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Original Article

Emergency Cholecystectomy Versus Percutaneous Cholecystostomy for The Treatment of Acute Cholecystitis in High-Risk Surgical Patients

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ABSTRACT

Objective: To compare the outcomes of emergency cholecystectomy versus percutaneous cholecystostomy for treatment of acute cholecystitis in high-risk surgical patients.

Study Design: Quasi-experimental study.

Place and Duration of Study: Department of Surgery, Combined Military Hospital Quetta, Pakistan from Apr 2022 to Sep 2023.

Methodology: After taking written informed consent, eighty-eight patients who fulfilled the inclusion criteria were enrolled in the study. The patients were divided into two groups of 44 each by odd and even number. Patients in Group-A underwent percutaneous cholecystostomy and in Group-B emergency cholecystectomy was performed. The outcome measures were assessed till the patients were discharged and then on the 30th postoperative day.

Results: The mean age of the patients was 51.0±7.41 years in Group-A and 53.00±8.53 years in Group-B. In-hospital mortality occurred in 6(13.6%) patients in Group-A compared to 1(2.3%) patient in Group-B (p=0.049). Thirty days mortality occurred in 7(15.9%) patients in Group-A and 1(2.3%) patient in Group-B (p=0.026). Complications occurred in 4(9.1%) patients in Group-A compared to 14(31.8%) patients in Group-B (p=0.008).

Conclusion: In high-risk surgical patients with acute cholecystitis, emergency cholecystectomy was significantly associated with lower rates of in-hospital and 30 days' mortality, but higher rates of complications compared to percutaneous cholecystostomy.

Keywords: Acute Cholecystitis, Emergency Cholecystectomy, Percutaneous Cholecystostomy.

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INTRODUCTION

Acute cholecystitis (AC) is described as an acute gallbladder inflammation and is a common cause for a visit to the emergency department.[1] Patients usually present with pain in the right upper quadrant of the abdomen with fever and chills.[2] AC, typically due to gallstone obstruction of the cystic duct, affects about 200,000 people in the United States each year.[3] For more than a century, open cholecystectomy (OC) was the gold standard, while laparoscopic cholecystectomy was introduced in the 1980s and is now the worldwide accepted gold standard.[4] Its success was due to its advantages of less postoperative pain, better cosmetic results, and shorter hospital stays concerning the open approach.[5] However, the management of patients at high risk of perioperative death due to their general condition, namely high-risk surgical patients, is controversial. Currently, the choice of treatment is still a dilemma in patients with high risk for severe underlying disease or poor general conditions.[6]

Emergency cholecystectomy (EC) in high-risk patients lead to serious morbidity and mortality owing to reduced physiological reserve.[7] High risk patients are typically defined as those who are elderly over 70 years old, those with significant comorbidities such as CVD, COPD, ASA grade III and IV, and a score of >13 according to the APACHE II classification with moderate to severe acute cholecystitis according to the Tokyo guidelines (TG07). Since 1980, percutaneous cholecystostomy (PC) has been proposed and used for the treatment of AC in patients with high surgical risk due to the severity of cholecystitis and/or the underlying medical comorbidities.[8] This procedure resolves local and systemic inflammation without the risks of surgery, and is increasingly being performed as an alternative to EC for the treatment of high-risk patients with AC. However, PC is not a definitive treatment since the gallbladder is not removed. This may lead to recurrent cholecystitis, and other complications with severe clinical efects.[9] It is still unclear whether PC offers real advantages and

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whether it should be considered the procedure of choice for the treatment of AC in high-risk patients. Therefore, for each case, a tailored and shared decision-making process is mandatory.[10]

However, up till now, few studies managed to compare the results of both approaches, leaving open the discussion of which is the best solution. Therefore, the current study aims to compare the outcomes of emergency cholecystectomy versus percutaneous cholecystostomy for the treatment of acute cholecystitis in high-risk surgical patients and determine which method is more effective and safer. The study also aims to provide guidelines about a better surgical intervention that is associated with enhanced efficacy and safety profile and thus can be applied in high-risk surgical patients while minimizing morbidity associated with this condition. By analyzing the effectiveness, safety, and postoperative complications of both procedures, this study aims to provide valuable insights into the optimal management approach for these patient populations.

METHODOLOGY

This quasi-experimental study was carried out at the Department of Surgery Combined Military Hospital, Quetta from April 2022 to September 2023, after obtaining approval from the Ethical Review Committee (ERC number 19/2023). The sample size of 88 patients was calculated by keeping 95% confidence level, 7% margin of error, taking the expected frequency of acute cholecystitis as 12.8%.[11] Non-probability consecutive sampling technique was used.

Inclusion Criteria: Patients of age 40 to 80 years, of both genders, ASA grade III and IV, and a score of >13 (defining a high-risk patient) according to the APACHE II classification with moderate to severe acute cholecystitis according to the Tokyo guidelines (TG07) were included in the study.

Exclusion Criteria: Patients who previously had open cholecystectomy or had cholecystectomy as part of a bigger procedure or for a malignancy and those who underwent a subtotal cholecystectomy were excluded from the study.

The diagnostic criteria of TG07 for AC and the severity evaluation criteria of TG07 for AC (Figure-I) were used to determine whether the patients who were admitted to the emergency room were classified as AC.

The primary outcome measures assessed were in-hospital mortality (defined as death occurring during hospital stay), 30-day mortality (mortality occurring within 30 days following intervention) and the rate of complications (procedure related). The secondary outcome measure assessed were length of intensive care unit (ICU) stay and length of hospital stay (in days).

Grade	Description
Grade I (mild)	Acute cholecystitis without organ dysfunction
Grade II (moderate)	Associated with any single following conditions WBC > 180,000/mm³ Palpable tender mass in right upper quadrant Symptoms longer than 72 hours Marked local inflammation (gangrenous cholecystitis, pericholecystic abscess, hepatic abscess, biliary peritonitis, emphysematous cholecystitis)
Grade III (severe)	Associated with any organ dysfunction of the following: Cardiovascular: Hypotension requiring vasopressors Neurologic: Decreased level of consciousness Respiratory: PaO_2/FiO_2 < 300 Renal: Oliguria, creatinine > 2.0 mg/dL Hepatic: PT-INR > 1.5 Hematologic: Platelets < 100,000/mm³

PT-INR, prothrombin time–international normalized ratio; *WBC*, white blood cell.

Figure-1: Tokyo Guidelines Grade Descriptions of Severity of Acute Cholecystitis.[1]

All participants who fulfilled the selection criteria were enrolled after taking written informed consent. Detailed history, physical examination and preoperative findings were noted down. The surgical technique was standardized for both groups. The patients were divided into two groups by odd and even number i.e. 44 in each group. Patients in Group-A underwent percutaneous cholecystostomy and patients in Group-B underwent emergency laparoscopic cholecystectomy. (Figure-2) Patients who were subjected to biliary drainage were recommended for interval cholecystectomy after a complete clinical recovery. All patients were followed up daily till discharge and then weekly till 30th postoperative day for assessing the outcomes.

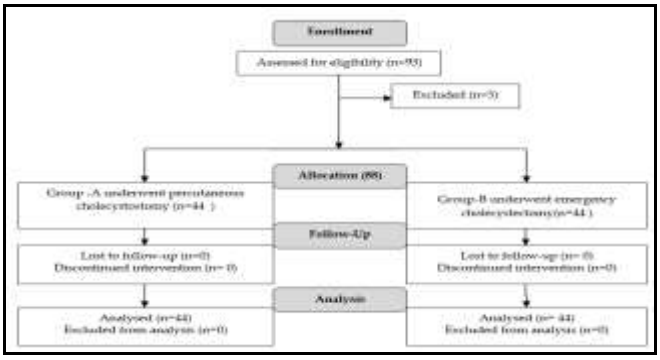

Figure-2: Phases of The Study

Data was analyzed using Statistical Package for Social Sciences version 25.0 Quantitative variables such as age, duration of stay in the ICU, and length of hospital stay were presented as Mean±SD. Qualitative data such as gender, ASA grade, severity of AC, calculus/acalculous cholecystitis, in-hospital and 30-day mortality, complications, and type of complications were presented as frequency and percentage. Both groups were compared in terms of length of hospital stay and length of stay in the ICU using an independent t-test. Comparison of both groups in terms of in-hospital mortality, 30-day mortality, and complications was done by using Chi-square/Fisher exact test and a *p*-value of ≤0.05 was considered significant.

RESULTS

A total of 88 patients were enrolled. The mean age of the patients was 51.0±7.41 years in Group-A (percutaneous cholecystostomy) and 53.0±8.53 years in Group-B (emergency cholecystectomy). The mean duration of hospital stay in Group-A was 14.5±2.94 days and in Group-B it was 8.1±1.68 days and this difference was statistically significant (*p*-value <0.001). The mean duration of stay in the ICU in Group-A was 6.8±0.91 days and in Group-B it was 4.9±0.79 days and this difference was statistically significant (*p*-value<0.001) (Table-I).

Table-I: Comparison of Quantitative Variables Among Groups (n=88)

Variables	Group (n=44)	Mean±SD	*p*-value
Age (years)	A (Percutaneous cholecystectomy)	51.0±7.41	–
	B (Emergency cholecystostomy)	53.0±8.53	
Duration of hospital stay (days)	A (Percutaneous cholecystectomy)	14.5±2.94	<0.001
	B (Emergency cholecystostomy)	8.1±1.68	
Duration of stay in the ICU (days)	A (Percutaneous cholecystectomy)	6.8±0.91	<0.001
	B (Emergency cholecystostomy)	4.9±0.79	

In terms of age group, 22(50%) patients were of age group 35 to 50 years, 18(40.9%) patients of 51 to 60 years and 4(9.1%) patients of 61 to 70 years in Group-A, whereas, in Group-B, 19(43.2%) patients were of age group 35 to 50 years, 16(36.4%) patients of 51 to 60 years and 9(20.4%) patients of 61 to 70 years. In Group-A, 32(72.7%) patients had ASA grade III and 12 (27.3%) patients had ASA grade IV, whereas, in Group-B, 30(68.2%) patients had ASA grade III and 14(31.8%) patients had ASA grade IV. There were 33(75%) males and 11(25%) females in Group-A and 30(68.2%) males and 14(31.8%) females in Group-B. Calculous AC was present in 34(77.3%) patients and acalculous AC in 10(22.7%) patients in Group-A and 27(61.4%) patients had calculous AC and 17(38.6%) patients had acalculous AC in Group-B. The severity of AC in Group-A was mild in 8(18.2%) patients, moderate in 26(59.1%) patients and severe in 10 (22.7%) patients and in Group-B, the severity of AC was mild in 6(13.6%) patients, moderate in 30(68.2%) patients and severe in 8(18.2%) patients (Table-II).

Table-II: Comparative Analysis of Baseline Characteristics among Groups (n=88)

Variables	Group-A n=44 Frequency (%)	Group-B n=44 Frequency (%)
Age group		
35 to 50 years	22(50%)	19(43.2%)
51 to 60 years	18(40.9%)	16(36.4%)
61 to 70 years	4(9.1%)	9(20.4%)
American Society of Anesthesiologists (ASA)		
Grade III	32(72.7%)	30(68.2%)
Grade IV	12(27.3%)	14(31.8%)
Gender		
Male	33(75%)	30(68.2%)
Female	11(25%)	14(31.8%)
Type of cholecystitis		
Calculous	34(77.3%)	27(61.4%)
Acalculous	10(22.7%)	17(38.6%)
Severity of Acute Cholecystitis		
Mild	8(18.2%)	6(13.6%)
Moderate	26 (59.1%)	30(68.2%)
Severe	10 (22.7%)	8(18.2%)

In-hospital mortality occurred in 6(13.6%) patients in Group-A compared to 1(2.3%) patient in Group-B (*p*=0.049). 30 days mortality occurred in 7(15.9%) patients in Group-A and 1(2.3%) patient in Group-B (*p*=0.026). Complications occurred in 4(9.1%) patients in Group-A compared to 14(31.8%) patients in Group-B (*p*=0.008). With respect to type of complications, in Group-A, biliary leakage occurred in 2(4.5%) patients, subhepatic fluid collection occurred in 1(2.3%) patients and wound infection occurred in 1(2.3%) patients, whereas, in Group-B, biliary leakage occurred in 5(11.4%) patients, subhepatic fluid collection occurred in 4(9.1%) patients, wound infection occurred in 2(4.5%) patients, atelectasis occurred in 1(2.3%) patients and choledocholithiasis occurred in 2 (4.5%) patients (*p*=0.165) (Table-III).

Table-III: Comparison of In-Hospital Mortality, 30 Days Mortality and Complications Among Groups (n=88)

Variables	Group-A (n=44) Frequency (%)	Group-B (n=44) Frequency (%)	*p*-value
In-hospital mortality			
Yes	6(13.6%)	1(2.3%)	0.049
No	38(86.4%)	43(97.7%)	
30 days mortality			
Yes	7(15.9%)	1(2.3%)	0.026
No	37(84.1%)	43(97.7%)	
Complications			
Yes	4(9.1%)	14(31.8%)	0.008
No	40(90.9%)	30(68.2%)	
Type of complication			
No complication	40(90.9%)	30(68.2%)	0.165
Biliary leakage	2(4.5%)	5(11.4%)	
Subhepatic fluid collection	1(2.3%)	4(9.1%)	
Wound infection	1(2.3%)	2(4.5%)	
Atelectasis	0(0%)	1(2.3%)	
Choledocholithiasis	0(0%)	2(4.5%)	

DISCUSSION

The current study findings revealed that in high risk surgical patients who had cholecystitis, emergency cholecystectomy was significantly associated with lower rates of in-hospital mortality, 30 days mortality, shorter duration of stay in the ICU and shorter duration of stay in the hospital, compared to percutaneous cholecystostomy. However, PC was significantly associated with lower rates of complications compared to EC. Majority of the patients in our study were males, of age range 35 to 50 years, ASA grade III, had calculus cholecystitis and had moderate severity of AC.

Surgery is the mainstay of treatment of patients with acute cholecystitis.[12] Current recommendations indicate laparoscopic cholecystectomy in all three severity levels of gallbladder inflammation provided the patient can tolerate surgery after evaluating the surgical risk.[14,15] Certain guidelines recommend as a therapeutic alternative the possibility of PC and supportive treatment in patients with a severe and moderate grade of acute cholecystitis when there is a high surgical risk.[16] However, few studies have compared EC with PC and hence no consensus has been developed.[17] Keeping this in view, our study compared the outcomes of PC versus EC in high risk surgical patients who had AC.

Our study revealed that in patients who underwent PC versus EC, the rate of in-hospital mortality was 13.6% versus 2.3% (p=0.049), the rate of 30 days mortality was 15.9% versus 2.3% (p=0.026), respectively, i.e. EC was significantly associated with lower rates of in-hospital and 30 days mortality. Huang et al. similarly revealed that the rate of mortality was significantly higher in patients who underwent PC compared to those who underwent EC i.e. relative risk=2.87 (p=0.007)18. Akarsu *et al*. also revealed that the rate of mortality was significantly lower in patients who underwent EC compared to PC (p<0.001).[19] These studies support our study findings that EC in high-risk surgical patients with AC is associated significantly with lower rates of mortality than PC.

In terms of complications, our study revealed that PC was significantly associated with lower rates of complications compared to EC i.e. 9.1% versus 31.8% (p=0.008), respectively. Garces-Albir *et al*. revealed that the rate of complications was lower in the patients who underwent PC compared to those who underwent EC i.e. 14% versus 22.6%.[20] This study supports our study findings. Huang *et al*. revealed that there was no significant difference between the two interventions in terms of complications.[18] The findings of Huang *et al*., is not consistent with our study results.

In our study, the duration of hospitalization was significantly longer in the PC group compared to EC group i.e. 14.5±2.94 days versus 8.1±1.68 days, respectively. Huang *et al*., similarly revealed that the duration of hospitalization was significantly shorter in the EC group compared to PC group as indicated by weighted mean difference of 6.92 (p<0.00001).[18] Similar findings were revealed by Akarsu *et al*., that the duration of hospitalization was significantly shorter in patients who underwent EC compared to PC (p<0.001).[19] These findings are consistent with our study results.

LIMITATIONS OF STUDY

There were certain limitations of the study. Results of this study cannot be generalized because it was a single center study with a small sample size. Secondly, the long-term complications were not assessed in the patients i.e. beyond 30 days. Lastly, the need of re-intervention was not assessed in our study as well as the type of comorbid conditions which could have affected the outcomes.

CONCLUSIONS

The current study concluded that the rate of in-hospital mortality and 30 days mortality was significantly lesser in the EC group compared to PC group. EC was also significantly associated with shorter duration of ICU and hospital stay than PC. However, PC was significantly associated with lower rates of complications compared to

EC. Hence, the study results propose that PC should not be viewed as a substitute to EC; rather, it should be saved for patients who refuse surgery even after being informed that it is the best course of action, or in cases where performing a cholecystectomy is absolutely contraindicated due to a very high surgical risk.

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Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

NA & MOF: Conception, study design, drafting the manuscript, approval of the final version to be published.

SI & TMF: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

FS & HM: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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