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Surgical outcomes of laparoscopic cholecystectomy in scleroatrophic gallbladders

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Background/aims: *Macroscopic appearance of the gallbladder is an important factor in laparoscopic cholecystectomy. The aim of this study was to evaluate surgical outcomes in patients with scleroatrophic gallbladders who underwent laparoscopic cholecystectomy.* ***Methods:*** *From 2002-2007, 295 patients were found to have a scleroatrophic gallbladder during laparoscopic cholecystectomy. The investigated variables included gender, age, body mass index, preoperative ultrasound evidence of gallbladder wall thickening, number of gallstones, diameter of common bile duct, preoperative endoscopic retrograde cholangiopancreatography, surgeon's experience, gallbladder adhesion score, drain use, conversion rate, operative time, intraoperative and postoperative complications, mortality, and length of hospital stay.* ***Results:*** *Most of the patients were male (56.3%). Overall mean age was 55.50±13.75 years. Mean body mass index was 27.91±4.43 kg/m^2. Based on preoperative ultrasound findings, thickened gallbladder wall was present in 30.8% of patients, dilated common bile duct in 30.2% and multiple gallstones in 83.1%. Preoperative endoscopic retrograde cholangiopancreatography was performed in 32.5% of patients. High-grade adhesions (≥III) were encountered in 68.1% of patients. The conversion rate was 23.1%. The overall intraoperative complication rate was 31.5%. Drains were used in 63.7% of patients. Mean operative time was 65.2±32.6 minutes. The rate of postoperative complications was 9.5%. Median hospital stay was 1 day (range: 1-31 days). Mortality occurred in 3 patients (1.0%).* ***Conclusions:*** *This study demonstrates that scleroatrophic gallbladders present more difficulties during laparoscopic cholecystectomy and are associated with a higher conversion rate. Therefore, it is highly important that patients whose preoperative imaging studies suggest a scleroatrophic gallbladder be referred to an experienced center for hepato-biliary surgery.*

Key words: Laparoscopic cholecystectomy, scleroatrophic gallbladder, conversion, bile duct injury

Skleroatrofik safra keselerinde laparoskopik kolesistektominin cerrahi sonuçları

Amaç: *Safra kesesinin makroskopik görünümü laparoskopik kolesistektomide önemli bir faktördür. Bu çalışmada, skleroatrofik safra kesesi olup laparoskopik kolesistektomi yapılan hastalarda cerrahi sonuçlar değerlendirilmiştir.* ***Yöntem:*** *2002-2007 yılları arasında, laparoskopik kolesistektomi sırasında 295 hastada skleroatrofik safra kesesi olduğu tespit edildi. Hastalar, yaş, cinsiyet, vücut kitle indeksi, preopertatif çekilen ultrasonografide safra kesesi duvar kalınlığı, safra taşı sayısı ve koledok çapı, preoperatif endoskopik retrograd kolanjiopankreatikografi yapılıp yapılmaması, cerrahın tecrübesi, safra kesesi adezyon skoru, dren kullanımı, konversiyon oranı, ameliyat süresi, intraoperatif ve postoperatif komplikasyonlar, mortalite ve hastanede kalış süresine göre incelendi.* ***Bulgular:*** *Hastaların çoğunluğu erkekti (%56.3). Ortalama yaş 55.50±13.75 idi. Ortalama vücut kitle indeksi 27.91±4.43 kg/m^2 idi. Preopertatif ultrason bulgularına göre, safra kesesi duvarında kalınlaşma oranı %30.8, koledok dilatasyonu oranı %30.2 ve multipl safra taşı oranı %83.1 idi. Preoperatif endoskopik retrograd kolanjiopankreatikografi, hastaların %32.5'inde yapıldı. Yüksek dereceli adezyonlara (≥III) hastaların %68.1'inde rastlandı. Konversiyon oranı %23.1 idi. Genel intraoperatif komplikasyon oranı %31.5 idi. Hastaların %63.7'sinde dren kullanıldı. Ortalama ameliyat süresi 65.2±32.6 dakikaydı. Postoperatif komplikasyon oranı %9.5 idi. Ortalama hastanede kalış süresi bir gündü (1-31 gün). 3 hastada (%1) mortalite görüldü.* ***Sonuç:*** *Bu çalışma, skleroatrofik safra keselerinin daha fazla cerrahi zorluklara neden olduğunu ve daha yüksek konversiyon oranıyla ilişkili olduğunu göstermektedir. Bu yüzden, preoperatif görüntüleme yöntemleriyle skleroatrofik safra kesesi olduğu düşünülen hastaların hepatobiliyer cerrahide deneyimli bir merkeze sevk edilmesi oldukça önemlidir.*

Anahtar kelimeler: Laparoskopik kolesistektomi, skleroatrofik safra kesesi, konversiyon, safra yolu yaralanması

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INTRODUCTION

Laparoscopic cholecystectomy (LC) has become the gold standard surgical procedure for symptomatic cholelithiasis. The success rate in LC is closely associated with the experience of the surgeon as well as the macroscopic appearance of the gallbladder (1). Normally, there is no distinct edema or adhesion in Calot's triangle, and the structures within it are easily identified. LC is easily conducted and the gallbladder is easily dissected from the bed in this condition. In patients with chronic calculous atrophic cholecystitis, in whom there is severe dense fibrosis and scarring in Calot's triangle, the difficulty of completing LC increases significantly.

The risk of bleeding and bile duct injury during LC greatly increases while dissecting in Calot's triangle, particularly in the presence of severe inflammation or fibrosis of the gallbladder (2). Although Gigot et al. (1) showed that scleroatrophic cholecystitis with a short cystic duct is a risk factor for bile duct injury, they did not mention a specific definition of scleroatrophic cholecystitis. There are not enough reports in the medical literature describing a scleroatrophic gallbladder and its surgical outcomes. In this study, we define scleroatrophic gallbladders according to their laparoscopic appearance, and analyze the surgical outcomes of LC in patients with scleroatrophic gallbladders.

MATERIALS AND METHODS

From 2002-2007, 295 patients whose gallbladder appearance was detected to be scleroatrophic during attempted LC were included in the study. Data were collected prospectively. Variables included information about age, gender, body mass index (BMI), preoperative ultrasound evidence of gallbladder wall thickening, number of gallstones, diameter of common bile duct (CBD), performance or not of preoperative endoscopic retrograde cholangiopancreatography (ERCP), surgeon's experience, adhesion score of the gallbladder, use of drain, rate of conversion, operating time, intraoperative and postoperative complications, mortality, and length of hospital stay.

Operative Technique

Laparoscopy was performed with a standard four-port technique either in the American or French position. In case of a difficult LC, such as a scleroatrophic gallbladder or a gallbladder adherent to other organs or structures, the blunt tip of the suction-irrigation tube is used when tissue is friable and inflamed in order to define and isolate the cystic duct and identify the infundibulum-cystic duct area. We do not apply Endoclips to the cystic duct without identifying this area. In case of a large cystic duct, we prefer to seal the remnant with an Endoloop. If we cannot identify the cystic duct during LC, then we convert to an open procedure. Sometimes, in case of a gallbladder buried in the liver or densely adherent to the liver bed, we prefer to use Ultracision® (Ethicon Endo-Surgery, Inc., OH, USA) during the dissection to minimize bleeding from the liver bed. A drain was placed according to the surgeon's preference.

Definition of Variables

Preoperative ultrasonography results were analyzed for three separate factors: gallbladder wall thickening greater than 4 mm in cross-section, number of gallstones (single or multiple), and CBD dilatation (read as positive if the duct measured greater than 6 mm).

Our laparoscopic surgery group developed an adhesion scoring over the course of time, based on the degree of inflammatory changes in the gallbladder, as a guide for predicting the course of the operation. After the laparoscope was placed, the extent and thickness of the adhesions in the gallbladder region were graded by the surgeon as follows: grade I, no adhesions; grade II, flimsy adhesions that permit easy dissection; grade III, chronic pericholecystitis and pericholecystic fibrosis, making dissection difficult, but permitting visualization of the anatomy; and grade IV, thickened gallbladder wall and anatomical distortion due to dense adhesions around the gallbladder, which do not permit safe dissection.

A scleroatrophic gallbladder was defined laparoscopically as a gallbladder profoundly altered by long-standing chronic cholecystitis as indicated by a scarred and contracted appearance, with scarring in the porta hepatis.

Operative time was calculated from the initiation of skin incision to the completion of skin closure. Bile duct injuries were classified according to Strasberg's classification (3), and Strasberg Type A injuries were not included in this study. Postoperative bleeding was defined as bleeding that required transfusion. Experience of the surgeon was assigned to one of three categories: service chief, staff surgeon or fellow.

Statistical Analysis

Statistical analyses were carried out using SPSS software (SPSS 18.0.1 for Windows; SPSS, Chicago, IL, USA). Pearson's chi-square test was used for qualitative data and Student's *t*-test for quantitative data. All data were expressed as mean ± standard deviation except when otherwise indicated. Statistical significance was defined as $p<0.05$.

RESULTS

Most of the patients were male (56.3%). Overall mean age was 55.5 ±13.75 years. Mean BMI was 27.91±4.43 kg/m^2. Based on preoperative ultrasound findings, thickened gallbladder wall was present in 30.8% of patients, dilated CBD in 30.2%, and multiple gallstones in 83.1%. Preoperative ERCP was performed in 32.5% of patients. Patient characteristics and operative data are summarized in Table 1.

Among the 295 patients with scleroatrophic gallbladder, high-grade adhesions (≥III) were encountered in 68.1%. Conversion to open surgery was needed in 23.1%, intraoperative complications were encountered in 31.5%, and drains were used in 63.7%. The mean operating time was 65.2±32.6 minutes. Postoperative complications occurred in 9.5% of patients. Median hospital stay was 1 day (range: 1-31 days, Table 1).

When we reviewed the intraoperative complications, the most frequent complication was gallbladder rupture (Table 2). Most of the conversions were due to inability to clearly expose the anatomy (Table 3). Of the patients who underwent conversion for obscure anatomy, 3 patients had gallbladder carcinoma, 2 had cholecystoduodenal fistula and 3 had Mirizzi's syndrome.

When we reviewed all histopathological results, we found that 7 patients (2.4%) had gallbladder carcinoma. Of these 7 patients, 5 were diagnosed with gallbladder carcinoma by intraoperative frozen section. Of these 5 patients, 3 underwent conversion and received definitive major surgery, and 2 patients underwent surgery that did not proceed beyond LC and were followed up. The remaining 2 patients with gallbladder carcinoma were diagnosed postoperatively.

Postoperative complications are shown in Table 4. Intraoperative and postoperative biliary complications, treatment modalities and surgical outcomes are shown in Tables 5 and 6. Major bile duct injuries were confirmed intraoperatively in 8 patients (2.7%). Seven patients underwent conversion to

Table 1. Preoperative, intraoperative and postoperative data

Gender	Male	166 (56.3%)
	Female	129 (43.7%)
Age (years)		55.50±13.75
Body mass index (kg/m^2)		27.91±4.43
Gallbladder wall thickness (≥4 mm)		91 (30.8%)
Multiple gallstones		245 (83.1%)
CBD diameter (≥6mm)		89 (30.2%)
Preoperative ERCP performed		96 (32.5%)
Gallbladder adhesion score	Grade I	26 (8.8%)
	Grade II	68 (23.1%)
	Grade III	78 (26.4%)
	Grade IV	123 (41.7%)
Use of drain		188 (63.7%)
Conversion to open surgery		68 (23.1%)
Overall intraoperative complications		93 (31.5%)
Operative time (minutes)		65.2±32.6
Overall postoperative complications		28 (9.5%)
Reoperation		4 (1.4%)
Mortality		3 (1.0%)
Hospitalization period (days; median, range)		1 (1-31)
Operating surgeon	Service chief	176 (59.7%)
	Staff surgeon	72 (24.4%)
	Surgical fellow	47 (15.9%)

CBD: Common bile duct. ERCP: Endoscopic retrograde cholangiopancreatography.

Table 2. Intraoperative complications

Bleeding	20 (6.8%)
Gallbladder rupture	51 (17.3%)
Bleeding + Gallbladder rupture	14 (4.7%)
Major bile duct injury	8 (2.7%)
Total	93 (31.5%)

Table 3. Reasons for conversion to open cholecystectomy

Inability to define anatomy of Calot's triangle	57 (19.3%)
Bile duct injury	7 (2.4%)
Bleeding	4 (1.4%)
Total	68 (23.1%)

Table 4. Postoperative complications

Bleeding	14 (4.8%)
Nonspecific abdominal pain and fever	4 (1.4%)
Biliary complications	4 (1.4%)
Wound infection	3 (1.0%)
Cardiac event	2 (0.7%)
Subhepatic collection	1 (0.3%)
Total	28 (9.5%)

open surgery. One patient underwent laparoscopic repair of a bile duct injury. Postoperatively, biliary complications were detected in 4 patients. None of the patients with postoperative biliary complications required relaparotomy (Table 6).

The bleeding rate was high in the postoperative period (Table 4). Three patients with bleeding required reoperation (Table 7). One patient with postoperative signs of peritoneal irritation, fever, leukocytosis, and intra-abdominal fluid collection on ultrasound was found to have duodenal injury.

Mortality occurred in 3 patients (1.0%). In one of these, a stent had been placed in the CBD preoperatively, and during LC the patient underwent conversion to open surgery. Postoperatively, bile leakage from the cystic duct stump was detected via ERCP. The patient died two months later from biliary sepsis and hemobilia. The second patient had been on long-term anticoagulation for cardiac valve replacement. After LC, the patient underwent reoperation due to bleeding, and the source was found to be the liver bed. This patient died one month later from nosocomial infections. The third patient had no surgical complications and died from myocardial infarction on postoperative day 25.

The surgeon's experience was not found to be significantly associated with conversion rates, intraoperative complications or postoperative complications ($p>0.05$).

DISCUSSION

Scleroatrophic gallbladders are macroscopically visible entities that are frequently encountered during LC. In case of inflammation, atrophy and fibrosis of the gallbladder with tight adhesion between the gallbladder and liver, the structures within Calot's triangle are difficult to identify. If acute cholecystitis is excluded, cases of difficult LC mainly consist of scleroatrophic gallbladders. In a series of 4,624 patients, Collet (4) reported an incidence of 8.4% for scleroatrophic gallbladder. Similarly, during the period covered in this study, we found scleroatrophic gallbladder to be present in approximately 10% of all patients undergoing LC.

Perissat et al. (5) indicated that scleroatrophic gallbladder still constitutes the greatest challenge in LC. However, the etiology of this condition remains unclear. ERCP often leads to inflammation around the gallbladder, including the hepatoduodenal ligament, making a subsequent laparoscopic procedure more demanding (6,7). It has been shown that tissue collagen levels both in the submucosal area of the gallbladder wall and in the pericholecystic tissue are significantly higher in men than in women, suggesting that in the context of symptomatic gallbladder stones, inflammation and fibrosis are more extensive in men than in women (8). According to the results of our study, male gender and preoperative ERCP appear to be related to scleroatrophic gallbladder.

The conversion rate in LC is linked directly to the macroscopic appearance of the gallbladder (9). Z'graggen et al. (10) reported that the conversion rate dramatically increases in patients with acute cholecystitis, scleroatrophic cholecystitis or CBD stones. In a meta-analysis of recent studies, the overall conversion rate for delayed-interval LC (LC performed 6 weeks after a bout of acute cholecystitis) was 23% (11). Delayed-interval operation allows maturation of the acute inflammation, resultant fibrosis, neovascularization, and contraction, and makes the dissection technically difficult and the operation potentially hazardous

Table 5. Types and management of bile duct injuries detected intraoperatively

Type of bile duct injury	n	Management	Outcome
Strasberg Type D	5	Primary common bile duct repair (3) Repair over a T-tube (1) Laparoscopic common bile duct repair (1)	Well
Strasberg Type E1	3	Repair over a T-tube (3)	Well

Table 6. Postoperative biliary complications and management

Biliary complication	n	Management	Outcome
Bile leakage from the drain	1	Medical follow-up	Well
Bile leakage from the cystic duct stump	1	Endoscopic stenting	Death
Subhepatic biloma	2	Percutaneous drainage	Well

Table 7. Reasons for reoperation and management

Reason for reoperation	n	Management	Outcome
Duodenal injury	1	Duodenal repair	Well
Bleeding	3	Gallbladder bed hemostasis	Well (2) Death (1)

(12). In predicting operative difficulty, the most difficult are scleroatrophic gallbladders, and in many of these cases, there is severe inflammation surrounding the gallbladder, resulting in a high conversion rate (13). In our study, the conversion rate was 23.1% for patients with scleroatrophic gallbladder. This is in contrast to a conversion rate of 4.8% in 3,575 patients undergoing LC in general in our clinic (14). The high incidence of patients with wall thickening on ultrasound and ERCP findings in our present study shows that scleroatrophic gallbladders might be associated with previous attacks of acute cholecystitis or acute cholangitis. High-grade adhesions (≥III) in scleroatrophic gallbladders are also consistent with repeated attacks of cholecystitis.

It is generally accepted that conversion to an open procedure should not to be considered a complication when the decision to convert is based on marked inflammatory changes or difficulties in outlining the confluence of the cystic duct. Furthermore, a dissection that is difficult laparoscopically can be equally difficult during open surgery, and conversion does not guarantee that inadvertent biliary or vascular injuries will be avoided (15). We did not encounter intraoperative major bile duct injury or bleeding in any of our patients who underwent conversion to open surgery.

Some authors have reported that laparoscopic subtotal cholecystectomy (LSC) has been used as an alternative to conversion to open surgery in difficult LCs (2,15-17). It has been shown that LSC prevented bile duct injury and decreased conversion rates in selected patients (2,15-17). However, LSC is not a routine alternative to conversion because this technique requires experience. Even though good results have been obtained with this method in some patients, the incidence of persistent bile leakage, intra-abdominal abscess or remaining gallstones is high (2,15-17). We did not use this technique in any of our patients.

From the results of our study, it is apparent that conversion rates as well as overall intraoperative and postoperative complication rates for scleroatrophic gallbladders are high. One of the most important problems known to be associated with LC is the high rate of bile duct injury compared to open cholecystectomy. In previously published series, the incidence of biliary tract injury has ranged from 0.1% to 2% during LC (10,18-22) and from 0% to 0.7% during open cholecystectomy (23,24). It is now widely accepted that the inflammatory status of the gallbladder and the presence of stone migration are risk factors for complications (1). Georgiades et al. (25) suggested an independent relationship between inflammation and

bile duct injury. Cheema et al. (26) reported a higher incidence of bile duct injury among patients who underwent delayed LC because of fibrosis and adhesions. In our study, the incidence of intraoperatively identified major bile duct injury was 2.7%, which is much higher than the 0.03% seen in our previous study of patients undergoing LC for any reason (14). An overall postoperative complication rate of 4.8% has been reported for patients with scleroatrophic gallbladder (4). In our study, however, the overall rate of postoperative complications was 9.5%, with bleeding being the most important reason for postoperative complications as well as for reoperation. Sometimes, in case of a gallbladder buried in the liver or densely adherent to the liver bed, unexpected difficult-to-control bleeding may occur during the dissection of scleroatrophic gallbladders. The liver bed was the source of bleeding in three of our patients who underwent reoperation.

Mortality in patients undergoing LC has ranged from 0.06 to 0.2% (10,21,22). In our previous study of patients undergoing LC for any reason, mortality was 0.14% (14). In this special patient population, the mortality was 1.0%. The most important reason for mortality in LC is bile duct injury (1). In our study, two deaths were associated with the laparoscopic surgery. One patient died from hemobilia and biliary sepsis resulting from bile duct injury. The other patient died from intraabdominal abscess and multiple organ failure that developed after liver bed bleeding.

The operating surgeon's experience in our study was not associated with differences in conversion rates, intraoperative complications or postoperative complications. This may be explained by the fact that the least experienced surgeons performing LC in our center are already qualified general surgeons who are doing a subspecialty in gastroenterological surgery, and by the fact that a senior surgeon always participates in each LC procedure.

The extensive use of drains and the relatively long operating times in our study are due to the additional difficulty associated with scleroatrophic gallbladder and the high rate of conversion. We advocate the liberal use of drains when LC is difficult. A drain may be helpful in the early recognition of postoperative complications such as bleeding, biliary fistula or intestinal perforation, and may prevent fluid collection in the gallbladder bed as well.

In difficult LCs, such as those performed for scleroatrophic gallbladder, it should be kept in mind that other pathological conditions may be present in these patients. The incidence of gallbladder cancer detected after LC has been reported to be 0.54%–2.1% (27-29). Gallbladder carcinoma was detected in 7 patients (2.4%) in our study. Of these 7 patients, 5 were diagnosed via intraoperative frozen section. In these patients, findings that suggested gallbladder carcinoma were gallbladder wall thickening, difficulty in grasping the gallbladder wall and dense fibrotic adhesions in the periphery of the cystic lymph node. Of the five patients whose cholecystectomy was completed laparoscopically, three underwent conversion to open surgery with liver bed resection and dissection of the hepatoduodenal and paraaortic lymph nodes. In two patients with gallbladder carcinoma, surgery was not extended beyond laparoscopy due to the tumors being early in development, the patients' being advanced in age, and the patients' families being hesitant about open surgery in this situation. Two others were diagnosed with gallbladder carcinoma after LC, and then liver bed resection and hepatoduodenal and paraaortic lymph node dissection were performed in a secondary surgery. It is well known that preoperative diagnosis of gallbladder carcinoma is difficult. Kraas et al. (30) reported that gallbladder malignancy is most commonly suspected intraoperatively or diagnosed postoperatively after pathological examination of the resected gallbladder. Ultrasonography is usually unsuccessful in the early detection of gallbladder cancer, especially if inflammation is present (31,32).

In conclusion, this study demonstrates that scleroatrophic gallbladders present more difficulties for LC and are associated with a higher conversion rate. Morbidity and mortality in these patients are also high. The possibility of major bile duct injury is substantially increased. A scleroatrophic gallbladder can indicate not only chronic inflammation but also other serious conditions such as gallbladder carcinoma, Mirizzi's syndrome and cholecystenteric fistula. Therefore, it is highly important that patients whose preoperative imaging studies suggest a scleroatrophic gallbladder be referred to an experienced center for hepato-biliary surgery. For preoperative prediction of the presence of scleroatrophic gallbladders in patients, further research is needed.

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