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Complication and Outcome of Laparoscopic vs Open Cholecystectomy: A Retrospective Study

[1]Ashok Kumar, [2]Sushant Kumar Sharma, [3]Mahima Srivastava and [4]Tauseef Kibria

[1-4]Department of surgery Shri Krishna medical college Muzaffarpur India

ABSTRACT

Cholecystectomy the surgical removal of the gallbladder, is a widely performed procedure for symptomatic gallstone disease. Laparoscopic cholecystectomy (LC) and open cholecystectomy (OC) are two predominant surgical approaches, each with distinct advantages and drawbacks. This retrospective study aims to comprehensively evaluate the complications and outcomes associated with these approaches, guiding evidence-based decision-making. Spanning a one-year period from January-December 2023, this single-center retrospective study compared LC and OC outcomes in patients with symptomatic gallstones. Data encompassed demographic, clinical, surgical and postoperative aspects. Statistical analysis included descriptive statistics, chi-squared tests, t-tests, Mann-Whitney U-tests and multivariate regression. LC (n = 250) patients were younger with a lower BMI than OC (n = 200) patients. LC was associated with a significantly shorter operative time ($p<0.001$) and reduced postoperative pain scores ($p<0.001$). LC also resulted in shorter hospital stays ($p<0.001$) and higher patient satisfaction levels across all aspects, including surgical approach ($p<0.001$). Postoperative complications, including wound infection, bleeding and bile leaks, were less frequent in LC, though not always statistically significant. This study reaffirms the advantages of LC in terms of shorter operative times, improved pain management, shorter hospitalization and higher patient satisfaction. While complications did not consistently differ significantly, LC demonstrated a lower incidence. Consideration of individual patient factors and surgeon expertise is crucial in selecting the most suitable approach. This study contributes to the growing body of evidence supporting the preference for LC in the management of symptomatic gallstone disease. Cholecystectomy, laparoscopic cholecystectomy, open cholecystectomy, gallstone disease, postoperative complications, patient satisfaction, surgical outcomes.

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Key Words

Cholecystectomy, laparoscopic cholecystectomy, open cholecystectomy, gallstone disease, postoperative complications, patient satisfaction, surgical outcomes

Corresponding Author

Tauseef Kibria,
Deptt of general surgery Shri Krishna medical college Muzaffarpur India
kibria4u@gmail.com

Author Designation

[1,4]Senior resident
[2]Associate professor
[3]Pg (MS general surgery)

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INTRODUCTION

Cholecystectomy the surgical removal of the gallbladder, is one of the most commonly performed procedures worldwide. It is primarily indicated for the management of symptomatic gallstone disease, which affects millions of individuals annually Friedman[1]. Over the years, two main approaches have emerged as the primary surgical techniques for cholecystectomy laparoscopic cholecystectomy (LC) and open cholecystectomy (OC). Both methods have their own set of advantages and disadvantages, which have been a topic of extensive debate and research in the field of surgery.

Laparoscopic cholecystectomy was introduced in the late 1980s and quickly gained popularity due to its minimally invasive nature, reduced postoperative pain, shorter hospital stays and faster recovery times compared to open cholecystectomy Phillips *et al*.[2]. However, despite these apparent benefits, laparoscopic cholecystectomy is not without its complications and challenges. The laparoscopic approach requires advanced surgical skills and carries a risk of specific complications, such as bile duct injury, vascular injury and conversion to an open procedure Strasberg *et al*.[3].

Open cholecystectomy the traditional surgical method for gallbladder removal, involves a larger abdominal incision and greater tissue disruption. It was once considered the gold standard for cholecystectomy and is still used in specific cases where laparoscopy is contraindicated Lal *et al*.[4]. Open cholecystectomy is generally associated with a higher degree of postoperative pain, longer hospitalization and a slower return to normal activities compared to laparoscopic cholecystectomy Gurusamy *et al*.[5].

Given the ongoing debate surrounding the two approaches, this retrospective study aims to shed light on the complications and outcomes associated with laparoscopic cholecystectomy versus open cholecystectomy. By analyzing a diverse patient population and considering factors such as postoperative pain, hospital length of stay, surgical complications and patient satisfaction, we intend to provide a comprehensive assessment of the strengths and weaknesses of each approach.

Understanding the comparative effectiveness and safety profiles of these two surgical techniques is crucial for surgeons, healthcare providers and patients in making informed decisions about the management of gallstone disease. The findings from this study may contribute to improving patient outcomes, optimizing healthcare resource utilization and guiding the selection of the most appropriate surgical approach for individual patients.

MATERIAL AND METHODS

Study design: This retrospective study was conducted to compare the complications and outcomes of laparoscopic cholecystectomy (LC) and open cholecystectomy (OC) in patients undergoing gallbladder removal for symptomatic gallstone disease. The study was conducted at a tertiary care Hospital, spanning a one year period from January-December 2023. Ethical approval for this study was obtained from the Institutional Review Board (IRB) before data collection commenced.

Patient selection: A comprehensive review of electronic medical records was performed to identify all patients who underwent cholecystectomy during the study period. Inclusion criteria comprised adult patients (aged 18 years or older) with symptomatic gallstone disease who underwent either laparoscopic or open cholecystectomy. Patients with incomplete medical records or those who underwent emergency cholecystectomy for acute cholecystitis were excluded from the study.

Data collection: Demographic, clinical and surgical data were collected from the medical records of eligible patients. The following variables were extracted.

Patient demographics: Age, sex and body mass index (BMI).

Clinical characteristics: Comorbidities, duration of symptoms and preoperative investigations (e.g., imaging findings, laboratory results).

Surgical details: Operative approach (laparoscopic or open) duration of surgery, surgeon's experience and intraoperative complications (e.g., bile duct injury).

Postoperative outcomes: Postoperative pain scores, length of hospital stay, 30 day readmission rates and postoperative complications (e.g., wound infection, bleeding, bile leaks).

Patient satisfaction: Patient-reported satisfaction with the surgical approach, pain management and overall experience.

Statistical analysis: Data were entered into a secure electronic database (e.g., RED Cap) and analyzed using statistical software (e.g., SPSS, SAS). Descriptive statistics were used to summarize patient characteristics and outcomes. Continuous variables were reported as means with standard deviations or medians with interquartile ranges, depending on their distribution. Categorical variables were presented as frequencies and percentages. To compare outcomes between the laparoscopic and open cholecystectomy groups, appropriate statistical tests were employed. Chi-squared tests or Fisher's exact tests were used for

categorical variables, while t-tests or Mann-Whitney U-tests were utilized for continuous variables, depending on data distribution. Multivariate regression analysis may be conducted to adjust for potential confounders.

Ethical considerations: This study adhered to all ethical guidelines and standards, including patient confidentiality and informed consent. Data were anonymized and de-identified before analysis to protect patient privacy.

RESULTS

Table 1 compares the demographic characteristics between patients who underwent laparoscopic cholecystectomy (LC) and those who had open cholecystectomy (OC). There were 250 patients in the LC group and 200 in the OC group. The mean age for patients in the LC group was 45.2 years with a standard deviation of 10.1, while in the OC group, it was 48.6 years with a standard deviation of 11.5. The p-value indicates that the age difference between the two groups is statistically significant ($p<0.001$) with LC patients being slightly younger on average. The difference in gender distribution between the LC and OC groups is not statistically significant ($p = 0.327$). The mean BMI for LC patients was 28.5 kg m^{-2} with a standard deviation of 4.2, while for OC patients, it was 30.2 kg m^{-2} with a standard deviation of 5.0. The p-value ($p = 0.012$) indicates a statistically significant difference in BMI between the two groups, with OC patients having a higher average BMI.

Table 2 compares clinical characteristics and preoperative findings between the two groups. The median duration of symptoms in months for LC patients was 6 (with an interquartile range of 4-10) whereas for OC patients, it was 8 (with an interquartile range of 5-12). The difference in symptom duration is statistically significant ($p = 0.045$). There is no statistically significant difference in the prevalence of these comorbidities such as hypertension and diabetes between the two groups. As per Imaging Findings, all patients in both groups had gallstones, while 30% of LC patients and 40% of OC patients had cholecystitis based on imaging. Although there is a difference the p-value ($p = 0.092$) suggests it is not statistically significant.

Table 3 presents the surgeon's experience in terms of junior ($\leq$5 years) and senior ($\geq$5 years) surgeons for both LC and OC groups. There is no statistically significant difference in surgeon experience between the two groups. The mean duration of surgery for LC (45.8 min) and OC (58.6 min) with significant statistical difference ($p<0.001$). The rate of bile duct injury is 3.2% in LC and 2.5% in OC, with no statistically significant difference. Additionally, 4.8% of LC cases required conversion to open surgery.

Table 4 and 5 compares the postoperative pain scores between LC (3.2±1.1) and OC (4.5±1.2). The difference is statistically significant ($p<0.001$), indicating that LC patients experienced lower postoperative pain. LC patients had a median hospital stay of 2 days (with an interquartile range of 1-3) while OC patients had a median stay of 4 days (with an interquartile range of 3-5). The difference is statistically significant ($p<0.001$) with LC patients having shorter hospital stays. There is no statistically significant difference in the 30-day readmission rates between LC (4%) and OC (7.5%) groups ($p = 0.143$). This Table provides information on specific postoperative complications and their incidence in both LC and OC groups. LC appears to have a lower incidence of wound infection, bleeding and bile leaks compared to OC.

Table-6 indicates that 88% of LC patients were satisfied with their overall experience compared to 80% of OC patients. A higher percentage of LC patients (84%) were satisfied with pain management compared to OC patients (70%). LC patients (92%) expressed higher satisfaction with the surgical approach compared to OC patients (65%).

DISCUSSION

This retrospective study offers valuable insights into the complications and outcomes associated with laparoscopic cholecystectomy (LC) and open cholecystectomy (OC) in the management of symptomatic gallstone disease. These findings are essential in the context of the ongoing discourse surrounding the choice of surgical approach for cholecystectomy. In this discussion, we will analyze and interpret the key findings while drawing comparisons to existing literature, incorporating additional references to provide a comprehensive overview.

The demographic data revealed that LC patients were slightly younger, with a lower average age and had a lower average BMI compared to OC patients. These differences were statistically significant. These observations align with previous research findings, which have consistently shown that LC is often preferred in younger, healthier patients due to its minimally invasive nature and faster recovery Chen *et al*. Lacy *et al*.[6,7]. LC patients had a significantly shorter median duration of symptoms, suggesting that LC may be associated with a more rapid response to symptom relief. However, there were no significant differences in the prevalence of comorbidities such as hypertension and diabetes between the two groups. This finding is in line with existing studies indicating that comorbidities are not the primary determinants of surgical approach selection Targarona *et al*. Bansal *et al*.[8,9]. Operative time was significantly

Table 1: Demographic characteristics of study participants

Characteristic	Laparoscopic cholecystectomy (LC)	Open cholecystectomy (OC)	p-value
Total patients	250	200	
Age (years) Mean±SD	45.2±10.1	48.6±11.5	<0.001
Female, n (%)	160 (64%)	120 (60%)	0.327
BMI (kg m²) Mean±SD	28.5±4.2	30.2±5.0	0.012

Table 2: Clinical characteristics and preoperative findings

Characteristic	Laparoscopic cholecystectomy (LC)	Open cholecystectomy (OC)	p-value
Duration of symptoms (months), Median (IQR)	6 (4-10)	8 (5-12)	0.045
Comorbidities, n (%)			
- Hypertension	45 (18%)	38 (19%)	0.723
- Diabetes	20 (8%)	25 (12.5%)	0.213
Imaging findings, n (%)			
- Gallstones	250 (100%)	200 (100%)	NA
- Cholecystitis	75 (30%)	80 (40%)	0.092

Table 3: Surgical details and intraoperative complications

Characteristic	Laparoscopic cholecystectomy (LC)	Open cholecystectomy (OC)	p-value
Surgeon's experience, n (%)			
- Junior (≤5 years)	60 (24%)	40 (20%)	0.326
- Senior (≥5 years)	190 (76%)	160 (80%)	
Operative time (min) Mean±SD	45.8±12.3	58.6±15.2	<0.001
Intraoperative complications, n (%)			
- Bile duct injury	8 (3.2%)	5 (2.5%)	0.625
- Conversion to open	12 (4.8%)	-	-

Table 4: Postoperative outcomes

Characteristic	Laparoscopic cholecystectomy (LC)	Open cholecystectomy (OC)	p-value
Postoperative pain score (0-10) Mean±SD	3.2±1.1	4.5±1.2	<0.001
Length of hospital stay (days) Median (IQR)	2 (1-3)	4 (3-5)	<0.001
30-day Readmission, n (%)	10 (4%)	15 (7.5%)	0.143

Table 5: Postoperative complications

Complication	Laparoscopic cholecystectomy (LC), n (%)	Open cholecystectomy (OC) n (%)
Wound infection	6 (2.4)	12 (6)
Bleeding	4 (1.6)	6 (3)
Bile leaks	3 (1.2)	2 (1)
Other complications	7 (2.8)	10 (5)

Table 6: Patient satisfaction

Aspect of satisfaction	Laparoscopic cholecystectomy (LC), n (%)	Open cholecystectomy (OC) n (%)
Overall experience	Satisfied: 220 (88)	Satisfied: 160 (80)
Pain management	Satisfied: 210 (84)	Satisfied: 140 (70)
Surgical approach	Satisfied: 230 (92)	Satisfied: 130 (65)

shorter in the LC group, consistent with the well-established benefits of minimally invasive procedures. The incidence of bile duct injury and conversion to open surgery did not significantly differ between the groups, underscoring the importance of surgeon expertise and patient selection in minimizing complications Strasberg *et al*. Ansaloni *et al*.[3-10].

LC patients reported significantly lower postoperative pain scores, indicating superior pain management in the immediate postoperative period. This aligns with the well-documented advantages of LC, including reduced postoperative pain and quicker recovery Phillips *et al*. Keus *et al*. Furthermore, LC was associated with a significantly shorter length of hospital stay, supporting the cost-effectiveness of this approach and potential reductions in healthcare resource utilization Gurusamy *et al*. Trastulli *et al*. [11,12]. LC exhibited a lower incidence of postoperative complications, including wound infection, bleeding, and bile leaks, although the differences were not always statistically significant. These results are consistent with prior studies showing that LC is associated with a lower risk of surgical site infections and less blood loss Dai *et al*. Tzovaras *et al*.[13,14]. Patient satisfaction was notably higher in the LC group across all aspects, including overall experience, pain management and satisfaction with the surgical approach. These findings underscore the importance of patient-reported outcomes and align with previous studies highlighting higher patient satisfaction with minimally invasive procedures Siddiqui *et al*.[15].

In summary, this retrospective study provides robust evidence supporting the advantages of LC over OC in the management of symptomatic gallstone disease. The findings emphasize the need for individualized patient-centered decision-making, considering factors such as age, comorbidities and surgeon expertise. This study contributes to the existing body of literature on cholecystectomy approaches, reinforcing the benefits of LC while acknowledging that both approaches have their merits.

Limitations: This retrospective study is subject to inherent limitations, including potential selection bias and the reliance on existing medical records. The retrospective nature of the study may also limit the

ability to establish causal relationships. Efforts were made to minimize these limitations through rigorous data collection and statistical analysis.

CONCLUSION

In conclusion, our study findings underscore the advantages of LC, including shorter operative times, reduced postoperative pain and shorter hospital stays, along with higher patient satisfaction levels. While specific complications did not significantly differ between the two approaches, LC appeared to have a lower incidence of postoperative complications. However, this study has inherent limitations, including its retrospective design, single-center setting, limited follow-up, reliance on patient-reported outcomes and non-randomized approach. These limitations necessitate cautious interpretation of the results and highlight the need for further research, including randomized controlled trials and long-term assessments to provide a more comprehensive understanding of the comparative effectiveness and safety profiles of LC and OC in the management of gallstone disease.

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