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# Complications of Laparoscopic Cholecystectomy: Our Experience from a Retrospective Analysis

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**Abstract**

**AIM:** The aim of this study was to evaluate the intraoperative and postoperative complications of laparoscopic cholecystectomy, as well as the frequency of conversions.

**MATERIAL AND METHODS:** Medical records of 740 patients who had laparoscopic cholecystectomy were analysed retrospectively. We evaluated patients for the presence of potential risk factors that could predict the development of complications such as age, gender, body mass index, white blood cell count and C-reactive protein (CRP), gallbladder ultrasonographic findings, and pathohistological analysis of removed gallbladders. The correlation between these risk factors was also analysed.

**RESULTS:** There were 97 (13.1%) intraoperative complications (IOC). Iatrogenic perforations of a gallbladder were the most common complication - 39 patients (5.27%). Among the postoperative complications (POC), the most common ones were bleeding from abdominal cavity 27 (3.64%), biliary duct leaks 14 (1.89%), and infection of the surgical wound 7 patients (0.94%). There were 29 conversions (3.91%). The presence of more than one complication was more common in males (OR = 2.95, CI 95%, 1.42-4.23, $p < 0.001$). An especially high incidence of complications was noted in patients with elevated white blood cell count (OR = 3.98, CI 95% 1.68-16.92, $p < 0.01$), and CRP (OR = 2.42, CI 95% 1.23-12.54, $p < 0.01$). The increased incidence of complications was noted in patients with ultrasonographic finding of gallbladder empyema and increased thickness of the gallbladder wall > 3 mm (OR = 4.63, CI 95% 1.56-17.33, $p < 0.001$), as well as in patients with acute cholecystitis that was confirmed by pathohistological analysis (OR = 1.75, CI 95% 2.39-16.46, $p < 0.001$).

**CONCLUSION:** Adopting laparoscopic cholecystectomy as a new technique for treatment of cholelithiasis, introduced a new spectrum of complications. Major biliary and vascular complications are life threatening, while minor complications cause patient discomfort and prolongation of the hospital stay. It is important recognising IOC complications during the surgery so they are taken care of in a timely manner during the surgical intervention. Conversion should not be considered a complication.

## Introduction

Adopting laparoscopic cholecystectomy in a treatment of symptomatic cholelithiasis introduced a new spectrum of associated intraoperative and postoperative complications. Minor complications (biliary and non-biliary) are usually treated conservatively. Major complications (biliary and vascular) are life threatening and increase mortality rate, therefore creating the need for conversion to open surgical approach in order to treat them. The frequency of complications associated with laparoscopic cholecystectomy varies from 0.5 to 6% [1-4]. The most serious complications are associated with high mortality rate: injury of common bile duct with an incidence of 0.1-0.6% [5, 6], injuries of large blood vessels 0.04-1.22% depending on the study [7]. The most common complication is iatrogenic perforation of the gallbladder with spilt gallstones with an incidence of 10-30% [8]. Injuries during the laparoscopic cholecystectomy can be prevented by

precise operative technique, clear visualisation of anatomical landmarks, and careful dissection of tissues. Intraoperative cholangiography should be used in case of a dilemma [4, 9, 10].

Male gender, age, presence of systemic inflammatory response syndrome (defined by elevated inflammatory parameters- elevated white blood cell count and C- reactive protein), acute inflammation of the gallbladder and preoperative ultrasonographic finding of increased thickness of the gallbladder wall, and/or presence of gallbladder empyema, are all factors that increase risk for possible development of intraoperative laparoscopic complications, and the possibility of needing a conversion [11-14].

The aim of this study was to evaluate the intraoperative and postoperative complications of laparoscopic cholecystectomy, as well as the frequency of conversions.

## Patients and Methods

We retrospectively analysed medical records of 740 patients who were diagnosed with cholelithiasis and had laparoscopic cholecystectomy in the General Hospital in Berane, Montenegro, in the time period between 2005 and 2014. The analysis included operative protocols, anesthesiology records, the medical history which included the history of the disease, documented laboratory findings and imaging results.

We analysed the type and frequency of intraoperative and postoperative complications, as well as factors that increase the risk for development of complications. We noted causes and incidence of conversions and the way they resolved. We noted gender, age, body mass index (BMI), white blood cell count, and level of C-reactive protein (CRP), preoperative ultrasonographic findings, pathohistological findings of the surgically removed gallbladder, as well as their correlation with the occurrence of complications.

The patients were divided into groups according to their age (older than 65, and younger than 65), gender (male, and female), BMI (greater than 25 kg/m$^2$, and less than 25 kg/m$^2$), white blood cell count (greater than 10 x 10$^9$/l, and less than 10 x 10$^9$/l), and CRP level (greater than 5 ml/l, and less than 5 ml/l). Subsequently, the correlation between these factors and type/frequency of intraoperative and postoperative complications were analysed. All surgically extracted gallbladders were examined by pathophysiologists in order to confirm the diagnosis of acute cholecystitis, chronic cholecystitis or presence of malignancy. Subsequently, correlations between these pathohistological findings and type/frequency of intraoperative and postoperative complications were analysed.

An ultrasonographic exam was performed 24 hours before each surgery. In order to simplify the analysis of the correlation between ultrasonographic findings and possible complications, all ultrasonographic findings were grouped into three groups: group I- chronic cholecystitis, group II- acute cholecystitis, gallbladder empyema, increased gallbladder wall thickness > 3 mm, and group III- gallbladder with fibrous changes and a calculus with > 2 cm in diameter. We used a standard four-port technique in all surgical interventions.

In order to test the differences between the groups and correlation between the presence of the risk factors and outcomes of the surgical interventions regarding the complications, we used Chi-square test, Fisher test, Mann-Whitney test. We used a multivariate regression analysis to determine the most important predictors of complications during and after the surgery. The results were considered statistically significant if the $p < 0.05$. The statistical analysis was performed by using statistical package SPSS v. 19.

### *Ethics*

Each subject signed the acceptance of the study protocol, in which the Ethical Principles for Medical Research Involving Human Subjects (the Helsinki Declaration) were clearly stated.

## Results

Out of the 740 patients in the study, 502 were female (67.8%), and 238 were male (32.2%). The median age was 51 years, including participants that were 16 to 98 year old. There were 97 patients (13.1%) with intraoperative complications (IOC) (Table 1). The most common complications noted were: iatrogenic perforations of the gallbladder- 39 (5.27%), bleeding from the tissues adjacent to the gallbladder 21 (2.83%), gallstones spilt into the peritoneal cavity 15 (2.02%).

Intraoperative bleeding from the cystic artery occurred in 5 (0.67%), bleeding from the port in 9 (1.21%) and bleeding from the ligaments of the liver in 4 patients (0.54%). The transection of the common bile duct, a major complication, occurred in in only one patient (0.13%) This complication caused conversion to open procedure and was resolved by hepatopathy with a T-drain. IOC was more frequent in males (34 males, or 25.21%) compared to females (63 females, or 7.37%).

**Table 1: Intraoperative complications (IOC)**

| | IOC | Σ |
|---|---|---|
| N | 97 | 13.1% |
| IOC – types | | |
| Bleeding from tissues adjacent to gallbladder | 21 | 2.83% |
| Bleeding from cystic artery | 5 | 0.67% |
| Iatrogenic perforations of the gallbladder | 39 | 5.27% |
| Injuries to the common bile duct | 1 | 0.13% |
| Bleeding from the abdominal wall (port) | 9 | 1.21% |
| Spilled gallstones | 15 | 2.02% |
| Bleeding from the ligaments of the liver | 4 | 0.54% |
| Lesions of the omentum | 3 | 3.09% |

There were 70 patients (9.45%) with postoperative complications (POC) (Table 2). The most common postoperative complications were: bleeding from the abdominal cavity more than 100 ml/24h (in 27 patients or 3.64%), bile leaks through the drain > 50-100 ml/24h (14 patients, or 1.89%). Less frequent complications were surgical wound infection (7 patients, or 0.94%), incisional hernia at the place of port (3 patients, or 0.40%), and intra-abdominal abscess caused by residual calculus in the abdominal cavity (2 patients, or 0.27%). In the postoperative period, one case of subhepatic collection and 2 cases of abscess formed around retained calculi were treated by laparotomy and they subsequently resolved. Hematoma of the abdominal wall around the working port was noted in 5 patients (0.67%). Choledocholithiasis was noted in 3 patients (0.40%), and this was resolved by endoscopic papillotomy. Carcinoma of the gallbladder was confirmed by pathohistological analysis in 4 patients (0.54%). POC was more frequent in males (26 patients, or 18.48%) compared to females (44 patients, or 5.17%).

**Table 2: Postoperative complications (POC)**

| | POC | Σ |
|---|---|---|
| N | 70 | 9.45% |
| POC - types | | |
| → Bleeding from abdominal cavity >100 ml/24h | 27 | 3.64% |
| → Bile leaks >50-100 ml/24h | 14 | 1.89% |
| → Subhepatic collection | 3 | 0.40% |
| → Surgical wound infection | 7 | 0.94% |
| → Incisional hernia | 3 | 0.40% |
| → Hematoma of the abdominal wall | 5 | 0.67% |
| → Gallbladder carcinoma | 4 | 0.54% |
| → Retained calculus in choledochal duct | 3 | 0.40% |
| → Lost gallstones (abscess) | 2 | 0.27% |
| → Choleperitoneum | 2 | 0.27% |

Both IOC and POC were more common in males compared to females, and this difference was statistically significant ($\chi^2$ = 0.548, p<0.01). There were 29 conversions (3.91%), and they were more common in males (19 males, 7.98%) compared to females (10 females, or 1.99%). This difference was also statistically significant ($\chi^2$ = 6.743, p<0.05). The causes for conversions are shown in Table 3.

Table 4 shows analysed variables and their correlations with an occurrence of POC and IOC. In addition, it shows the correlation between the noted risk factors and the need for a conversion. The multivariate regression analysis showed the most important predictive factors for the occurrence of IOC, POC, and conversions with the confidence interval of 95%.

**Table 3: Causes of conversions**

| | Male | Female | Σ |
|---|---|---|---|
| Conversions- causes | 19 (7.98%) | 10 (1.99%) | 29 (3.91%) |
| Difficult access to Calot's triangle. Identification of anatomical structures | 7 | 5 | 12 (41.37%) |
| Bleeding from the tissues adjacent to gallbladder | 2 | 0 | 2 (6.89%) |
| Spilled gallstones | 2 | 1 | 3 (10.34%) |
| Gallbladder empyema | 3 | 2 | 5 (17.24%) |
| Mirizzi II | 2 | 1 | 3 (10.34%) |
| Bleeding from the vascular supply | 2 | 0 | 2 (6.89%) |
| Transection of the common bile duct | 1 | 0 | 1 (3.45%) |
| Impacted calculus | 0 | 1 | 1 (3.45%) |

The occurrence of more than one complication was more common in males compared to females (OR 2.95, CI 95% 1.42-4.23, p < 0.001), in the group with increased white blood cell count (OR 3.98, CI 95% 1.68-16.92, p < 0.01), and the group with increased levels of CRP (OR 2.42, CI 95% 1.23-13.54, p < 0.01).

**Table 4**: **Correlation between examined variables and incidence of complications**

| Variable | N/% | IOC | POC | CONV | P value |
|---|---|---|---|---|---|
| Age | | | | | |
| <65 | 552 (74.6%) | 63 (11.41%) | 44 (7.97%) | 10 (1.82%) | <0.05 |
| >65 | 188 (25.4%) | 34 (18.08%) | 26 (13.82%) | 19 (10.10%) | |
| Gender | | | | | |
| Male | 238 (32.2%) | 34 (25.21%) | 26 (18.48%) | 19 (7.98%) | <0.001 |
| Female | 502 (67.8%) | 63 (7.37%) | 14 (5.17%) | 10 (1.99%) | |
| BMI | | | | | |
| <25 | 295 (39.8%) | 12 (4.06%) | 9 (3.05%) | 2 (0.67%) | <0.001 |
| >25 | 445 (60.1%) | 85 (13.7%) | 61 (13.7%) | 27 (6.06%) | |
| White blood cell count | | | | | |
| <10X10$^9$/l | 452 (61.08%) | 29 (6.41%) | 20 (4.42%) | 2 (0.44%) | <0.01 |
| >10X10$^9$/l | 288 (38.91%) | 68 (18.%) | 50 (17.36%) | 27 (9.37%) | |
| CRP | | | | | |
| <5 | 392 (52.95%) | 34 (8.67%) | 21 (5.35%) | 3 (0.76%) | 0.0001 |
| >5 | 348 (47.02%) | 63 (18.%) | 49 (14.08%) | 26 (7.47%) | |
| Pathohist report: | | | | | |
| Acute cholecystitis | 201 (27.1%) | 67 (33.3%) | 50 (24.8%) | 26 (12.93%) | <0.001 |
| Chronic cholecystitis | 539 (72.8%) | 30 (5.5%) | 20 (3.7%) | 3 (0.55%) | |
| Ultrasound findings: | | | | | |
| Group I (chronic cholecystitis) | 419 (56.6%) | 19 (4.53%) | 10 (2.38%) | 1 (0.23%) | |
| Group II (empyema, gangrene, wall thickness >3mm) | 235 (31.3%) | 65 (27.6%) | 46 (19.5%) | 26 (11.06%) | <0.001 |
| Group III (gallbladder wall fibrosis, calculus >2cm) | 86 (11.6%) | 13 (15.1%) | 14 (16.2%) | 2 (2.32%) | |

In addition, the ultrasonographic findings of empyema, gangrene of the gallbladder wall, and increased gallbladder wall thickness > 3 mm (group II) is a significant predictor of complications and

conversion (OR = 4.63, 95% CI 1.56-17.33, p < 0.001). Pathohistologic analysis of the surgically extracted gallbladder with the diagnosis of acute cholecystitis was also the significant predictor for complications and conversion (OR 1.75, 95% CI 2.39-16.46, P < 0.001).

## Discussion

Laparoscopic cholecystectomy became the preferred method for the treatment of symptomatic cholelithiasis. Laparoscopic cholecystectomy has many advantages over the standard open cholecystectomy: minimal trauma, decreased pain, shorter hospital stay, satisfactory cosmetic outcome, quick recovery, and return to work. However, numerous studies have shown this that laparoscopic cholecystectomy is associated with a higher frequency of complications compared to the standard open cholecystectomy including lesions to the common bile duct, injury to the vascular and visceral structures during the application of a Veress needle, and a trocar with fatal outcomes [1-4, 15].

Review of recent literature shows that the incidence of injuries to the common bile duct is 0.1-0.6% [5, 6, 9]. Nuzzo et al [9] analysed complications of laparoscopic cholecystectomies done in 184 hospitals in Italy in the time period from 1998 to 2000 and reported 235 (or 0.41%) injuries of the common bile duct. In the presented study, we report one case of the common bile duct transection (0.13%) that was corrected by choledochoeneteroanastomosis with the Roux-en-Y loop. Although recent publications lead to the conclusion that injuries of the common bile duct are more commonly encountered with the laparoscopic procedure, the controversy related to this issue is still present [10, 16, 17]. Tanitia e al. [16] analysed data from 13,305 laparoscopic cholecystectomies that were done over a period of 13 years and found that 52 (0.32%) cases had a transection of the common bile duct.

As laparoscopic cholecystectomies gained wider acceptance, the spectrum of complications associated with this procedure also became wider. Vascular injuries are the most common ones, and after the complications of anaesthesia, they are the second leading cause of mortality and morbidity in laparoscopic surgery [18-20]. Our study shows that there were 21 patients with bleeding from the tissues adjacent to the gallbladder, 5 from the cystic artery, 4 with bleeding from the ligaments of liver, and 9 from the abdominal wall during the placement of ports. Although we did not have major vascular complications, we had 4 conversions because of the bleeding.

Both biliary and nonbiliary complications take an important place in the published studies. The most common biliary complications described are lesions of the common bile duct, lesions of the right hepatic duct, and perforation of the gallbladder with spilt calculi. Vascular injuries, injuries to the intestine, diaphragm, and iatrogenic pneumothorax represent the most important non-biliary complications.

In our study, there were 14 patients with the bile leak > 50-100 ml/24 h in the postoperative period. Other studies have shown that the injuries that are most commonly seen are minor injuries to the gallbladder, and ducts of Luschka with bile leaks, smaller bleeds with hematomas of the abdominal wall at the place of port, or in the tissues adjacent to the gallbladder. Although major injuries to the great blood vessels like the aorta, inferior vena cava, or iliac artery are rare, they are associated with high mortality rate [7, 18-20]. A study by Kaushik R [7] reports that complications with bleeding occur at a rate at up to 10%. In this study, he analysed 10,320 publications in English, and showed results from seven medical centers by seven authors with more than 1,000 laparoscopic cholecystectomies each. Khan reported 2 complications with bleeding (0.04%) out of 4,975 laparoscopic surgeries. Marakis G et al [20] reported 15 (1.22%) out of 1,225, and Kaushik R, 6 (0.49%) out of 1,233 laparoscopic cholecystectomies [7]. Intraoperative bleeding can be caused by insertion of the trocar, dissection of the gallbladder and the structures of the Calot's triangle. Postoperative bleeding can be caused by the removal of clips or ligatures and due to necrosis of the wall caused by effects of term cauterization.

The experience of the surgical team with the operative technique and equipment are important factors in preventing the complications. Surgeons who performed less than 100 laparoscopic cholecystectomies had more complications compared to surgeons with the greater number of surgeries [21, 22]. Contrary to that, there are other studies that show that surgeons with the greater number of laparoscopic surgeries have more complications [23].

Perforation of a gallbladder with gallstones spilt into the peritoneal cavity is a frequent complication, especially when associated with acute cholecystitis and larger gallstones [14, 17, 24]. Z'graggen K et al. [17] published a prospective study on 10,174 patients and showed that 1.4% complications were due to spilt gallstones. The estimated rate of gallbladder perforation is 10-30%. Duca et al [8] reported that the incidence of iatrogenic perforation of the gallbladder was 1,517 (15.9%) out of 9,542 patients who underwent laparoscopic cholecystectomy. In our study, we report 39 (5.27%) iatrogenic perforations of the gallbladder. Out of that, 15 cases (2.02%) were associated with spilt gallstones, which is in accordance with studies published by others.

Studies show that the most common complications after spilt and retained calculi in the abdominal cavity are: intra-abdominal abscesses, fistulas, and tumefactions of the abdominal wall [25-27]. Dasari BVM et al. [26] reported spilt calculi in 19.8% laparoscopic cholecystectomies in their study. In our study, we report abscess collections during the postoperative period in 2 cases (0.27%). They required laparotomy and evacuation. In addition, we report that spilt gallstones during surgery were a cause for conversion to open procedure in 3 cases (10.34% out of all conversions).

In recent publications, the incidence of injuries to the intestine varies between 0.07 to 0.7%. Intestinal injuries are usually caused by insertion of the trocar, dissection of adhesions from previous surgeries, or from the present inflammation. Frequently, they are not recognised intraoperatively [15]. Some authors report intestinal ischemia, as well as an evisceration of the section of intestine through a port [28, 29]. None of the cases from our study had intestinal injuries.

Surgical wound infection is a complication that occurs with higher frequency in open cholecystectomy compared to laparoscopic cholecystectomy [30, 31]. In our prospective study, we report 7 (0.94%) patients with the operative wound infection. Three patients (0.40%) had the incisional hernia, which agrees with studies published by other researchers. Boni et al. [30] reported that incisional complications were less commonly encountered in laparoscopic cholecystectomies compared to open cholecystectomies (mean 1.1% vs. 4.0%).

Hernias at the port insertion site have been reported in many papers with the incidence between 0.14% and 22%. Bunting DM [32] analysed 7 studies published in English, that were completed in the time period between 1995 and 2010, and that included 5984 patients who had laparoscopic cholecystectomies. This analysis reports 99 (on average 1.7%) cases of a hernia at the port insertion site as a postoperative complication. In the 7 studies that were included in this analysis, the incidence of this postoperative complication varies from 0.3% to 5.4%. The most common causes for the development of an incisional hernia were increased BMI, a diameter of the trocar duration of the surgery, a presence of a preexisting hernia, severity of inflammation, widening of the port for extraction of a gallbladder, and the age of the patient [32, 33].

In modern laparoscopic surgery, conversion is not considered to be a complication, but instead a way for the surgeon to safely finish the surgery. Therefore, the surgeon should have a low threshold for conversion [14, 26, 27]. In our study, we report 29 conversions (3.91%). Conversions were more frequent in males (7.98%) compared to females (1.99%), which agrees with studies published by others. Marakis G. et al. [20] published results of a 12-year study that included 1,225 patient who had laparoscopic cholecystectomies. This study reports 19 (1.5%) major complications, and 7.4% conversions. A meta-analysis on 14,545 laparoscopic cholecystectomies by Yang TF et al. reports 940 (6.41%) conversions [12]. This analysis shows that older age, male gender, acute cholecystitis, a gallbladder wall thickness > 3 mm and history of previous surgeries is all predictive factors for conversion.

The rate of conversion reported in today's literature are 2-15% [34]. In cases with acute inflammatory process reported rates of conversion increase up to 35% [13].

In conclusion, intraoperative complications and postoperative complications associated with laparoscopic cholecystectomy have their own specific characteristics. They are more common in patients with older age, male gender, with increased levels of markers of inflammation (white blood cell count and CRP), and in cases of acute cholecystitis confirmed by pathohistology. In addition, a preoperative ultrasonographic finding of gallbladder empyema, or gallbladder wall thickness > 3 mm, suggests that there might be an increased probability for the development of complications. Major vascular complications like the injury of the common bile duct, bleeding from the aorta, inferior vena cava or iliac blood vessels, are life threatening, and the surgeon is required to do a conversion. Conversions in these cases should not be perceived as a failure, but instead as a necessary procedure that will increase patient safety and likelihood for a favourable outcome.

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