	12.2-15.8	9.9
HCT (%)	37.7-48	29.4
Plt (/μL)	14.2-42.4	56.3×10^4
Liver Function Test		
AST (IU/L)	10-35	61
ALT (IU/L)	10-35	41
Total bilirubin (mg/dL)	0.2-1.3	24.8
Direct bilirubin (mg/dL)	< 0.23	17.54
ALP (U/L)	30-120	681
GGT(U/L)	15-50	2163
Serological tests		
HBsAg		(negative)
HBsAb		(negative)
Procalcitonin (ng/mL)	0-0.07	3.04
Coagulation		
PT (sec)	0.8-16	11.5
aPTT (sec)	24-38	29.5
INR	< 1.2	1.1

ALP, alkaline phosphatase; ALT, alanine transaminase; aPTT, activated partial thromboplastin time; AST, aspartate aminotransferase; GGT, Gamma Glutamyl Transferase; Hb, hemoglobin; HBsAb, hepatitis B surface antibody; HBsAg, hepatitis B surface antigen; Hct, hematocrit; INR, international normalized ratio; PLT, Platelet; PT, prothrombin time; RBC, red blood cell; WBC, white blood cell.

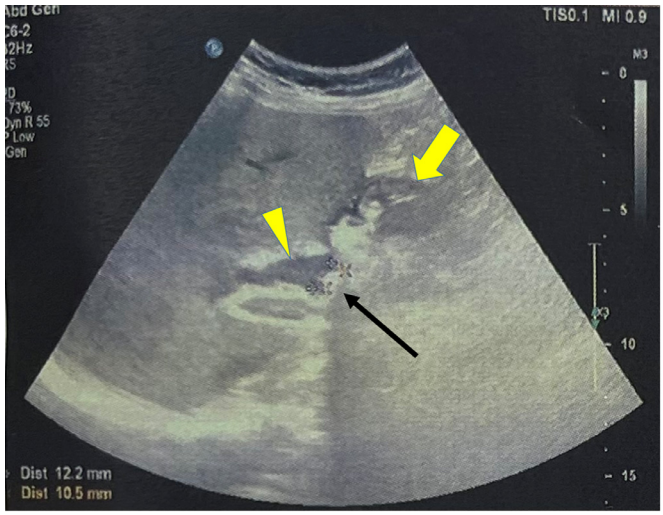

Fig. 1 – Abdominal ultrasound shows contracted gallbladder with apparent wall thickening (yellow arrow) and dilated common hepatic duct (yellow arrow head). A hyperechoic lesion with posterior acoustic shadowing at the common hepatic duct area (black arrow) suggested choledocholiathiasis.

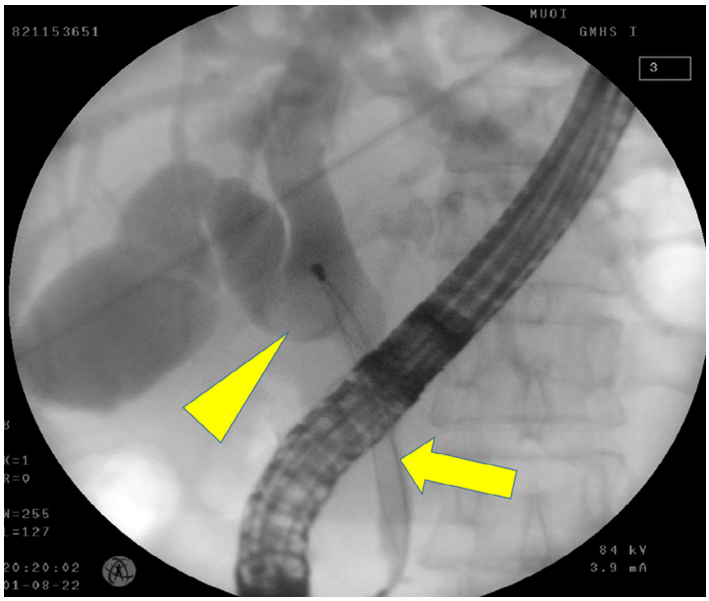

Fig. 2 – The ERCP showed a narrowed CBD (arrow) compressed by a large gallstone (arrowhead) and dilated common hepatic duct.

Discussion

MS is a rare complication where the CBD is blocked by stones in the gallbladder's neck and cystic duct, leading to choledochitis. McSherry and Csendes described 2 MS types. Our case showed a dilated CBD externally compressed by a stone in the cystic duct, supporting a type I MS diagnosis.

Preoperative identification of MS is crucial to prevent bile duct damage. Indeed, prior studies indicated that 17% of patients with MS without a preoperative diagnosis suffered intraoperative bile duct injuries. Compared to studies on patients with fewer preoperative diagnoses, those with more preoperative diagnoses had much lower risks of conversion, procedure-related complications, and reoperation [1,5]. Therefore, identifying MS prior to surgery is critical for successful laparoscopic surgery. Among various imaging modalities, ERCP is the most sensitive diagnostic test for MS, with a sensitivity of 55%-90% [7,8]. Therefore, ERCP can be diagnostic and therapeutic by decompressing the obstructed CBD preoperatively with the ENBD tube. The ENBD tube could be a useful landmark to identify the CBD during surgery. Intraoperative

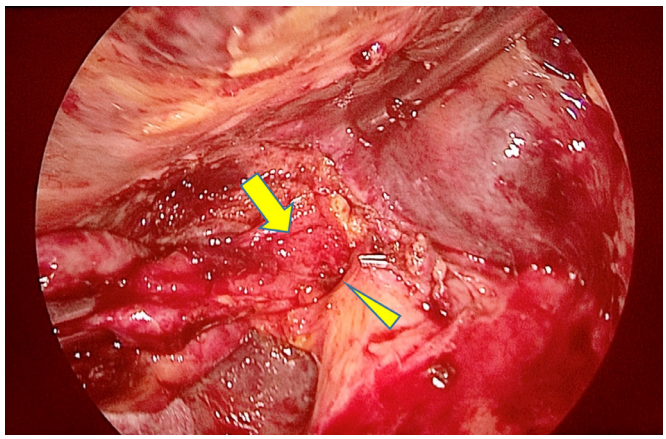

Fig. 3 – The cut edge of the gallbladder after subtotal cholecystectomy was performed due to severe inflammation in the Calot's triangle. The arrow indicates the mucosa of the leftover gallbladder wall, and the arrowhead indicates the cystic duct orifice.

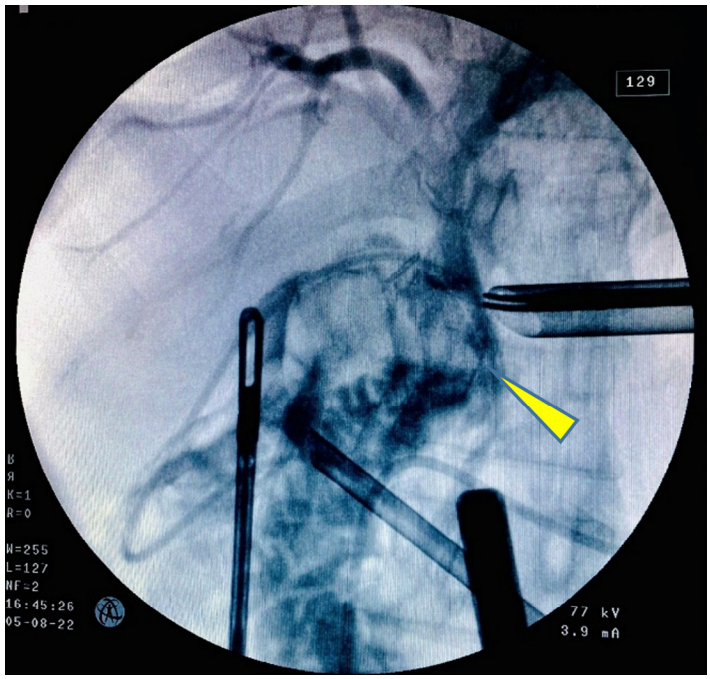

Fig. 4 – The intraoperative cholangiogram confirmed a stone obstructing the cystic duct (arrowhead), extrinsically compressing the main bile duct.

cholangiography could easily be performed via the ENDB tube to provide important information about the patient's bile duct anatomy [4].

There is currently no standard treatment for MS. Laparoscopy has traditionally not been recommended for treating MS due to severe inflammation in the gallbladder's neck area, which makes identifying anatomical structures during surgery relatively difficult, especially the CBD and gallbladder boundaries [9]. Consequently, bile duct injury is the most dangerous complication of laparoscopic cholecystectomy in MS. Some studies reported that the complication and reoperation rates could be ≤60% and ~5%, respectively [8,10]. Studies have also shown a high conversion rate and bile duct injuries during laparoscopic cholecystectomy for MS. Therefore, the preferred procedure for such patients is a laparoscopic subtotal cholecystectomy [5,11].

Moreover, along with surgery, alternative intervention methods have been reported to treat MS with promising outcomes. Benninger et al. [12] reported successful treatment of complex cholelithiasis in patients with or without MS using extracorporeal shockwave lithotripsy (ESWL). However, even with a good complete stone fragmentation rate, patients need to undergo multiple ESWL sessions and ERCP must be performed later in most cases due to residual stones in the

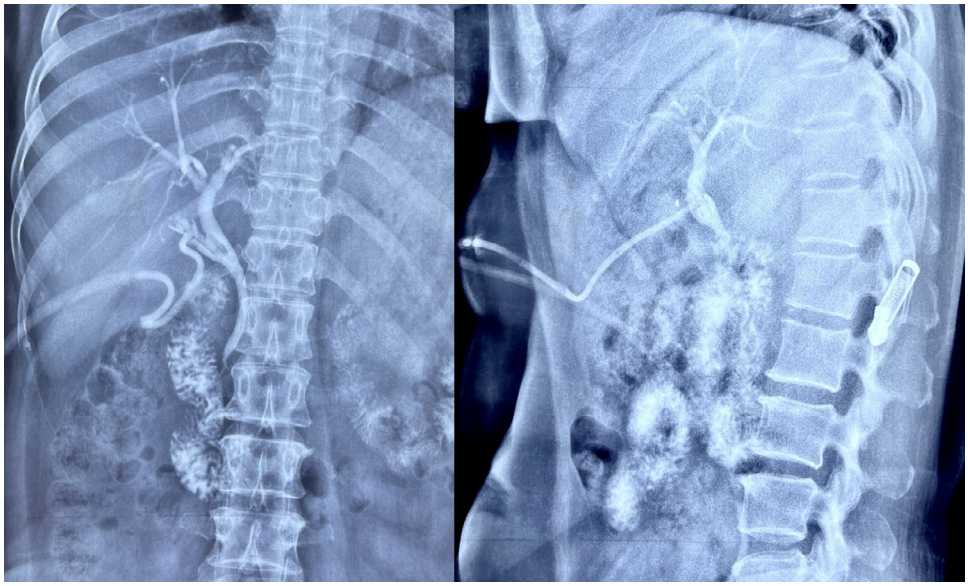

Fig. 5 – The postoperative cholangiogram confirmed a normal bile duct with complete stone clearance.

CBD, which makes the procedure complicated and not cost-effective. According to some publications, complete ductal clearance of stones can be achieved in up to 98%-100% of patients with difficult bile duct stones by EHL combined with mother-baby peroral cholangioscopy [13,14]. Though we believe that the procedure is safe and effective, the "mother and baby" endoscope system is not widely used in our country due to its high cost and supply shortage. Thus, the accessibility of the system to the impacted stone in the proximal cystic duct or neck of the gallbladder, especially in MS type I, is still controversial [14].

The conventional approach for MS involved a partial cholecystectomy with a small gallbladder flap left for the repair of the destroyed bile duct, which was later secured by a T-tube over the fistula to prevent postoperative strictures or bile leakage [8]. In more complex cases, especially MS type III or IV, hepaticojejunostomy reconstruction may be required if there is severe damage to the CBD wall. While several studies have reported successful laparoscopic subtotal cholecystectomy for type I MS, they described the procedure without any surgical tips. Here, we reported our operative strategy in laparoscopic subtotal cholecystectomy for MS. Our key to successfully managing type I MS was the removal of the impacted stone, the cause of this condition, via the trans-infundibulum approach, followed by a subtotal resection of the gallbladder's wall and insertion of a drain over the closure of the gallbladder's stump. The trans-infudibulum approach has the benefit of not needing a choledochotomy or fistulotomy, preventing bile duct injury and postoperative bile leak. Thus, EHL under cholangioscope control allows full access and complete clearance of the CBD, even with heavily impacted stones, since residual lithiasis is one of the most common complications of laparoscopic treatment of MS. A retrospective review of 425 consecutive patients who underwent laparoscopic bile duct exploration by Senra et al. [5] reported 11 patients with MS type II treated with laparoscopic subtotal cholecystectomy. The trans-infudibulum approach combined with intraoperative stone extraction by flexible cholangioscope was performed successfully in all cases with no conversion and minor complications. Despite a relatively high frequency of MS type II (40%) and type III (20%), Kamalesh et al. [15] treated MS laparoscopically in 20 patients and completed the procedures in 70% of them with a similar technique. Therefore, laparoscopic transvesical access could be a simple, safe, and effective strategy for the treatment of MS [5,16].

Postoperative bile leak may occur in 18%-20% of patients after subtotal cholecystectomy [11]. While most cases are self-limiting, it can sometimes be life-threatening. Therefore, in our case, CBD closure was performed over a T-tube to decompress the bile duct, which also permits postoperative cholangiography to determine whether the normal anatomy has been restored. We believe that it is not only much more effective but also less invasive and safer than a biliary bypass. Most studies also reported that bilioenteric reconstruction is not necessary in the majority of type I and II MS and in some cases of type III MS [5,15,16]. For complex type III and type IV MS, open surgery was still the favorite treatment modality [15,17].

Recent researches have shown that laparoscopic surgery with subtotal cholecystectomy was successfully completed and could be a valuable and effective surgical treatment option for MS. The procedure should be recommended based on each center's proficiency in laparoscopic surgery.

Conclusion

Our report aimed to improve experience and knowledge on the laparoscopic management of type I MS. Preoperative diagnosis is crucial for successful laparoscopic treatment. A laparoscopic subtotal cholecystectomy using a trans-

infundibulum approach is a safe and feasible method for complete stone extraction while avoiding choledochotomy or fistulotomy and their associated complications, especially with a frozen Calot's triangle.

Author's contributions

Pham VQ and Nguyen MD: Case file retrieval and case summary preparation. Pham VQ and Nguyen MD: preparation of manuscript and editing. All authors read and approved the final manuscript.

Availability of data and materials

Data and materials used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

Our institution does not require ethical approval for reporting individual cases or case series. Written informed consent was obtained from the patient(s) for their anonymized information to be published in this article.

Patient consent

Informed consent for patient information to be published in this article was obtained.

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