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Original Research Article

A PROSPECTIVE OBSERVATIONAL STUDY ON THE INCIDENCE AND CAUSES OF CONVERSION FROM LAPAROSCOPIC TO OPEN CHOLECYSTECTOMY

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ABSTRACT

Background: Laparoscopic cholecystectomy is the standard surgical treatment for symptomatic gallstone disease because of its minimal invasiveness and favorable postoperative outcomes. However, conversion to open cholecystectomy remains necessary in difficult cases to ensure patient safety and prevent major complications. The present study was conducted to evaluate the incidence and causes of conversion from laparoscopic to open cholecystectomy.

Materials and Methods: This prospective observational study was conducted in the Department of General Surgery at Dr. Susheela Tiwari Government Hospital over a period of 18 months. A total of 100 patients with symptomatic cholelithiasis undergoing laparoscopic cholecystectomy were included. Preoperative clinical and ultrasonographic findings, intraoperative findings, conversion rates, causes of conversion, and postoperative complications were analyzed.

Results: Among the 100 patients, females constituted 71% and males 29%. The conversion rate from laparoscopic to open cholecystectomy was 11%. The most common causes of conversion were bleeding (36.36%), dense adhesions (36.36%), and anatomical distortion (27.27%). Preoperative ultrasonographic factors such as gallbladder wall thickness >4 mm, pericholecystic fluid, contracted gallbladder, empyema, and gangrenous gallbladder were found to be associated with difficult laparoscopic cholecystectomy. Intraoperative findings such as adhesions and difficult Calot's triangle dissection were major contributors to operative difficulty. Postoperative complications were observed in 17% of patients, with wound infection being the most common.

Conclusion: Conversion from laparoscopic to open cholecystectomy remains an important safety strategy in difficult gallbladder surgery. Preoperative ultrasonographic assessment and careful intraoperative evaluation can help predict difficult laparoscopic cholecystectomy and facilitate timely conversion, thereby reducing complications and improving patient outcomes.

Keywords: Laparoscopic cholecystectomy; Open cholecystectomy; Conversion; Cholelithiasis; Gallstone disease; Risk factors.

INTRODUCTION

Gallstone disease is one of the most common gastrointestinal disorders worldwide and constitutes a major health burden, accounting for a significant proportion of hepatobiliary surgical admissions. It develops due to a multifactorial interaction between cholesterol supersaturation of bile, gallbladder

hypomotility, and genetic predisposition, resulting in the formation of gallstones. Although many individuals remain asymptomatic, symptomatic gallstone disease commonly presents with right upper quadrant pain, dyspepsia, nausea, vomiting, and other biliary symptoms, often affecting quality of life and requiring surgical intervention..[1,2]

The prevalence of gallstone disease varies considerably across different populations, ranging from 5% to 15% in Western countries and showing a rising trend in Asian populations, including India. Epidemiological studies have demonstrated that age, female gender, obesity, metabolic syndrome, diabetes mellitus, and dietary factors significantly contribute to gallstone formation. In the Indian population, the burden of gallstone disease has been increasing, making it an important surgical concern.[2,3]

Laparoscopic cholecystectomy (LC) has become the gold standard treatment for symptomatic cholelithiasis because of its well-established advantages over open cholecystectomy, including reduced postoperative pain, shorter hospital stay, faster recovery, and improved cosmetic outcomes. Since its widespread adoption, laparoscopic cholecystectomy has largely replaced open surgery in routine surgical practice and remains the preferred treatment modality worldwide.[4,5]

Despite its safety and effectiveness, laparoscopic cholecystectomy is not always feasible in all patients. In certain cases, conversion to open cholecystectomy becomes necessary to ensure patient safety and prevent serious complications. Conversion should not be considered a surgical failure but rather a prudent intraoperative decision aimed at minimizing morbidity and avoiding life-threatening complications such as bile duct injury, uncontrolled hemorrhage, or visceral injury. Studies have reported conversion rates ranging from 2% to 15%, influenced by patient-related, disease-related, and surgeon-related factors.[6,7]

Several factors have been identified as predictors of difficult laparoscopic cholecystectomy and subsequent conversion to open surgery. These include advanced age, male gender, acute cholecystitis, gallbladder wall thickening, previous upper abdominal surgery, obesity, dense adhesions, and distorted anatomy in Calot's triangle. Preoperative identification of these risk factors is essential for surgical planning, informed consent, and optimization of perioperative management.[8–10]

One of the most important aspects in laparoscopic cholecystectomy is the prevention of biliary injury, which remains a serious complication associated with difficult dissection and unclear anatomy. The concept of the critical view of safety (CVS) and careful intraoperative judgment have significantly reduced the incidence of bile duct injury and improved operative outcomes.[11,12]

The Tokyo Guidelines 2018 have further emphasized the importance of early diagnosis, severity grading, and timely surgical intervention in acute cholecystitis, helping surgeons identify difficult cases and improve decision-making regarding conversion.[13]

Understanding the incidence and causes of conversion from laparoscopic to open cholecystectomy remains important for improving surgical outcomes, reducing complications, and enhancing patient safety. Preoperative identification of factors associated with difficult laparoscopic cholecystectomy can help in better surgical planning, patient counseling, and intraoperative preparedness. Therefore, the present study was undertaken to evaluate the incidence and causes of conversion from laparoscopic cholecystectomy to open cholecystectomy and to assess the preoperative and intraoperative factors associated with difficult laparoscopic cholecystectomy.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of General Surgery at Dr. Susheela Tiwari Government Hospital over a period of 18 months after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrolment.

The study included 100 consecutive patients diagnosed with symptomatic cholelithiasis and scheduled for laparoscopic cholecystectomy. Patients undergoing primary open cholecystectomy, those with suspected gallbladder malignancy, patients unfit for general anesthesia, and those unwilling to participate were excluded from the study.

A detailed clinical history and physical examination were performed in all patients. Baseline demographic and clinical parameters, including age, gender, presenting symptoms, duration of illness, and associated comorbidities, were recorded. Routine preoperative investigations were carried out, including hematological and biochemical parameters. Preoperative ultrasonography was performed in all cases to assess gallbladder pathology and identify factors associated with difficult laparoscopic cholecystectomy, including number of calculi, gallbladder wall thickness, gallbladder distension or contraction, pericholecystic fluid collection, common bile duct dilatation, common bile duct stones, mucocele, empyema, and gangrenous changes.

All patients underwent laparoscopic cholecystectomy under general anesthesia using the standard four-port technique. Intraoperative findings such as adhesions, difficult dissection at Calot's triangle, anomalous vessels, mucocele, empyema, gangrenous gallbladder, bleeding, and anatomical distortion were recorded. Conversion to open cholecystectomy was performed when safe continuation of laparoscopic dissection was not feasible or when intraoperative complications were encountered.

The primary outcome measure was the incidence of conversion from laparoscopic to open cholecystectomy. Secondary outcome measures

included identification of the causes of conversion, assessment of preoperative and intraoperative factors associated with difficult laparoscopic cholecystectomy, and postoperative complications such as wound infection, bile leak, and fever.

Data were analyzed using Jamovi software (Version 2.6.26). Quantitative variables were expressed as mean ± standard deviation, while qualitative variables were expressed as frequencies and percentages. Associations between categorical variables were assessed using the Chi-square test. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 100 patients with symptomatic cholelithiasis undergoing laparoscopic cholecystectomy were included in the study. The demographic profile, ultrasonographic findings, intraoperative findings, conversion rate, causes of conversion, and postoperative complications were analyzed.

The majority of the patients were female (71%), while 29% were male. The age distribution showed that most patients belonged to the 51–60 years (27%) and >60 years (26%) age groups, indicating a higher prevalence of gallstone disease in middle-aged and elderly individuals.

Table 1: Baseline Demographic Characteristics

Variable	Frequency (n)	Percentage (%)
Age group (years)		
21–30	5	5
31–40	22	22
41–50	20	20
51–60	27	27
>60	26	26
Gender		
Female	71	71
Male	29	29

Preoperative ultrasonography showed that multiple gallstones were present in 79% of patients, while single calculi were found in 21%. A distended gallbladder was observed in 49% of cases. Gallbladder wall thickness >4 mm was present in 22%, and common bile duct dilatation (>6 mm) was seen in 17%. Other findings included mucocele (12%), contracted gallbladder (6%), pericholecystic fluid (4%), common bile duct stones (4%), liver cirrhosis (4%), empyema (2%), and gangrenous gallbladder (1%).

Table 2: Preoperative Ultrasonographic Findings

Ultrasonographic finding	Frequency (n)	Percentage (%)
Multiple calculi	79	79
Single calculus	21	21
Distended gallbladder	49	49
GB wall thickness >4 mm	22	22
CBD dilatation >6 mm	17	17
Mucocele GB	12	12
Contracted GB	6	6
Pericholecystic fluid	4	4
CBD stone	4	4
Liver cirrhosis	4	4
Empyema GB	2	2
Gangrenous GB	1	1

Analysis of ultrasonographic predictors of difficult laparoscopic cholecystectomy showed that gallbladder wall thickness >4 mm was associated with difficult laparoscopic cholecystectomy in 81.82% of cases. Similarly, all cases with pericholecystic fluid, contracted gallbladder, liver cirrhosis, empyema, and gangrenous gallbladder were associated with operative difficulty.

Table 3: Association of Ultrasonographic Findings with Difficult Laparoscopic Cholecystectomy

Ultrasonographic factor	Total cases	Difficult laparoscopic cholecystectomy n (%)
GB wall thickness >4 mm	22	18 (81.82%)
Pericholecystic fluid	4	4 (100%)
Contracted GB	6	6 (100%)
Liver cirrhosis	4	4 (100%)
Empyema GB	2	2 (100%)
Gangrenous GB	1	1 (100%)

Intraoperatively, adhesions were the most common finding (18%), followed by difficult Calot's triangle dissection (15%), mucocele gallbladder (12%), and anomalous vessels (5%). Difficult laparoscopic

cholecystectomy was observed in 83.33% of patients with adhesions and in 100% of patients with difficult Calot's triangle, empyema, and gangrenous gallbladder.

Table 4: Intraoperative Findings Associated with Difficult Laparoscopic Cholecystectomy

Operative finding	Total cases	Difficult laparoscopic cholecystectomy n (%)
Adhesions	18	15 (83.33%)
Difficult Calot's triangle	15	15 (100%)
Mucocele GB	12	6 (50%)
Anomalous vessels	5	3 (60%)
Empyema GB	2	2 (100%)
Gangrenous GB	1	1 (100%)

Out of 100 laparoscopic cholecystectomies attempted, 89 cases were successfully completed laparoscopically, while 11 cases required conversion to open cholecystectomy, resulting in a conversion rate of 11%.

The decision for conversion was most commonly taken within the first 15–45 minutes of surgery, reflecting early identification of difficult operative conditions.

The most common causes of conversion were bleeding (36.36%), dense adhesions (36.36%), and anatomical distortion (27.27%), which were the major factors contributing to inability to safely continue laparoscopic dissection.

Table 5: Surgical Outcome and Causes of Conversion

Variable	Frequency (n)	Percentage (%)
Completed laparoscopically	89	89
Converted to open	11	11
Causes of conversion (n=11)		
Bleeding	4	36.36
Dense adhesions	4	36.36
Anatomical distortion	3	27.27

Postoperative complications were observed in 17% of patients, while 83% had an uneventful postoperative recovery. The most common postoperative complication was wound infection (8%), followed by bile leak (5%) and fever (4%).

Table 6: Postoperative Complications

Postoperative complication	Frequency (n)	Percentage (%)
None	83	83
Wound infection	8	8
Bile leak	5	5
Fever	4	4

The present study demonstrates that difficult laparoscopic cholecystectomy and conversion to open cholecystectomy were associated with adverse preoperative ultrasonographic findings and difficult intraoperative conditions, particularly gallbladder wall thickening, adhesions, difficult Calot's triangle dissection, and bleeding. These findings emphasize the importance of careful preoperative assessment and timely intraoperative decision-making to improve surgical outcomes.

DISCUSSION

Laparoscopic cholecystectomy (LC) is the standard surgical treatment for symptomatic gallstone disease because of its established advantages over open cholecystectomy, including reduced postoperative pain, shorter hospital stay, faster recovery, and lower postoperative morbidity.[4] Despite its widespread acceptance and safety, conversion to open cholecystectomy (OC) remains necessary in a proportion of patients when safe laparoscopic dissection cannot be achieved. Conversion should be considered a safety-oriented intraoperative decision aimed at preventing major complications rather than a failure of the laparoscopic approach.

In the present study, the conversion rate from laparoscopic to open cholecystectomy was 11%, which falls within the reported range of 2–15% in the literature.[6,7] This conversion rate is comparable with the findings of Aggarwal et al. (5.99%), Harish et al. (10%), and Faraj et al. (4.5%), although slightly higher in the present study, possibly due to a greater proportion of patients with inflammatory gallbladder pathology and difficult operative anatomy. [15,17,18] These findings highlight the persistent operative challenges associated with laparoscopic cholecystectomy despite advances in surgical techniques.

The female predominance (71%) observed in the present study is consistent with the known epidemiology of gallstone disease, which has a higher prevalence in women due to hormonal influences such as estrogen-induced cholesterol supersaturation and progesterone-mediated gallbladder hypomotility.[1,2] Similar gender distribution has been reported in multiple epidemiological studies. However, despite female

predominance in disease occurrence, previous studies have shown that male gender is associated with a higher risk of conversion because of delayed clinical presentation and advanced inflammatory changes at the time of surgery.[9,10]

Increasing age remains an important factor associated with difficult laparoscopic cholecystectomy. In the present study, the majority of patients belonged to the age groups 51–60 years and >60 years, which correlates with previous studies showing that older patients are more likely to have recurrent attacks of inflammation, fibrosis, and adhesions, thereby increasing operative difficulty and conversion rates.[9,10] Rothman et al. identified advanced age as an independent predictor of conversion in their systematic review and meta-analysis.[10]

Preoperative ultrasonography plays a critical role in predicting difficult laparoscopic cholecystectomy. In the present study, gallbladder wall thickness >4 mm was associated with difficult laparoscopic cholecystectomy in 81.82% of cases. Similarly, pericholecystic fluid, contracted gallbladder, empyema, gangrenous gallbladder, and liver cirrhosis were strongly associated with operative difficulty. These findings are consistent with previous studies that identified thickened gallbladder wall and inflammatory changes as major predictors of difficult surgery and conversion.[8–10] The present study reinforces the importance of ultrasonographic risk stratification in preoperative planning.

Intraoperative findings remain the most decisive factors influencing conversion. In the present study, adhesions (18%) and difficult Calot's triangle dissection (15%) were the most important operative findings associated with difficult laparoscopic cholecystectomy. Adhesions were associated with difficult dissection in 83.33% of cases, while difficult Calot's triangle dissection was associated with operative difficulty in 100% of cases. These findings are consistent with Hussain, who emphasized that dense adhesions and unclear anatomy remain the most common causes of difficult laparoscopic cholecystectomy.[11]

The most common causes of conversion in the present study were bleeding (36.36%), dense adhesions (36.36%), and anatomical distortion (27.27%). Similar observations have been reported by Tang and Cuschieri, who demonstrated that bleeding and difficult anatomy are major contributors to conversion and postoperative morbidity.[7] This emphasizes the importance of early recognition of unsafe operative conditions and timely conversion.

One of the most serious complications during laparoscopic cholecystectomy is bile duct injury, which is commonly associated with difficult anatomy and poor visualization. Although bile duct injury was not a major cause of conversion in the present study, prevention of biliary injury remains a critical determinant in the decision to convert. Strasberg highlighted the importance of obtaining the critical view of safety (CVS) before clipping and dividing structures in Calot's triangle, significantly reducing biliary injury rates.[12] This principle remains central to safe laparoscopic cholecystectomy.

The Tokyo Guidelines 2018 recommend early diagnosis, severity grading, and timely surgical intervention in acute cholecystitis to improve operative outcomes and reduce difficult dissections.,[13] In the present study, severe inflammatory conditions such as empyema and gangrenous gallbladder were strongly associated with difficult laparoscopic cholecystectomy, supporting the relevance of these guidelines in surgical practice.

Postoperative complications in the present study were observed in 17% of patients, with wound infection (8%) being the most common complication, followed by bile leak (5%) and fever (4%). These findings are comparable to those reported by recent studies, suggesting acceptable postoperative morbidity following laparoscopic cholecystectomy and converted open cholecystectomy.[14–18]

The present study adds to the growing evidence from the Indian subcontinent by reinforcing the predictive role of preoperative ultrasonographic findings and intraoperative operative difficulty in anticipating conversion from laparoscopic to open cholecystectomy. Recognition of these factors can improve surgical planning, patient counseling, and intraoperative preparedness.

However, the study has certain limitations. The relatively small sample size and single-center design may limit the generalizability of the findings. Additionally, surgeon-related factors such as experience, learning curve, and operative decision-making variability were not assessed, which may have influenced the conversion rate.

Overall, the present study demonstrates that difficult laparoscopic cholecystectomy is strongly associated with adverse ultrasonographic and intraoperative findings, particularly gallbladder wall thickening, adhesions, difficult Calot's triangle dissection, and bleeding. Conversion to open cholecystectomy should be viewed as a proactive safety strategy aimed at preventing major morbidity rather than as a technical failure. Careful preoperative risk stratification and timely intraoperative decision-making remain essential for optimizing surgical outcomes.

CONCLUSION

Laparoscopic cholecystectomy remains the preferred treatment for symptomatic gallstone disease; however, conversion to open cholecystectomy remains an important and sometimes unavoidable intraoperative decision in difficult cases.

The present study demonstrated an 11% conversion rate, with bleeding, dense adhesions, and anatomical distortion being the most common causes of conversion. Preoperative ultrasonographic findings such as gallbladder wall thickening, pericholecystic fluid, contracted gallbladder, empyema, and

gangrenous changes, along with intraoperative findings like adhesions and difficult Calot's triangle dissection, were found to be important predictors of difficult laparoscopic cholecystectomy.

Early identification of these risk factors can improve surgical planning, optimize patient counseling, and enhance intraoperative preparedness. Timely conversion to open cholecystectomy should be regarded as a safe and proactive surgical strategy aimed at preventing major complications and improving patient outcomes rather than as a failure of laparoscopic surgery.

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