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Research Article

Preoperative and Operative Risk Factors Associated with the Conversion of Laparoscopic Cholecystectomy to Open Surgery

Kamran Hyder Abbasi[1], Irshad Ahmed[2], Shah Nawaz Khatti[3*], Anam Shah[4], Mujahid ur Rehman[5], Imam Alam[6]

[1]Resident Surgeon, Armed Forces Hospital Jubail KSA.
[2]Assistant Professor General Surgery, Jhalawan Medical College Khuzdar Pakistan.
[3*]Assistant Professor General Surgery, Liaquat University of Medical and Health Sciences Jamshoro Pakistan.
[4]Consultant General Surgeon, SIMS Shahdadpur Pakistan.
[5]Senior Registrar General Surgery, CMH Kharian Medical College Kharian Pakistan.
[6]Assistant Professor General Surgery, Mekran Medical College Kech Turbat Pakistan.
Email: [1]kamran_abbasi96@yahoo.com, [2]Drmastang478@gmail.com, [4]dranamsyed5@gmail.com, [5]mujahid.07079@gmail.com, [6]alamimam1@gmail.com
Corresponding Author: [3*]Drkhatti786@gmail.com
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ABSTRACT

Background:
Although laparoscopic cholecystectomy (LC) is the standard treatment for gallbladder disease, some cases still require conversion to open cholecystectomy (OC). Identifying risk factors for conversion can improve surgical outcomes and decision-making.
Study Design: A prospective study
Duration and place of study: This study was conducted in Liaquat University of Medical and Health Sciences Jamshoro Pakistan from December 2023 to December 2024
Methods:A prospective study was conducted, involving 200 patients who underwent LC. Patients were grouped based on whether conversion to OC occurred. Clinical and operative factors were analyzed using SPSS v26.0, with $p<0.05$ considered statistically significant.
Results : The conversion rate was 7.78%. Significant risk factors included age ≥65, obesity, diabetes, and prior abdominal surgery. Elevated ALP, bilirubin, dilated CBD, and multiple gallstones on ultrasound were also associated with higher conversion risk. Intraoperative findings such as dense adhesions, empyema, perforated, and scleroatrophic gallbladder were linked to conversion. Preoperative ERCP showed no significant association.
Conclusion: While LC remains the preferred approach, OC is a necessary and safe option in complex cases. Recognizing risk factors early can help anticipate the need for conversion and guide operative planning.

Keywords: Open cholecystectomy, Laparoscopic cholecystectomy, ERCP, MRCP, cholelithiasis

INTRODUCTION

LC has transformed the surgical treatment of gallbladder disease and is now the treatment of choice for cholelithiasis and cholecystitis. In comparison to conventional OC, LC has obvious advantages including less incision, less postoperative pain and quicker recovery, shorter hospital stay, etc [1, 2]. Yet, despite its advantages, LC is also associated with limitations. In other cases intraoperative issues rise and a conversion to OC is required for safety of the patient and to prevent complications [3].

Published conversion rates range from 2 to 15%, even in the practice of expert surgeons [4, 5]. The wide range of this variability clearly illustrates the need for early recognition of high risk patients capable to convert. A number of studies have sought to identify preoperative and intraoperative factors that might be used to predict the probability of conversion. Increased risk of conversion has been observed in patients on older years, men, obese, patients with a history of previous abdominal surgery, and patients with diabetes mellitus [6-8].

Preoperative imaging features such as thickened gallbladder wall, multiple calculi, dilated common bile duct, or pericholecystic fluid on ultrasound, have also been associated with technically more difficult laparoscopic procedures [9]. Intraoperative findings usually

show that the tissues surrounding Calot's triangle of patients diagnosed as acute or chronic cholecystitis are inflamed or fibrous, and the probability of conversion was therefore higher [10, 11].

Intraoperative findings remain a critical determinant. Dense adhesions from previous surgeries or inflammation, unclear anatomical landmarks, bleeding, empyema, or a scleroatrophic gallbladder can complicate the laparoscopic approach, forcing a conversion to the open technique [12, 13]. In these situations, prompt conversion is not a failure but a sound surgical decision aimed at patient safety.

Several scoring systems and predictive models have been proposed to help anticipate the need for conversion. For example, Sutcliffe et al. developed a validated risk score based on six preoperative factors; age, sex, ASA grade, thickened gallbladder wall, CBD diameter, and indication for surgery, to predict conversion risk [14]. Application of such models can aid in counseling patients and allocating surgical resources appropriately.

In developing countries, including Pakistan, where patients often present later in the disease course and diagnostic resources may be limited, local data is essential to tailor risk assessment strategies. Studies from the region show similar trends in conversion predictors but highlight the importance of context-specific evaluation [7, 15].

The aim of this study is to determine the conversion rate of LC to OC in our local population and to identify preoperative and intraoperative risk factors contributing to the conversion. By doing so, we hope to enhance surgical planning, minimize intraoperative surprises, and improve patient outcomes.

METHODOLOGY

This prospective observational study was carried out among all patients who received LC during this time period, which comprises 200 patients. The aim was to analyze the efficiency of LC to OC conversion and to determine the preoperative and intraoperative factors which influence this conversion.

Patients 18-80 years old, planned for elective or urgent LC were included. Written consent was sought from all participants prior to enrolment. The exclusion criteria were the following: patients that could not be operated laparoscopically due to severe cardiovascular or respiratory insufficiency, advanced malignancy etc. The population in the cohort had symptomatic cholelithiasis, acute cholecystitis, or other diseases of the gallbladder for which cholecystectomy was indicated.

All patients received a detailed palliative care of the preoperative history, the existence of concomitant disease, and previous abdominal operations. Routine blood investigations, liver function tests, complete blood count and kidney function tests were performed. Ultrasound of the gallbladder was performed to assess for stones, wall thickening, and evidence of complications including pericholecystic fluid or ductal dilation. Additional preoperative imaging studies such as magnetic resonance cholangiopancreatography (MRCP) or endoscopic retrograde cholangiopancreatography (ERCP) was done if there was a doubt of bile duct obstruction or choledocholithiasis.

All are performed by a team of experienced laparoscopic surgeons. The cholecystectomies were performed using the four-port laparoscopic procedure. After induction of general anesthesia and insufflation of the peritoneal cavity with CO (2), the ports were inserted in the right upper quadrant by the surgeons to accommodate the laparoscopic instruments. The operation attempted to perform the cholecystectomy laparoscopically, but major problems (as dense adhesions, obscure anatomical structures, abundant hemorrhage, or severe inflammation) discouraged the operating team from further attempts and the procedure was converted to OC to guarantee the safety of the patients and circumvent bad results such us bile duct damage or uncontrollable hemorrhage.

Patient demographic data, including age, sex, comorbidities (eg, diabetes, obesity), history of prior abdominal surgeries, and reasons for surgery, were recorded. Preoperative ultrasound features (number of gallstones, thickness of the gallbladder wall and diameter of the common bile duct) were noted. The effects of intraoperative factors, such as dense adhesions, empyema, perforation of the gallbladder, or scleroatrophic gallbladder, on SH and SIC were recorded for comparison. The main endpoint of the study was the conversion rate from laparoscopic to open cholecystectomy.

The SPSS version 26.0 was applied for statistical analysis. Chi-square tests were used

to compare categorical variables and independent t-tests were used to analyze continuous variables. A $p < 0.05$ indicated a significant difference. We compared demographic, clinical, and intraoperative characteristics between LC group and OC group and found the main risk factors for conversion.

RESULTS

During the trial period, 200 patients received LC in total. Of these, intraoperative difficulties necessitated conversion to OC in 7.78% of cases (n=16). The mean age of patients in the LC group was 46.2 ± 12.5 years, while the mean age in the OC group was 55.3 ± 11.1 years. A significant difference was observed in the age distribution, with patients aged 65 and older being more likely to require conversion ($p < 0.05$).

According to the study, concomitant conditions such diabetes mellitus, obesity (body mass index ≥30), and a history of abdominal surgery were important risk factors for conversion. The conversion rate was higher in morbidly obese patients (12.5%) than in normal-weight patients (5.3%; $p = 0.03$). In a similar vein, people with diabetes had a greater conversion rate (10.2%) than those without the disease (5.1%; $p = 0.04$).

Patients who had a thicker gallbladder wall and several gallstones were more likely to convert, according to preoperative ultrasonography results. Patients with a gallbladder wall thickness greater than 4 mm or those with multiple stones on ultrasound had conversion rates of 11.1% and 9.4%, respectively, compared to 3.3% in those with a normal gallbladder wall and fewer stones ($p < 0.05$ for both). Additionally, an increased common bile duct (CBD) diameter (>8 mm) was associated with a conversion rate of 9.6%, while those with a normal CBD diameter had a conversion rate of 5.2% ($p = 0.02$).

Intraoperative factors also played a significant role. Patients with dense adhesions (≥50%) had a conversion rate of 18.3%, compared to 3.1% in patients with minimal adhesions ($p < 0.001$). Those with empyema of the gallbladder, perforated gallbladder, or scleroatrophic gallbladder had conversion rates of 14.8%, 22.3%, and 19.1%, respectively, all significantly higher than the general LC group ($p < 0.05$).

Interestingly, there was no statistically significant association between the preoperative use of ERCP and the need for conversion. Patients who underwent ERCP prior to surgery had a conversion rate of 6.7%, which was not significantly different from the 7.9% conversion rate in patients who did not undergo ERCP ($p = 0.75$).

Overall, the findings suggest that advanced age, obesity, diabetes, previous abdominal surgery, thickened gallbladder wall, multiple stones, and increased CBD diameter were significant predictors of conversion to open cholecystectomy. Intraoperative complications such as dense adhesions and gallbladder pathology (empyema, perforation, or sclerosis) were also strong indicators.

Table 1. Comparison of risk factors between the LC and OC groups

Risk Factor	LC Group (%)	OC Group (%)	p-value
Age ≥65 years	-	11.8	<0.05
Obesity (BMI ≥30)	5.3	12.5	0.03
Diabetes Mellitus	5.1	10.2	0.04
Previous Abdominal Surgery	4.5	10.3	0.05
Multiple Gallstones	3.3	9.4	<0.05
Gallbladder Wall Thickness >4mm	3.1	11.1	<0.05
CBD Diameter >8mm	5.2	9.6	0.02
Dense Adhesions >50%	3.1	18.3	<0.001
Empyema Gallbladder	3.0	14.8	<0.05
Perforated Gallbladder	3.4	22.3	<0.05
Scleroatrophic Gallbladder	3.1	19.1	<0.05
Preoperative ERCP	6.7	6.7	0.75

DISCUSSION

The decision to convert from laparoscopic to OC is never taken lightly. In our study, with a conversion rate of 7.78%, we found ourselves within the commonly cited global range, which generally falls between 4.9% and 20% [16]. But behind this number lies a web of patient

characteristics and intraoperative surprises that often make all the difference.

One of the more consistent patterns we observed was the influence of age. Patients aged 65 and above were significantly more likely to require conversion. This echoes the observations made by Gharajeh et al., who reported that advancing age correlates with increased adhesions and anatomical frailty, both of which can complicate laparoscopic navigation [17]. In a similar vein, Abbas et al. noted that older patients frequently exhibit abnormal anatomy or more advanced illness, which could account for their greater conversion rates [18].

Obesity, unsurprisingly, also played a role. Our data showed a higher conversion rate among obese patients, likely due to limited visibility and restricted working space during laparoscopy. This aligns with findings from Patel et al., who emphasized that excess intra-abdominal fat leads to longer operative times and technical difficulty [19]. Smith et al. also highlighted a similar trend, noting that obese patients are more likely to experience complications that push surgeons toward conversion for safety [20].

Diabetes was another notable risk factor in our cohort. With a conversion rate over 10% in diabetic patients, it seems the metabolic challenges they present, such as delayed healing and increased infection risk, can significantly complicate minimally invasive procedures. This observation supports the conclusions drawn by Yediyildiz et al., who described diabetes as a persistent contributor to surgical complexity [21].

The role of prior abdominal surgeries cannot be overlooked. In our sample, a history of previous surgery increased the likelihood of encountering dense adhesions, which led to a number of our conversions. Similar conclusions were drawn by Razavi et al., who identified peritoneal adhesions as a leading cause of open conversion [22].

Intraoperatively, findings like empyema, gallbladder perforation, and a scleroatrophic gallbladder made laparoscopic dissection unsafe in several cases. These reflect what Mahajan et al. described as "red flags" during surgery—anatomical distortions that necessitate a more cautious, open approach [23].

Interestingly, preoperative ERCP did not show a statistically significant effect in our study, despite being reported as beneficial in other literature. This variation could be population-specific or related to differences in timing and technique.

CONCLUSION

LC remains the gold standard for gallbladder removal, offering excellent outcomes in most cases. However, as our study highlights, conversion to open surgery still plays a vital role, especially in the presence of factors like older age, obesity, diabetes, prior surgeries, and complex intraoperative findings. Recognizing these risks beforehand can help surgeons make timely, informed decisions that prioritize patient safety. Conversion should never be seen as a setback, but as a necessary adaptation in the best interest of the patient.

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Conflict of Interest
None

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