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Predictive factors of mortality and hospitalization in elderly patients undergoing laparoscopic cholecystectomy for acute cholecystitis

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ABSTRACT

Introduction: Gallstone disease is a prevalent condition, affecting over 10% of the population, and acute cholecystitis (AC) remains a frequent cause of emergency gastrointestinal admissions. The Tokyo Guidelines (TG18/TG13) provide criteria for assessing the severity of AC and guide treatment decisions. This study aims to identify factors associated with mortality and prolonged hospitalization in elderly patients undergoing laparoscopic cholecystectomy (LC) for AC.

Materials and Methods: This retrospective study included patients aged 70 and older who underwent LC for TG18/TG13 grade 1–2 AC between 2016 and 2023. Patients with recurrent AC, organ dysfunction, or a history of ERCP were excluded. Data on demographics, comorbidities (Charlson Comorbidity Index (CCI)), ASA (American Society of Anesthesiologists) scores, CRP/Albumin ratio (CAR), POSSUM (Physiological and Operative Severity Score for the Enumeration of Mortality and Morbidity) scores, postoperative outcomes, and length of hospital stay were collected. Statistical analyses were performed to evaluate the correlation between clinical factors and outcomes, including mortality and hospitalization duration.

Results: A total of 52 patients, with a mean age of 74 years, were included. Mortality occurred in 4 patients (7.6%). Higher ASA, CCI, and POSSUM scores were significant predictors of mortality. CAR and serum albumin levels showed borderline significance. The timing of surgery and Tokyo severity scores were not associated with mortality. A positive correlation was found between the timing of surgery and length of hospital stay. The POSSUM score had higher specificity and sensitivity compared to CCI in predicting mortality.

Conclusion: The POSSUM score was superior to CCI and ASA in predicting mortality in elderly patients undergoing LC for AC. The CAR ratio also showed potential as a predictive factor. These scores may help in optimizing treatment decisions and outcomes in this high-risk population.

Keywords: Acute cholecystitis, Charlson comorbidity index, elderly patients, laparoscopic cholecystectomy, POSSUM score

Introduction

Gallstone diseases affect more than 10% of the population and are one of the most common reasons for emergency gastrointestinal admissions.[1] Acute cholecystitis (AC) is a condition that requires thorough evaluation in terms of the need for hospitalization and emergency surgery. This condition involves a spectrum ranging from the severity of cholecystitis to the patient's comorbidities and current physical capacity. A multiparametric assessment of the disease is crucial for prognosis.[2]

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The Tokyo Guidelines (TG18/TG13) are widely used for disease severity evaluation and treatment planning.[3] According to these criteria, laparoscopic cholecystectomy (LC) is recommended for patients with grade 1 and grade 2 inflammation, while percutaneous cholecystostomy is prioritized for those with grade 3 AC associated with organ dysfunction.[4] Therefore, accurate assessment of disease severity is one of the key factors influencing the treatment plan.

Other factors affecting surgical decisions include the patient's overall condition. The Charlson Comorbidity Index (CCI) and the American Society of Anesthesiologists (ASA) score are crucial in evaluating general health status. Surgery can be recommended if the patient is expected to tolerate the procedure based on these criteria.[3] In some studies, additional scoring systems such as the CRP/albumin ratio (CAR) and POSSUM (Physiological and Operative Severity Score for the Enumeration of Mortality and Morbidity) have also been investigated for their predictive value.[5,6] Furthermore, studies examining the impact of surgical timing on outcomes are also available.[7]

The aim of this study is to predict the factors affecting mortality and hospitalization in elderly patients who underwent LC due to AC.

Materials and Methods

This retrospective study includes patients who underwent laparoscopic cholecystectomy for acute cholecystitis between January 2016 and June 2023 at a tertiary hospital. Approval was obtained from the hospital's ethics committee for this study. Patients aged 70 years and older with TG18/TG13 grade 1–2 AC were included. Patients with multiple episodes of acute cholecystitis, a history of endoscopic retrograde cholangiopancreatography (ERCP), or organ dysfunction were excluded. The diagnosis of acute cholecystitis and the decision for surgery were made according to the TG18/TG13 criteria (3,4). All patients received intravenous (IV) hydration and IV antibiotics upon admission and were kept nil per os (NPO) until surgery. The timing of surgery was left to the surgeon's discretion.

Demographic characteristics, comorbidities, duration of symptoms, blood test results, POSSUM, CCI, and ASA scores, postoperative outcomes, and length of hospital stay were recorded. Postoperative complications classified as Clavien-Dindo grade 2 and above were considered complications. Patient data were obtained from the hospital's information system. The CAR was calculated as the serum CRP/serum albumin ratio. Surgical timing was defined as the number of days from the onset of symptoms to surgery.

Statistical Analysis

The Kolmogorov-Smirnov test was used to test the assumption of normal distribution. The Mann-Whitney U test was applied to compare mean differences between groups. The chi-square test was used to compare categorical variables. Spearman correlation analysis was used to evaluate the correlation between the length of hospital stay and blood test results and scores. ROC analysis was performed to assess the relationship between CCI, POSSUM scores, and mortality. Data analysis was conducted using IBM SPSS 25. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 52 patients were included in the study, with an average age of 74 years. The gender distribution was similar. The mean POSSUM score was 17.0, while the mean CCI score was 4.9. The average length of hospital stay was 7.7 days. The average symptom duration at emergency admission was 2.2 days. A total of 3 patients experienced complications, and 4 patients had mortality. The demographic and clinical data of the patients are shown in Table 1.

Table 1. Demographic data and clinical features

	n=52
Age, mean (SD), year	74.5±4.2
Gender (Male/Female), n	27/25
POSSUM	17.0±3.1
CCI	4.9±1.5
CAR	2.66±3.28
WBC (×10^9/L)	10.4±5.1
Platelet (10^3 /μl)	269.1±70.5
CRP (mg/dL)	8.6±8.7
Albumin (g/dL)	3.7±0.6
Hospital stay (days)	7.7±4.5
Symptom duration at emergency admission (days)	2.2±0.6
Complication (yes/no)	3/49
Mortality (yes/no)	4/48

POSSUM: Physiological and Operative Severity Score for the enumeration of Mortality and morbidity; CCI: Charlson Comorbidity Index; CAR: CRP/albumin ratio; WBC: White blood cell; CRP: C-reactive protein.

Table 2. Relationship between mortality and parameters

	No Mortality (n=48)	Mortality present (n=4)	p
POSSUM	16 (13-21)	25 (23-27)	0.001
CCI	4 (3-9)	7.5 (7-8)	0.003
CAR	2.35±2.93	5.55±5.40	0.064
Albumin (g/dL)	3.9 (2.1-4.7)	3.3 (3.1-3.6)	0.071
WBC (×10^9/L)	9.2 (4.5-27.0)	12.7 (9.3-16.2)	0.169
CRP (mg/dL)	5.5 (0.5-28.7)	17.4 (3.1-31.7)	0.219
Day of surgery (from symptom onset)	5 (1-16)	4 (2-5)	0.171
ASA			
2	26	0	0.009
3	22	4	
Tokyo 2018 severity grade			
1	15	0	0.185
2	33	4	

POSSUM: Physiological and Operative Severity Score for the enumeration of Mortality and morbidity; CCI: Charlson Comorbidity Index; CAR: CRP/albumin ratio; WBC: White blood cell; CRP: C-reactive protein; ASA: American Society of Anesthesiologists classification.

Table 3. Correlation of length of stay and parameters

	R value	P value
Day of surgery (from symptom onset)	0.834	<0.001
CCI	0.328	0.024
POSSUM	0.236	0.111
CAR	-0.021	0.897
ASA	0.284	0.041
Age, mean (SD), year	0.232	0.117
Albumin (g/dL)	-0.557	<0.001

CCI: Charlson Comorbidity Index; POSSUM: Physiological and Operative Severity Score for the enumeration of Mortality and morbidity; CAR: CRP/albumin ratio; ASA: American Society of Anesthesiologists classification.

A total of 4 patients experienced mortality. A comparison of clinical data between patients with and without mortality is shown in Table 2. ASA, CCI, and POSSUM were found to be significant predictors of mortality. CAR and serum albumin levels were near-significant in predicting mortality. The timing of surgery and Tokyo severity score were not associated with mortality.

The correlation between length of stay and clinical parameters is shown in Table 3. A positive correlation was found between the timing of surgery and length of stay. CCI, ASA, and albumin levels had a moderate to low correlation with the length of stay. The POSSUM score was associated with mortality but was not related to the length of stay.

The ROC analysis results for POSSUM and CCI scores in predicting mortality are shown in Table 4. A POSSUM

Table 4. ROC analysis of the effects of CCI and POSSUM on mortality

	AUC (95% CI)	Cutoff points	P-value	Sensitivity (%)	Specificity (%)
POSSUM	1.000 (1.000-1.000)	20.5	0.001	100	95.8
CCI	0.948 (0.887-1.000)	6.5	0.003	100	91.7

ROC: receiver operating characteristic; AUC: area under the curve; CI: confidence interval, CCI: Charlson Comorbidity Index; POSSUM: Physiological and Operative Severity Score for the enumeration of Mortality and morbidity.

score of 20.5 and a CCI score of 6.5 had 100% sensitivity, with POSSUM having higher specificity at this cutoff. The area under the curve was also higher for POSSUM at a score of 20.5.

The ROC curve analysis of POSSUM and CCI scores in predicting mortality is shown in Figure 1.

Discussion

While LC is the primary treatment for AC, percutaneous cholecystostomy (PC) is an important treatment option in high-risk patients. Studies have shown that LC is superior to PC even in high-risk patients.[8] However, it should not be overlooked that LC can be a procedure prone to complications in AC. In patients with a CCI score of 5 and above, the mortality rate exceeds 3%.[9] Therefore, it is essential to be cautious when making surgical decisions, especially in elderly patients with AC.

Various scoring systems have been developed to predict mortality and morbidity in patients with AC. ASA and CCI are the most commonly used.[3] The POSSUM score and inflammation-based CAR are also parameters with high prognostic value.[5] In patients aged 80 years and older undergoing LC for AC, mortality rates can range from 4% to 40%.[10,11] In our study, the mortality rate in patients aged 70 and older was 7.6%.

In the S.P.Ri.M.A.C.C. study, the POSSUM score was found to be more effective than CCI in predicting mortality both at admission and at 30 days.[12] Similarly, in our study, we found that the POSSUM score had a higher area under the curve and specificity compared to CCI. In the S.P.Ri.M.A.C.C. study, the cutoff for POSSUM was 25, while in our study, it was 20. This difference was attributed to the mean age of 59 years in the S.P.Ri.M.A.C.C. study compared to 74 years in our study. We concluded that, due to the older patient group, smaller physiological impairments had more mortal effects in our patients. In the study by Yılmaz et al.[5], CAR was found to be a significant predictor of mortality. Similarly, in our study, the CAR ratio was borderline significant.

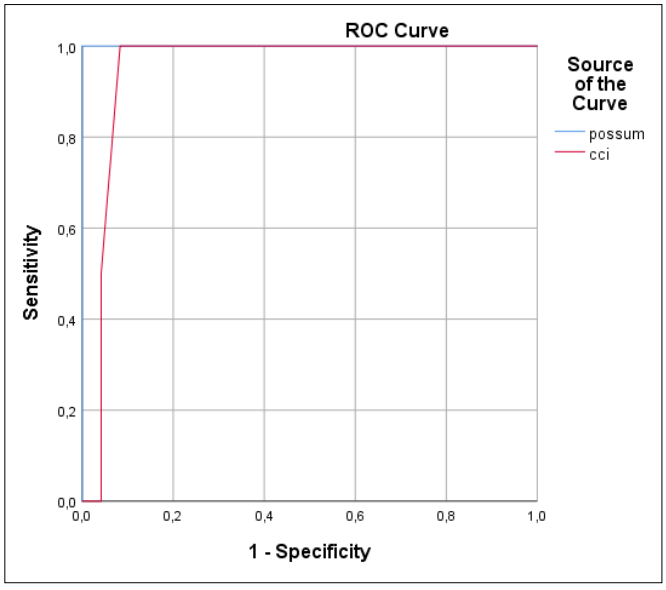

Figure 1. ROC curve graph of the mortality relationship between CCI and POSSUM score.

In our study, the most important factors determining the length of hospital stay were the timing of surgery and albumin levels. Similar to our study, Lucocq et al.[13] found that early surgical timing was associated with early discharge. The average hospital stay in our study was 7.7 days. In the study by Osterman et al.[14], patients with an ASA score of 3 had a 2-day longer hospital stay after LC compared to those with ASA scores of 1–2. Another study found a correlation between CCI and prolonged hospital stay.[15] In our study, CCI and ASA scores were also correlated with the length of stay. Although the POSSUM score was associated with mortality, it was not significantly related to the length of stay. This was thought to be due to the POSSUM score reflecting the patient's immediate condition, which might improve during the hospital stay.

The limitations of our study are the retrospective design and the small number of patients spread over a long period of time. Another bias of the study is that the surgeries were performed by multiple surgeons. The strength of the study is that it is focused on a specific subgroup of patients aged 70 and over.

Conclusion

In conclusion, we found that the POSSUM score was superior to the CCI and ASA scores in predicting mortality in patients undergoing LC for AC. Additionally, the CAR ratio was also useful in predicting mortality. We believe these scores can be beneficial in planning appropriate treatment approaches for AC.

Disclosures

Ethichs Committee Approval: Approval was obtained from the Ethics Committee Gaziantep City Hospital Non-Interventional Clinical Researches on 18/09/2024, with reference number 33/2024.

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