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Subtotal cholecystectomy as a management option for difficult cholecystectomy

Colecistectomía subtotal como opción de manejo para colecistectomía difícil

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ABSTRACT

Objective: To describe the risks associated with subtotal cholecystectomy in patients with difficult cholecystectomy. **Material and methods:** A two-year review of the Hospital General León database was performed from January 2013 to December 2015. This was a retrospective study with reconstructed cohort analysis determining the risks associated with the intervention. **Results:** 18 patients operated on subtotal cholecystectomy due to difficult cholecystectomy were reported; in 18 patients included in the study, it was found associated morbidity of 44.4% (33.4% biliary leakage, 5.5% surgical site infection, and 5.5% residual choledocholithiasis). The most frequent postoperative complication was biliary leakage, 83.3% resolved nonoperatively, and 16.7% required endoscopic retrograde cholangiopancreatography (ERCP) with sphincterotomy for its resolution. No associated mortality or bile duct injury was found in this cohort. **Conclusion:** Subtotal cholecystectomy is a safe, feasible, and reproducible procedure as a management option for difficult cholecystectomy that keeps the incidence of bile duct injury at neutral margins.

RESUMEN

Objetivo: Describir los riesgos asociados a la colecistectomía subtotal en pacientes con colecistectomía difícil. Material y métodos: Se realizó una revisión de dos años de la base de datos del Hospital General León dentro del periodo enero de 2013 a diciembre de 2015. Se trata de un estudio retrospectivo con análisis de cohortes reconstruidas que determinan los riesgos asociados con la intervención. Resultados: Se reportaron 18 pacientes intervenidos de colecistectomía subtotal debido a colecistectomía difícil; 18 pacientes incluidos en el estudio, se encontró que la morbilidad asociada de 44.4% (33.4% fuga biliar, 5.5% infección de sitio quirúrgico y 5.5% coledocolitiasis residual). La complicación postoperatoria más frecuente es la fuga biliar, 83.3% resuelve de manera no operatoria y 16.7% requirió una colangiopancreatografía retrógrada endoscópica (CPRE) con esfinterotomía para la resolución de la misma. No se encontró mortalidad asociada ni lesiones de la vía biliar en esta cohorte. Conclusión: La colecistectomía subtotal es un procedimiento seguro, factible y reproducible como opción de manejo para la colecistectomía difícil que mantiene en márgenes neutros la incidencia de lesión de la vía biliar.

INTRODUCTION

Cholelithiasis is a public health problem that affects 1-4% of the world's population annually. Ten to 15% of the world's population has cholelithiasis. Gallbladder pathology is one of the common and costly digestive diseases. In the USA, an estimated 6.3 million men and 14.3 million women in the 20-74 age group have cholelithiasis, representing 10-20% of the US population. Laparoscopic cholecystectomy is one of the most frequently performed by general surgeons, reaching > 750,000 interventions per year, uncomplicated biliary colic being its most common indication.[1]

In Mexico, the prevalence of biliary lithiasis is 14.3%, with an incidence of 44% in women and 12% in men.[2]

Total cholecystectomy in patients with difficult cholecystectomy is a surgical procedure with an elevated risk of bile duct injury compared to cholecystectomies on non-inflamed

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gallbladders.[3] Serious complications occur in up to 2.6% of laparoscopic cholecystectomies, with major bile duct injuries occurring in 0.3-0.5%.[4]

An incidence of difficult cholecystectomies of 16% (one in six) has been reported,[5] being the most significant risk an acute inflammatory pathology secondary to a desmoplastic reaction that causes retraction and difficulty in dissection, obliterating surgical planes towards the hepato-cystic triangle and obscuring crucial structures.[6] Other pre-surgical difficulty-related risk factors include acute cholecystitis of ≥ 72 hours, leukocytosis > 18,000/mm^3, palpable mass in the right hypochondrium, comorbidities such as type 2 diabetes mellitus (T2DM), systemic arterial hypertension, and suspicion of emphysematous cholecystitis.[7]

Difficult cholecystectomy refers to the surgical removal of the gallbladder when there are some associated conditions of the organ itself, of its neighboring organs, or of the patient, which do not allow an easy, fast, and comfortable dissection of the gallbladder, and which result in prolongation of the surgical time and increased risk of complications for the patient such as biliary tract injuries.[8]

The risk of hemorrhage and bile duct injury increases when performing Calot's triangle dissection, especially in the presence of acute inflammation or fibrosis of the gallbladder. Subtotal cholecystectomy has proven to be a safe surgical termination method, i.e., it avoids biliary lesions and is effective, considering that it does not require a second surgical time in difficult cholecystectomies.[9]

Since the emergence of laparoscopy, many innovations and technical modifications have been made to the satisfaction of the patient and the surgeon. Laparoscopic cholecystectomy has revolutionized the management of cholelithiasis, declaring itself the gold standard for dealing with any benign gallbladder disorder;[10] however, in the context of cholecystitis, extensive experience is required for a better and safe outcome.[11]

Studies with some cases of subtotal laparoscopic cholecystectomy have shown promising results in patients with various forms of cholecystitis; despite this, its indications, feasibility, performance, and technical characteristics are under-documented.[12,13]

Because of the above, it is impossible to precisely define the terms "difficult gallbladder" and "difficult cholecystectomy" since "difficulty" is a relative term, and certain general principles should be followed before embarking on laparoscopic cholecystectomy. The surgeon's goal should not only be to provide the benefits of minimal access to surgery but also to avoid operative complications and decrease postoperative morbidity.[14,15]

HISTORICAL BACKGROUND

Madding first reported subtotal cholecystectomy in 1955 as an alternative to cholecystectomy and a salvage procedure in technically difficult cholecystectomy cases. His technique involved incision of the gallbladder in the fundus, followed by stone extraction and excision of the anterior gallbladder wall.[16] Thirty years later, Bornman and Terblanche described their experience in the management of difficult cholecystectomy in cases of severe cholecystitis and portal hypertension. These authors performed subtotal cholecystectomy by excision in parts of the gallbladder, starting at the Hartmann's pouch and leaving a rim of the posterior wall attached to the liver. The mucosa of this remnant was coagulated, and the gallbladder stump was closed with a tobacco-pouch suture. Numerous surgeons adopted this technique with some minor modifications.[17]

With the introduction of laparoscopic cholecystectomy by Mühe (1985) and Mouret (1987), laparoscopic subtotal cholecystectomy was considered a salvage technique in cases of difficult cholecystectomy to avoid injury to the bile duct and vascular structures.[18] Bickel and Shtamler described their successful experience treating six patients with laparoscopic subtotal cholecystectomy; they opened the gallbladder with electrocautery and resected only the anterior wall leaving the posterior wall attached to the liver, which was subsequently coagulated.[19]

Palanivelu et al., published the most extensive series of laparoscopic subtotal cholecystectomies in the literature, which included 206 patients with liver cirrhosis and cholelithiasis.[20]

Currently, some publications demonstrate the safety and effectiveness of subtotal cholecystectomy, whether laparoscopic or open, and more and more lines of research are opening about this management option for patients with difficult cholecystectomy.[21,22]

The difficulty encompasses various factors, including the patient, the surgical scene, and the surgeon himself. The various safety measures in a safe laparoscopic cholecystectomy should not be undermined and left to oblivion. The surgeon should be familiar with multiple strategies under difficult circumstances. Subtotal cholecystectomy sometimes proves to be the only alternative for the surgeon.[23,24]

MATERIAL AND METHODS

A review of the database of the Hospital General León, León, Guanajuato, Mexico, was performed during the period from January 2013 to December 2015 and found 18 patients operated on for subtotal cholecystectomy due to difficult cholecystectomy. A retrospective study with reconstructed cohort analysis was performed to determine the associated risks in this type of patients.

Inclusion criteria: 1) Age between 15 and 85 years, 2) Severe cholecystitis with inflammation or fibrosis of Calot's triangle (pyocystitis, gangrenous cholecystitis, cirrhosis), 3) Presence of Mirizzi syndrome.

Exclusion criteria: 1) Patients younger than 15 years and older than 85. **Elimination criteria:** 1) Patients with the histopathological result of gallbladder cancer. 2) Patients with incomplete data in the file.

Statistical analysis: descriptive and inferential statistics with tests of association of reconstructed cohorts.

RESULTS

The records of patients who underwent subtotal cholecystectomy between January 2013 and December 2015 were analyzed, identifying 21 patients, of which 18 met the inclusion criteria, and three were excluded.

The female sex corresponds to 61.11% (n = 11), while the rest (38.89%, n = seven) corresponds to the male sex; their age ranged from 21 to 71 years, with an average of 48 years.

Of the 18 patients selected, 11 had chronic degenerative diseases (61.1%), of whom six had T2DM (33.3%), and five had obesity (27.8%).

As for the results of laboratory studies, we found a mean leukocyte count of 7,031 μL (range 6,900 to 18,000 μL); neutrophils of 51.3% (range 36 to 84.6%); hemoglobin of 12.8 mg/dL (range 10.8 to 15.1 mg/dL); platelets of 288,333 μL (range 160,000 to 574,000 μL); total bilirubin of 0.7 mg/dL (range 0.2 to 1.5 mg/dL); direct bilirubin of 0.37 mg/dL (range 0.2 to 1.1 mg/dL); alkaline phosphatase of 91.2 μL (range 43 to 159 μL); aspartate aminotransferase of 45.2 μL (range 22 to 70 μL); alanine aminotransferase of 46.9 μL (range 9 to 90 μL) and international normalized ratio (INR) of 1.09 (range 0.89 to 1.26).

All patients had a preoperative ultrasound of the liver and biliary tract; the findings reported were as follows: cholelithiasis in 100% of the patients; the mean common bile duct diameter was 5.9 mm (range 3 to 11 mm); the wall thickness was 4.1 mm (range 2 to 6 mm), and the gallbladder volume was 52.6 ml (range 16 to 124 ml). Among other ultrasonographic findings, we found three patients with the WES (*wall echoes shadow*) triad (16.7%), two patients with fatty liver (11.1%), and seven patients with choledocholithiasis (38.9%).

Four had a history of acute pancreatitis (22.2%), and five patients (27.8%) had choledocholithiasis confirmed and resolved by ERCP. The preoperative diagnosis in the operated patients was chronic cholelithiasis in 10 of them (55.6%), acute chronic cholelithiasis in seven (38.8%), and hydro-cholecystitis in one (5.6%); on the other hand, the postoperative diagnosis was chronic cholelithiasis in four patients (22.3%), chronic cholelithiasis in four patients (22.3%), and choledocholithiasis in four patients (27.8%).3%), in four more with acute chronic cholelithiasis (22.3%), three patients had Mirizzi's syndrome (16.7%), two patients presented piocholecystitis (11.1%), two reported xanthogranulomatous cholecystitis (11.1%), one with cholecystic-colonic fistula (5.5%) and one more with cholecystic-duodenal fistula (5.5%).

The trans operative findings reported were in 88.9% of the patients (n = 16) without identification of the structures of the hepato-cystic triangle and in 11.1% (n = two) the presence of Mirizzi syndrome, which is why it was decided to perform a subtotal cholecystectomy.

The surgery in all patients was cholecystectomy, four were programmed as an open (22.2%) procedure, and 14 were programmed laparoscopic (77.8%). The surgery performed was reconstituted subtotal cholecystectomy with closure with continuous stitches in five patients (27.8%); closure with separate stitches in 11 patients (61.2%); closure with continuous stitches and closure of duodenal fistula was performed in one patient (5.5%), and in another patient closure with continuous stitches with right hemicolectomy and ileal-transverse anastomosis was performed (5.5%). The sutures were made with poliglecaprone because it is a monofilament, synthetic, slow absorption material.

The mean operative time of the surgeries mentioned was 112.2 minutes (85 to 150 minutes). The mean postoperative bleeding was 205 ml (range 20 to 350 ml). No incidents or trans-operative complications were reported in any patient *(Figure 1)*.

Patient follow-up averaged 45 months, and postoperative complications were identified in eight patients (44.4%), of which six showed biliary leakage (33.3%), one had surgical site infection (5.5%), and one had residual choledocholithiasis (5.5%).

The complication occurred between day 1 and day 29 (mean 4.5 days), and specifically, the biliary leak was observed between day 1
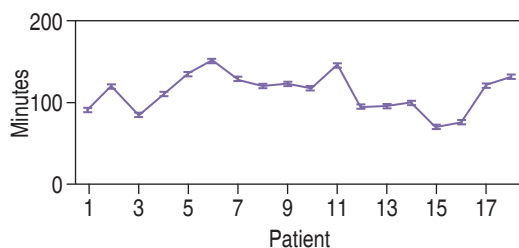

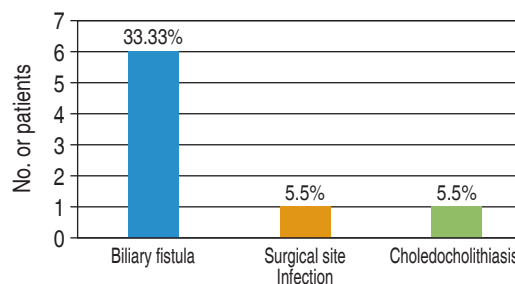*Figure 1: Surgical time in minutes. Own elaboration according to the study.*

Figure 2: Post-surgical complications. Own elaboration according to the study.

and day 5 postoperatively (mean 2.7 days) *(Figure 2)*.

Postoperative evolution was adequate in 66.7% of the patients (n = 12), and the morbidity found was 33.3% (n = 6) with biliary leakage. No postoperative mortality was reported during patient follow-up.

Regarding biliary leak, being the most frequent complication (33.3%) (n = six), the mean number of days with the presence of biliary leak was 14.8 days (range from seven to 20 days); one of the patients underwent ERCP for persistent high biliary fluid expense at day 15, showed remission of the leak at day 19. The site of the leak was identified at the level of the gallbladder stump and a stent was placed in the biliary tract. Five patients with biliary leak were managed non-operatively and showed remission of the leak without the need for additional procedures.

One patient presented surgical site infection on postoperative day 22; intrahospital treatment was given considering it low risk with ceftriaxone 1 g intravenous every 12 hours plus metronidazole 500 mg intravenous every eight hours for five days,[25] in addition to surgical bed cleaning. He improved on the seventh day of treatment and was discharged home. Another patient presented residual choledocholithiasis on postoperative day 29 requiring ERCP for its resolution.

The mean number of days of in-hospital stay was 2.4 (range one to seven days). In all cases, a Saratoga type passive drain was used, introducing a 20 Fr Nelaton tube fenestrated in a ¾-inch Penrose tube, directed towards the subhepatic space, and extracting it through the right flank; the drain lasted on average 11.6

days (range from four to 21 days) and it was removed once the output decreased. There were no complications associated with the use of drainage.

There was no evidence of collections, residual cholelithiasis, gallbladder cancer, episodes of biliary colic pain, or other postoperative complications during patient follow-up.

The histopathological result was incomplete gallbladder with data of acute cholecystitis in 100%.

DISCUSSION

Laparoscopic cholecystectomy has become the treatment of choice for chronic cholelithiasis and cholecystitis, where extensive experience is required to obtain a satisfactory result.[26] Severe inflammation, gallbladder edema, and adhesion between adjacent structures prevent a clear anatomical identification of the artery and cystic duct, resulting in an increased risk of injury to the main bile duct and hemorrhage. Strasberg refers to three conceptual steps to avoid bile duct injury, which entail safety within laparoscopic cholecystectomy:

1. Achieve a critical vision of security; in case of difficulty, we move on to the next point.
2. Turning point, when it is decided to stop the dissection attempt in laparoscopic cholecystectomy and to finish the surgery with another method, and
3. Perform a safe and efficient rescue procedure.[26]

When is it decided that we are at the tipping point? Asking another surgeon for help is considered good practice.

In our study, we have identified that the predictor factors that may play a role in difficult cholecystectomy and the need for subtotal cholecystectomy are the presence of obesity in 33.3% and T2DM in 27.8%; thickening of the gallbladder wall seen in the preoperative liver and biliary tract ultrasound with an average of 4.1 mm; the finding of choledocholithiasis by ultrasound and the need to perform preoperative ERCP, which was present in 38.8% of the patients. No associations were found between

the need for subtotal cholecystectomy due to difficult cholecystectomy and alterations in the laboratory studies or the other ultrasonographic findings analyzed.

According to the study by Roesch-Dietlen et al., the most critical risk factors for difficult cholecystectomy resolved by reconstituted subtotal cholecystectomy were obesity in 28% (p = 0.185) without specifying grade and T2DM in 15% (p = 0.084).[27] Although both comorbidities are more frequently observed in difficult cholecystectomies, no statistically significant difference is found in the influence of performing a subtotal cholecystectomy. Preoperative risk factors are of little utility in performing a subtotal cholecystectomy. Instead, this is done by observing the transoperative findings, the main one being the difficulty in achieving the critical safety view, i.e., complete dissection of the hepato-cystic triangle demonstrating the cystic duct, the cystic artery, and cystic plaque.

Madni et al., proposed the Parkland scale to classify the grade of cholecystitis based on the first laparoscopic look once the four trocars had been introduced, which showed a positive correlation with the pathology report, operative time, conversion rate, days of hospital stay, and biliary leak, the latter only with grade V.[27] The rate of subtotal cholecystectomies was not evaluated, nor if when converting surgery a total cholecystectomy was achieved; however, it is interesting to propose a trans-surgical scale before attempted dissection that unifies the definitions, since currently, the turning point is subjective limited to the surgeon himself or to whoever assists him. Further studies and validation are required for this scale in the context of use in subtotal cholecystectomy.

A demonstration of the subjectivity of the tipping point is given by Ashfaq A et al. in presenting a cohort study of 2,212 patients undergoing laparoscopic cholecystectomy, in which they reported 351 (15.8%) difficult cholecystectomies, describing three predictors of conversion: urgent surgery (OR: 0.80; 95% CI: 0.351-0.881, p = 0.032.); previous abdominal surgery (OR: 2.18; 95% CI: 1.181-4.035, p = 0.013.); and gangrenous cholecystitis (OR: 1.92; 95% CI: 1.356-4.044, p = 0.033.), without having performed any

subtotal cholecystectomy, concluding that total laparoscopic cholecystectomy can be safely performed in difficult gallbladder situations with a lower conversion rate than previously reported and without bile duct injury.[28] In any case, the universal safety culture for cholecystectomy calls for us to stay within narrow confidence limits, recognizing the skills and limitations of each surgeon to avoid a major complication such as bile duct injury.

The morbidity associated with subtotal cholecystectomy in patients with difficult cholecystectomy was 44.4%, and the most frequent postoperative complication was a biliary leak in 33.3% (n = six) of the patients. Most patients who presented it were treated nonoperatively, and few patients required ERCP. In our analysis, 5.5% (n = 1) of the patients required ERCP to resolve the biliary leak. Residual choledocholithiasis requiring ERCP was reported in 5.5% (n = 1) and surgical site infection in 5.5% (n = 1) of the patients analyzed.

One of the fears when performing subtotal cholecystectomy is the risk of forming new stones in the remaining gallbladder stump. During the postoperative follow-up, which averaged 45.1 months, residual cholelithiasis was not detected, and no patient required surgical resection of the remaining gallbladder stump. Dissanaike et al., after a median follow-up of six years, recurrent biliary events in reconstituted subtotal cholecystectomy were 19%, while with fenestrated subtotal cholecystectomy, they were 9%; however, biliary leakage in the fenestrated type was 18%[29] with the same management features previously described. No mortality associated with subtotal cholecystectomy was found in patients with difficult cholecystectomy.

The world literature reports a risk of bile duct injury of 0.8%, which increases in patients with difficult cholecystectomy up to 4%;[1] in our study, no association of subtotal cholecystectomy with bile duct injury was found.

CONCLUSION

Subtotal cholecystectomy is a safe surgical termination method that avoids biliary lesions and is effective, considering that it does not require a second surgical time in difficult cholecystectomies. Postoperative complications are mild and resolve with non-operative management.

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Disclosure: None of the authors have a conflict of interest in the conduct of this study.

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