



## RESEARCH ARTICLE

# An Observational Study to Determine the Factors Predisposing to the Conversion of Laparoscopic Cholecystectomy to Open Cholecystectomy

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## ABSTRACT

**Background:** Laparoscopic cholecystectomy (LC) is the gold-standard treatment for symptomatic gallstone disease. However, conversion to open cholecystectomy (OC) remains necessary in a subset of patients due to difficult anatomy, inflammation, or intraoperative complications. Identification of preoperative predictors can improve operative planning and patient counseling.

**Aim:** To identify clinical, biochemical, and ultrasonographic factors associated with conversion of laparoscopic cholecystectomy to open cholecystectomy.

**Methods:** A hospital-based cross-sectional observational study was conducted in the Department of General Surgery, VIMSAR, Burla, from April 2021 to October 2022. A total of 256 patients undergoing elective laparoscopic cholecystectomy were included. Demographic characteristics, laboratory parameters, ultrasonographic findings, and operative outcomes were analyzed using SPSS software.

**Results:** Among 256 patients, 44 (17.2%) required conversion to open cholecystectomy. Male gender ( $p < 0.001$ ), BMI  $> 30 \text{ kg/m}^2$  ( $p < 0.001$ ), recurrent attacks of cholecystitis ( $p = 0.001$ ), elevated serum amylase ( $p = 0.018$ ), contracted gallbladder ( $p = 0.013$ ), gallbladder wall thickness  $> 3 \text{ mm}$  ( $p = 0.002$ ), and previous abdominal surgery ( $p < 0.001$ ) were significantly associated with conversion. Age, serum bilirubin, serum alkaline phosphatase, and pericholecystic collection were not significant predictors.

**Conclusion:** Readily available preoperative clinical and radiological factors can reliably predict difficult laparoscopic cholecystectomy and the likelihood of conversion to open surgery.

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## INTRODUCTION

One of the most prevalent gastrointestinal conditions in the world, gallstone disease affects 3–20% of people. A considerable percentage of patients experience biliary colic, acute or chronic cholecystitis, choledocholithiasis, gallstone pancreatitis, and other consequences that necessitate surgery, even if the majority of gallstones remain asymptomatic. The only effective treatment for symptomatic gallstone disease is still cholecystectomy. Laparoscopic cholecystectomy has been the gold standard for treating gallbladder disease since it was first introduced in 1985. Laparoscopic surgery delivers better cosmetic results, less morbidity, shorter hospital stays, quicker recovery, and less postoperative pain than open cholecystectomy. Due to these benefits, laparoscopic procedures are now widely used all over the world.[1]

Even with improvements in surgical knowledge and tools, laparoscopic cholecystectomy is not always a successful procedure. In certain situations, conversion to open surgery is still required to guarantee patient safety and prevent major consequences. Globally, the conversion rate

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is reported to be between 3% to 10%; however, patients with complex gallbladder disease, significant inflammation, obesity, prior abdominal surgery, or challenging anatomy may have greater rates. Conversion should be viewed as a wise intraoperative choice meant to reduce problems rather than as a surgical failure. However, conversion is linked to longer hospital stays, higher postoperative morbidity, longer recovery times, and higher medical expenses. Predicting a challenging laparoscopic cholecystectomy before to surgery is therefore very important from a clinical standpoint.[2]

Numerous clinical, biochemical, and ultrasonographic indicators have been studied as conversion predictors. Potential risk factors include advanced age, male gender, obesity, recurrent episodes of cholecystitis, high inflammatory markers, gallbladder wall thickening, constricted gallbladder, pericholecystic fluid accumulation, and prior abdominal surgery. However, different research and populations have different predictive values for these characteristics. Finding trustworthy predictors can help reduce perioperative problems, enhance surgical expertise allocation, optimise operating room schedule, and enable proper patient counselling. Additionally, early detection of technical challenges may aid surgeons in making prompt conversion decisions, enhancing patient safety.[3]

The goal of the current study was to assess the numerous clinical, laboratory, ultrasonographic, and demographic parameters related to the conversion from laparoscopic to open cholecystectomy and to ascertain their predictive value for challenging gallbladder surgery.

## METHODS

### Study Design

Hospital-based cross-sectional observational study.

### Study Setting

Department of General Surgery, VIMSAR, Burla, Odisha.

### Study Period

April 2021 to October 2022.

### Sample Size

256 patients undergoing elective laparoscopic cholecystectomy.

### Inclusion Criteria

- Age 18–70 years.
- Elective laparoscopic cholecystectomy for gallstone disease.

### Exclusion Criteria

- Carcinoma gallbladder.

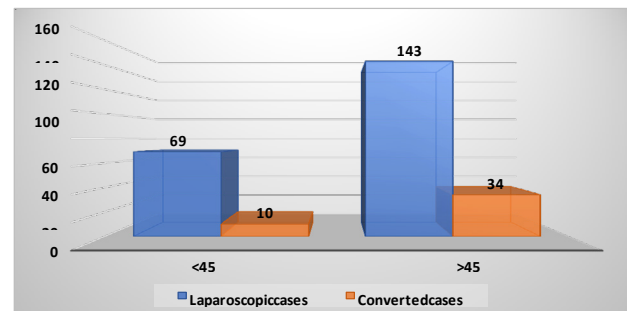


Figure1: Relation with Age Pvalue is 0.199.

Table1: RelationwithAge

| Age   | Laparoscopiccases | Convertedcases | Total |
|-------|-------------------|----------------|-------|
| <45   | 69                | 10             | 79    |
| >45   | 143               | 34             | 177   |
| Total | 212               | 44             | 256   |

- Perforated gallbladder.
- Obstructive jaundice due to CBD stones.
- Contraindications to laparoscopy.

### Variables Studied

- Age
- Gender
- BMI
- Total leukocyte count
- Serum bilirubin
- Serum alkaline phosphatase
- Serum amylase

Table 2: Age distribution among study population

| Study population | Mean age in years | Standard deviation |
|------------------|-------------------|--------------------|
| 256              | 50.98             | 10.76              |

The mean age of our study population was 50.98±10.76 years.

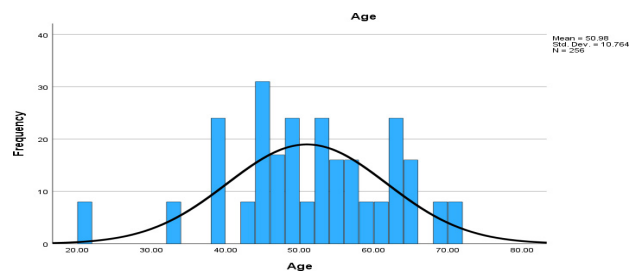


Figure 2: Study age frequency distribution

**Table3:** Relationship with gender

| Gender | Laparoscopiccases | Converted cases | Total |
|--------|-------------------|-----------------|-------|
| Female | 157               | 19              | 176   |
| Male   | 55                | 25              | 80    |
| Total  | 212               | 44              | 256   |

pvalue<0.001,ODD'SRATIO=0.266,95%CI0.136-0.521

- Gallbladder status
- Gallbladder wall thickness
- Pericholecystic collection
- Previous abdominal surgery
- Intraoperative findings

### Statistical Analysis

Data were analyzed using IBM SPSS software. Categorical variables were compared using Chi-square tests. A p-value <0.05 was considered statistically significant.

### RESULTS

Among 256 patients undergoing laparoscopic cholecystectomy, 212 procedures were completed laparoscopically, while 44 cases required conversion to open cholecystectomy, resulting in a conversion rate of 17.2%.

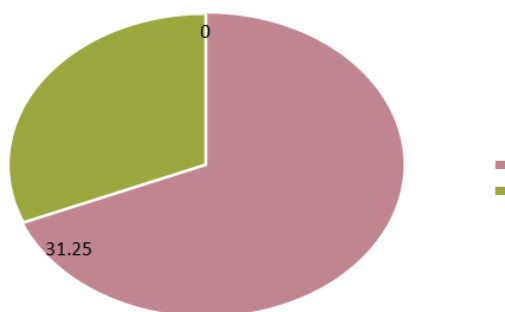
Male patients demonstrated a significantly higher conversion rate than females (31.2% vs. 10.8%;  $p<0.001$ ). Similarly, obesity was associated with increased conversion, with patients having BMI >30 kg/m<sup>2</sup> showing significantly higher risk ( $p<0.001$ ). Recurrent attacks of cholecystitis were strongly associated with conversion ( $p=0.001$ ).

### AGE(INYEARS)

Missing

### GENDER

25 male patients (31.25%) planned for lap cholecystectomy from a total of 80 males, underwent conversion to open

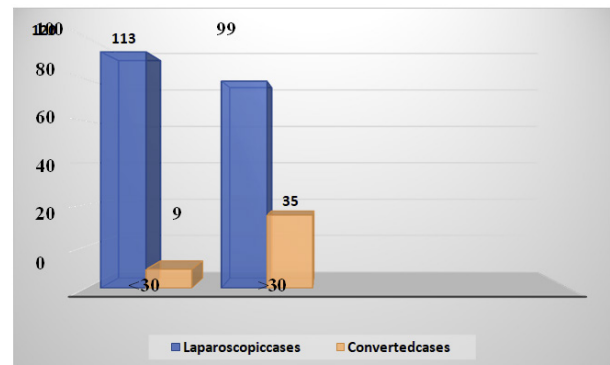


**Figure3:** Gender percentage BMI

**Table 4:** Relation with BMI

| BMI   | Laparoscopiccases | Convertedcases | Total |
|-------|-------------------|----------------|-------|
| <30   | 113               | 9              | 122   |
| >30   | 99                | 35             | 134   |
| Total | 212               | 44             | 256   |

pvalue<0.001,OR1.6,95%CI0.766-3.513



**Figure 4:**Relation with BMI

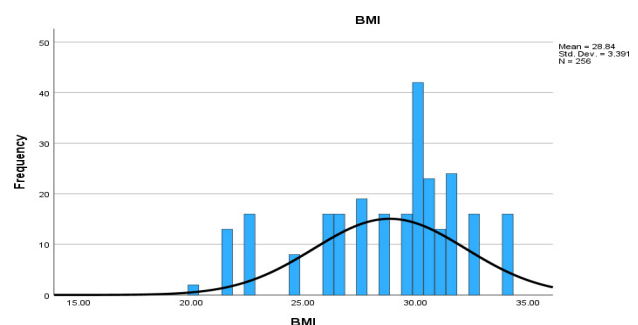
surgery. Compared to this, only 19 females (10.7%) underwent conversion to open cholecystectomy.

35(26.11%) patients with BMI>30 underwent conversion to open surgery. Compared to this, only 9 patients (7.37%) with BMI < 30 underwent conversion to open surgery

### HISTORY OF PREVIOUS ATTACK

Out of a total 214 patients who had history of previous attack, 7 cases (3.27%) were converted to open cholecystectomy. 37(88%) out of 42 cases with acute cholecystitis were converted

Among laboratory parameters, elevated serum amylase was significantly associated with conversion ( $p=0.018$ ), whereas serum bilirubin and alkaline phosphatase were not significant predictors. TLC showed only a weak association.



**Figure 5:** BMI frequency curve

Table 5: Relation with previous attack

| H/O PREV ATTACK | Laparoscopic cases | Converted cases | Total |
|-----------------|--------------------|-----------------|-------|
| Chronic         | 207                | 07              | 214   |
| Acute           | 05                 | 37              | 42    |
| Total           | 212                | 44              | 256   |

p value<0.001

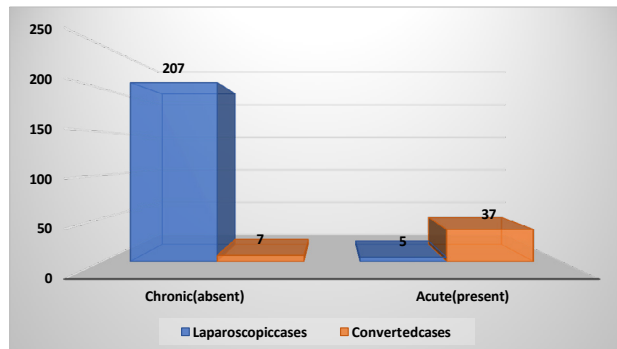


Figure 6: Relation with Previous attack

## TLC

205 patients had raised TLC of all the patients selected for laparoscopic cholecystectomy. 40 of them (19.51%) had to undergo conversion to open cholecystectomy

Table 6:Relation with TLC

| TLC    | Laparoscopiccases | Convertedcases | Total |
|--------|-------------------|----------------|-------|
| <10000 | 47                | 4              | 51    |
| >10000 | 165               | 40             | 205   |
| Total  | 212               | 44             | 256   |

Pvalue is 0.048,OddsRatiois0.77,95%CI0.970-8.369

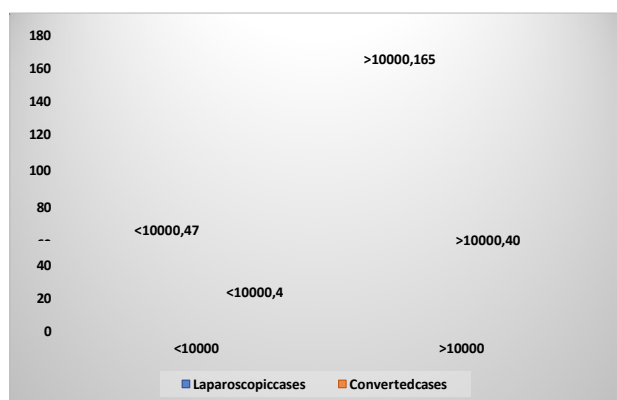


Figure 7: Relation with TLC

## TOTALSERUMBILIRUBIN

31(20.52%) cases of laparoscopic cholecystectomy who had higher serum total bilirubin had to undergo conversion to open cholecystectomy.

Table 7:Relation with serum bilirubin

| Totalserum Bilirubin | Laparoscopic cases | Converted cases | Total |
|----------------------|--------------------|-----------------|-------|
| <1.2                 | 92                 | 13              | 105   |
| >1.2                 | 120                | 31              | 151   |
| Total                | 212                | 44              | 256   |

pvalueis0.089

Table 8: Relation with serum ALP

| ALP       | Laparoscopic cases | Converted cases | Total |
|-----------|--------------------|-----------------|-------|
| <100mg/dl | 187                | 37              | 224   |
| >100mg/dl | 25                 | 7               | 32    |
| Total     | 212                | 44              | 256   |

Pvalue is 0.452

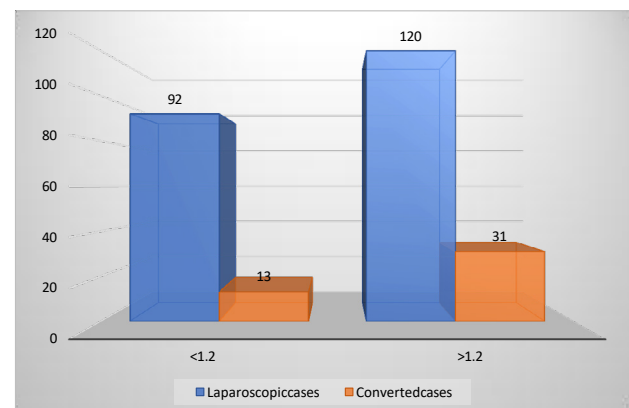


Figure 8:Relation with serum bilirubin

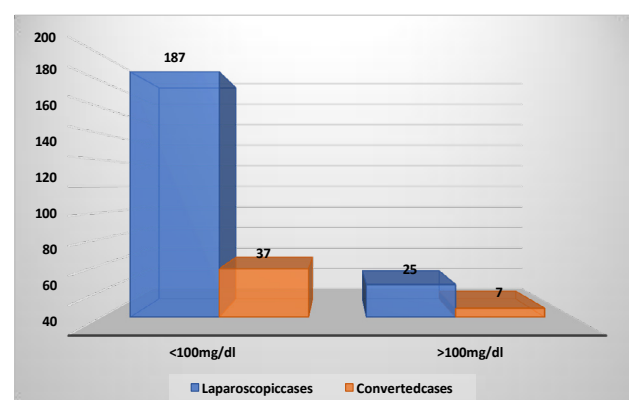


Figure 9:Relation with serum ALP

**Table9:** Relation with serum amylase

| Amylase   | Laparoscopic cases | Converted cases | Total |
|-----------|--------------------|-----------------|-------|
| <150mg/dl | 162                | 26              | 188   |
| >150mg/dl | 50                 | 18              | 68    |
| Total     | 212                | 44              | 256   |

pvalue=0.018,OddsRatiois2.243,95%CI1.137-4.425

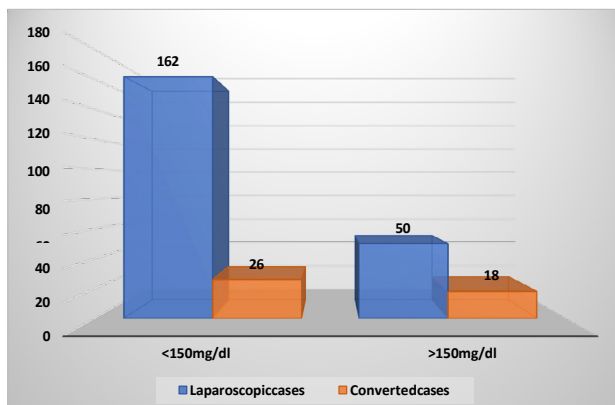
**Table10:**Relation with GBstatus

| GB status  | Laparoscopic cases | Converted cases | Total |
|------------|--------------------|-----------------|-------|
| Normal     | 175                | 29              | 204   |
| Contracted | 37                 | 15              | 52    |
| Total      | 212                | 44              | 256   |

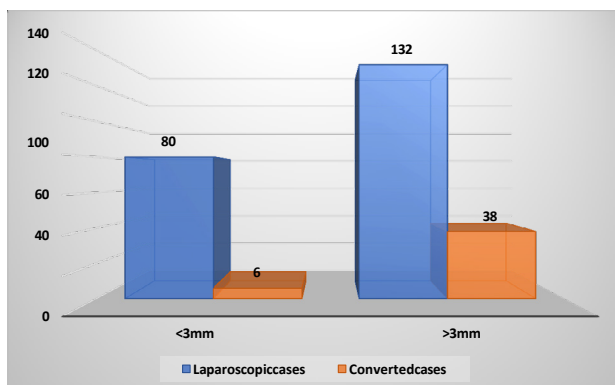
pvalueis0.013,Odds Ratio is2.446,95%CI1.194-5.012

### SERUM ALP

Patients who had serum ALP within normal limits were 224. 37 of them (16.51%) had to undergo conversion to open cholecystectomy. 7 (21.87%) patients who had raised serum ALP underwent conversion.



**Figure10:** Relation with serum amylase



**Figure11:** Relation with GB wall thickness

**Table 11:** Relation with GB wall thickness

| GBWall Thickness | Laparoscopic cases | Converted cases | Total |
|------------------|--------------------|-----------------|-------|
| <3mm             | 80                 | 6               | 86    |
| >3mm             | 132                | 38              | 170   |
| Total            | 212                | 44              | 256   |

P value=0.002,OddsRatiois3.838,95%CI1.553-9.485

### SERUM AMYLASE

68 patients who underwent cholecystectomy had raised serum amylase, of them 18 (26.47%) patients had to undergo conversion to open cholecystectomy.

Ultrasonographic findings revealed that contracted gallbladder (p=0.013) and gallbladder wall thickness >3 mm (p=0.002) significantly increased the risk of conversion. Pericholecystic collection was not significantly associated with conversion (p=0.558).

### GALL BLADDER STATUS

52 patients of all the cases, had contracted gall bladder on ultrasonography. Of those, 15 cases (28.84%) underwent open cholecystectomy after difficulty with laparoscopic approach.

### GALLBLADDERWALLTHICKNESS

170 patients planned for laparoscopic cholecystectomy had increased GB wall thickness. 38 of them (22.35%) had to undergo conversion to open cholecystectomy.

Patients with previous abdominal surgery had a markedly increased conversion rate (45.8%), making it one of the strongest predictors of conversion (p<0.001). Intraoperative causes of conversion included severe inflammation (40%), pneumoperitoneum failure (40%), frozen Calot's triangle (15%), hemorrhage (10%), and common bile duct injury (5%).

### PREVIOUS SURGERY

Of all the patients in the study, 24 had history of previous abdominal surgery. 11 patients (45.83%) of them had to undergo conversion to open cholecystectomy.

**Table12:**Relation with history of previous surgery

| H/Oprev.Abd. Surgery | Laparoscopic cases | Converted cases | Total |
|----------------------|--------------------|-----------------|-------|
| Absent               | 199                | 33              | 232   |
| Present              | 13                 | 11              | 24    |
| Total                | 212                | 44              | 256   |

pvalue<0.001,OR1.28,95%CI0.558-2.945

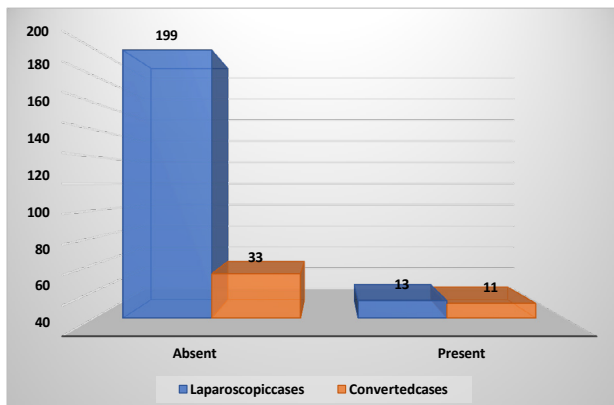


Figure 12: Relation with history of previous surgery

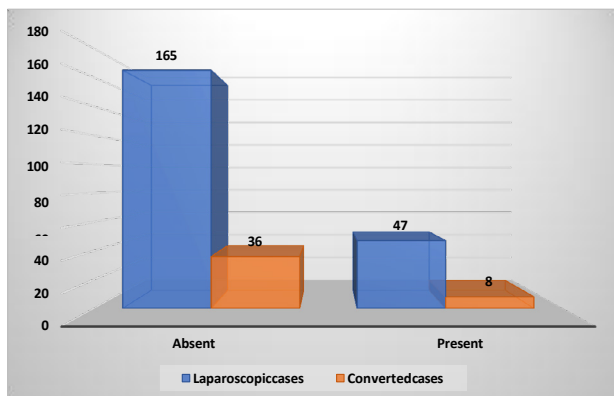


Figure13:Relation with pericholecystic collection

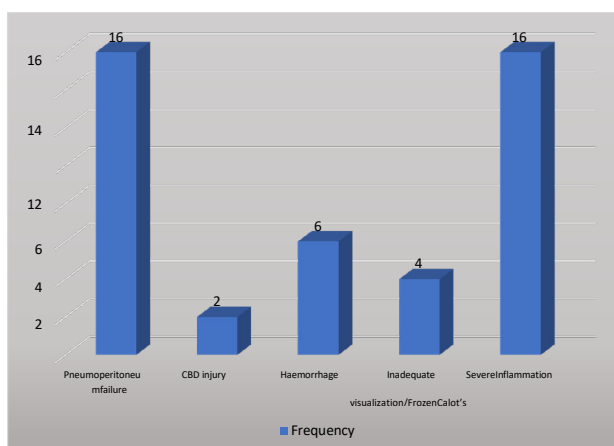


Figure14: Intraoperative findings in convertedcases

## PERICHOLECYSTICCOLLECTION

Prior to surgery, ultrasonographically 55 patients had pericholecystic collection. 8 such cases (14.54%) had to undergo conversion to open cholecystectomy.

Table13:Relation with pericholecystic collection

| Pericholecystic Collection | Laparoscopic cases | Converted cases | Total |
|----------------------------|--------------------|-----------------|-------|
| Absent                     | 165                | 36              | 201   |
| Present                    | 47                 | 8               | 55    |
| Total                      | 212                | 44              | 256   |

p value=0.558

Table14:Intraoperative findings inconverted cases

| INTRAOP Causes of conversion                      | Frequency |
|---------------------------------------------------|-----------|
| Pneumoperitoneumfailure                           | 16        |
| CBDinjury                                         | 2         |
| Haemorrhage                                       | 6         |
| Inadequatevisualization/<br>FrozenCalot'striangle | 4         |
| SevereInflammation                                | 16        |

## TRAOPERATIVECAUSESINCONVERTEDCASES

Missing

## DISCUSSION

Laparoscopic cholecystectomy is currently the standard treatment for symptomatic gallstone disease because of its advantages over conventional open surgery. Conversion to open cholecystectomy is still a significant hurdle, nevertheless, especially for patients with complex gallbladder disease. The current study assessed a number of preoperative and intraoperative variables linked to conversion and found a number of important predictors.[4]

Compared to the typically stated rate of 3–10%, the overall conversion rate found in this study was 17.2%. This could be explained by the fact that patients with complicated gallbladder pathology, obesity, recurring inflammation, and advanced disease were included.[5]

Although it did not reach statistical significance, being older than 45 was linked to a higher conversion frequency. The current results imply that age alone may not be a reliable indicator of difficult surgery, despite the fact that growing older has been identified as a risk factor in a number of studies.[6]

Conversion was shown to be significantly predicted by male gender. Male patients had more significant fibrosis and inflammation, which made dissection inside Calot's triangle challenging. Similar higher conversion rates among male patients have been documented by earlier researchers, most likely as a result of delayed healthcare-seeking behaviour and more severe disease at presentation.

Another significant predictor of conversion was obesity. Excessive intra-abdominal fat and thicker abdominal walls can obfuscate anatomy, make trocar placement more difficult, and increase operating time. The study's substantial correlation between conversion and BMI >30 kg/m<sup>2</sup> supports earlier research findings.[7]

Conversion was substantially correlated with recurrent cholecystitis episodes. Laparoscopic dissection is difficult because chronic inflammation encourages fibrosis, adhesions, and distortion of normal anatomy. Open surgery is consequently more likely to be necessary for patients who have repeated attacks.[8]

Serum amylase showed a strong correlation with conversion across laboratory measures, while bilirubin and alkaline phosphatase did not. Increased amylase may indicate more severe biliary disease or related pancreatic inflammation, making surgery more challenging. The results of ultrasonography provide useful prediction data. Significant predictors included a contracted gallbladder and a gallbladder wall thickness of more than 3 mm. Chronic inflammation and fibrosis are frequently indicated by thickened gallbladder walls, which can obfuscate tissue planes and complicate surgery. One of the most accurate sonographic indicators of a challenging cholecystectomy is the thickness of the gallbladder wall.[9]

One of the biggest risk factors was found to be a history of prior abdominal surgery. Adhesions from previous surgery can make it more difficult to see, restrict safe access to the operating field, and raise technical difficulty. Conversion was necessary for over half of these patients.[10]

The reasons for conversion were further emphasised by intraoperative findings. The highest percentage of conversions were caused by severe inflammation and failure to create pneumoperitoneum; frozen Calot's triangle, bleeding, and bile duct damage were next. For prompt decision-making and the avoidance of difficulties, it is essential to recognise these elements[11].

Overall, the study demonstrates that a number of easily accessible clinical and radiological criteria can be utilised to pinpoint patients who are more likely to undergo conversion and enable more effective surgical planning.

## CONCLUSION

The current study shows that a number of easily accessible preoperative characteristics can be used to predict conversion from laparoscopic to open cholecystectomy. Male gender, obesity (BMI >30 kg/m<sup>2</sup>), recurrent episodes of cholecystitis, high serum amylase, contracted gallbladder, gallbladder wall thickness >3 mm, and prior

abdominal surgery were among the characteristics that were found to be substantially linked with an increased risk of conversion. On the other hand, no significant predictors were discovered for age, serum bilirubin, serum alkaline phosphatase, or pericholecystic collection. The main intraoperative causes of conversion were severe inflammation, pneumoperitoneum failure, frozen Calot's triangle, haemorrhage, and common bile duct injury. The overall conversion rate was 17.2%. Better operating planning, the proper distribution of surgical competence, and knowledgeable patient counselling are made possible by the early identification of high-risk patients.

Conversion should not be viewed as a failure or problem, but rather as a wise surgical tactic. Prompt conversion can enhance patient safety, shorten operating times, and avoid major difficulties. The results of this study provide evidence in favour of using preoperative risk assessment models to forecast challenging laparoscopic cholecystectomy procedures and enhance surgical results. To evaluate these predictions and provide standardised risk-scoring systems for everyday clinical practice, more multicenter research is advised.

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