

# INTRAOPERATIVE RISK FACTORS PREDICTING CONVERSION OF LAPAROSCOPIC CHOLECYSTECTOMY TO OPEN CHOLECYSTECTOMY: A PROSPECTIVE OBSERVATIONAL STUDY

## General Surgery

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## ABSTRACT

**Background:** Laparoscopic cholecystectomy (LC) is the preferred surgical treatment for gallstone disease owing to its minimally invasive nature and favorable postoperative outcomes. Despite technical advancements, conversion to open cholecystectomy (OC) remains necessary in selected cases due to intraoperative challenges. **Objective:** To identify and analyze intraoperative risk factors predicting conversion from laparoscopic cholecystectomy to open cholecystectomy in a tertiary care centre. **Methods:** A prospective observational study was conducted on patients undergoing laparoscopic cholecystectomy. Intraoperative findings were documented and analyzed to determine factors associated with conversion. **Results:** Conversion from laparoscopic to open cholecystectomy was observed in a subset of patients. Dense adhesions and severe inflammatory changes around the gallbladder were the most frequently encountered intraoperative findings associated with conversion. Difficulty in identifying Calot's triangle anatomy and significant intraoperative bleeding also contributed to the need for conversion. These intraoperative factors demonstrated a strong association with conversion to open surgery. The overall conversion rate from laparoscopic to open cholecystectomy was 10.9%. **Conclusion:** Early recognition of intraoperative risk factors aids in timely conversion, thereby reducing complications and improving surgical outcomes.

## KEYWORDS

Laparoscopic cholecystectomy, Open cholecystectomy, Conversion, Intraoperative risk factors, Gallstone disease

## INTRODUCTION

Laparoscopic cholecystectomy has become the gold standard for gallstone disease surgery due to its lower postoperative pain, shorter hospital stay, faster recovery, and better cosmetic outcomes when compared to open surgery [1,2]. Since its widespread acceptance, LC has largely supplanted open cholecystectomy; nonetheless, transitioning to open surgery remains an important feature of safe surgical practice [3].

The reported conversion rate from laparoscopic to open cholecystectomy ranges from 2% to 15%, depending on patient, illness, and intraoperative factors [4,5]. Conversion should not be considered a failure of laparoscopic technique but rather a judicious decision made to ensure patient safety and avoid serious complications such as bile duct injury or uncontrolled hemorrhage [6]. Several investigations have found preoperative risk factors for conversion, such as advanced age, male gender, obesity, acute cholecystitis, and gallbladder wall thickness [7,8]. However, intraoperative results frequently provide a more accurate estimate of surgical complexity and the necessity for conversion [9].

Dense adhesions, frozen Calot's triangle, severe inflammation, impacted stones in Hartmann's pouch, and anatomical differences can all complicate laparoscopic dissection [10, 11]. These disorders may obfuscate normal anatomy, raise the risk of bile duct injury, and lengthen the operational time. Delayed conversion in the midst of severe intraoperative conditions has been linked to increased morbidity, longer hospital stays, and higher complication rates [12, 13]. Thus, early detection of intraoperative risk factors is critical for timely decision-making.

**Aim:** The study aimed to analyze intraoperative risk factors responsible for conversion of laparoscopic cholecystectomy to open cholecystectomy.

## MATERIALS AND METHODS

This prospective study was conducted in the Department of Surgery at J.A. Group of Hospitals, Gwalior, Madhya Pradesh, India. This was a prospective observational study carried out over a period of 18 months, from 2022 to 2024. A total of 175 patients undergoing laparoscopic cholecystectomy were enrolled in the study based on specific inclusion and exclusion criteria.

## Inclusion Criteria

- Patients undergoing laparoscopic cholecystectomy.
- Patients willing to provide written informed consent.
- Age between 18 and 60 years.

## Exclusion Criteria

- Patients not willing to participate in the study.
- Patients below 18 years or above 60 years of age.
- Patients deemed medically unfit for laparoscopic cholecystectomy.

## Statistical Analysis

Data were entered in Microsoft Excel and analyzed using appropriate statistical software. Categorical variables were expressed as frequencies and percentages. Quantitative variables were presented as mean  $\pm$  standard deviation. Associations between intraoperative factors and conversion were analyzed using chi-square or Fisher's exact test. A p-value  $<0.05$  was considered statistically significant. Ethical approval was obtained from the Institutional Ethics Committee, and written informed consent was taken from all participants.

## RESULTS

The prospective study on intraoperative factors leading to conversion of laparoscopic cholecystectomy to open cholecystectomy were done on 175 patients to fulfil the aims and objective of this study.

**Table 1:** Baseline demographic and clinical characteristics of study participants (n = 175)

|                           |                                | Number | Percent (%) |
|---------------------------|--------------------------------|--------|-------------|
| Age Group (years)         | 19-30 years                    | 26     | 14.9%       |
|                           | 31-40 years                    | 49     | 28%         |
|                           | 41-50 years                    | 56     | 32%         |
|                           | 51-60 years                    | 44     | 25.1%       |
| Age (Mean $\pm$ SD) years | 42.68 $\pm$ 10.04              |        |             |
| Gender                    | Female                         | 145    | 82.9%       |
|                           | Male                           | 30     | 17.1%       |
| Clinical characteristics  | Obesity                        | 2      | 1.1%        |
|                           | Diabetes                       | 2      | 1.1%        |
|                           | Hypertension                   | 2      | 1.1%        |
|                           | Past Abdominal Surgery History | 2      | 1.1%        |
|                           |                                |        |             |

\*Multiple responses allowed

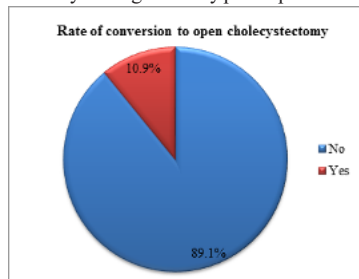
The baseline demographic and clinical characteristics of the study participants. Most patients were in the 41–50 years age group, with a predominance of female patients. A small proportion of patients had associated clinical characteristics such as obesity, diabetes mellitus, hypertension, and history of previous abdominal surgery.

**Table 2:** Distribution of study participants according to Intraoperative factors

| Intraoperative factors                     |     | Number | Percent (%) |
|--------------------------------------------|-----|--------|-------------|
| Adhesions At Calot's                       | No  | 133    | 76%         |
|                                            | Yes | 42     | 24%         |
| Adhesions in entire abdomen/Frozen abdomen | No  | 172    | 98.3%       |
|                                            | Yes | 3      | 1.7%        |
| Enlarged Caudate Lobe                      | No  | 174    | 99.4%       |
|                                            | Yes | 1      | 0.6%        |
| Inability to Retract Gall Bladder          | No  | 169    | 96.6%       |
|                                            | Yes | 6      | 3.4%        |
| Bleeding                                   | No  | 152    | 86.9%       |
|                                            | Yes | 23     | 13.1%       |
| Anatomic Difficulty                        | No  | 152    | 86.9%       |
|                                            | Yes | 23     | 13.1%       |
| Impacted Stone at Hartmann's               | No  | 174    | 99.4%       |
|                                            | Yes | 1      | 0.6%        |
| Inflammation of Gallbladder                | No  | 156    | 89.1%       |
|                                            | Yes | 19     | 10.9%       |
| Cystic Duct Avulsion                       | No  | 173    | 98.9%       |
|                                            | Yes | 2      | 1.1%        |
| Choledocholithiasis                        | No  | 175    | 100%        |
|                                            | Yes | 0      | 0%          |
| Dilated Cystic Duct                        | No  | 169    | 96.6%       |
|                                            | Yes | 6      | 3.4%        |
| Failed Instrumentation                     | No  | 174    | 99.4%       |
|                                            | Yes | 1      | 0.6%        |
| Pyocoele                                   | No  | 175    | 100%        |
|                                            | Yes | 0      | 0%          |
| Bile Duct Injury                           | No  | 172    | 98.3%       |
|                                            | Yes | 3      | 1.7%        |
| Cholecystoduodenal fistula                 | No  | 175    | 100%        |
|                                            | Yes | 0      | 0%          |
| Mirizzi Syndrome                           | No  | 175    | 100%        |
|                                            | Yes | 0      | 0%          |
| Suspected CA Gall Bladder                  | No  | 175    | 100%        |
|                                            | Yes | 0      | 0%          |

Table 2 illustrates the distribution of intraoperative findings observed during laparoscopic cholecystectomy. Adhesions at Calot's triangle were the most frequently encountered intraoperative finding, followed by gallbladder inflammation, intraoperative bleeding, and anatomical difficulty. Other intraoperative findings such as frozen abdomen, impacted stone at Hartmann's pouch, cystic duct avulsion, and bile duct injury were observed in a smaller number of patients, while conditions like choledocholithiasis, pyocoele, Mirizzi syndrome, and cholecystoduodenal fistula were not observed.

**Graph 1:** Depicts the overall rate of conversion from laparoscopic to open cholecystectomy among the study participants.



**Table 3:** Rate of conversion to open cholecystectomy according to the intraoperative factors

| Intraoperative Factors | Number of conversions | Percentage (%) of conversion | OR (95%CI) | P value |
|------------------------|-----------------------|------------------------------|------------|---------|
|------------------------|-----------------------|------------------------------|------------|---------|

|                                            |     |    |        |                          |        |
|--------------------------------------------|-----|----|--------|--------------------------|--------|
| Adhesions at Calot's                       | No  | 3  | 2.26%  | 0.04 (0.01 - 0.14)       | <0.001 |
|                                            | Yes | 16 | 38.10% | 1 (ref)                  |        |
| Adhesions in entire abdomen/Frozen abdomen | No  | 17 | 9.88%  | 0.06 (0.01 - 0.64)       | 0.002  |
|                                            | Yes | 2  | 66.67% | 1 (ref)                  |        |
| Enlarged Caudate Lobe                      | No  | 18 | 10.30% | 0.00001 (0.000 - 0.0001) | 0.004  |
|                                            | Yes | 1  | 100%   | 1 (ref)                  |        |
| Inability to Retract Gall Bladder          | No  | 13 | 7.69%  | 0.00001 (0.000 - 0.0001) | <0.001 |
|                                            | Yes | 6  | 100%   | 1 (ref)                  |        |
| Bleeding                                   | No  | 6  | 3.95%  | 0.03 (0.01 - 0.10)       | <0.001 |
|                                            | Yes | 13 | 56.52% | 1 (ref)                  |        |
| Anatomic Difficulty                        | No  | 8  | 5.26%  | 0.06 (0.02 - 0.18)       | <0.001 |
|                                            | Yes | 11 | 47.83% | 1 (ref)                  |        |
| Impacted Stone at Hartmann's Pouch         | No  | 18 | 10.34% | 0.00001 (0.000 - 0.0001) | 0.004  |
|                                            | Yes | 1  | 100%   | 1 (ref)                  |        |
| Inflammation of Gallbladder                | No  | 11 | 7.05%  | 0.10 (0.03 - 0.31)       | <0.001 |
|                                            | Yes | 8  | 42.11% | 1 (ref)                  |        |
| Cystic Duct Avulsion                       | No  | 17 | 9.83%  | 0.00001 (0.000 - 0.0001) | <0.001 |
|                                            | Yes | 2  | 100%   | 1 (ref)                  |        |
| Dilated Cystic Duct                        | No  | 17 | 10.06% | 0.22 (0.04 - 1.31)       | 0.072  |
|                                            | Yes | 2  | 33.33% | 1 (ref)                  |        |
| Failed Instrumentation                     | No  | 18 | 10.34% | 0.00001 (0.000 - 0.0001) | 0.004  |
|                                            | Yes | 1  | 100%   | 1 (ref)                  |        |
| Bile Duct Injury                           | No  | 16 | 9.30%  | 0.00001 (0.000 - 0.0001) | <0.001 |
|                                            | Yes | 3  | 100%   | 1 (ref)                  |        |

Table 3 shows the association between various intraoperative factors and conversion to open cholecystectomy. Factors such as adhesions at Calot's triangle, frozen abdomen, intraoperative bleeding, anatomical difficulty, severe gallbladder inflammation, cystic duct avulsion, and bile duct injury demonstrated a statistically significant association with conversion, as reflected by higher odds ratios and significant p-values.

## DISCUSSION

The present prospective observational study assessed intraoperative risk variables for conversion from laparoscopic to open cholecystectomy. Conversion was strongly linked to intraoperative observations such as dense adhesions, severe inflammation, complex anatomy, and hemorrhage.

Dense adhesions at Calot's triangle and a frozen abdomen were the best predictors of conversion in this study. Adhesions obscure typical anatomical landmarks and raise the possibility of bile duct damage, making safe laparoscopic dissection harder. Bingener et al. found similar findings, identifying thick adhesions as the major cause of conversion following laparoscopic cholecystectomy [14]. Ibrahim et al. discovered a significantly greater conversion rate in patients with severe adhesions [15].

Severe gallbladder inflammation and frozen Calot's triangle were

significant intraoperative problems in this investigation. Inflammatory alterations produce fibrosis and anatomical deformation, which increases the risk of conversion. Lo et al. found that acute and chronic inflammatory alterations were significant contributors to difficult dissection and conversion to open surgery [16]. These findings are similar to the current study, in which gallbladder inflammation was strongly associated with conversion.

Intraoperative hemorrhage was another major predictor of conversion in the current investigation. Bleeding not only reduces sight but also raises surgical risk, necessitating prompt conversion. Peters et al. underlined that uncontrolled bleeding during laparoscopic cholecystectomy is a good reason for conversion to avoid complications [17]. Early conversion in such cases has been demonstrated to reduce morbidity and surgical time.

Anatomical difficulty, especially difficulty identifying the cystic duct and artery, was found to be strongly linked with conversion in the current study. Schafer et al. concluded that ambiguous biliary architecture is a major risk factor for bile duct injury and conversion, emphasizing the significance of prompt decision-making [18].

In this study, cystic duct avulsion and bile duct damage were two rare but substantial intraoperative consequences linked with conversion. Sugrue et al. proposed that conversion be regarded a protective measure in the presence of such problems in order to avoid catastrophic results [19].

Overall, the current study's findings complement the existing literature, which states that converting from laparoscopic to open cholecystectomy should not be viewed as a problem, but rather as a sensible surgical decision aimed at patient safety. Early detection of intraoperative risk factors and quick conversion are critical in reducing complications and enhancing outcomes [20].

## CONCLUSION

Intraoperative risk factors such as dense adhesions, severe inflammation, difficult anatomy, and bleeding significantly predict conversion from laparoscopic to open cholecystectomy. Early recognition and timely conversion are essential to ensure patient safety and optimal surgical outcomes.

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