



# Laparoscopic modified subtotal cholecystectomy is a safe method in the management of mirizzi syndrome type I

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## ARTICLE INFO

### Keywords:

Bile leak  
Biliary tract injury  
Mirizzi syndrome  
Subtotal cholecystectomy  
Difficult cholecystectomy

Received: Nov 15, 2021

Accepted: Dec 28, 2021

Available Online: June 24, 2022

### DOI:

[10.5455/annalsmedres.2021.11.618](https://doi.org/10.5455/annalsmedres.2021.11.618)

## Abstract

**Aim:** Efforts to reveal the cystic duct and the cystic artery during standard cholecystectomy in Mirizzi Syndrome (MS) without preoperative or intraoperative diagnosis increase the risk of biliary and vascular injury due to intense fibrosis in the Calot's triangle. We aim to evaluate the postoperative results of a group of MS type I patients who were diagnosed by video scope intraoperatively and underwent laparoscopic modified subtotal cholecystectomy (LMSC) in the same session since safe dissection of Calot's triangle could not be performed.

**Methods:** Ten out of 1680 patients who underwent conventional laparoscopic cholecystectomy for acute or chronic cholecystitis between 2017 and 2019 were diagnosed with MS type I intraoperatively. These 10 patients underwent LMSC and their demographic characteristics, preoperative clinical histories, radiological images, intraoperative and postoperative findings were evaluated retrospectively. Intraoperative MS type determination and LMSC technique are explained.

**Results:** The diagnoses of MS type I in all our cases were made laparoscopically with the help of a videoscope during the operation where safe dissection of the Calot's triangle could not be performed in either elective or emergency cholecystectomy. LMSC was performed without leaving any cavity behind, and there was no need for any intervention at the operation site (suture, staple closure) since the cystic duct orifice was already obstructed due to fibrosis as visually verified by the camera. There were no intraoperative bile duct injuries or postoperative biliary fistula. None of our patients developed postcholecystectomy syndrome (Follow-up range 1-38 months).

**Conclusion:** The LMSC is a safe procedure in the diagnosis and surgery of MS type I where safe dissection of Calot's triangle could not be performed.



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## Introduction

Mirizzi syndrome (MS), which is a rare complication of gallbladder stones, is encountered in 0.18-5.7% of patients [1]. In MS, fibrosis which develops due to chronic inflammation causes biliary tract dislocation and hardening of the tissues in the Calot's triangle. For these reasons, Calot's triangle dissection becomes imperatively difficult during the operation and serious bile duct injuries may occur [2-5].

Today, there is no well-established international guideline regarding the clinical follow-up and surgery of MS. Despite advances in imaging technology, the preoperative diagnosis rate is between 0-33% [5]. Many MS patients are

diagnosed intraoperatively [5]. Not recognizing MS intraoperatively and attempts to reveal cystic artery and cystic duct (CD) may cause serious bile duct injuries [5,6]. Even if MS is diagnosed intraoperatively, it is known that the risk of biliary tract injury does not decrease during Calot's triangle dissection [7].

Few studies in the literature have reported that during difficult dissections, opting for laparoscopic subtotal cholecystectomy instead of proceeding to open surgery can both reduce the rate of conversion to open surgery and the risk of biliary tract injury [8]. In the 2018 Tokyo guidelines, bail-out procedures such as subtotal cholecystectomy were recommended to prevent bile duct injury according to intraoperative findings in acute cholecystitis [9]. These findings include factors related to inflammatory changes around the gallbladder, the Calot's triangle area, and the gallbladder bed as well. Similarly, impacted gallstone in the confluence of cystic, common hepatic, and

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common bile duct (i.e., Mirizzi syndrome) causes recurrent inflammation of the distended gallbladder with compression of the common hepatic duct by tense Hartmann's pouch [10]. Therefore, when the Critical View could not be obtained due to inflamed or adhered triangle of Calot, laparoscopic subtotal cholecystectomy can safely complete the procedure without pursuing further dissection of structures in the triangle of Calot particularly in Type I Mirizzi syndrome without cholecysto-choledochal biliary fistula [11]. Strasberg et al. classified subtotal cholecystectomy as “fenestrating” when the gallbladder remnant is left open or the cystic duct is closed from inside, and “reconstituting” when a closed gallbladder remnant cavity is left [12]. However, the postcholecystectomy syndrome may be seen due to the remaining cavity [13-14]. In our study unlike many studies, laparoscopic modified subtotal cholecystectomy (LMSC) was performed without leaving any cavity in the gallbladder neck and putting any sutures to the site in MS type I with closed cystic duct orifice.

Our aim in this study was to evaluate the efficiency of LMSC in determining the risk of bile duct injury and the MS type intraoperatively. In addition, we aimed to demonstrate the intraoperative surgical steps and present the postoperative results of our cases.

## Materials and Methods

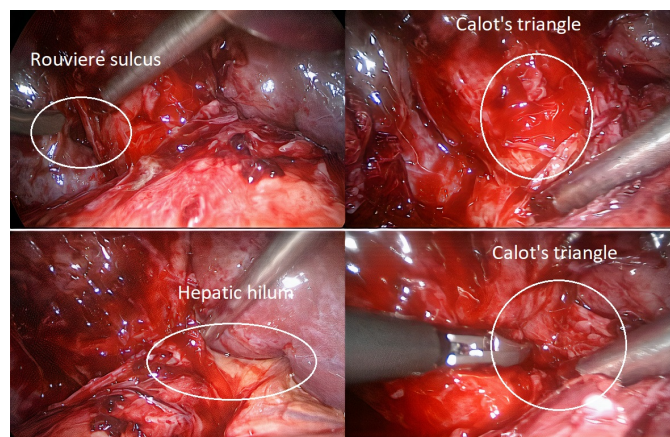
### Patients

Conventional laparoscopic cholecystectomy was performed in 1395 of 1680 patients who underwent laparoscopic cholecystectomy surgery for acute or chronic cholecystitis due to gallstones between the years 2017 and 2019. In 275 cases, cholecystectomy was performed by switching to open surgery because laparoscopic procedures could not be performed. LMSC was performed in 10 patients who were diagnosed with MS type I intraoperatively. The preoperative clinical histories, radiological images, history of non-invasive/ minimal invasive diagnostic methods, intraoperative and postoperative findings of those cases were obtained from the hospital's registry system and evaluated retrospectively after obtaining the approval of the ethics committee (Date: 27.06.2019, no: 2019 / 10-23). Determination of MS type by LMSC method and surgical steps were described.

### Surgical procedure

In all cases, a standard laparoscopic cholecystectomy procedure was started with the placement of 4 trocars. Intra-abdominal exploration was performed first. If the adhesion between the gallbladder and the surrounding tissue was explored, it was removed carefully by blunt-sharp dissection. After the gallbladder was exposed and retracted, the infundibulum, Calot's triangle, and hepatic hilum were determined. If the biliary tract and vascular structure could not be determined by dissection due to the hard and dense tissues in the Calot's triangle, the dissection of the Calot's triangle was stopped as continued dissection would increase the risk of bile duct injury. Rouviere sulcus was identified (figure 1).

Above this sulcus level, the infundibulum was opened from the curved area and the content of the gallbladder was



**Figure 1.** The dissection of the Calot's triangle biliary tract and vascular structure could not be determined by dissection due to the hard and dense tissues in the Calot's triangle.

aspirated. Stones placed in the Hartmann's pouch were taken out within the endobag. The gallbladder was irrigated with a physiological saline solution and subsequently, the cystic duct orifice was identified in the gallbladder lumen. The MS type I diagnosis was established following the evaluation of cystic duct orifice (closed), demonstration of the absence of cholecystocholedochal fistula, and adhesion of Hartmann's pouch to the CBD. The length of the gallbladder was checked from the inside and outside the lumen to avoid possible damage to the bile ducts during resection. Gallbladder resection was started from the closest point to the orifice of the cystic duct to avoid leaving a cavity behind. When the dissection could not be performed due to intense fibrosis between the posterior wall of the gallbladder and the liver bed, the anterior leaf of the gallbladder was resected retrogradely. No opening was observed in the cystic duct by videoscope; therefore, it was not tied, and the site was not sutured (figure 2).

The gallbladder's posterior wall mucosa was cauterized. The LMSC operation was terminated by placing a drain in the gallbladder lodge.

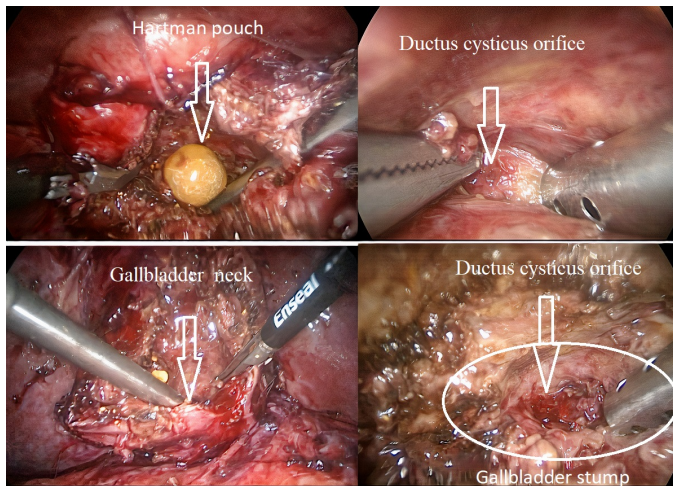
## Results

### Preoperative findings

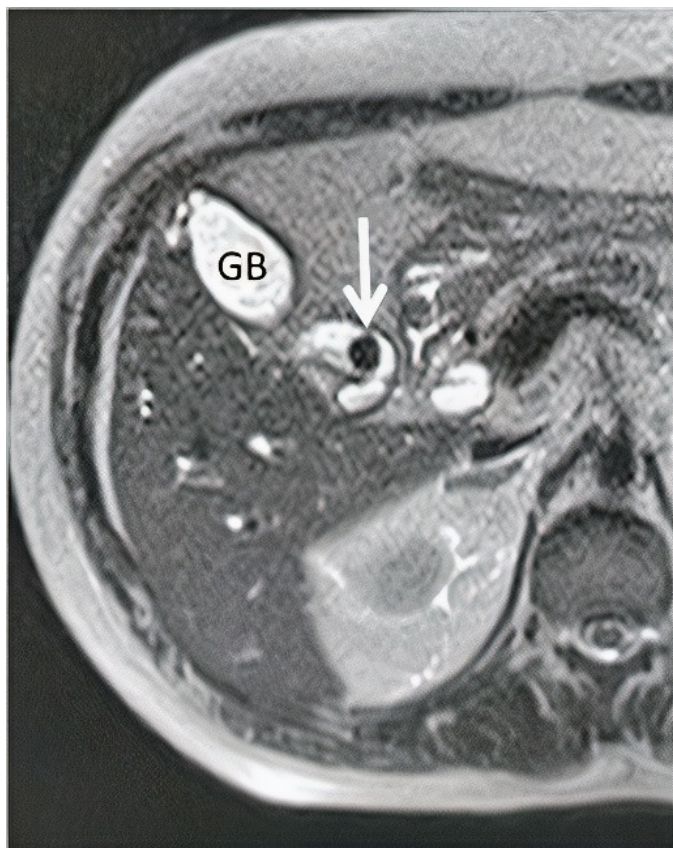
Ten patients (6 male, 4 female) were included in this study who were admitted to the hospital with signs and symptoms of acute cholecystitis (AC). Abdominal ultrasonography (USG) revealed that all patients had gallstones varying from 10 to 27 mm in size. Four (40%) patients responded to medical treatment (Table 1) and underwent surgery under elective conditions. Additional imaging assessment was performed in 6 (60%) patients who did not respond to medical treatment (Table 1). Magnetic resonance cholangiopancreatography (MRCP) revealed atrophic gallbladder, stone in gallbladder neck and CBD, inflammation in CBD wall, and dilated intrahepatic bile ducts (IHBD) and CBD in two patients (20%) (Figure 3).

The stone in the CBD was extirpated by endoscopic retrograde cholangiopancreatography (ERCP). Later, these

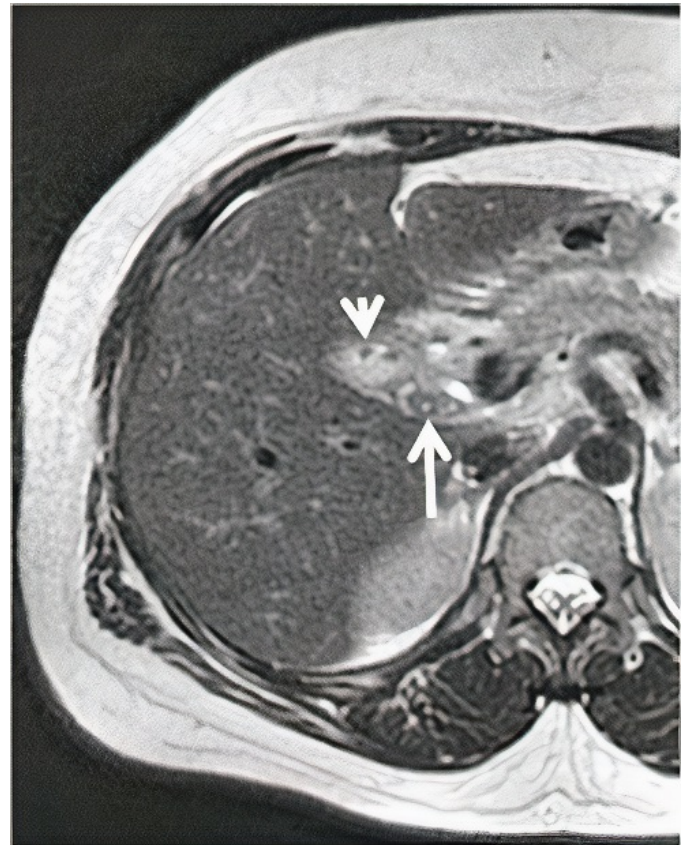




**Figure 2.** Opening of the gallbladder, removal of stones from the Hartmann’s pouch, an inspection of the gallbladder Hartmann’s pouch, when the orifice of the ductus cysticus was examined with the camera, it was closed due to fibrosis



**Figure 3.** 49-year-old man with Mirizzi syndrome. Axial T2-weighted imaging of magnetic resonance cholangiopancreatography shows gallstone (arrow) in the gallbladder (GB) neck.



**Figure 4.** 44-year-old woman with Mirizzi syndrome. Axial T2-weighted imaging of magnetic resonance cholangiopancreatography shows thick-walled obliterated cystic duct (arrow) in Calot’s area. Note that there are two small hypointense gallstones (arrowhead) in the gallbladder neck.

two patients underwent surgery under elective conditions. In one patient (10%), the cystic duct was obliterated on MRCP (Figure 4).

In the other two patients (20%), the gallbladder was hydropic, with marked inflammation in the wall of the gallbladder and CBD, while IHBD and CBD were slightly dilated. In those patients, ERCP and sphincterotomy were performed due to debris in the CBD lumen, however, the acute course did not regress after these interventions. Percutaneous cholecystostomy (PC) was performed as the first-choice intervention instead of emergency surgery due to morbid obesity and muscular dystrophy. After the regression of acute course, they subsequently underwent elective surgery for symptomatic cholecystitis. The remaining two (20%) patients underwent emergency surgery (Table 1).

*Intraoperative findings*

In 5 (50%) patients, bile leakage was observed from the cystic duct orifice after the Hartmann’s pouch was emptied. The leakage decreased and eventually stopped during the operation. Acholic bile was present in the gallbladder of the other 5 (50%) patients. Bile leakage was not observed from the cystic duct orifice of these patients.

**Table 1.** Characteristics of Mirizzi syndrome type I patients in the study.

G/A	ASA Score	RMT	Comorbidities	MRCP	CT	ERCP	PC	EMS	ES
F/42	II	None	Morbid Obesity	Hydropic GB, debris in CBD, inflamed GB and CBD wall, slight dilatation in IHBD and CBD		Sphincterotomy, drainage of pus and debris from CBD, normal biliary tract	Yes	None	yes
F/44	II	Yes	None				None	None	Yes
M/69	III	None	Diabetes Mellitus, Coronary Artery Disease, Hypertension	Atrophic GB, stone in CBD, inflammation of CBD wall, dilatation of IHBD and CBD, gallstone impaction in the GB neck	GB size:28x19x20 mm, gallstone impaction in the GB neck	Sphincterotomy, extraction of stone from CBD, dilatation of IHBD and CBD	None	None	Yes
F/44	II	None	None		Hydropic GB, inflamed GB wall		None	Yes	None
M/40	III	Yes	Myotonic Dystrophy				None	None	Yes
M/49	III	None	Myotonic Dystrophy	Hydropic GB, gallstone impaction in the GB neck, inflammation of GB and CBD wall, slight dilation of IHBD and CBD		Sphincterotomy, drainage of pus and debris from CBD, normal biliary tract	Yes	None	Yes
M/63	III	None	Diabetes Mellitus, Morbid Obesity, Chronic Obstructive Pulmonary Disease, Hypertension	Atrophic GB, stone in CBD, inflammation of CBD wall, dilation in IHBD and CBD, gallstone impaction in the GB neck	Gallbladder size: 33x17x19mm, gallstone impaction in the GB neck	Sphincterotomy, extirpation of stone from CBD, dilatation of IHBD and CBD	None	None	Yes
F/37	II	Yes	None				None	None	Yes
F/61	II	Yes	None				None	None	Yes
M/20	II	None	Right Pulmonary Atresia		Hydropic GB, inflamed GB wall		None	Yes	None

AC: Acute Cholecystitis, ASA: American Society of Anesthesiologists, CBD: Common Bile Duct, CT: Computerized Tomography, EMS: Emergency Surgery, ES: Elective Surgery, ERCP: Endoscopic Retrograde Cholangiopancreatography, F: Female, G/A: Gender/Age, GB: Gallbladder, IHBD: Intrahepatic Biliary Duct, M: Male, MRCP: Magnetic Resonance Cholangiopancreatography, PC: Percutaneous Cholecystostomy, RMT: Response to medical treatment



Of note, intraoperative cholangiography could not be performed in our patients because Calot's triangle dissection could not be performed, and the lumen of the cystic duct was not open.

#### Follow-up

Bile duct fistula was not observed in any of our patients in the postoperative period. In addition, no other sign of morbidity or mortality developed. One patient was lost to follow-up. The remaining 9 patients returned to our institution for postoperative follow-up with a median of 10 months of follow-up (range 1-38 months) and none of those patients had recurrent right upper quadrant pain or cholelithiasis during the follow-up period.

#### Discussion

The optimal surgical method which reduces the risk of bile duct injury and the rate of conversion to open surgery in MS has not been described yet [5]. As a result of chronic inflammation in MS, a frozen structure occurs due to intense fibrosis in the gallbladder wall and surrounding connective tissue. Therefore, safe dissection often cannot be performed in the gallbladder bed and the Calot's triangle [15]. In conventional cholecystectomy operation, it is necessary to dissect the Calot's triangle to release the cystic duct all around and reveal the cystic artery for a "critical view of safety" [16]. Efforts to reveal cystic artery and cystic duct in MS cases - may cause serious bile duct injuries when the prompt diagnosis has not been established before or during the surgery [5,6]. In our study, we were not able to perform a safe Calot's triangle dissection during conventional laparoscopic cholecystectomy due to dense adhesions around the gallbladder. Therefore, following the emptying of the gallbladder, the diagnosis of MS Type I was established intraoperatively. LMSC was performed without leaving a cavity in the gallbladder and without closing the cystic duct (the cystic duct orifice was already obstructed due to fibrosis). According to our experience and long-term follow-ups of the presented patients, we believe that in cases where the Calot's triangle cannot be safely dissected during conventional laparoscopic cholecystectomy, the LMSC method makes it easier to determine the type of MS and avoid the catastrophic consequences of bile duct injury by performing less invasive surgery.

While the biliary tract injury rate is 16% in MS open surgery, this rate increases up to 40% in laparoscopic surgery. Therefore, laparoscopic surgery is not recommended in MS due to high rates of conversion to open surgery (11.1-80%) [5, 17-18]. On the contrary, in the review study by Antoniou et al., it was stated that the risk of bile duct injury was similar in both the open and laparoscopic surgeries due to the difficulty of dissection of the Calot's triangle [7]. Nevertheless, a limited number of studies in the literature reported that subtotal cholecystectomy reduces the risk of biliary tract injury in patients when the critical view could not be obtained [7]. In their study of 28 cases, Sinha et al. reported that postoperative bile leakage from the cystic duct was observed in 17% of patients who underwent subtotal cholecystectomy [19]. In the study of Lee, subtotal cholecystectomy was performed

in 15 cases with the remaining gallbladder stump being closed and postoperative bile leakage from the gallbladder stump was seen in 26% of patients [20]. Similarly, in a study of 27 cases by Shin et al. postoperative bile leakage was reported in 22.2% of patients with subtotal cholecystectomy and closed gallbladder stump [21]. These studies have shown that subtotal cholecystectomy reduces the rate of bile duct injury in cases with difficult cholecystectomy, where safe dissection of the Calot's triangle cannot be performed. However, although the closure of the gallbladder stump decreases the rate of bile leakage, the fistula rates are still high. These fistulas mostly close spontaneously or after a CBD stent placement [19-21]. In those studies, MS cases were not examined under a separate group and there was no discrimination of MS type, therefore we cannot make a direct comparison. Nonetheless, bile duct injury and bile leakage were not observed with subtotal cholecystectomy in our study, even though the cystic duct was not closed. This can be explained by the fact that all our cases were diagnosed as MS type I where the cystic duct is closed due to fibrosis in terms of definition [22].

A large cavity in the neck of the gallbladder may cause postcholecystectomy syndrome [13, 14]. Therefore, in our study, unlike other studies, resection was performed as close to the cystic duct orifice as possible in order not to leave an empty cavity in the gallbladder outlet neck. In our LMSC procedure, the Hartmann's pouch was emptied, and although bile leakage from the cystic duct orifice was observed initially, it stopped during the operation. Initial bile leakage from the cystic duct orifice did not change our surgical strategy since the closed cystic duct orifice was demonstrated by the videoscope in our patients. Postoperative sphincterotomy with ERCP and common bile duct stent was considered in case of bile leakage from the cystic duct. However, postoperative biliary fistula did not develop in any of our patients in the follow-up.

In our approach, since the dissection of the Calot's triangle is not forced in patients with suspected MS, the structure of the tissues in that area remains undamaged. After the gallbladder is drained, it is possible to reveal the anatomy and assess the presence of the MS. Following the diagnosis of MS, the important step is to determine the type of MS, because the surgical procedure varies according to each type. When the intraoperative cholecystocholedocal fistula (type II) is detected, if the fistula diameter is small, cholecystectomy is recommended as in type I. However, if the fistula diameter is large, primary repair of the fistula or choledochoplasty is advised. Choledochoplasty or Roux-en-Y hepaticojejunostomy is applied in type III and IV MS [23-27]. In our study, after the diagnosis of MS was established, the type of MS was easily determined by examining the gallbladder neck and Hartmann's pouch under direct visualization with a videoscope. Intraoperative cholangiography was not considered due to the absence of a fistula and closed cystic duct orifice in our cases.

In their series of 49 cases, Shirah et al. stated that the preoperative diagnosis of MS is not unequivocal, and they were in a constant dilemma. They reported that the main diagnosis is established intraoperatively, and the determination of the intraoperative MS type improved their results [28]. Safioleas et al. reported that 70% of MS cases were

diagnosed intraoperatively and 77% of these cases were type I [29]. In our study, although MS was suspected preoperatively in 60% of cases, the exact diagnosis of MS and the type of MS were determined intraoperatively. These results show the importance of intraoperative evaluation for the management of the patient.

## Conclusion

The difficult Calot's triangle dissection constitutes the major challenge in MS due to intense fibrosis around the cystic duct and artery. In cases where safe Calot's triangle dissection cannot be performed, the type of MS can be determined by a videoscope following drainage of the gallbladder intraoperatively. LMSC can be safely performed without leaving any cavity in the gallbladder neck and putting any sutures to the site in MS type I with a closed cystic duct orifice.

## Ethical approval

Medical Sciences University Izmir Tepecik Health Practice Research Center Non-interventional Ethics committee (Decision no; 2019/10-23, Date; 27/06/2019)

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