ORIGINAL RESEARCH PAPER

Surgery

FACTORS PREDICTING CONVERSION OF LAPAROSCOPIC CHOLECYSTECTOMY TO OPEN CHOLECYSTECTOMY IN ACUTE CHOLECYSTITIS: A STUDY FROM TERTIARY CARE HOSPITAL

KEY WORDS: Laparoscopic cholecystectomy, acute cholecystitis, minimally invasive surgery

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ABSTRACT

Introduction: Laparoscopic cholecystectomy is a safe, feasible, and effective alternative. However, the limitations inherent to laparoscopic surgery, such as a two-dimensional view and lack of tactile feedback, become more pronounced in acute inflammation cases, leading to higher conversion rates to open cholecystectomy. Identifying predictive factors for successful laparoscopic procedures can improve patient counseling, resource optimization, and clinical outcomes. **Methodology:** A cross-sectional study was conducted over one year (April 2023 to March 2024) involving 45 patients with acute cholecystitis admitted to a tertiary care hospital affiliated with Bangalore Medical College and Research Institute, Bangalore, India. Data were collected through detailed histories, clinical examinations, and investigations, with all surgeries performed within 72 hours of symptom onset. Statistical analysis was conducted using SPSS version 22, applying the Student's T-test and Chi-square test. **Results:** The study included 45 patients, aged 20-72 years (mean age 49.72 ± 13.89 years). Five patients (11.12%) required conversion to open cholecystectomy. Statistically significant differences were observed in age, duration of onset, and hospital stay between the laparoscopic and open surgery groups ($p<0.05$). WBC count, total bilirubin, and alkaline phosphatase levels were significantly higher in the open surgery group ($p<0.05$). **Conclusion:** Identifying predictive factors for the conversion of laparoscopic to open cholecystectomy in acute cholecystitis cases enhances patient management and clinical outcomes. Factors such as advanced age, increased WBC count, higher bilirubin and alkaline phosphatase levels, and intraoperative severity play a critical role in determining the surgical approach.

INTRODUCTION:

Laparoscopic cholecystectomy is the "gold standard" for treating symptomatic gallstones, especially those presenting with acute cholecystitis.[1] As experience with laparoscopic surgery has grown, numerous studies have shown that it is safe, feasible, and valid as an alternative for patients with acute cholecystitis. The main advantages are reduced postoperative pain, shorter hospital stays and recovery periods, and improved cosmetic outcomes with this minimally invasive procedure.[2]

However, the limitations inherent to the laparoscopic surgery technique, including the limitations of a two-dimensional view without any feeling of physical presence, become more striking in cases of acute inflammation.[3] For this reason, a much higher conversion to open cholecystectomy is often seen in an acute case rather than in any elective surgery, and conversion percentages range between 2 percent and 15 percent by different surgeons due to multifarious complications during the laparoscopic procedure.[4]

There are predictive factors that predict the likelihood of successful completion of laparoscopic cholecystectomy in acute cholecystitis before surgery. The identification of such factors will enable providers to counsel patients better in terms of recovery planning and realistic post-operative expectations.[5] Such predictive markers improve not only clinical outcomes but also optimize the use of resources and minimize patient morbidity.

With the complexity of managing acute cholecystitis through laparoscopy, further research and improvements in surgical skills will further evolve and maximize the success rates of such interventions.

Aims And Objective Of The Study:

To evaluate the factors predicting conversion of Laparoscopic cholecystectomy to open cholecystectomy in acute cholecystitis cases.

Methodology:

A cross-sectional study was conducted for 1 year from April 2023 to March 2024 on 45 patients with acute cholecystitis cases admitted to a tertiary care hospital attached to Bangalore Medical College, and Research Institute, Bangalore, India.

Inclusion Criteria:

- Patients with age of more than 18 years diagnosed preoperatively acute cholecystitis.
- Patients willing to give informed consent for investigations, treatment, and surgical management.

Exclusion Criteria:

- Patients with age less than 18 years.
- Patients who are not willing to give informed consent.
- Cases with biliary complications preoperatively like obstructive jaundice, cholangitis, gall bladder perforation, severe comorbid conditions, choledocholithiasis
- Patients with a history of any other co-morbidities and chronic conditions.
- Patients unfit for surgery on an urgent basis.

Duration Of The Study: 1 Year

The study was conducted after obtaining the permission of the Institutional Ethics Committee and consent from patients. A detailed history, clinical examination, and investigations were done from all the patients operated within 72 hours of the onset of pain and other symptoms. All the collected data was coded and entered into a Microsoft Excel sheet which was re-checked and analyzed using SPSS statistical software version 22. The Student's T-test and Chi-square test were used to compare various pre-disposing factors leading to open cholecystectomy.

RESULTS:

All 45 patients were planned to undergo laparoscopic cholecystectomy within 72 hours of the onset of symptoms for acute cholecystitis. The age ranges between 20 to 72 years with a mean age of 49.72 ± 13.89 years. The average duration of onset of symptoms was 2.8 ± 0.58 days. The mean duration of hospital stay was 6.87 ± 0.98 days.

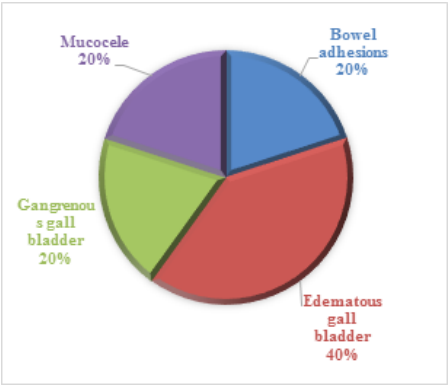

Figure 1. Reason for conversion of the case to open (n=5)

Out of all, 5 (11.12%) patients were converted to open cholecystectomy during surgery. The main reasons for conversion included bowel adhesions, an edematous-friable gall bladder, Gangrenous gall bladder, and mucocele, respectively.

Table 1. Mean Difference Of Different Study Variables

Variable	Lap (n=40)	Open (n=5)	P-Value
Age	43.52 ± 10.17	67.13 ± 6.7	<0.001
Duration of onset	2.67 ± 0.17	2.96 ± 0.7	0.027
Duration of hospital stay	3.97 ± 1.17	7.81 ± 2.3	<0.001

*Student's T-test calculated

The average age of patients undergoing laparoscopic surgery is significantly lower at 43.52 ± 10.17 years compared to 67.13 ± 6.7 years for those undergoing open surgery (p<0.001). The duration of onset for laparoscopic cases is 2.67 ± 0.17 days, slightly shorter than the 2.96 ± 0.7 days observed in open cases, with a p-value of 0.027, indicating statistical significance. Moreover, the duration of hospital stay is notably shorter for laparoscopic surgery patients, averaging 3.97 ± 1.17 days, compared to 7.81 ± 2.3 days for open surgery patients (p<0.001).

Table 2. Relationship Between Gender And Study Groups

Variable	Lap (n=40)	Open (n=5)	P-Value
Male	15	4	0.439
Female	25	1	

*Chi-Square test calculated (^{2}=0.5992)

For the laparoscopic group, there were 15 males and 25 females, while the open cholecystectomy group comprised 4 males and 1 female. No statistically significant difference was observed in the distribution of gender between the two surgical groups (P-value >0.05).

Table 3. Mean difference of different study variables

Variable	Lap (n=40)	Open (n=5)	P-Value
WBC Count	8,000 ± 2,000 cells/mm^3	12,000 ± 3,500 cells/mm^3	<0.001
Total Bilirubin	1.0 ± 0.3 mg/dL	2.1 ± 0.97 mg/dL	<0.001
Alkaline phosphatase	75 ± 20 U/L	120 ± 35 U/L	0.023

*Student's T-test calculated

The WBC count for Lap patients averages 8,000 ± 2,000 cells/mm^3, significantly lower than the 12,000 ± 3,500 cells/mm^3 observed in Open patients, with a p-value of <0.001. Total bilirubin levels are also lower in Lap patients, at 1.0 ± 0.3 mg/dL, compared to 2.1 ± 0.97 mg/dL in Open patients, with a p-value of <0.001. Additionally, alkaline phosphatase levels are 75 ± 20 U/L in Lap patients, which is significantly lower than the 120 ± 35 U/L found in open patients, with a p-value of 0.02.

Table 4. Distribution of varying intraoperative severity

Intraoperative severity	Lap (n=40)	Open (n=5)	P-Value
Edematous less severe I a	35	0	<0.001
Edematous acutely severe II b	4	3	
Mucocele II	1	1	
Gangrenous III	0	1	
Empyema IV	0	0	NA

*Chi-Square test calculated (^{2}=28.580)

In the Lap group (n=40), 35 cases were categorized as having edematous less severe inflammation (Ia), compared to none in the Open group (n=5), with a p-value of <0.001. Four cases in the Lap group had edematous acutely severe inflammation (IIb), while three were observed in the Open group. Mucocele (II) was present in one case in each group. The Lap group had one gangrenous case (III), whereas the Open group had none. There were no cases of empyema (IV) in either group.

Table 5. Distribution Of Comorbidity Among Patients

Variable	Lap (n=40)	Open (n=5)	P-Value
No Co-morbidity	25	1	0.116
Diabetes	8	3	
Hypertension	7	1	

*Chi-Square test calculated (^{2}=4.314)

In the Lap group (n=40), 25 patients had no comorbidities compared to one patient in the Open group (n=5), with a p-value of 0.116. Diabetes was present in eight Lap patients and three Open patients, while hypertension was observed in seven Lap patients and one Open patient.

Table 6. Comparison of mean values of Laboratory variables

Intraoperative severity (n=45)	WBC Count	Total Bilirubin	Alkaline phosphatase
Edematous less severe I a (n=35)	8,000 ± 2,000	1.0 ± 0.3	75 ± 20
Edematous acutely severe II b (n=7)	8,200 ± 2,100	1.2 ± 0.7	77 ± 23
Mucocele II (n=2)	8,800 ± 2,300	1.7 ± 0.6	83 ± 21
Gangrenous III (n=1)	12,000 ± 3,500	2.1 ± 0.97	120 ± 35

Empyema IV (n=0)	NA	NA	NA
P-Value	0.0818	0.0462	0.0832

*Student's T-test calculated

The p-values were 0.0818 for WBC count, 0.0462 for total bilirubin, and 0.0832 for alkaline phosphatase. Total bilirubin levels have shown statistically significant differences among different groups, but no such statistically significant variation was noted in the WBC count or alkaline phosphatase level.

The surgery was successful in 43 (95.6%) patients and 2 (4.4%) patients of open procedure landed major complications including ICU admission with the postop leak, sepsis (wound infection), and renal insufficiency respectively.

DISCUSSION:

The study included 45 patients, amongst which 11.12% of patients needed conversion to open surgery. Advanced age, a higher WBC count, elevated total bilirubin, and increased alkaline phosphatase levels were noted as the most important predictive variables. Intraoperative findings included bowel adhesions, edematous-friable gall bladder, gangrenous gall bladder, and mucocele were quite a few of the many reasons for conversion.

The average age of patients undergoing laparoscopic cholecystectomy in this study was significantly lower at 43.52 ± 10.17 years compared to open cholecystectomy. Kanaan et al., noted a younger demographic for laparoscopic surgeries, highlighting its preference among younger patients due to quicker recovery and less postoperative pain.[6] The average duration of onset of symptoms (2.67 ± 0.17 days) in our study aligns with findings by Strasberg, who reported similar durations, emphasizing the effectiveness of early laparoscopic intervention.[7]

The mean duration of hospital stay for laparoscopic surgery patients in this study was 3.97 ± 1.17 days, significantly larger than for open surgery patients. Similar findings are reported by Giger et al., who indicated shorter hospitalization periods for laparoscopic cholecystectomy, thereby reducing healthcare costs and increasing patient satisfaction.[8]

The lower WBC count, total bilirubin (, and alkaline phosphatase levels in laparoscopic cases indicate less severe inflammation and quicker postoperative recovery, consistent with the results of studies by Chandler et al. and Keus et al., who found similar trends in biochemical markers favoring laparoscopic over open cholecystectomy.[9,10]

Our study found an 11.12% conversion rate to open cholecystectomy due to reasons like bowel adhesions, edematous-friable gall bladder, gangrenous gall bladder, and mucocele. Studies by Sakpal et al. and Papi et al. similarly report conversion rates ranging from 10-15%, with comparable reasons, underscoring the challenges faced during laparoscopic procedures in acute cases.[11,12]

The distribution of intraoperative severity showed a higher incidence of less severe cases (Ia) in laparoscopic surgeries, while open surgeries were more associated with severe conditions like gangrenous gall bladder. This finding is consistent with the studies by Hobbs et al. and Tiwari et al.[13,14] Additionally, the presence of comorbidities such as diabetes and hypertension was not significantly different between the groups, mirroring the results of Krishna et al., who noted that the primary determinant for conversion was the severity of inflammation rather than comorbid conditions.[15]

CONCLUSION:

In conclusion, this study recognizes important predictive factors for a change in laparoscopic cholecystectomy to an open cholecystectomy with cases of acute cholecystitis. Advanced age, a higher WBC count, elevated total bilirubin, and increased levels of alkaline phosphatase were significantly associated with the conversion. Preoperatively recognizing these factors enhances the quality of patient counseling, optimization of resources, and better clinical outcomes. Further scientific advances and research in these techniques of laparoscopic procedures are necessary to develop and enhance the success of such minimally invasive treatments of acute cholecystitis.

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