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ISSN: 2617-0817 E-ISSN: 2789-5912

Original Article

Postoperative Complications in Elective Versus Emergency Cholecystectomy - A Comparative Study

DOI: dx.doi.org

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Received: 24 Jan 2024
Accepted: 26 Jan 2024
Published: 28 Feb 2024

Published by:
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ABSTRACT

Background: *Cholecystectomy remains one of the most common abdominal surgeries done worldwide and the timing of surgery— elective vs. emergency—continues to be controversial. This study aims to compare postoperative complications between elective and emergency cholecystectomy after adjusting for significant patient and disease factors.* ***Methods & Materials:*** *This observational study included 120 cholecystectomy patients—60 elective and 60 emergency cases. Postoperative complications over 30 days were recorded, including wound infection, bile leak, fever, reoperation, ICU admission, readmission, and mortality. Descriptive statistics compared demographics and intraoperative data, while Cox proportional hazards regression assessed the impact of surgery type on complications, adjusting for confounders.* ***Results:*** *The emergency group experienced notably higher wound infection rates (16.7% vs 5.0%, p=0.04), postoperative fever (25% vs 8.3%, p=0.02), and conversion to open surgery (16.7% vs 1.7%, p=0.01). Hospital stays longer than 5 days were significantly more common for emergency cases (36.7% vs 3.3%, p<0.001). Readmission was four times more likely in the emergency group (13.3% vs 3.3%, p=0.04). On multivariable Cox regression analysis, emergency surgery was the strongest independent predictor of complications (HR=2.45, 95% CI: 1.32-4.55, p=0.004), followed by diabetes (HR=2.10, p=0.02) and age >60 years (HR=1.80, p=0.045).* ***Conclusion:*** *Emergency cholecystectomy is associated with significantly higher postoperative complication rates, increased in-hospital stay, increased likelihood of conversion to open procedure, and increased readmission rates. These findings strongly support early elective surgery for symptomatic gallstones when clinically appropriate to avoid emergency presentations with their associated increased morbidity.*

Keywords: *Cholecystectomy; Elective surgery; Emergency surgery; Postoperative complications; Surgical timing; Gallstone disease; Laparoscopic conversion; Length of stay; Readmission rates.*

(The Planet 2024; 8(1): 244-248)

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INTRODUCTION

Cholecystectomy remains one of the most common abdominal surgeries in the world with an estimated 1,000,000 procedures performed annually in the US [1]. Laparoscopic cholecystectomy has been the gold standard in the management of symptomatic gallstone disease since its introduction late in the 1980s because it possesses advantages like less pain post-surgery, reduced hospital stays, faster recovery, and improved cosmetic outcomes [2]. The timing of cholecystectomy—whether electively or urgently performed, is continuous and continues to be a significant issue of debate among the surgical community for achieving the best patient outcomes. Gallstone disease occurs in approximately 10-15% of Western adults with symptomatic presentation in approximately 20% [3]. Most patients are operated on electively after being diagnosed with symptomatic cholelithiasis, but most present with acute gallstone-related complications like cholecystitis, cholangitis, or pancreatitis which need emergency operation [4]. Timing of the operation is a decision-making exercise with complex patient factors, gravity of the disease, resource availability, as well as potential complications. Emergency cholecystectomy is typically performed in the setting of acute inflammation, anatomy distortion, and systemic inflammatory response syndrome, creating technical challenges that may result in higher rates of complications [5]. They are at risk of bile duct injury, bleeding, open procedure conversion, and infection [6]. Conversely, elective cholecystectomy provides an opportunity for optimization of comorbidities in the patient, proper preoperative planning, and operation under optimal conditions [7]. However, the duration from diagnosis to elective surgery exposes patients to recurrent biliary attacks, which can cause emergency admission and unplanned intervention [8]. There have been a number of studies

ISSN: 2617-0817 E-ISSN: 2789-5912

comparing results between these two approaches with inconsistent findings. Cao et al. showed that early cholecystectomy in acute cholecystitis reduces hospital stay without increasing complication rates [9]. Another study, nonetheless, has revealed increased rates of some complications like bile leak and wound infection in the emergency setting [10]. Additionally, patient age, comorbidity status, and severity of gallstone disease are critical determinants of postoperative results regardless of the timing of surgery [11]. The economic impact of these diverse techniques is significant. Emergency cholecystectomies also carry longer hospital stays and higher costs of dealing with complications, increasing healthcare costs [12]. Moreover, the societal impact of complications—such as longer recovery time, longer return to work, and poor quality of life—is experienced by patients and the healthcare system [13]. Despite extensive amounts of work in this field, heterogeneity remains large in study design, definition of complications, and criteria for patient selection, making direct comparison difficult. Most of the literature to date is also focused on the measurement of individual complications and not on overall outcome, and few studies controlled well for confounding variables that influence surgical risk. This comparative analysis aims to address these gaps by systematically investigating postoperative complications of elective and emergency cholecystectomy operations after adjusting for significant patient and disease factors. By identifying certain risk factors for poor outcomes in each setting, we hope to produce evidence-based guidelines for optimizing surgical timing and perioperative management practices. Our findings can inform clinical decision-making, facilitate improved surgical risk counseling for patients, and potentially reduce the burden of complications from one of the most common surgeries in medicine.

METHODS & MATERIALS

This comparative observational study was conducted on 120 patients who underwent cholecystectomy at Ad-din Sakina Women's Medical College and Hospital, Jashore, Bangladesh between July, 2022 and June, 2023. Patients were divided into two groups based on the timing of surgery: elective (n=60) and emergency (n=60). Inclusion criteria encompassed patients aged 18 years and older diagnosed with symptomatic gallstone disease or acute cholecystitis, who were fit for surgery under general anesthesia. Patients with known malignancy, co-existing severe systemic illness (ASA IV and above), or incomplete records were excluded. Preoperative evaluations included clinical examination, laboratory investigations, and abdominal ultrasonography. All surgeries were performed via laparoscopic approach initially, with conversion to open cholecystectomy recorded when necessary. Postoperative complications were monitored for 30 days and included wound infection, bile leak, postoperative fever, reoperation, ICU admission, readmission, and mortality. Demographic data, intraoperative findings, and complication rates were compared between the two groups using descriptive statistics. Frequencies and percentages were calculated for categorical variables. Chi-square or Fisher's exact test was used for group comparisons, and a p-value of <0.05 was considered statistically significant. Cox proportional hazards regression analysis was performed to determine the association between type of surgery and time-to-complication events, adjusting for confounding variables such as age, sex, BMI, diabetes, and hypertension. Data analysis was performed using the statistical software SPSS version 26.

RESULTS

Table – I: Demographic Profiling of the Study Population (*n*=120)

Variable	Elective (n=60)	Emergency (n=60)	P-value
Age (years)			
18–30	8 (13.3%)	3 (5%)	0.20
31–40	12 (20%)	6 (10%)	0.13
41–50	18 (30%)	12 (20%)	0.23
51–60	14 (23.3%)	20 (33.3%)	0.22
>60	8 (13.3%)	19 (31.7%)	0.01
Gender			
Male	28 (46.7%)	35 (58.3%)	0.19
Female	32 (53.3%)	25 (41.7%)	0.19
BMI > 30	10 (16.7%)	18 (30%)	0.08

Table I summarizes the demographic characteristics of 120 cholecystectomy patients, divided into equal numbers of elective (n=60) and emergency (n=60) groups. The age distribution shows wide variability, with a particularly significant disparity in the over-60-year age groups, with many more patients aged >60 years being found in the emergency group (31.7% vs 13.3%, p=0.01). The elective group skewed younger patients, with higher percentages of the 18-30 and 31-40 age groups, though this was not statistically significant. Gender distribution showed a minor female predominance in the elective group (53.3%) compared to a male predominance in the emergency group (58.3%), though this was not statistically significant (p=0.19). Also, the emergency group showed a higher prevalence of obesity (BMI >30) at 30% compared with the elective group at 16.7%, and this did not quite but was not quite significant (p=0.08).

ISSN: 2617-0817 E-ISSN: 2789-5912

Table – II: Intraoperative Findings of the Study Population (*n*=120)

Finding	Elective (n=60)	Emergency (n=60)	P-value
Acute inflammation	5 (8.3%)	40 (66.7%)	<0.001
Adhesions	8 (13.3%)	28 (46.7%)	<0.001
Gangrenous gallbladder	0 (0%)	6 (10%)	0.012
Bile duct dilatation	4 (6.7%)	7 (11.7%)	0.34

Table II compares intraoperative observations across emergency and elective cholecystectomy groups, indicating significant pathological distinctions encountered intraoperatively. Acute inflammation was much more prevalent in the emergency group (66.7%) compared with the elective group (8.3%) and was highly significant (p<0.001). Similarly, adhesions existed in nearly half (46.7%) of emergency cases but only 13.3% of elective cases (p<0.001), indicating harder operative conditions in emergent cases. Gangrenous gallbladder, indicating severe disease, was found only in the emergency group (10% vs 0%, p=0.012), stressing the gravity of pathology in acute presentation. Bile duct dilatation showed a slight rise in the emergency group (11.7% vs 6.7%), but this was not statistically significant (p=0.34).

Table – III: Postoperative Complications of the Study Population (*n*=120)

Complication	Elective (n=60)	Emergency (n=60)	P-value
Wound infection	3 (5%)	10 (16.7%)	0.04
Bile leak	1 (1.7%)	6 (10%)	0.05
Post-op fever	5 (8.3%)	15 (25%)	0.02
Reoperation required	0 (0%)	2 (3.3%)	0.15
ICU admission	1 (1.7%)	5 (8.3%)	0.09

Table III shows postoperative complications identified within 30 days of operation in the two patient groups. The emergency group demonstrated significantly higher post-operative wound infection (16.7% vs 5.0%, p=0.04) and post-operative fever (25% vs 8.3%, p=0.02) rates than the elective group. Bile leak, a serious technical complication, was also more frequent in emergency (10% vs 1.7%) cases, with this result trending toward borderline statistical significance (p=0.05). More severe complications requiring reoperation were identified in the emergency group alone (3.3% vs. 0%), albeit without statistical significance (p=0.15). ICU stay, an indicator of poor postoperative status, was more common in emergency patients (8.3% vs. 1.7%), reaching but not achieving significance (p=0.09).

Table – IV: Length of Hospital Stay (*n*=120)

Stay Duration	Elective (n=60)	Emergency (n=60)	P-value
≤ 2 days	40 (66.7%)	8 (13.3%)	<0.001
3–5 days	18 (30%)	30 (50%)	0.01
> 5 days	2 (3.3%)	22 (36.7%)	<0.001

Table IV shows the differences in hospital stay duration between elective and emergency cholecystectomy patients. The majority of elective cases (66.7%) experienced short hospital stays of ≤2 days, which stood in stark contrast to the reality that just 13.3% of emergency cases experienced such brief admissions (p<0.001). Intermediate admissions of 3-5 days were more likely to be seen in the emergency group (50% vs 30%, p=0.01). The most significant difference was in hospital stays exceeding 5 days, which were needed for 36.7% of emergency patients and only 3.3% of elective patients (p<0.001).

Table – V: Conversion to Open Surgery (*n*=120)

Surgical Outcome	Elective (n=60)	Emergency (n=60)	P-value
Laparoscopic completed	59 (98.3%)	50 (83.3%)	0.01
Converted to open	1 (1.7%)	10 (16.7%)	0.01

Table V documents the rate of conversion of laparoscopic to open cholecystectomy in the study groups. Successful laparoscopic cholecystectomy was achieved in 98.3% of elective compared to 83.3% of emergency cases, with the difference being statistically significant (p=0.01). Conversely, conversion to open surgery occurred in 16.7% of emergency cases compared to a paltry 1.7% of elective cases (p=0.01).

Table – VI: 30-Day Readmission & Mortality (*n*=120)

Outcome	Elective (n=60)	Emergency (n=60)	P-value
Readmission	2 (3.3%)	8 (13.3%)	0.04
Mortality	0 (0%)	2 (3.3%)	0.15

ISSN: 2617-0817 E-ISSN: 2789-5912

Table VI presents important quality measures of 30-day outcomes following cholecystectomy in both patient groups. The emergency group was discovered to have a significantly increased readmission rate at 13.3% compared to just 3.3% in the elective group (p=0.04), representing a four-fold risk of unplanned hospital return. This notable difference is likely explained by the higher complication rates and more severe disease presentations among emergency patients. 30-day mortality was limited to the emergency group (3.3% vs 0%) but the difference was not significant (p=0.15).

Table – VII: Cox Proportional Hazards Model for Postoperative Complications

Variable	Hazard Ratio (HR)	95% Confidence Interval (CI)	P-value
Emergency surgery	2.45	1.32 – 4.55	0.004
Age > 60	1.80	1.01 – 3.22	0.045
Male gender	1.25	0.75 – 2.10	0.39
BMI > 30	1.62	0.89 – 2.96	0.11
Diabetes	2.10	1.13 – 3.91	0.02
Hypertension	1.15	0.63 – 2.12	0.65

Table VII presents a multivariate Cox proportional hazards regression analysis of independent predictors of postoperative complications. The strongest predictor was emergency surgery, with patients who underwent emergency cholecystectomy experiencing a 2.45-fold increased hazard of complications compared to elective cases (95% CI: 1.32-4.55, p=0.004) after adjusting for other variables. Increasing age (>60 years) was associated with an 80% increase in the risk of complications (HR=1.80, 95% CI: 1.01-3.22, p=0.045). Diabetes mellitus was the other significant predictor with a hazard ratio of 2.10 (95% CI: 1.13-3.91, p=0.02). Other factors such as male gender, obesity (BMI >30), and hypertension trended towards increased risk but did not reach statistical significance. This analysis provides significant evidence that the timing of cholecystectomy independently influences postoperative outcomes even after controlling for pertinent patient characteristics and comorbidities, which validates the preference for elective procedures when clinically feasible.

DISCUSSION

This study demonstrates deep disparities in outcomes between emergency and elective cholecystectomy, with emergency procedures uniformly associated with higher complication rates, longer stays, and increased use of resources. Our findings are consistent with the mounting evidence that the timing of cholecystectomy has a profound effect on patient outcomes. Population information presented a higher percentage of older patients (>60 years) in the emergency group, as seen consistent with previous work which revealed older patients tend to be more prone to have acute gallbladder disease that requires emergency intervention [14]. The multivariate model confirmed increased age to be a confirmed risk factor for complications (HR=1.80). Intraoperative inspection evidenced significantly higher rates of acute inflammation (66.7% vs 8.3%) and adhesions (46.7% vs 13.3%) in emergencies, evidencing technical challenges likely to yield the virtual tenfold higher rate of conversions to open technique (16.7% vs 1.7%). These results confirm a high multicenter study by Harboe et al., in which high incidence in acute conditions by far higher conversion rates due to inflammatory processes obscuring anatomical landmarks [15]. The higher incidence of postoperative complications in emergency procedures, particularly wound infections (16.7% vs 5.0%) and bile leakage (10% vs 1.7%), is similar to the findings of a systematic review by Huang et al., which they determined greater technical complications in acute presentation [16]. The emergency allows for an environment where dissection can be compromised, leading to the increased risk of bile duct injury and subsequent leakage. Hospital stay was much longer in emergency presentations, with 36.7% requiring >5 days of hospitalization compared with just 3.3% of elective presentations. This finding has important implications for healthcare resource use and supports early intervention for symptomatic gallstone disease. Johner et al. demonstrated that early elective cholecystectomy is not only safer but also cheaper than delaying until potential emergency presentation [17]. Our Cox regression model picked out emergency surgery as the strongest independent predictor of complications (HR=2.45) when confounding factors such as age, gender, and comorbidities were controlled for. This is significant because it suggests that surgical timing in itself—rather than simply patient-related factors—contributes significantly to outcomes. Sutcliffe et al. similarly found the emergency presentation to have a 2.72-fold increased risk of complications in their multicenter study [18]. Diabetes was also another significant predictor (HR=2.10), consistent with a study by Park et al., which found that impaired glucose metabolism was a risk factor for intraoperative and postoperative complications [19]. The microvascular changes and decreased immunity resulting from diabetes are likely responsible for slow wound healing and vulnerability to infection. The emergency group had four times higher readmission rates (13.3% vs 3.3%), a major burden on healthcare systems and patient quality of life. Ingraham et al.'s large database study found comparable disparities, and unplanned readmissions following emergency cholecystectomy much higher than following elective surgery [20]. Although the mortality differential did not reach statistical significance, the mere occurrence of deaths in the emergency group (3.3% vs 0%) is noteworthy. This trend has been replicated with larger cohorts, with Chen et al. reporting a three-fold increased risk of mortality with emergency versus elective cholecystectomy in their population-based analysis [23]. Collectively, these results support an early elective treatment strategy for symptomatic gallstone disease was indicated clinically. For suitable candidates, early scheduling of

ISSN: 2617-0817 E-ISSN: 2789-5912

elective cholecystectomy after initial presentation with biliary complaints can prevent future emergency presentations and their associated higher complication rates.

Limitations of the Study

The study's observational design limits causal inference, and unmeasured confounding effects could influence results despite statistical adjustment. The sample size of 120 patients, while adequate to detect large differences, could limit statistical power to detect smaller effect sizes, particularly for rare complications.

CONCLUSION

This study demonstrates that emergency cholecystectomy is associated with significantly higher rates of postoperative complications, increased length of stay in hospital, greater conversion to open surgery, and higher readmission than elective surgery. Multivariate analysis confirms emergency surgery as an independent risk factor for adverse outcomes, as well as advanced age and diabetes. These findings strongly support early elective cholecystectomy for symptomatic gallstones where clinically indicated, possibly precluding progression to acute presentations that require emergency operation with their consequent increased morbidity.

RECOMMENDATION

Subsequent research must focus on developing validated risk stratification instruments that will enable the identification of the highest-risk patients for complications to allow more individualized surgical timing decisions. Multicenter prospective trials are required to determine the impact of standardized care pathways on outcomes and define the optimal timing window for cholecystectomy after initial presentation with biliary symptoms.

Funding: No funding sources
Conflict of interest: None declared

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