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Timely Conversion of Laparoscopic Cholecystectomy to Open Cholecystectomy is Crucial to Avoid Complications

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Abstract

Laparoscopic cholecystectomy is the gold standard for gallbladder disease, but the decision to switch to open surgery is still a critical one. The purpose of the study was to determine the conversion rate, to identify predictive risk factors and to analyze the results of the institution-wide conversion rate. A retrospective cohort study was conducted in the Department of Surgery, Community Based Medical College, Bangladesh (CBMC,B), Mymensingh, Bangladesh, between January 2020 and December of 2022, to assess factors leading to the change from laparoscopic to open cholecystectomy and analyze the impact of early change on patient safety and post-operative outcomes. Medical records of 320 patients, who had a laparoscopic cholecystectomy course for symptomatic gallbladder disease. Demographics, pre-operative findings, operative details and post-operative results were collected. Conversion from laparoscopic cholecystectomy to open cholecystectomy rate was 4.7% (n=15). Bivariate analysis revealed age at surgery (p=0.001), particularly age 50-59 years (20.8% change), gender (19.1% vs. 2.2%, p=0.002), and history of upper abdominal surgery (26.7% vs. 3.6%, p=0.008). A slight positive correlation between age (r=0.42) and gender (r=0.36) was confirmed by Pearson correlation. The main causes of change were thickened adhesions (40%) and acute inflammations (33.3%). The converted group had significantly more time to return to activity (92.5±18.3 vs. 54.2±12.5 minutes, p=0.001) and more hospital stays (5.8±1.6 vs 2.3±0.8 days, p=0.001). The patient profile for transfer from laparoscopic cholecystectomy to open cholecystectomy was clear for high-risk patients. We observed that time-oriented transformation guided by pre-operative risk factors and intra-operative challenges are key surgical judgment that reduces the risk of major complications and prioritises patient safety in favour of procedural rigour.

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Introduction

Laparoscopic cholecystectomy (LC) was first reported in Germany (1985) and France (1987) more than four decades ago. Over the past two decades, laparoscopic cholecystectomy (LC) has become gold standard for the surgical treatment of gallbladder disease. A shorter hospital stay, less postoperative pain, faster recovery, better cosmesis are some of the advantages of LC over open surgery.[1,2] The complications encountered during LC are numerous: some that are specific to this unique technique and some that are common to laparoscopic surgery in general. These include complications related to anesthesia; complications related to peritoneal access (e.g., vascular injuries, visceral injuries, and port-site hernia formation); complications related to pneumoperitoneum (e.g., cardiac complication, pulmonary complications, and gas embolism) and complications related to thermocoagulation. Specific complications of LC are gall bladder perforation, hemorrhage, bile leakage, bile duct injury, and wound sepsis, hematoma, foreign body inclusions, adhesions, metastatic port-site deposits.[3,4] Some of

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these complications and several other factors can necessitate the conversion from LC to open cholecystectomy. Approximately 75% of all cholecystectomies are performed laparoscopically, and conversion to the open procedure ranges from 4% to 10% nationwide. The conversion from LC to open cholecystectomy results in a significant change in outcome for the patient because of the higher rate of postoperative complications and the longer hospital stay.[5-7] Outcome of LCs would be greatly influenced by surgeon-specific factors, such as training, experience, skill and judgment. In addition, numerous patient and disease-related factors, such as male gender, obesity, old age (>60), prior abdominal surgery, acute cholecystitis, choledocholithiasis, and anomalous anatomy have been reported as significant risk factors for conversion to the open procedure.[5-9] The initial rate of common bile duct (CBD) injury in LC ranged from 0.2% to 3%, or up to 5 times higher than in OC.[4,5] However, experience with LC and improved laparoscopic principles encouraging the accurate anatomical identification of structures, limited dissection within Calot's triangle, and the judicious use of intraoperative cholangiography have stabilized the CBD injury rate to a range of 0.25% to 0.5% nationwide.[9] More importantly, LC has been shown to have significant advantages over OC by reducing postoperative pain and thereby accelerating recovery and return to work and activity.[5-9] Despite this progress, there are still a substantial proportion of patients in whom LC cannot be successfully performed and conversion to open surgery is required. This study retrospectively reviews LC series in this hospital and to compare the results with other reported literature.

Methods

This retrospective cohort study was conducted in the Department of Surgery, Community Based Medical College, Bangladesh (CBMC,B), Mymensingh, Bangladesh, between January 2020 and December 2022. Medical records of 320 patients who had symptomatic gallbladder disease had laparoscopic cholecystectomy were selected as samples. The study included all adult patients (aged 18 years or over), who had been diagnosed with symptomatic gallstones (including biliary colic, acute cholecystitis and chronic cholecystitis) and who were scheduled for elective or emergency limbic surgery in an outpatient setting. Patients who had a planned open cholecystectomy or surgery that was part of another major abdominal operation were excluded from the analysis to ensure a homogenous cohort for the assessment of factors related to unexpected changes.

All patients underwent standardized pre-operative evaluation, including detailed history, physical examinations, routine laboratory tests and abdominal ultrasound to confirm the diagnosis and assess the severity of disease. Informal written consent was obtained from all patients after a comprehensive explanation of the laparoscopic procedure, its potential risks and the clear option to switch to open cholecystectomy if deemed necessary to ensure their safety.

All procedures were performed by one experienced surgeon to minimize operator-induced variability. The standard four-port technique was used for laparoscopic access. Pneumoperitoneum was established and a chest examination was performed to obtain a critical safety opinion. All patients were given prophylactic intravenous antibiotics before induction of anaesthesia. The decision to switch to an open operation was made by the surgeon during the operation, based on factors such as thick adhesions, unclear anatomy, uncontrolled bleeding, or suspected bile duct injury.

Data was obtained from patient records using a structured questionnaire approach. The primary endpoint was the rate of change in the number of open laparoscopic cholecystectomies. Secondary results included analysis of pre- and intra-operative factors predictive of conversion, documented reasons for conversion, and the incidence of post-operative complications in both treated and untreated groups. Collected data was analyzed using Statistical Package for Social Sciences (SPSS) version 23.0 for Windows. Continuous variables were presented as mean±SD (standard deviation) and categorical variables as frequency and percentage. For comparison, Student's t-test and Chi-square test were used. A p-value <0.05 was considered statistically significant. The Pearson correlation was also used to evaluate the relationship between the various risk factors and the rate of conversion.

Ethical clearance was obtained from the Ethical Review Committee of Community Based Medical College, Bangladesh (CBMC,B), Mymensingh, Bangladesh.

Results

Out of 320 patients, most of them belonged to the <40 years age group 180(56.3%) and male-female ratio was 1:5.8 (Table-I). However, bivariate analysis revealed several factors that were significantly related to Conversion from laparoscopic cholecystectomy to open cholecystectomy occurred in 4.7%(n=15). There was a strong age-related variation (p=0.001), gender (19.1 % vs. 2.2 %, p=0.002), previous upper abdominal surgery history (26.7% vs. 3.6%, p=0.008), and pre-operative inflammation (as diagnosed with ultrasound procedure) (1.3% severe vs. 1.1% mild, p=0.001) – all were identified as risk factors for these conditions (Table-II).

Table-I. Demographic characteristics of the patients (N=320)

Variables	Category	Frequency	Percentage
Age group (in years)	<40	180	56.3
	40–49	72	22.5
	50–59	48	15.0
	≥60	20	6.2
Gender	Male	47	14.7
	Female	273	85.3

Table-II. Association between patient factors and conversion to open surgery

Variables	Category	Converted (n=15)	Not Converted (n=305)	χ^2 value	p-value
Age group (in years)	<40	1 (0.6%)	179 (99.4%)	19.52	0.001
	40–49	2 (2.8%)	70 (97.2%)		
	50–59	10 (20.8%)	38 (79.2%)		
	≥60	2 (10.0%)	18 (90.0%)		
Gender	Male	9 (19.1%)	38 (80.9%)	14.73	0.002
	Female	6 (2.2%)	267 (97.8%)		
Previous upper abdominal surgery	Yes	4 (26.7%)	11 (73.3%)	10.11	0.008
	No	11 (3.6%)	294 (96.4%)		
Severity of inflammation	Mild	2 (1.1%)	175 (98.9%)	18.84	0.001
	Moderate	6 (8.3%)	66 (91.7%)		
	Severe	7 (23.3%)	23 (76.7%)		

Chi-square tests were applied to reach p-value.

Fig. 1 shows the reasons for conversion. Overall complication rates were low at 3.4%, mostly due to superficial wounds (2.5%), supporting the overall safety of the LC (Fig. 2). Patients in conversion group had significantly longer operation time (92.5±18.3 min. vs. 54.2±12.5 min.; p=0.001) and a more than 2-fold increase in hospital stay (5.8±1.6 days vs. 2.3±0.8 days). The most important events were significantly higher incidences of intraoperative bleeding (33.3% vs. 3.3%; p=0.041) and post-operative complications (2.0% vs. 1.0%; p=0.001) (Table-III). This risk profile was further confirmed by Pearson correlation coefficient tests, which showed significant positive correlation between conversion and age (r=0.42, p=0.002), male gender (r=0.36. p=0.004) and gallbladder wall thickness (r=0.31, p=0.011) (Table-IV).

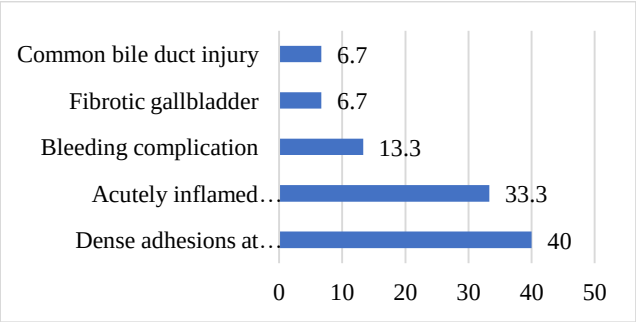

Fig. 1: Distribution of reasons for conversion from laparoscopic to open cholecystectomy (in percentages) (n=15)

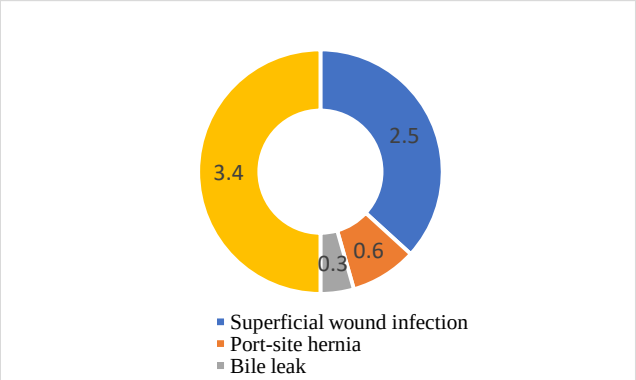

Fig. 2: Distribution of postoperative complications following laparoscopic cholecystectomy (N=320)

Table-III. Operative and postoperative outcomes

Variable	Converted (n=15)	Non-converted (n=305)	p-value
Mean operative time (min.)	92.5±18.3	54.2±12.5	0.001*
Mean hospital stay (days)	5.8±1.6	2.3±0.8	0.001*
Intraoperative bleeding	2 (13.3%)	10 (3.3%)	0.041#
Postoperative complications	5 (33.3%)	6 (2.0%)	0.001#

*=Student's t-test and #=Chi-square test were applied to reach p-value.

Table-IV. Correlation between risk factors and conversion to open surgery

Variables	Pearson Correlation Coefficient (r)	p-value
Age	0.42	0.002
Male gender	0.36	0.004
Gallbladder wall thickness	0.31	0.006
Prior abdominal surgery	0.28	0.011

Pearson's correlation coefficient tests were applied.

Discussion

This retrospective analysis of 320 laparoscopic cholecystectomy procedures performed in one institution provides valuable insight into the real-world profile, risk factors and outcomes of this procedure, with particular emphasis on the critical decision to switch to open surgery. Our findings are consistent with existing literature and highlight specific trends in our patient population. The demographic profile of our cohort, with a median age of 39.6 years and a high prevalence of women (85.3%), is consistent with typical gallstone epidemiology.[1,10] The overall conversion rate of 4.7% (15 of 320 patients) is within

the widely reported national and international ranges of 4-10%,[1,6,7] which confirms that our data are generalizable. This conversion rate, although modest, represents a critical subset of patients for whom surgical strategies have to be changed significantly to ensure safety.

Our study clearly identified several patient-related factors that significantly increased the risk of transference. The most striking difference was the strong age-related variation, with a jump from 0.6% in patients aged 40-59 years to 20.8 % in the 50-59 age group. This is consistent with the findings of previous studies, which also identified advanced age as a key predictor, probably as a result of an increased incidence of chronic inflammations and fibrosis.[6,7] In addition, the male sex, the history of previous upper abdominal surgery and the severity of inflammation as seen on ultrasound prior to surgery were all confirmed as significant risk factors. Correlation analysis further strengthened these associations, with age being the most positive (r=0.42). These findings are consistent with studies consistently pointing to acute cholecystitis, male anatomy and pre-operative adhesions as major contributors to difficult laparoscopic removal procedures.[6,8,9] This body of evidence underlines the importance of thorough pre-operative stratification of risks.[11,12] Patients presenting with these risk factors should be warned in advance of an increased likelihood of conversion.

The intraoperative causes of the switch in our series were mainly technical, with the most important causes being dense adhesions in the Calot's triangle (40%) and acutely inflamed gallbladder (33.3%). This finding is almost universal in the literature described such conversion.[1,6,8] These factors directly undermine the critical safety perspective, making continued laparoscopic surgery unsafe and increasing the risk of catastrophic bile duct injury (BDI). The presence of one BDI in our converted group, though rare, is a stark reminder of that risk. Our institutional BDI of 0.3% (in 320 patients) is in line with the modern reference value of 0.25-0.5,[9,13] which suggests that the decision to switch to a BDI in other complex cases was probably a preventive measure to avoid further serious morbidity.

The effects of conversion were profound and statistically significant. Patients requiring transplantation had 70% longer average operative time, 150% longer hospital stays, and dramatically higher rates of both intraoperative bleeding (13.3% vs. 3.3%) and postoperative complications (33.3% vs. 2.0%). These findings are clear and reflect the results reported by previous studies,[1,7,8] which confirm that conversion changes the patients' recovery path significantly. However, it must be read correctly. The higher complication rate in the group of patients transferred should not be misinterpreted as an argument against transfer; rather, it reflects the inherent complexity of the pathology that made transfer necessary in the first place. In principle, the transfer is a sign of a complex case and its results must be compared with a possible alternative – a severe vascular or biliary injury resulting from a forced laparoscopic procedure.[10] This leads us to the central thesis of our study: the critical importance of the early stages of conversion. A late conversion, done after a long, fruitless autopsy or after complications, is likely to result in even worse outcomes. The prudent decision to perform a transplant in the face of obscured anatomy or uncontrolled bleeding is a hallmark of good surgical judgment and expertise.[6,14] It is a strategic retreat to avoid a catastrophic complication, thus upholding the overriding principle of patient safety over procedural rigidity.

Despite the problems in this subgroup of patients, the overall safety profile of LC in our centre is confirmed by a low overall complication rate of 3.4 %, which is comparable to the rates reported in the other series.[1,12,15] The most common complication was superficial surgical site infection, which is a known and curable condition.

The limitations of the retrospective design of this study apply. Although experience with individual surgeons ensures technical consistency, this may limit the generalizability of the exact conversion rate in other settings with different surgeons. Furthermore, some data on potential confounding factors such as body mass index (BMI) or detailed operational findings other than those reported were not available for analysis. Future prospective multi-centre studies may provide a more complete model for the risk.

Conclusion

To conclude, our study confirms that although laparoscopic cholecystectomy is a safe and effective procedure for the majority of patients, the risk profile for high-risk patients is clear. Factors such as advanced age, male gender, prior abdominal surgery and sonographic evidence of severe inflammation should alert the physician to the increased risk of transmission. The decision to switch to open cholecystectomy procedures when it is not possible to safely define the anatomy or control the bleeding is not a failure, but a prudent and necessary step in the continuum of care of the patient. Time-oriented transformation guided by pre-operative risk factors and intra-operative findings is a key part of a safe surgery that is essential for avoiding major complications and optimizing outcomes in complex gallstone disorders.

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