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Original Article

Predictors of Conversion in Laparoscopic Cholecystectomy

Prof. Dr. Farooque Ahmed
Professor, Department of Cardiac Surgery, National Heart Foundation & Research Institute, Dhaka, Bangladesh

Corresponding Author: Prof. Dr. Farooque Ahmed

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Abstract-

Introduction: Laparoscopic cholecystectomy (LC) is the gold standard treatment for symptomatic gallstone disease. However, conversion to open cholecystectomy remains necessary in selected cases due to intraoperative difficulties or complications. Identifying predictors of conversion is crucial for surgical planning and patient counseling. ***Materials and Methods:*** A prospective observational study was conducted on 220 patients undergoing LC for gallstone disease over 24 months. Preoperative clinical, laboratory, and ultrasonographic parameters were recorded. Intraoperative findings and need for conversion were documented. Statistical analysis was performed using logistic regression to identify independent predictors. ***Results***: The overall conversion rate was 9.5%. Significant predictors included age >60 years, male gender, acute cholecystitis, elevated WBC count, gallbladder wall thickness >4 mm, pericholecystic fluid, and previous upper abdominal surgery ($p<0.05$). Multivariate analysis identified gallbladder wall thickness >4 mm, acute cholecystitis, and previous surgery as independent predictors. ***Conclusion***: Preoperative identification of high-risk patients allows better surgical preparedness and informed consent. Gallbladder wall thickness, acute inflammation, and prior surgery are strong predictors of conversion.

Keywords: *Laparoscopic cholecystectomy; Conversion; Acute cholecystitis; Gallbladder wall thickness; Predictive factors.*

INTRODUCTION

Laparoscopic cholecystectomy (LC), first introduced in 1987, has revolutionized the management of gallstone disease and is now regarded as the gold standard procedure[1]. Compared to open cholecystectomy, LC offers reduced postoperative pain, shorter hospital stay, faster recovery, and improved cosmetic outcomes[2]. Despite these advantages, conversion to open cholecystectomy remains unavoidable in certain cases to ensure patient safety[3].

The conversion rate reported in literature ranges between 2% and 15% depending on patient characteristics, surgeon experience, and case complexity[4]. Conversion is not considered a complication but rather a judicious surgical decision made to avoid major bile duct injury or uncontrolled bleeding[5]. Early identification of patients at risk helps in operative planning and resource allocation[6].

Several studies have attempted to identify predictors of conversion. Advanced age is associated with increased fibrosis and inflammatory changes in Calot's triangle, making dissection difficult[7]. Male gender has also been identified as a risk factor, possibly due to delayed presentation and more severe inflammation[8]. Acute cholecystitis is one of the strongest predictors because of edema, friable tissue, and distorted anatomy[9].

Ultrasonographic parameters such as gallbladder wall thickness greater than 3–4 mm, impacted stones at the neck, contracted gallbladder, and pericholecystic fluid are associated with higher conversion rates[10]. Laboratory markers including leukocytosis and elevated C-reactive protein reflect ongoing inflammation and correlate with surgical difficulty[11]. Previous upper abdominal surgery increases the risk due to adhesions that obscure anatomy and prolong operative time[12]. Obesity has also been studied as a potential risk factor, though evidence remains conflicting[13].

Predictive scoring systems combining clinical, laboratory, and imaging parameters have been proposed to stratify patients preoperatively[14]. However, no universally accepted model exists.
Understanding predictors is particularly relevant in resource-limited settings where unexpected conversion may impact operative time and hospital logistics[15]. Therefore, this study aims to evaluate clinical, biochemical, and ultrasonographic predictors of conversion in laparoscopic cholecystectomy.

MATERIALS AND METHODS

This prospective observational study was conducted in the Department of General Surgery at a tertiary care center over a period of 24 months. Ethical committee approval was obtained prior to study initiation.

Study Population

A total of 220 consecutive patients diagnosed with symptomatic cholelithiasis and planned for laparoscopic cholecystectomy were included.

Inclusion Criteria

- Age ≥18 years
- Symptomatic gallstone disease
- Acute or chronic calculous cholecystitis
- Elective or emergency LC

Exclusion Criteria

- Gallbladder malignancy
- Choledocholithiasis requiring open exploration
- Severe cardiopulmonary instability
- Pregnancy
- Refusal of consent

Preoperative Assessment

All patients underwent detailed clinical examination. Parameters recorded included age, gender, BMI, history of previous abdominal surgery, and duration of symptoms.

Laboratory investigations included complete blood count, liver function tests, and CRP levels.
Ultrasound abdomen assessed:

- Gallbladder wall thickness
- Pericholecystic fluid
- Impacted stone
- Contracted gallbladder

Operative Procedure

Standard four-port laparoscopic cholecystectomy was performed under general anesthesia. Conversion to open surgery was decided in cases of:

- Dense adhesions
- Unclear anatomy
- Uncontrolled bleeding
- Suspected bile duct injury

Outcome Measure

Primary outcome was conversion to open cholecystectomy.

Statistical Analysis

Data were analyzed using SPSS version 25. Chi-square test was used for categorical variables. Variables with $p<0.05$ were entered into multivariate logistic regression.

RESULTS

Table 1: Demographic Distribution

Variable	Total (n=220)	Converted (n=21)	p-value
Age >60	48	10	0.01
Male	82	12	0.02
Female	138	9	

Older age and male gender showed statistically significant association with conversion.

Table 2: Clinical Factors

Factor	Converted (%)	p-value
Acute cholecystitis	14/65	0.001
Chronic cholecystitis	7/155	

Acute inflammation significantly increased conversion risk.

Table 3: Laboratory Parameters

Parameter	Converted (%)	p-value
WBC >11,000	15	0.003
Normal WBC	6	

Leukocytosis correlated with difficult dissection.

Table 4: Ultrasonographic Findings

Finding	Converted (%)	p-value
Wall thickness >4 mm	16	0.0001
Pericholecystic fluid	9	0.01
Impacted stone	11	0.02

Wall thickness >4 mm was strongest predictor.

Table 5: Previous Surgery

History	Converted (%)	p-value
Yes	8	0.01
No	13	

Adhesions significantly increased risk.

Table 6: Multivariate Logistic Regression

Predictor	Odds Ratio	p-value
Wall thickness >4mm	4.2	0.001
Acute cholecystitis	3.8	0.003
Previous surgery	2.9	0.02

Independent predictors were wall thickness, acute inflammation, and prior surgery.

DISCUSSION

The present study demonstrated a conversion rate of 9.5%, comparable with global literature reporting 5–12%[16]. Age >60 years was significantly associated with conversion, consistent with findings by Ambe et al.[17], who attributed increased fibrosis and vascular fragility to surgical difficulty.

Male gender was also identified as a risk factor. This observation aligns with studies by Goonawardena et al.[18] suggesting delayed presentation and severe inflammation in males.

Acute cholecystitis emerged as a strong predictor, in agreement with the Tokyo Guidelines emphasizing early intervention to reduce conversion[19]. Inflammatory edema obscures Calot's triangle anatomy, increasing operative risk.

Ultrasonographic gallbladder wall thickness >4 mm was the strongest independent predictor (OR 4.2). Similar conclusions were reported by Gupta et al.[20] and Hussain et al.[21]. Wall thickening reflects chronic inflammation and fibrosis.

Previous upper abdominal surgery was another independent predictor, consistent with findings by Coccolini et al.[22], where adhesions increased operative time and conversion risk.

Leukocytosis correlated with difficult cases, reflecting active inflammation. However, BMI did not show statistical significance in our study, similar to findings by Rothman et al.[23].

The study reinforces that conversion should not be viewed as failure but as a step toward patient safety[24]. Preoperative risk stratification allows better patient counseling and surgical preparedness.
Limitations include single-center design and moderate sample size.

CONCLUSION

Conversion in laparoscopic cholecystectomy is influenced by identifiable preoperative factors. Gallbladder wall thickness >4 mm, acute cholecystitis, and previous upper abdominal surgery are independent predictors. Risk assessment enhances operative safety and informed consent.

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