Laparoscopic Subtotal Cholecystectomy for the Difficult Gallbladder: A Safe Alternative

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ABSTRACT

Background: The safe completion of cholecystectomy is dependent on proper identification and secure closure of the cystic duct. Effecting this closure poses a great challenge when inflammatory changes obscure the anatomy. Subtotal cholecystectomy allows for near complete removal of the gallbladder and complete evacuation of the stones while avoiding dissection in the hazardous area.

Objectives: To describe our experience with laparoscopic subtotal cholecystectomy.

Methods: Subtotal cholecystectomy was performed when the critical view of safety could not be achieved. Surgical technique was similar in all cases and included opening the Hartmann's pouch, removing stones obstructing the gallbladder outlet, and identifying the opening of the cystic duct. Surgery also included circumferential transection of the gallbladder neck, closure of the gallbladder stump, and excision of the gallbladder fundus. Data retrieved from patient charts included demographics, pre-operative history, operative and postoperative course, and late complications.

Results: A total of 53 patients underwent laparoscopic subtotal cholecystectomy (2010–2018). Ten patients were operated during the acute course of the disease and 43 electively. Acute cholecystitis was the leading cause for gallbladder removal. Cholecystostomy tube was placed in 18 patients during acute hospitalization. The gallbladder remnant was closed and a drain was placed in most patients. Of the 53 patients, 42 had an uneventful postoperative course. No bile duct injuries were observed in this series.

Conclusions: Laparoscopic subtotal cholecystectomy is an effective surgical technique to avoid bile duct injury when the cystic duct cannot safely be identified. Subtotal cholecystectomy has acceptable morbidity and obviates the need for conversion in these difficult cases.

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KEY WORDS: acute cholecystitis, difficult gallbladder, gallbladder stump, subtotal cholecystectomy

The clinical manifestations of gallstones disease vary widely from mild right upper quadrant pain to severe abdominal pain and sepsis [1]. Likewise, the spectrum of severity of cholecystitis ranges from mild pathological changes to complete obliteration of anatomical planes. Factors such as ongoing cystic duct obstruction, time from the onset of inflammation, previous gallbladder drainage, or liver conditions like cirrhosis, are associated with the degree of difficulty in removing the gallbladder. Laparoscopic cholecystectomy has virtually replaced conventional open cholecystectomy [2] but the "difficult" gallbladder is still a condition that poses technical challenges associated with a high rate of complications and leads to high rate of conversion to open surgery [3,4].

The safe completion of cholecystectomy is dependent on proper identification and secure closure of the cystic duct, but this may pose a great challenge when inflammatory changes, acute or chronic, obscure the anatomy. The concept of subtotal cholecystectomy is not new but has not gain popularity until recently [5-7]. It allows for near-complete removal of the gallbladder and complete evacuation of the stones while avoiding dissection in the hazardous area: the triangle of Calot. The original description for subtotal cholecystectomy was of an open procedure in patients with cirrhosis [8-10], but the minimally invasive laparoscopic approach is appealing and gaining popularity. Our aim was to review our experience with this procedure.

PATIENTS AND METHODS

DATA COLLECTION

Data regarding all patients who underwent laparoscopic subtotal cholecystectomy between June 2010 and June 2018, by a single surgeon, were prospectively collected. We retrospectively reviewed the demographic characteristics, preoperative history, indications for surgery, time from diagnosis to surgery, surgical technique, operative and postoperative course, and early and late complications. Follow-up was evaluated based on patient records. The study was approved by the local institutional review board.

SURGICAL TECHNIQUE

All the procedures were done laparoscopically. In cases in which dissection of the Calot's triangle for obtaining the the critical view could not be achieved safely, the decision to perform a subtotal cholecystectomy was made by the attending surgeon. The surgical approach was similar in all the presented cases through a standard 4-trocar technique. Dissection started with exposure of the gallbladder by lysis of adhesions, as needed. The gallbladder was drained and evacuated using a needle in cases in which the gallbladder was too distended to enable its grasping and mobilization. An attempt to dissect at the area of the Calot's triangle was made in all cases. However, the operating surgeon proceeded to subtotal cholecystectomy when the dissection seemed hazardous. The procedure included opening of the Hartmann's pouch, aspiration of bile, and removal of all stones into a collecting bag. Using this technique, we were able to verify the gallbladder anatomy through its lumen by clearing the stones obstructing the gallbladder outlet and identifying the opening of the cystic duct.

Circumferential transection of the gallbladder neck was completed using either electrocautery hook dissector, scissors, or ultrasonic shears and the outlet was secured by either sutures or pre-tied loop. Staplers were not used for this purpose. The gallbladder fundus was then excised and the procedure was completed by securing hemostasis, leaving a drain in the infra hepatic fossa (in most cases) and removal of the collecting bag through the 10 mm umbilical port. Intra-operative cholangiography was not performed in any of these cases.

RESULTS

Fifty-three patients (28 males; median age 67 years) underwent laparoscopic subtotal cholecystectomy over an 8-year period by one attending surgeon. Of these, 10 patients were operated during the acute disease and 43 patients were operated electively, 3 months, on average, from the acute event. The conditions (in some patients more than one) that led to surgery were acute cholecystitis (41), cholangitis (7), biliary pancreatitis (3), biliary colic (4), choledocholithiasis (6), and liver abscess (1). Of the 53 patients in this series, 18 had a cholecystostomy tube, and 7 had common bile duct stent prior to surgery (placed endoscopically or via percutaneous transhepatic route). Five patients underwent preoperative magnetic resonance cholangiopancreatography (MRCP), four patients underwent endoscopic retrograde cholangiopancreatography (ERCP), and nine underwent cholecystography for assuring biliary tree clearance.

The gallbladder remnant was closed in all patients by using a pre-tied loop in 27 patients and intra-corporeal sutures in 26 patients. In none of the patients was the gallbladder remnant left open. A drain was left in all cases but two, and was removed after an average of 2.3 days following surgery. Of note, one of the two patients who did not have a drain developed a sub-phrenic collection. The mean operative time was one hour, and there was one conversion to an open surgery due to bleeding. The average postoperative stay was 5 days.

Of the 53 patients, 42 patients had an uneventful postoperative course. However, from the remaining 11 patients, two had a bile leakage that ceased spontaneously, one had cystic stump stones, complicated by mild pancreatitis that was treated non-surgically. Four patients had cholangitis (one with intra-abdominal abscess). Of the four patients who developed cholangitis, two had spontaneous normalization of their clinical symptoms and laboratory values and the rest had MRCP that showed no stones in the common bile duct (CBD). None required ERCP postoperatively. Of note, none of the patients had a CBD injury. One patient visited an emergency department due to weakness, which required fluid resuscitation and analgesics. The patient was discharged without hospitalization. Only one patient was readmitted 29 days postoperatively due to septic shock following surgery and died during that hospitalization. Extensive workup did not reveal the etiology for this sepsis.

Of the 18 patients who had a cholecystostomy tube placed preoperatively, six had postoperative complications (33%), compared to only five who showed postoperative complications out of 35 who did not have a tube placed preoperatively (14%).

One patient was found to have gallbladder cancer on the final pathology report.

DISCUSSION

The safe dissection of the Calot's triangle to achieve the critical view and minimize vascular or biliary damage can be challenging. Several techniques aiming to avoid biliary injury in these cases were described, such as top down dissection of the gallbladder from the fundus to the infundibulum or drainage only by a cholecystostomy tube [8]. The concept of subtotal cholecystectomy was first described for open surgery, when difficulty in identifying the biliary anatomy was encountered [9,10]. In this procedure, the structures in the Calot's triangle are avoided and a small gallbladder remnant is left behind [11].

As laparoscopy is the standard procedure for gallbladder removal, the difficult gallbladder is a common reason to convert to an open surgery when the risk for injury is high because of limited exposure. However, conversion to an open procedure does not necessarily improve the exposure, especially in obese patients, and the same anatomical difficulties may prevail even after conversion. Furthermore, experience in open surgery has declined in recent years, and conversion to open surgery would not necessarily make the operation easier [12-17]. Indeed, in many cases subtotal cholecystectomy was conducted regardless of conversion [5]. Moreover, in a recent meta-analysis, Elshaer and colleagues [18] showed that patients who underwent laparoscopic subtotal cholecys-

tectomy had lower risk of subhepatic collections, retained stones, wound infections, reoperations, and mortality compared with patients who underwent open subtotal cholecystectomy. Hence, laparoscopic subtotal cholecystectomy can prevent both the need to convert to an open procedure, with its associated morbidity, and the risks of hazardous dissection of Calot's triangle [19].

Most of the studies describing laparoscopic subtotal cholecystectomy include patients who underwent early surgery for acute cholecystitis [20-22]. However, in our series most of the patients underwent laparoscopic subtotal cholecystectomy at a delayed, elective operation, after an episode of acute cholecystitis that was treated with antibiotics and in some cases, with cholecystostomy tube drainage. Contrary to the technical difficulty attributed to edema and acute inflammation, when surgery was performed early, chronic inflammation and fibrosis were the main reasons in our series for the need for subtotal cholecystectomy to avoid bile duct injury. While it is well-established that early cholecystectomy for acute cholecystitis is advantageous, delayed surgery, often preceded by gallbladder drainage, is still widely prevalent, for various reasons, and these patients will continue to pose a surgical challenge.

Our technique for laparoscopic subtotal cholecystectomy starts with opening the Hartmann's pouch, clearly above the danger zone, extracting the stones from the gallbladder outlet, and verifying the correct anatomy through the lumen of the gallbladder. We then fully transect the gallbladder neck and secure the gallbladder outlet by either sutures or a pre-tied loop. The gallbladder fundus is then excised to complete the procedure. This modification was performed for the first series of six patients undergoing laparoscopic subtotal cholecystectomy described by Bickel and Shtamler in 1993 [7]. Their technique was to open the gallbladder with a hook diathermy, resect the anterior gallbladder wall only, and leave the coagulated posterior gallbladder wall in place. The authors did not describe a closure of the Hartmann's pouch.

Beldi and Glättli [4] also presented their experience with laparoscopic subtotal cholecystectomy in 46 patients. They did not close the infundibulum remnant and left the posterior wall intact as well. However, Chowbey and colleagues [22] presented 53 cases of laparoscopic subtotal cholecystectomy using an Endo GIA™ for the gallbladder neck transection and closure in 40 patients, sequential large clips in nine patients, and a suture stump closure in five patients. Furthermore, they stripped off the posterior wall of the gallbladder off the liver bed by blunt dissection and diathermy. Harilingam and co-authors [23] presented their experience with 64 patients undergoing laparoscopic subtotal cholecystectomy. In those patients, the fundus was opened first to allow drainage of gallbladder content, followed by splitting of the gallbladder in two, dissection of the anterior wall to the Hartmann's pouch, and then dissection of the posterior wall of the gallbladder and intracorporeal stitch or pre-tied loop closure of the gallbladder remnant. Similar to our technique, the inside view of the gallbladder allows them to minimize the risk for the critical structures and perform intraoperative cholangiogram (IOC) when needed.

In our institution, we rarely perform an IOC. When choledocholithiasis is suspected (i.e., dilated bile-duct or persistently elevated cholestatic enzymes), we perform preoperative MRCP due to its availability and accuracy in diagnosing bile-duct stones. Furthermore, for cases in which the MRCP demonstrates choledochlithiasis, we perform ERCP for clearance of bile-duct stones prior to surgery.

In most cases of laparoscopic subtotal cholecystectomy, the cystic duct remnant is closed, either by clips, sutures, or staples. Michalowski et al. [24] found no differences in complication rate between the patients who underwent subtotal cholecystectomy and closure of the gallbladder remnant compared with those who had subtotal cholecystectomy without closure. In one of the largest meta-analysis regarding subtotal cholecystectomy, Elshaer and colleagues [18] reported on 30 studies with a total of 1231 patients who underwent partial cholecystectomy. The authors found no significant difference in complication rate between patients who had their remnant gallbladder stump closed and patients who did not. In our series, the gallbladder remnant was closed in all cases. Two patients (3.7%) had bile leak that ceased spontaneously without the need for intervention.

The opponents of subtotal cholecystectomy may argue that patients who undergo subtotal cholecystectomy have a higher risk of post-procedural biliary complications including post-cholecystectomy syndrome, cholecystitis, or cholangitis [25]. In our series, only one patient presented with post-procedural mild cholangitis due to cystic stump stones. While performing subtotal cholecystectomy, the surgeons should ensure that all stones from the gallbladder remnant are evacuated. However, the possibility of retained gallbladder remnant stones, sometimes detected years after the procedure, should be considered when performing a subtotal cholecystectomy.

LIMITATIONS

There are several important drawbacks of this study. It is retrospective in nature and the follow-up is limited. In addition, there was no comparison of patients who underwent total cholecystectomy for difficult gallbladders. The incidence of gallbladder remnant cancer in patients who underwent subtotal cholecystectomy is unknown and exceedingly difficult to estimate due to the rarity of gallbladder cancer and the limitations of the imaging for this diagnosis. We acknowledge the potential for cancer spread by opening the gallbladder and leaving a remnant behind. In our series, we encountered a single case of gallbladder cancer. This patient was referred to the hepatobiliary team for further management.

CONCLUSIONS

Laparoscopic subtotal cholecystectomy is an effective surgical technique to avoid biliary and vascular injuries when one cannot safely dissect and identify the structures in the Calot's triangle. Laparoscopic subtotal cholecystectomy accomplishes the purpose of the procedure with acceptable morbidity and mortality, and obviates the need for conversion in these difficult cases.

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Capsule

Neuropilin-1 is a T cell memory checkpoint limiting long-term antitumor immunity

Robust CD8+ T cell memory is essential for long-term protective immunity but is often compromised in cancer, where T cell exhaustion leads to loss of memory precursors. Immunotherapy via checkpoint blockade may not effectively reverse this defect, potentially underlying disease relapse. **Liu** et al. reported that mice with a CD8+ T cell-restricted neuropilin-1 (NRP1) deletion exhibited substantially enhanced protection from tumor rechallenge and sensitivity to anti-PD1 immunotherapy, despite unchanged primary tumor growth. Mechanistically, NRP1 cell-intrinsically limited the self-renewal of the CD44+PD1+TCF1+TIM3− progenitor exhausted T cells, which was associated with their reduced ability to induce c-Jun/AP-1 expression on T cell receptor restimulation, a mechanism that may contribute to terminal T cell exhaustion at the cost of memory differentiation in wild-type tumor-bearing hosts. These data indicate that blockade of NRP1, a unique "immune memory checkpoint", may promote the development of long-lived tumor-specific Tmem that are essential for durable antitumor immunity.

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