ORIGINAL ARTICLE

Percutaneous cholecystostomy in elderly patients with acute cholecystitis: Factors influencing mortality, morbidity, and length of hospital stay

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ABSTRACT

BACKGROUND: Acute cholecystitis (AC) is increasingly common and imposes a burden on healthcare systems, particularly in the elderly population. While laparoscopic cholecystectomy (LC) is the definitive treatment, percutaneous cholecystostomy (PC) is often preferred based on various factors. The treatment of elderly patients requires a multidisciplinary approach that carefully assesses surgical risks due to age-related changes and comorbidities. This retrospective study evaluates factors affecting mortality, morbidity, and hospital stay in elderly patients diagnosed with AC who presented to the emergency department and underwent PC.

METHODS: This retrospective study, conducted between January 2013 and January 2021, included patients aged 70 years and older with grade 2 and 3 AC, as classified by the Tokyo Guidelines, who underwent PC. Data on laboratory parameters, comorbidities, and outcomes were collected and analyzed.

RESULTS: Among the 76 included patients, complications occurred in 7.9% of cases, with catheter replacement being the most common complication. In-hospital mortality was 5.2%. Factors influencing hospital stay included intervention timing and serum albumin levels. Placement of percutaneous cholecystostomy within the first three days of hospitalization has been shown to shorten the length of hospital stay.

CONCLUSION: Personalized treatment strategies are essential for managing AC in elderly patients. Early placement of PC may reduce hospital stays and associated costs. Further research and updated guidelines are necessary to optimize outcomes in this demographic group.

Keywords: Acute cholecystitis; percutaneous cholecystostomy; elderly; hospitalization.

INTRODUCTION

Symptomatic cholelithiasis is a common condition, with less than 3% of patients progressing to acute cholecystitis (AC). However, AC is becoming an increasingly frequent reason for emergency department visits.[1] The rising incidence of AC-related emergency department visits is placing a burden on Western healthcare systems.[2]

The definitive treatment for AC is early laparoscopic cho-

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lecystectomy (LC). However, depending on factors such as the severity of cholecystitis, duration of symptoms, patient comorbidities, and the surgeon's experience, percutaneous cholecystostomy (PC) may also be preferred.[3] Acute cholecystitis in elderly patients presents unique challenges due to age-related physiological changes and an increased likelihood of comorbidities. Managing AC in this population requires a multidisciplinary approach that takes into account factors such as frailty, functional status, and the presence of geriatric syndromes. It is important to carefully evaluate the patient's overall health and personalize the treatment plan to minimize surgical and anesthesia-related risks.

Infection-related septicemia resulting from AC can lead to increased mortality, especially in frail patient groups. In light of this, PC may be preferred over surgical treatment.[4] According to the Tokyo guidelines, PC is a bridging therapy prior to LC and is not a definitive treatment for AC.[5] Some studies have also investigated the use of antibiotic therapy alone to mitigate reserve loss in frail patients.[6]

In this retrospective study, we examine factors affecting mortality, morbidity, and hospital stay in elderly patients diagnosed with AC who presented to the emergency department and underwent PC. Identifying these factors can help guide clinicians in optimizing patient care and decision-making processes. Additionally, we believe that highlighting the importance of specific parameters through correlation analyses can contribute to the development of customized treatment strategies.

MATERIALS AND METHODS

This single-center, retrospective study was conducted between January 2013 and December 2023. The STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist was used in this observational study. Approval was obtained from the Health Sciences University Fatih Sultan Mehmet Training and Research Hospital Clinical Research Ethics Committee (FSM EAH-KAEK 2023/59). The study included patients aged 70 years and older with grade 2 and grade 3 AC, as defined by the Tokyo guidelines, who were admitted to the general surgery department from the emergency department with a diagnosis of acute calculous cholecystitis and subsequently underwent PC. Disease severity and other patient parameters were retrospectively retrieved from the hospital information system.

Patients with a history of endoscopic retrograde cholangiopancreatography (ERCP), additional biliary tract diseases, or a follow-up period of less than 90 days were excluded from the study. Data collected included laboratory parameters, POSSUM (Physiological and Operative Severity Score for the enumeration of Mortality and morbidity), the Charlson Comorbidity Index (CCI), the American Society of Anesthesiologists (ASA) classification, length of hospital stay, 90-day mortality and readmission rates, and details of treatment. All data were recorded and managed using Microsoft Excel.[7-9]

Treatment selection was determined by the on-duty general surgeon. Patients were routinely started on intravenous antibiotic therapy upon hospitalization and monitored until transitioning to oral administration.

Definitions

Hospital Stay: The duration from admission to the general surgery department via the emergency department until discharge from the hospital.

Complications: Grade 3 and higher complications, as classified by the Dindo-Clavien classification, occurring during or after the intervention while the patient was hospitalized in the general surgery department.

Percutaneous Cholecystostomy: A procedure performed by a single experienced interventional radiologist. An 8 F pigtail drainage catheter (Flexima, Boston Scientific, USA) was inserted into the gallbladder using the Seldinger technique and left in place for free drainage.

Intervention Timing: The duration from hospital admission to the placement of the PC.

Statistical Analysis

IBM SPSS Statistics 22 (IBM SPSS, Türkiye) was used to perform statistical analyses of the study findings. The Kolmogorov-Smirnov test was applied to evaluate the normal distribution of the data. Independent sample t-tests and Mann-Whitney U tests were used to compare matched measurements. Pearson's χ^2 test was applied for categorical parameters, and Fisher's exact test was used when the frequency in categorical data was less than 5. Spearman correlation analysis was conducted to examine the relationship between hospital stay, mortality, and other parameters. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 76 patients aged 70 years and older were included in the study. The mean age of the patients was 82 years. Of the included patients, 32 were male and 44 were female. Demographic data and other parameters of the patients are presented in Table 1. Percutaneous cholecystostomy was performed on seven patients with an ASA score of 2 who declined surgery. A total of six patients developed complications, including catheter migration in four patients, intestinal perforation in one patient, and bleeding in one patient, resulting in a complication rate of 7.9%. In 94% of patients, percutaneous catheters were removed within 90 days, with a mean removal time of 68 days. Interval cholecystectomy was performed in 11 patients.

The relationship between mortality and various variables is shown in Table 2. The in-hospital mortality rate was 5.2%. Variables were evenly distributed between patients who ex-

Table 1. Demographic data of the patients, baseline biochemistry measurements, and intervention results

	n=76
Age, mean (SD), years	82.0±6.6
Gender (Male/Female), n	32/44
Comorbidities, n	
Diabetes Mellitus	34
Arterial Hypertension	63
Heart Disease	43
Cerebrovascular Disease	17
Dementia	16
Hemiplegia	10
Chronic Kidney Disease	9
ASA II	7
ASA III	51
ASA IV	18
POSSUM	19.0±2.6
CCI	6.2±1.2
WBC (×10^9/L)	14.3±5.6
Platelets (10^3/µL)	232.1±84.8
CRP (mg/dL)	13.6±8.6
Albumin (g/dL)	3.4±0.6
Total Bilirubin (mg/dL)	1.0±0.3
Direct Bilirubin (mg/dL)	0.4±0.1
ALP (U/L)	120±55
GGT (U/L)	87±41
ALT (U/L)	33±16
AST (U/L)	30±9
Hospital Stay (days)	10.0±5.4
Symptom Duration at Emergency Admission (days)	4.2±2.1
Complication (Yes/No)	6/76
Mortality (Yes/No)	4/72
Readmission (Yes/No)	1/71

ASA: American Society of Anesthesiologists Classification; POSSUM: Physiological and Operative Severity Score for the Enumeration wof Mortality and Morbidity; CCI: Charlson Comorbidity Index; WBC: White Blood Cell; CRP: C-Reactive Protein; ALP: Alkaline Phosphatase; GGT: Gamma-Glutamyl Transferase; ALT: Alanine Transaminase; AST: Aspartate Aminotransferase.

perienced mortality and those who did not. The parameter closest to statistical significance in this analysis was albumin level (p=0.093).

Factors influencing hospital stay are detailed in Table 3. The parameter most strongly associated with hospital stay was

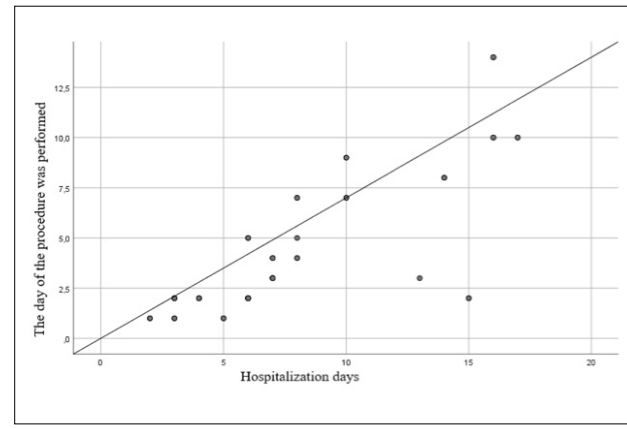

Figure 1. Graph of the relationship between length of stay and intervention timing.

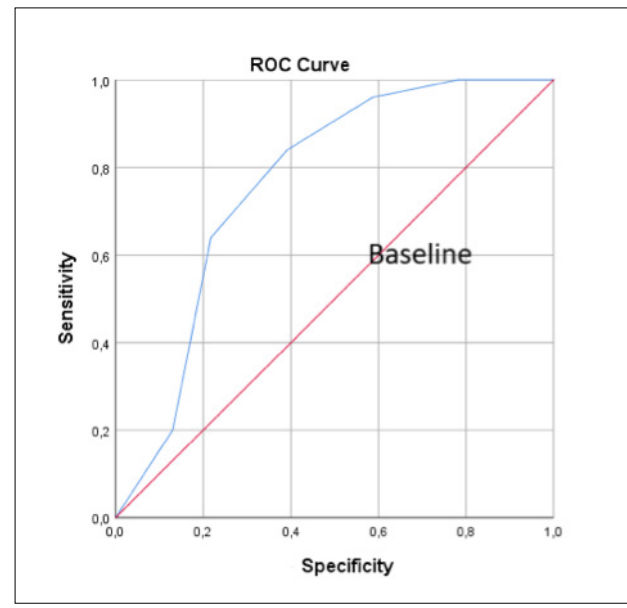

Figure 2. ROC curve analysis of timing of early intervention with a hospital stay of less than seven days.

intervention timing. Another parameter associated with hospital stay was the serum albumin level during hospitalization; as albumin levels increased, hospital stay duration decreased.

The relationship between intervention timing and hospital stay is illustrated in Figure 1. Delays in intervention timing were associated with longer hospital stays.

The receiver operating characteristic (ROC) analysis of the relationship between intervention timing and hospital stay is shown in Table 4. A significant correlation was found between early placement of percutaneous cholecystostomy within the first three days of hospital admission and shorter hospital stays.

The ROC curve analysis of the relationship between hospital stay exceeding seven days and early intervention timing in patients undergoing PC is depicted in Figure 2.

Table 2. Relationship between mortality and parameters

Mortality	No Mortality (n=72)	Mortality (n=4)	p value
POSSUM	19 (16-26)	18 (16-28)	0.831
CCI	6 (4-9)	7 (5-8)	0.372
Albumin (g/dL)	3.5 (1.5-4.7)	2.9 (2.5-3.3)	0.093
WBC (×10^9/L)	14.0 (3.5-29.0)	12.0 (6.8-19.0)	0.582
CRP (mg/dL)	14.0 (1.5-31.0)	9.0 (2.8-29)	0.678
Total Bilirubin (mg/dL)	1.0 (0.5-1.6)	1.1 (0.8-1.5)	0.711
Direct Bilirubin (mg/dL)	0.4 (0.2-0.7)	0.5 (0.4-0.6)	0.620
ALP (U/L)	114 (68-219)	128 (87-201)	0.389
GGT (U/L)	89 (39-155)	85 (44-143)	0.806
ALT (U/L)	35 (18-46)	31 (14-52)	0.712
AST (U/L)	29 (15-39)	30 (16-41)	0.609
Intervention Timing (days)	3 (1-15)	4.5 (2-13)	0.281

POSSUM: Physiological and Operative Severity Score for the Enumeration of Mortality and Morbidity; CCI: Charlson Comorbidity Index; WBC: White Blood Cell; CRP: C-Reactive Protein; ALP: Alkaline Phosphatase; GGT: Gamma-Glutamyl Transferase; ALT: Alanine Transaminase; AST: Aspartate Aminotransferase.

Table 3. Correlation of factors affecting length of stay

	R value	P value
Intervention timing (days)	0.649	< 0.001
CCI	0.134	0.264
POSSUM	0.129	0.284
Age (year)	0.078	0.520
Albumin (g/dL)	-0.237	0.050

CCI: Charlson Comorbidity Index, POSSUM: Physiological and Operative Severity Score for the enumeration of Mortality and morbidity

with comorbidities. In particular, a PC may be a preferable option for elderly and frail patients. However, it is important to note that PC is only a bridging therapy.[5] While various studies indicate that PC has higher complication and mortality rates compared to LC, this may be attributed to inadequate randomization, resulting in a higher prevalence of comorbid diseases in the PC group.[2]

Another treatment option for AC in elderly patients is intravenous antibiotic therapy. A study comparing PC and antibiotic therapy found that PC was superior.[10] One of the most common indications for PC is the lack of response to antibiotic therapy. However, the optimal duration of antibiotic therapy and the timeline for achieving a treatment response

Table 4. Examining the relationship between the procedure day and early discharge with ROC analysis

Factor	AUC (95% CI)	Cutoff points	P-value	Sensitivity (%)	Specificity (%)
Intervention timing (day)	0.763 (0.653-0.874)	3.5	<0.001	84	60.1

DISCUSSION

Although LC is the gold standard treatment for AC, individualized treatment options should be considered for patients

are unclear.[11] In our study, antibiotic therapy was continued throughout the patient's hospitalization. Additionally, PC was performed regardless of symptom duration in patients whose

symptoms persisted for more than three days and who did not exhibit adequate clinical and laboratory responses.

The rate of complications following PC has been decreasing due advancements in technology and increased experience in interventional radiology. The success rate of PC has improved over the years. In studies conducted before 2013, the major complication rate exceeded 10%, with the most common complications being catheter dislocation, bleeding, and bile leakage.[12,13] More recent studies have reported a major complication rate of less than 10%.[14] In our study, the complication rate was 7.9%, with no deaths related to complications.

Mortality during hospitalization was 5.2%, which is similar to the mortality rates reported in similar studies.[10,15] Chou et al.[12] found no significant relationship between the timing of PC interventions and mortality. Similarly, our study found no association between PC intervention timing and mortality. The parameter closest to statistical significance was albumin level (p=0.092), with lower albumin levels observed in patients who experienced mortality. In addition to assessing comorbidities, the CCI and the POSSUM were calculated to better evaluate the physiological status of patients at the time of emergency admission. Both scoring systems were found to have no relationship to mortality. We believe this is because the selected patient group consisted of frail individuals with numerous comorbidities, resulting in a narrow range of CCI and POSSUM scores.

In the study by Chou et al.,[12] parameters such as the ASA score, age, total bilirubin level, and platelet count were identified as independent variables affecting hospital stay in patients undergoing PC. Intervention timing was also one of the factors affecting hospital stay. Similarly, in the study by Yirgin et al.,[15] early PC placement was associated with shorter hospital stays. However, the duration of post-intervention hospitalization was similar between patients who underwent early versus late placement of PC. These results are similar to the results of our study. Early PC placement was associated with earlier discharge and reduced hospital costs. In our study, early intervention timing was defined by ROC analysis as placement within the first three days of hospital admission. Additionally, higher serum albumin levels were associated with earlier discharge, serving as an independent variable. The Charlson Comorbidity Index was examined for comorbidities, but its relationship with a long hospital stay was not identified. The POSSUM score at the time of hospital admission was also not associated with prolonged hospital stay.

Although PC is considered a bridging therapy, some studies regard it as a permanent treatment option.[10] However, the general consensus is that PC is a bridging therapy.[5] While the recommended timing for PC catheter removal is 6-8 weeks as a bridging therapy, this timing is controversial.[16] Some studies argue that the catheter should not be removed until surgery, while others argue the opposite, suggesting that the catheter should be removed after the resolution of acute cholecystitis.[17-20] There are even studies suggesting that removing the PC catheter after two weeks is an independent risk factor for early recurrence.[21] The removal of the PC catheter should be planned on a patient-specific basis. Additionally, the PC catheter should be clamped before removal. If the patient can tolerate clamping for 24-48 hours, the catheter should then be removed.[22] In our study, we clamped the catheter after the resolution of cholecystitis and removed it if the patient tolerated clamping.

Another controversial issue is the timing of LC after PC. The decision on when to perform cholecystectomy following percutaneous cholecystostomy depends on various factors, including the patient's general health status, the severity of cholecystitis, and the presence of any complications. A retrospective study comparing patients who underwent LC within the first seven days after PC with those who underwent LC after seven days found no significant differences in operation duration, adhesions, and amount of bleeding.[23] In another study, the interval was grouped as less than 3 days, 3-14 days, and more than 14 days. It was shown that as the interval increased, the length of hospital stay decreased.[24] In the study by Giannopoulos et al.,[25] which compared interval cholecystectomy timing as less than eight weeks versus more than eight weeks, no significant difference was found between the groups. However, in the study by Altieri et al.,[26] it was concluded that performing cholecystectomy earlier than eight weeks increased complications.

The optimal management of acute cholecystitis in elderly patients remains an area of ongoing research, and further studies are needed to develop personalized treatment strategies for this vulnerable population. Our study has several limitations, including the lack of randomization in the timing of PC intervention. Additionally, the retrospective nature of the study and the inability to assess frailty scales in patients are other limitations.

CONCLUSION

As the elderly population continues to grow, more research and guidelines are needed to optimize outcomes and minimize unnecessary risks in the treatment of acute cholecystitis in this demographic group. In conclusion, the treatment of acute cholecystitis in elderly patients requires a comprehensive and individualized approach due to unique challenges and associated factors. Early PC placement can contribute to shorter hospital stays and reduced costs.

Ethics Committee Approval: This study was approved by the Health Sciences University Fatih Sultan Mehmet Training and Research Hospital Clinical Research Ethics Committee (Date: 23.03.2023, Decision No: FSM EAH-KAEK 2023/59).

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Authorship Contributions: Concept: E.T., B.A.; Design: E.T., G.N.T.; Supervision: B.A.,Y.G.; Resource: G.Y.; Materials: M.T.A.; Data collection and/or processing: A.S.Y.; Analysis

and/or interpretation: A.B.; Literature search: E.T.; Writing: E.T., G.N.T.; Critical review: B.A.

Conflict of Interest: None declared.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Akut kolesistitli yaşlı hastalarda perkütan kolesistostomi: Mortalite, morbidite ve hastanede kalış süresini etkileyen faktörler

AMAÇ: Akut kolesistit (AK) giderek yaygınlaşmakta ve özellikle yaşlı popülasyonda sağlık sistemlerine yük getirmektedir. Laparoskopik kolesistektomi (LK) kesin tedavi olsa da, çeşitli faktörlere bağlı olarak perkütan kolesistostomi (PK) de tercih edilmektedir. Yaşlı hastaların tedavisi, yaşa bağlı değişiklikler ve eşlik eden hastalıklar nedeniyle cerrahi riskleri dikkatlice değerlendiren multidisipliner bir yaklaşım gerektirir. Bu retrospektif çalışmada, acil servise başvuran ve PK uygulanan AK tanısı almış yaşlı hastalarda mortalite, morbidite ve hastanede kalış süresini etkileyen faktörleri tartışıyoruz.
GEREÇ VE YÖNTEM: Ocak 2013 ile Ocak 2021 arasında yürütülen bu retrospektif çalışma, Tokyo Kılavuzlarına göre 2. ve 3. derece AK'li ve PK uygulanan 70 yaş ve üzeri hastalara odaklandı. Laboratuvar parametreleri, eşlik eden hastalıklar ve sonuçlarla ilgili veriler toplandı ve analiz edildi.
BULGULAR: Dahil edilen 76 hasta arasında, vakaların %7.9'unda komplikasyonlar meydana geldi ve en sık görülen komplikasyon kateter çıkmasıydı. Hastanede yatış sırasında ölüm oranı %5.2 idi. Hastanede kalış süresini etkileyen faktörler arasında müdahale zamanlaması ve serum albümin seviyeleri yer alıyordu. Hastaneye yatışın ilk üç gününde perkütan kolesistostomi yerleştirilmesinin hastanede kalış süresini kısalttığı gösterilmiştir.
SONUÇ: Yaşlı hastalarda AK yönetiminde kişiselleştirilmiş tedavi stratejileri önemlidir. Erken PC yerleştirilmesi hastanede kalış süresini ve maliyetleri azaltabilir. Bu demografik grupta sonuçları optimize etmek için daha fazla araştırma ve kılavuza ihtiyaç vardır.

Anahtar sözcükler: Akut kolesistit; hastanede kalış; perkütan kolesistostomi; yaşlılık.

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