ORIGINAL ARTICLE

What is the effect of percutaneous cholesistostomy in patients with acute cholecystitis? when is the right time for the procedure?

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ABSTRACT

BACKGROUND: Acute cholecystitis (AC) is one of the most common emergency diseases in surgical practice. Although the gold standard treatment is laparoscopic cholecystectomy, percutaneous cholecystostomy (PC) is performed in some patients due to age, comorbidity, and delays in admission. We aimed to investigate the effect of timing on the clinical process of patients undergoing PC.

METHODS: Patients who underwent PC between February 2017 and December 2021 were included in the study. Those who underwent PC in the first 72 h were determined as the early PC group, and those who underwent PC after 72 h were determined as the late PC group. Demographic information of the patients, clinical information before drainage, biochemical values of the first 3 days, length of hospital stay, morbidity and mortality in the early and late period after drainage, and elective cholecystectomy information were recorded. These data were compared between the two groups.

RESULTS: One hundred and twenty-two patients were included in the study. Early PC was performed in 98 patients (80.3%) and late PC was performed in 24 patients (19.7%). The median follow-up period was 26.6 months (min:0.25-max:67) in the early PC group and 26.4 months (min:0.6-max:66) in the late PC group (P=0.408). There was no statistically significant difference in mean age, distribution of males and women, concomitant disease, Charlson Comorbidity Index, hepatopancreatobiliary pathology (HPBP), endoscopic retrograde cholangiopancreatography in history and grade (TG18) compared to Tokyo classification (P>0.05). There was no difference between the biochemical parameters (P>0.05). In our study, the median length of hospital stay was 6 (min:2-max:36) days in the early PC group, and the median was 9 days (min:5-max:20) in the late PC group (P<0.001). A total of 25 patients developed HPBP after PC, 16 of which were AC. There was no statistically significant difference between the early and late PC groups in terms of HPBP development after PC (P=0.576). There was no statistically significant difference between the early and late PC group in terms of the rate of surgery and type of operation (emergency/elective, open/laparoscopic/conversion, total/subtotal, duration) (P>0.05).

CONCLUSION: Discussions about the right timing are ongoing. In our study, we found that patients who underwent early PC had shorter hospital stays. There was no difference between the early and late groups in terms of patient characteristics and severity of AC. PC procedure in AC should be based on algorithms determined by objective data instead of patient-based indications with randomized controlled trials.

Keywords: Cholecystectomy laparoscopic; cholecystitis acute; cholecystostomy.

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INTRODUCTION

Acute cholecystitis (AC) is a disease associated with inflammation of the gallbladder, accompanied by right upper quadrant pain, fever, and leukocytosis. AC is one of the most common emergency diseases in surgical practice.[1]

The gold standard treatment for AC is cholecystectomy, which can be performed as an emergency or interval procedure.

Early cholecystectomy, which is performed within 10 days of the onset of symptoms; American association of anesthesia (ASA) III and IV group, has a mortality rate of 5–30% in high-risk patients.[2] In this group of patients, antibiotic therapy and percutaneous cholecystostomy (PC) are two different treatment alternatives.

Although an interval cholecystectomy (IC) is recommended 6–8 weeks after an AC attack,[1,3] some researchers have suggested that PC may be a definitive treatment for AC in high-risk patients who are not eligible for surgery.[4] The optimal timing for the PC is unknown.[5] Delayed PC can lead to progressive inflammation of the gallbladder, causing uncontrolled sepsis or shock. In addition, antibiotic treatment is sufficient to control AC attacks in some patient groups.

This study aimed to evaluate the effect of drainage timing on the clinical status of the disease, the length of hospital stay, and the surgical procedure to be performed afterward in patients who underwent PC due to AC.

MATERIALS AND METHODS

Our study was planned retrospectively. Approval was obtained from the local ethics committee with the number KAEK/2022.09.198.

Patients who underwent PC between February 2017 and December 2021 were included in the study. Patients with concomitant pancreatitis and cholangitis with AC and patients who underwent drainage due to mechanical icterus were excluded from the study.

Between February 2017 and December 2021, 623 patients with the diagnosis of AC were followed. Of these patients, 182 patients who underwent emergency surgery and 296 patients who were followed up with medical treatment were excluded from the study. 145 PC-treated patients were examined. Of these patients, 23 patients who underwent drainage due to mechanical ictera, pancreatitis, and cholangitis accompanying AC were excluded from the study (Fig. 1).

The diagnosis of AC was made by patient history, physical examination, laboratory data, and radiological imaging (ultrasonography and/or computed tomography). Oral nutrition of all patients was discontinued, and medical treatment with intravenous hydration and antibiotics was started on the day of hospitalization.

The PC decision of the patients was made by taking into consideration the demographic characteristics of the patients, their comorbidities, the grade of AC according to Tokyo classification (TG18), clinical status, hepatopancreatobiliary pathology (HPBP) histories, and the duration of symptoms until the onset of the disease at admission.

The PC was performed by a radiologist who placed 8–10 Fr catheters transperitoneally with the ultrasound-guided Seldinger method. Bile culture was taken from the patients during the procedure. Patients whose clinic regressed after drainage

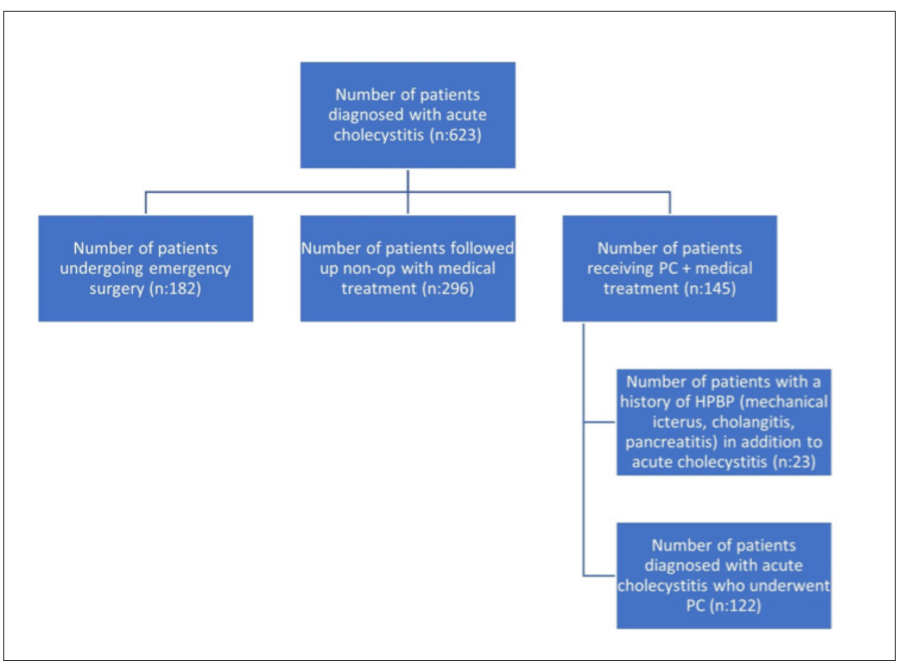

Figure 1. Flow chart of the study.

were discharged, and the catheter was checked by radiology after 3–4 weeks. After checking the bile flow for 24–48 h with the clamping test, the catheter was removed. Cholecystectomy was planned 6–8 weeks after PC.

Two groups were formed according to the time from the hospitalization of the patients to the time of PC. Those who had PC in the first 72 h were determined as the early PC group, and those who had PC after 72 h were determined as the late PC group.

Age, sex, concomitant disease, Charlson Comorbidity Index (CCI), previous HPBP histories, endoscopic retrograde cholangiopancreatography (ERCP) histories, symptom duration, and grade according to TG18 were recorded.

Biochemical parameters of patients in both groups within the first 3 days of admission from the hospital: white blood cell count (WBC), C-reactive protein (CRP), hemoglobin, PLT, BUN, creatinine, total bilirubin, direct bilirubin, alkaline phosphatase (ALP), gamma-glutamyl transferase (GGT), ALT, AST were recorded. These values were compared between both groups and in terms of their changes in the first 3 days.

Practices during hospital stay, intensive care unit hospitalization, length of hospital stay, length of stay after drainage, and hospital mortality information were recorded.

General mortality, complications, newly developed HPBP, and type of operation (emergency/elective, total/subtotal, open/laparoscopic/conversion, operative times) were recorded in the post-drainage period.

The risks of HPBP were evaluated by comparing the data of patients who had HPBP and those who did not have HPBP in the hospital and post-discharge follow-up after PC, on patients who remained after removal of patients with in-hospital mortality.

Operated and non-operated patients were compared, and their characteristics were evaluated.

Statistical Analysis

Whether the distribution of continuous and discrete numerical variables was distributed close to normal was evaluated by the Kolmogorov–Smirnov test. As a result of the goodness of fit tests, the significance of the differences between the groups in terms of continuous or discrete numerical variables where parametric test statistical assumptions were provided was evaluated by Student's t-test, while the significance of the differences in terms of continuous or discrete numerical variables where parametric test statistical assumptions were not provided was examined by Mann–Whitney U test.

In the analysis of categorical data, unless otherwise indicated, evaluation was performed by Pearson's $\chi 2$ test. On the other hand, in 2 × 2 crosstabs, if the expected frequency in at least 1/4 of the pores is below 5, the categorical data were examined by Fisher's probability test with a definite result, while the Continuity corrected $\chi 2$ test was used when the expected frequency was between 5 and 25. R × C (if at least one of the categorical variables in the row or column has more than two outcomes) was <5 in at least 1/4 of the cells in the cross-tables, and the categorical data were evaluated by the Fisher-Freeman-Halton test.

Whether there was a statistically significant change in biochemical measurements according to follow-up times within the groups was examined by analysis of variance in repetitive measurements or Friedman test using Wilks' Lambda test. If Wilks' Lambda test statistic results were found to be significant, the Bonferroni-corrected multiple comparison test was used to determine the follow-up time(s) that caused the difference with the Dunn–Bonferroni test if the results of the Friedman test statistic were found to be significant.

The most decisive factor(s) on the development of attacks after prolonged hospitalization and cholecystostomy were investigated by multivariate logistic regression analyses. As a result of univariate statistical analysis, all variables determined as P<0.25 were included in the regression models as candidate risk factors. In addition, the odds ratio, 95% confidence intervals, and Wald statistics for each variable were calculated.

The data were analyzed in the IBM SPSS Statistics 25.0 (IBM Corporation, Armonk, NY, US) package program. Unless otherwise indicated, the results for P<0.05 were considered statistically significant. However, Bonferroni correction was made to control the Type I error in all possible multiple comparisons.

RESULTS

Of the 122 patients, 98 (80.3%) underwent early PC, while 24 patients (19.7%) underwent late PC. In our study, drainage was applied to 29 (23.8%) patients on the day of admission to the hospital, 17 (13.9%) patients on the 1st day of follow-up, 37 (30.3%) patients on the 2nd day, 15 patients (12.3%) on the 3rd day, 11 (9%) patients on the 4th day, 5 (4.1%) patients on the 5th day, 4 (3.3%) patients on the 6th day, 2 (1.6%) patients on the 7th day, 1 (0.8%) patient on the 8th day, 1 (0.8%) patient on the 9th day. Tables 1 and 2 show the comparisons of demographic and clinical characteristics of the cases according to the time of PC.

There was no statistically significant difference in terms of mean age, distribution of males and women, concomitant disease, CCI, HPBP, and ERCP history, and grade according to TG18 classification between the early and late PC group (P>0.05). The median symptom duration was 4 days (min:1-max:22) in the early PC group and the median symptom duration was 6.5 days (min:1-max:11) in the late PC group. (P<0.001) The median follow-up period was 26.6 months (min:0.25-max:67) in the early PC group and 26.4 months (min:0.6-max:66) in the late PC group (P=0.408).

In our study, the median length of hospital stay was 6 (2–36) days in the early PC group, while 9 days (5–20) t in the late

Table 1. Demographic and clinical characteristics of the cases according to the time of cholecystostomy

	0–72 h (n=98, 80.3%)	>72 h (n=24, 19.7%)	Total (n=122)	P-value
Age (years) *	66.6±17.7	65.5±18.5	66.4±17.8	0.789†
Gender (%)				0.494‡
Male	47 (48.0)	14 (58.3)	61 (50.0)	
Female	51 (52.0)	10 (41.7)	61 (50.0)	
Concomitant disease (%)	65 (66.3)	11 (45.8)	76 (62.3)	0.105‡
DM	37 (37.8)	5 (20.8)	42 (34.4)	0.185‡
HT	44 (44.9)	7 (29.2)	51 (41.8)	0.242‡
CAD	18 (18.4)	2 (8.3)	20 (16.4)	0.358¶
Other cardiac	8 (8.2)	3 (12.5)	11 (9.0)	0.451¶
Other	29 (29.6)	3 (12.5)	32 (26.2)	0.148‡
Charlson Comorbidity Index** (%)	1 (0–7)	1 (1–2)	1 (0–7)	0.617¥
Pre-PC HPBP history	18 (18.4)	8 (33.3)	26 (21.3)	0.185‡
Pre-PC ERCP history	14 (14.3)	6 (25.0)	20 (16.4)	0.224¶
Symptom duration (days)	4 (1–22)	6.5 (1–11)	5 (1–22)	<0.001¥
Tokyo classification (%)				0.381§
Grade I	59 (60.2)	18 (75.0)	77 (63.1)	
Grade II	29 (29.6)	4 (16.7)	33 (27.1)	
Grade III	10 (10.2)	2 (8.3)	12 (9.8)	
Total follow-up time (months)	26.6 (0.25–67)	26.4 (0.6–66)	26.5 (0.25–67)	0.408¥

Descriptive statistics were expressed as * mean ± standard deviation or ** median (minimum-maximum). HPIP: Hapato pancreatic biliary pathology; † Student's t test; ‡ Continuity-corrected χ2 test; Fisher's probability test with definite results; ¥ Mann Whitney U test; § Pearson's χ2 test. N/A: No evaluation was made.

PC group was (P<0.001). There was no significant difference in the length of hospital stay after drainage between the early PC group (min:1-max:30) and the late PC group (min:2-max:11) (P=0.390).

It was seen that the patients who have higher TG18 grades also have longer hospitalization (>7 days) and higher drainage times (P=0.003, P<0.001, respectively). As a result of our analysis by evaluating all the parameters (TG18 grade, BUN, ALP, GGT, cholecystostomy time) were found to be significantly effective on the TG18 grade and the prolongation of cholecystostomy time (P=0.026, P<0.001, respectively).

In the post-drainage period, 25 patients were admitted to the emergency department due to HPBP. ERCP was performed in 9 patients in the post-drainage period. Of these patients, 7 presented with mechanical icterus caused by choledocholithiasis, one with cholangitis, and one patient with recurrent pancreatitis and mechanical icterus. ERCP procedure was performed in 6 patients in the preoperative period, in the postoperative period in 1 patient, and in 2 patients who did not undergo surgery. There was no statistically significant difference between the early and late PC groups in terms of HPBP and ERCP after drainage. (P=0.576, P=0.687, respectively)

There was no statistically significant difference between the early and late PC groups in terms of the rate of surgery (53 patients in the early PC group, 66.2%; 9 patients in the late PC group 47.4%), the time from drainage to surgery, cholecystectomy planning (emergency/elective), the type of cholecystectomy (open, laparoscopic, conversion), the completion of cholecystectomy (total/subtotal) and the duration of the operation (P>0.05).

Tables 3 and 4 show comparisons in terms of biochemical measurements of cases according to their cholecystostomy and follow-up times. There was no difference between the biochemical parameters between the early and late PC groups between the 0th day, 1st day, and 3rd day. (P>0.05). When the groups were evaluated in detail, WBC, CRP, Hemoglobin, PLT, BUN, creatinine, total bilirubin, and direct bilirubin values decreased in the early PC group within the first 3 days and a statistically significant difference was found (P<0.001). In the late PC group, WBC, BUN, creatinine, total bilirubin, and ALT values decreased in the first 3 days of follow-up and a statistically significant difference was found (P<0.001, P=0.002, P=0.006, P=0.002, P=0.002, P=0.002, respectively)

A total of 25 patients developed HPBP after PC, 16 of whom had AC. In Table 5, comparisons are made in demographic and clinical characteristics of the cases according to the groups with and without HPBP after PC. The group that had HPBP after PC and the group that did not have HPBP were as follows: there was no statistically significant difference in all parameters examined (P>0.05).

As a result of the comparisons made in demographic and clini-

Table 2. Other clinical findings of the cases according to the time of cholecystostomy

	0–72 h (n=98)	>72 h (n=24)	Total (n=122)	P-value
ICU hospitalization	7 (7.1%)	1 (4.2%)	8 (6.6%)	>0.999‡
Length of stay in the ICU (days)*	0 (0–21)	0 (0–10)	0 (0–21)	0.584¶
Hospitalization (days)*	6 (2–36)	9 (5–20)	6 (2–36)	<0.001¶
Hospitalization >7 days	29 (29.6%)	17 (70.8%)	46 (37.7%)	<0.001†
Length of stay after drainage (days)*	5 (1–30)	4 (2–11)	4.5 (1–30)	0.390¶
Hospital mortality	4 (4.1%)	1 (4.2%)	5 (4.1%)	>0.999‡
Overall mortality	18 (18.4%)	5 (20.8%)	23 (18.9%)	0.775‡
The post-PC HPBP story	19 (19.4%)	6 (25.0%)	25 (20.5%)	0.576‡
ERCP performed after drainage	8 (8.2%)	1 (4.2%)	9 (7.4%)	0.687‡
Surgical status				0.206†
Not	27 (33.8%)	10 (52.6%)	37 (37.4%)	
Done	53 (66.2%)	9 (47.4%)	62 (62.6%)	
Op time after drainage (weeks) *	9 (0.14–124)	9.5 (3–104)	9 (0.14–124)	0.898¶
Cholecystectomy planning				0.328‡
Urgent	6 (11.3%)	2 (22.2%)	8 (12.9%)	
Elective	47 (88.7%)	7 (77.8%)	54 (87.1%)	
Cholecystectomy type				0.206¥
Open	1 (1.9%)	1 (11.1%)	2 (3.2%)	
Laparoscopic	49 (92.5%)	7 (77.8%)	56 (90.3%)	
Conversion	3 (5.7%)	1 (11.1%)	4 (6.5%)	
Completion of cholecystectomy				>0.999‡
Total	50 (94.3%)	9 (100.0%)	59 (95.2%)	
Subtotal	3 (5.7%)	0 (0.0%)	3 (4.8%)	
Duration of surgery (min) *	55 (15–140)	67.5 (40–120)	60 (15–140)	0.653¶

Descriptive statistics; * expressed in median (minimum-maximum) format. † $\chi2$ test with continuity correction; ‡ Fisher's probability test with exact result; ¶ Mann–Whitney U test; ¥ Fisher-Freeman-Halton test.

cal characteristics of the cases according to the non-operated (n=37) and operated (n=62) groups after the removal of 23 patients with mortality in follow-up. The mean age of the operated group was statistically significantly lower (P=0.002) than the non-operated group and CCI and TG18 the grades were statistically significantly lower than the operated group (P=0.005, P=0.008, respectively). There was no statistically significant difference between the operated group and the non-operated group, in male-female distribution and HPBP history (P=0.262, P=0.999, respectively).

DISCUSSION

Although laparoscopic cholecystectomy is the gold standard treatment for AC, PC is an alternative treatment option for elderly patients with comorbidities and stage II and III (TG 18).[6]

In a systematic review of 312085 patients covering the years 2006–2016 published in 2018, it was seen that PC was used in bridging therapy and definitive treatment until cholecystectomy, although there were great differences in the indications, timing, and management of PC.[7]

In a systematic review of more than 1700 AC patients, authors had shown that 85.6% of PC procedures were performed successfully.[8] However, there is no complete consensus on its timing and indications.[5,9-11] When it comes to the optimal timing for drainage, there are differences in studies ranging from 6 h to 77 days.[7]

In a study that determined the 24-h limit for early and late PC, although the clinical status of the patients in the early group was worse, the length of hospital stay and the rate of bleeding due to the procedure was less in the early group than in the late group. The authors think that early PC may be more appropriate when patients have severe sepsis/septic shock, uncontrollable fever/pain, or local gallbladder complications.[12]

The most common reason for the application of PC was failure to respond to medical treatment with intravenous antibiotics, but there was no consensus among publications on the exact duration of antibiotic therapy.[7] Chok et al. suggested that response control to antibiotics should be done after three to four intravenous doses of antibiotics.[13]

Our clinical approach is to perform emergency cholecystec-

Table 3. Biochemical measurements of cases according to cholecystostomy and follow-up times

	0.day	1.day	3.day	P-value †
WBC 103				
0–72 h	13.96 (11.40–20.17)[a]	13.32 (10.12–18.00)[b]	8.00 (6.08–11.12)[a,b]	<0.001¶
>72 h	15.07 (9.86–17.77)[a]	12.95 (10.12–20.20)[b]	8.21 (6.82–9.28)[a,b]	<0.001¶
P-value ‡	0.691¥	0.764¥	0.675¥	
CRP				
0–72 h	186.0 (34.0–273.0)[a]	261.0 (127.5–309.0)[b]	93.0 (47.0–124.0)[a,b]	<0.001¶
>72 h	205.0 (75.0–284.0)	185.0 (157.0–301.0)	93.0 (46.0–120.0)	0.029¶
P-value ‡	0.788¥	0.319¥	0.920¥	
Hemoglobin				
0–72 h	13.04±1.89[a,c]	11.84±1.84[c]	11.31±1.53[a]	<0.001¶¶
>72 h	12.42±2.38	11.43±1.85	11.27±1.66	0.046¶¶
P -value ‡	0.359¥¥	0.513¥¥	0.938¥¥	
PLT				
0–72 h	243.0 (194.0–309.0)	231.0 (174.0–289.0)[b]	257.0 (229.0–370.0)[b]	<0.001¶
>72 h	234.0 (210.0–395.0)	257.0 (195.0–279.0)	297.0 (253.0–393.0)	0.039¶
P-value ‡	0.414¥	0.390¥	0.114¥	
BUN				
0–72 h	18.30 (12.03–23.94)[a]	16.82 (10.71–21.73)	10.73 (6.75–13.79)[a]	<0.001¶
>72 h	16.59 (9.92–22.32)[a]	11.94 (7.83–13.20)	7.27 (5.61–9.26)[a]	0.002¶
p-değeri ‡	0.608¥	0.048¥	0.054¥	
Creatinine				
0–72 h	0.91 (0.78–1.10)[a,c]	0.81 (0.67–0.97)[c]	0.76 (0.60–0.85)[a]	<0.001¶
>72 h	0.87 (0.72–0.98)[a]	0.71 (0.57–1.03)	0.62 (0.49–0.71)[a]	0.006¶
P-value‡	0.336¥	0.192¥	0.039¥	

Descriptive statistics; median [25th percentile-75th percentile] or mean ± standard deviation. † Comparisons between follow-up times when the cholostopostomy times were kept constant, the results for P<0.025 according to the Bonferroni correction were considered statistically significant. ‡ Comparisons by cholostostomy time at each follow-up time, results for P<0.0167 according to Bonferroni correction were considered statistically significant. ¶ Friedman test, ¶¶ Analysis of variance in repetitive measurements, Wilks' Lambda test, ¥ Mann Whitney U test, ¥¥ Student's t test. a: The difference between day 0 and day 3 was statistically significant (P<0.01), b: The difference between day 1 and day 3 was statistically significant (P<0.01), c: The difference between day 0 and day 1 was statistically significant (P<0.01).

tomy in patients presenting up to 10 days from the onset of symptoms, as recommended in the World Society of Emergency Surgery guidelines.[6] However, due to the risk of surgery and the duration of onset of symptoms, PC alone or in combination with antibiotic therapy is applied as the first choice instead of surgery. We determined the 72-h limit by taking into account the antibiotic dose administered in our study. Some patients underwent PC within the first 3 days without waiting for their response to antibiotics due to the gravity, comorbidities, and clinical conditions of AC tables. The response of some patients to antibiotic treatment for 3 days was evaluated by clinical and biochemical parameters. PC was applied to patients who did not have regression in their clinic. However, there was no significant difference between the early and late PC groups in terms of age, CCI, and disease severity according to the Tokyo classification (P>0.05). This situation was considered an indication of the uncertainty in the literature and its reflection in our clinical practice.

When we looked at the laboratory values in the early and late PC groups, there was no difference between the early and late PC groups in the first 3 days (P>0.05). However, when we evaluated the groups in detail, it was seen that there was a significant decrease in WBC and CRP values from infection parameters in the first 3 days in the early PC group, while only a significant decrease in WBC value was seen in the late PC group (P<0.001). This situation is similar to the studies indicating that significant reductions in clinical improvement, WBC, and CRP levels are seen within an average of 3–4 days after PC placement.[14,15]

A multivariant analysis of the length of hospital stay found that delay in intervention, advanced age, higher pulse rate in the emergency department, lower platelet count, higher serum total bilirubin levels and ASA score IV were independent risk factors.[12] In our study, it was seen that the elevation of TG18 grade and the delay in the time of cholecystostomy

Table 4. Biochemical measurements of cases according to cholecystostomy and follow-up times – read more

	0.day	1.day	3.day	P-value †
Total bilirubin				
0-72 h	1.00 (0.62–1.63)[a]	0.84 (0.43–1.36)[b]	0.52 (0.30–0.74)[a,b]	<0.001
>72 h	0.63 (0.42–1.68)[a]	0.64 (0.39–1.08)	0.45 (0.26–0.65)[a]	0.002
P-value ‡	0.255	0.396	0.506	
Direct bilirubin				
0–72 ours	0.42 (0.21–0.82)[a]	0.30 (0.19–0.56)[b]	0.22 (0.12–0.37)[a,b]	<0.001
>72 saat	0.32 (0.17–0.53)	0.28 (0.10–0.50)	0.27 (0.16–0.41)	0.417
P-value ‡	0.560	0.275	0.694	
ALP				
0–72 h	109.0 (83.5–180.0)	101.0 (82.0–172.5)	106.0 (80.0–162.5)	0.091
>72 h	84.0 (64.7–98.7)	073.5 (57.5–111.0)	69.0 (58.0–152.0)	0.419
P-value ‡	0.041	0.041	0.176	
GGT				
0–72 h	46.0 (23.0–99.5)	76.0 (24.5–121.5)	78.0 (37.0–143.5)	0.913
>72 h	39.0 (11.0–82.5)	32.0 (10.5–91.0)	36.0 (23.5–149.0)	0.439
P-value ‡	0.487	0.152	0.348	
ALT				
0–72 h	21.0 (11.2–39.7)	21.0 (12.2–43.0)	21.5 (12.0–35.7)	0.138
>72 h	15.0 (13.2–21.7)[c]	11.5 (9.0–15.0)[c]	13.0 (8.7–32.0)	0.002
P-value ‡	0.298	0.018	0.274	
AST				
0–72 h	21.0 (17.5–45.5)	27.0 (15.0–34.5)	22.0 (18.0–36.5)	0.320
>72 h	19.5 (16.7–37.5)	18.0 (11.0–24.5)	21.5 (15.2–32.0)	0.388
P-value ‡	0.730	0.089	0.711	

The results for P<0.025 according to the Bonferroni correction of the Friedman test were considered statistically significant. ‡ Comparisons according to cholostostomy time at each follow-up time, Mann Whitney U test, results for P<0.0167 according to Bonferroni correction were considered statistically significant. a: The difference between day 0 and day 3 was statistically significant (P<0.01), b: The difference between day 1 and day 3 was statistically significant (P<0.001), c: The difference between day 0 and day 1 was statistically significant (P<0.001)

prolonged hospitalization. Although the total length of hospital stay was longer in the late PC group, there was no significant difference between the length of stay after drainage in the early and late PC groups. The absence of a significant difference in the length of stay after drainage may cause an interpretation that it would be more appropriate to make the drainage decision in the early period. However, considering the patients who are not included in our study, such as age, duration of symptoms at hospital admission, comorbidities, bleeding diathesis, and patients whose symptoms regress with medical treatment, it should be kept in mind that early preference of PC has the risk of unnecessary invasive procedures on patients.

Complications of PC include catheter dislocation, bleeding, sepsis, bile leakage, intestinal perforation, pneumothorax, and vasovagal reactions.[12] In the study conducted by Sanjay et al., the complication rate was stated as 10%.[16] Winbladh et al.[8] identified catheter migration as the most common complication, with a rate of 8.6%. The post-PC bleeding rate was reported as 1.9%.[16] The transhepatic approach has a higher bleeding rate than the transperitoneal route.[17] In our study, all our patients underwent drainage by the same route (transperitoneal route). In our study, there was no bleeding from the catheter or deterioration in the hemodynamics of the patients. However, there was a significant decrease in hemoglobin values in the first 3 days in the early PC group. (P<0.001) 11 patients were admitted due to catheter dislocation within the first 3 weeks after discharge, 5 of these patients underwent catheter revision, while the other 6 patients were not considered for catheter revision.

In a study comparing patients who underwent PC in the first 24 h and afterward, there was no significant difference between the two groups in terms of in-hospital mortality.[12] In a multivariate analysis, low mean arterial pressure (<65 mmHg) was noted as an important risk factor for mortality.[12]

In our study, none of the patients died directly due to complications related to the procedure. Our in-hospital mortality

Table 5. Demographic and clinical characteristics of cases according to the HPBP

	HPBP no (n=92)	HPBP yes (n=25)	P-value
Age (years) *	66.8±16.6	61.2±20.9	0.162†
Gender (%)			0.111‡
Male	52 (53.6)	9 (36.0)	
Woman	40 (43.5)	16 (64.0)	
Charlson Comorbidity Index **	1 (1–7)	1 (0–2)	0.481¶
Pre-PC HPBP history (%)	19 (20.7)	7 (28.0)	0.608‡
Pre-PC ERCP (%)	16 (17.4)	4 (16.0)	>0.999¥
Tokyo classification (%)			0.743§
Grade I	59 (64.1)	18 (72.0)	
Grade II	27 (29.4)	6 (24.0)	
Grade III	6 (6.5)	1 (4.0)	
Basal biochemistray measurements			
WBC ***	14.97 (11.35–18.95)	16.71 (11.16–21.35)	0.724¶
CRP ***	166.0 (57.5–275.5)	186.0 (29.5–267.5)	0.842¶
Hemoglobin *	12.8±1.96	13.0±1.78	0.712†
PLT ***	243.5 (203.2–321.5)	249.0 (179.5–344.0)	0.751¶
Albümin *	3.46±0.56	3.71±0.71	0.371†
BUN ***	16.17 (11.68–24.07)	15.93 (12.72–18.65)	0.478¶
Creatinine ***	0.91 (0.75–1.12)	0.85 (0.82–1.04)	0.444¶
Total bilirubin ***	0.97 (0.63–1.61)	0.80 (0.57–1.68)	0.830¶
Direkt bilirubin ***	0.42 (0.26–0.70)	0.46 (0.24–1.16)	0.961¶
ALP ***	97.0 (76.2–149.5)	117.0 (97.0–229.0)	0.160¶
GGT ***	45.0 (20.5–86.0)	42.0 (15.0–193.0)	0.678¶
ALT ***	20.0 (14.0–39.0)	23.0 (11.5–43.0)	0.953¶
AST ***	22.5 (18.0–46.8)	22.5 (16.5–37.0)	0.700¶
Drainage timing (days) **	2 (0–8)	2 (0–9)	0.615¶
Length of hospital stay (days) **	6 (2–36)	7 (3–36)	0.321¶
Cholecystostomy time (%)			0.574¥
0–72 h	75 (81.5)	19 (76.0)	
>72 h	17 (18.5)	6 (24.0)	
Cholecystostomy withdrawal time**	24.5 (7–112)	26 (1–126)	0.670¶

Descriptive statistics; * mean ± standard deviation, expressed as ** median (minimum-maximum) or *** median [27th percentile-75th percentile]. HPIP: Hapato pancreatic biliary pathology, † Student's t test, ‡ Continuity-corrected $\chi 2$ test, ¶ Mann Whitney U test, ¥ Fisher's probability test with definite results, § Pearson's $\chi 2$ test.

rate was similar, although the co-morbidity rates of patients in the early PC group and grade 2–3 patient rates in the Tokyo guideline were higher, although not statistically significant, than in the late PC group.

The timing of the removal of PC tubes is controversial.[6,18] Publications stating that the removal of the PC tubes should be postponed until surgery, as well as publications suggesting that the PC tube should be removed after the resolution of AC.[15,16,19,20-22]

It is recommended to remove the tube because the tract matures within 3–6 weeks after the insertion of the PC catheter. The long stay of the tube increases the risk of biliary pathology and there is no increase in the risk of attack compared to those performed in the patient groups who did not undergo IC.[23] Hsieh et al. noted that a drainage period of >2 weeks was associated with increased recurrence within 2 months of the initial AC attack, possibly caused by bacterial colonization of the PC or tube.[24,25] In our study, we tended to remove the cholecystostomy tube between 3 and 6 weeks (54.1%). Only 5 of the patients had a cholecystostomy tube during surgery.

It is recommended to perform a clamping test before removing the PC catheter.[23] Although there is no standard clamping test, patients should be able to tolerate continuous clamping for at least 24–48 h.[20,26] During the clamping period, there should be no relapse symptoms or signs; otherwise, the PC catheter should not be removed.[23]

During the follow-up period, the recurrence rate of biliary events due to deaths due to causes other than biliary causes cannot be demonstrated.[23] In studies, the recurrence rate after PC placement ranged from 4% to 22%.[9,10,16,21] In our study, HPBP developed in 19.4% of the early cholecystostomy group and 25% of the late cholecystostomy group. (P=0.576) In all patients, this rate is 20.5%.

In one study, recurrence rates were found to be low within 2 months (12/184, 6.5%) and 1 year (17/184, 9.2%) after successful PC treatment.[26] These low recurrence rates have been linked to retention of the PC catheter in place until cholecystectomy in patients at high risk of recurrence (86/279; 30.8%) and laparoscopic cholecystectomy after PC treatment.[22] Two independent risk factors have been identified for permanent PC tubes: age >75 years and serum ALP levels> 135 IU/L.[16] When we compared the patients who had HPBP (n=25) in the post-PC, in-hospital, and post-discharge period after removing 5 patients with in-hospital mortality (n=92) with the patients who did not have HPBP (n=92), there was no significant difference in all the parameters examined (P>0.05). A risk factor for the development of HPBP after PC could not be identified.

The rate of IC after PC has been reported as 23–57% in different studies.[27,28] In our study, this rate was 66.2% in the early PC group, 47.4% in the late PC group, and 62.6% in the overall total (P=0.206). When we looked at the operated and non-operated patients, their grade was found to be significantly lower in the operated group than in the age, CCI, and TG18. (P=0.002, P=0.005, P=0.008, respectively)

The median surgery time after PC was 9 weeks (min: 0.14-max 124) in the early group, 9.5 weeks in the late group (min 3-max 104), and 9 weeks overall (min 0.14-max 124) (P=0.898). Of the 16 (25%) patients who underwent surgery within 6–8 weeks after PC, 14 were early and 2 were in the late PC group. This change in the time of surgery was not our clinical approach, but the hesitancy of the patients about the operation due to their age and comorbidities.

In a study comparing operative data between patients who underwent laparoscopic cholecystectomy early (<10 days) and late (10 days or longer) after PC, no statistical differences were found when comparing mean operative time, conversion rates, and postoperative morbidity. (P=0.459, P=0.435, P=0.343, respectively).[29] In our study, 6 patients (11.3%) in the early PC group, 2 patients (22.2%) in the late PC group, and 8 patients (12.9%) in total were operated under emergency conditions (P=0.328).

In the early PC group, subtotal cholecystectomy was performed in 3 patients. Conversion cholecystectomy was performed in 3 patients (5.7%) in the early PC group and 1 patient (11.1%) in the late PC group (P>0.999, P=0.206, respectively). These findings are based on Bikel et. It contradicts the study in which they found that the conversion rates were lower in patients with early PC (<2 days) than in patients with late PC (3–6 days).[30] The operation time was 55 (min:15-max:140) minutes in the early PC group, 67.5 (min:40-max:120) minutes in the late PC group, and 60 (min:15-max:140) minutes in the overall group (P=0.653). Similar conversion rates and operative times were interpreted as cholecystostomy time, not affecting the difficulty of IC.

The mortality rate of laparoscopic cholecystectomy following PC was shown in 5 patients (0.96%) in a study of 523 patients.[8,31] In our study, none of the 62 patients who underwent surgery had surgery-related mortality.

It was stated that the deaths that occurred in these patients during the follow-up period were mostly due to non-cognitive causes.[14,15,19,26,32,33] In our study, the overall mortality rate was 18.4% in the early PC group and 20.8% in the late PC group (P=0.775). Patients were mortal due to comorbid disorders (coronary artery disease, cerebrovascular disease, etc.).

Our study has some limitations. First, this is a retrospective study. Second, although the TG18 guideline was used for disease severity, a radiological grading of AC was not performed. We think that the wall thickness of the gallbladder, its hydrop, its relationship with the surrounding organs, and its compression of the biliary tract will affect the clinical course of the disease and the IC process. Although our rate of patients hospitalized in the intensive care unit is 6.6% (n=8) and there are similar rates and similar hospitalization periods among the early-late groups, the fact that the clinical data such as blood pressure, pulse, and fever are not taken into consideration at the time of admission and follow-up of the patients is another limitation.

CONCLUSION

Discussions on PC timing are ongoing. In our study, we found that patients with early PC had a shorter hospital stay than those with late PC. There was no difference between the early and late groups in patient characteristics and the severity of AC. We think that PC applications in AC in randomized controlled studies should be based on algorithms determined by objective data rather than patient-based indications. Thus, unnecessary PCs are avoided, and patients with indications can also have PCs in the earlier period. We think that the hospital stay will be shortened by applying it.

Ethics Committee Approval: This study was approved by the Kanuni Sultan Süleyman Training and Research Hospital Ethics Committee (Date: 20.09.2022, Decision No: KAEK/2022.09.198).

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ORİJİNAL ÇALIŞMA - *ÖZ*

Akut kolesistitli hastalarda perkütan kolesistostominin etkisi nedir? İşlem için doğru zaman ne zaman?

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AMAÇ: Akut Kolesistit (AK), cerrahi pratikte en sık görülen acil hastalıklardan biridir. Altın standart tedavi laparoskopik kolesistektomi olmasına rağmen, bazı hastalarda yaş, komorbidite ve başvurudaki gecikmeler nedeniyle perkütan kolesistostomi (PK) uygulanmaktadır. PK uygulanan hastalarda zamanlamanın klinik sürece etkisini araştırmayı amaçladık.

GEREÇ VE YÖNTEM: Şubat 2017 ile Aralık 2021 tarihleri arasında PK uygulanan hastalar çalışmaya dahil edildi. İlk 72 saatte PK uygulananlar erken PK grubu, 72 saat sonra uygulananlar ise geç PK grubu olarak belirlendi. Hastaların demografik bilgileri, drenaj öncesi klinik bilgileri, ilk üç gün biyokimyasal değerleri, hastanede kalış süreleri, drenaj sonrası erken ve geç dönemde morbidite ve mortalite, elektif kolesistektomi bilgileri kaydedildi. Bu veriler iki grup arasında karşılaştırıldı.

BULGULAR: Çalışmaya 122 hasta dahil edildi. 98 hastaya (%80.3) erken PK, 24 hastaya (%19.7) geç PK uygulandı. Medyan takip süresi erken PK grubunda 26.6 ay (min: 0.25-maks: 67), geç PK grubunda 26.4 ay (min: 0,6-maks: 66) idi (p=0.408). Tokyo sınıflamasına göre ortalama yaş, erkek ve kadın dağılımı, eşlik eden hastalık, Charlson komorbidite indeksi (CCI), hepatopankreatolilier patoloji (HPBP), endoskopik retrograd kolanjiyopankreatografi (ERCP) ve derece (TG18) açısından istatistiksel olarak anlamlı bir fark yoktu (p>0.05). Biyokimyasal parametreler arasında fark yoktu (p>0.05). Çalışmamızda erken PK grubunda ortalama hastanede kalış süresi 6 (min: 2-maks: 36) gün, geç PK grubunda ortalama 9 gün (min: 5-maks: 20) idi (p< 0.001). PK'den sonra 16'sı akut kolesistit olan toplam 25 hastada HPBP gelişti. Erken ve geç PK grupları arasında PK sonrası HPBP gelişimi açısından istatistiksel olarak anlamlı fark yoktu (p=0.576). Ameliyat oranı ve ameliyat tipi (acil/elektif, açık/laparoskopik/konversiyon, total/subtotal, süre) açısından erken ve geç PK grubu arasında istatistiksel olarak anlamlı fark yoktu (p>0.05).

SONUÇ: Doğru zamanlamayla ilgili tartışmalar devam etmektedir. Çalışmamızda erken PK uygulanan hastaların hastanede kalış sürelerinin daha kısa olduğunu bulduk. Hasta özellikleri ve akut kolesistit şiddeti açısından erken ve geç gruplar arasında fark yoktu. Akut kolesistit tedavisinde PK işlemi, hasta bazlı endikasyonlar yerine, randomize kontrollü çalışmalarla objektif verilerle belirlenen algoritmalara dayanmalıdır.

Anahtar sözcükler: Kolesistit akut; kolesistostomi; kolesistektomi laparoskopik.

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