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When to remove the drainage catheter in patients with percutaneous cholecystostomy?

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SUMMARY

OBJECTIVE: The treatment for patients with acute calculous cholecystitis who have high surgical risk with percutaneous cholecystostomy instead of surgery is an appropriate alternative choice. The aim of this study was to examine the promising percutaneous cholecystostomy intervention to share our experiences about the duration of catheter that has yet to be determined.

METHODS: A total of 163 patients diagnosed with acute calculous cholecystitis and treated with percutaneous cholecystostomy between January 2011 and July 2020 were reviewed retrospectively. The Tokyo Guidelines 2018 were used to diagnose and grade patients with acute cholecystitis.

RESULTS: The mean age was 71.81±12.81 years. According to the Tokyo grading, 143 patients had grade 2 and 20 patients had grade 3 disease. The mean duration of catheter was 39.12±37 (1–270) days. Minimal bile leakage into the peritoneum was noted in 3 (1.8%) patients during the procedure. The rate of complications during follow-up of the patients who underwent percutaneous cholecystostomy was 6.9% (n=11), and the most common complication was catheter dislocation. Cholecystectomy was performed in 33.1% (n=54) of the patients at follow-up. Post-cholecystectomy complication rate was 12.9%. At the follow-up, the rate of recurrent acute cholecystitis episodes was 5.5%, while the mortality rate was 1.8%. The length of follow-up was five years.

CONCLUSIONS: The rate of recurrence was significantly higher among the patients with catheter for <21 days. We recommend that the duration of catheter should be minimum 21 days in patients undergoing percutaneous cholecystostomy.

KEYWORDS: Acute cholecystitis. Cholecystostomy.

INTRODUCTION

Acute cholecystitis is one of the most common diseases in surgical clinics in developed countries[1]. According to the Tokyo Guidelines 2018 (TG18), percutaneous cholecystostomy (PC) can be performed in a selected group of grade 2 and three patients who are considered not being able to handle the high-risk surgery. However, the eligible patient selection for PC and the subsequent management of these patients in the clinic have not been clearly defined[2]. Patients with multiple comorbidities, late presentation to healthcare facility after the onset of symptoms, and unresponsive to antibiotic therapy are the candidates for PC[3]. Patients with high-grade disease according to the TG18 severity rating are associated with prolonged hospital stays and more common complications[4]. Surgical treatments tried to be minimized every passing day[5]. Our aim was to analyze the clinical follow-up of patients undergoing PC to determine the safe timing that can be recommended for the removal of the catheter by the algorithms to be created, thereby contributing to the development of treatment algorithms.

METHODS

This retrospective cohort study was conducted at the Haydarpasa Numune Training and Research Hospital, Istanbul, which is a tertiary care referral center. A total of 163 patients diagnosed with acute calculous cholecystitis and treated with PC between January 2011 and July 2020 were included. Upon the ethics committee approval (N°. HNEAH-KAEK 2021/KK/5), the hospital database was used to review the patients who had an entry for the "PC" procedure. The Tokyo Criteria were used for the diagnosis of acute cholecystitis[4]. Inclusion criteria were as follows:

- Patients with grades 2–3 acute cholecystitis according to the TG18 criteria,
- Patients with acute cholecystitis presenting to the hospital more than 72 h after the onset of symptoms and/or not clinically responding to intravenous (IV) antibiotic therapy within 48–72 h.
- Exclusion criteria were as follows:
- Patients undergoing PC for biliary drainage due to reasons such as malignancy and bile duct strictures.
- Patients with acute acalculous cholecystitis.

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Routine abdominal ultrasonography was performed in all patients. PC was performed by an experienced radiologist under local anesthesia, using the Seldinger technique under ultrasound guidance by a transhepatic or transperitoneal approach. A culture antibiogram was tested using the bile samples collected from each patient as a routine during PC. Stasis enzymes, bilirubin, white blood cell (WBC) and C-reactive protein (CRP) values before PC, and WBC and CRP values at discharge after PC were recorded for all the patients. The time from the onset of symptoms (days), comorbidities, American Society of Anesthesiologists (ASA) scores, names of microorganisms in case of growth in the culture, the timing of drainage tube removal, the technique for tube placement, the presence/absence of recurrent acute calculous cholecystitis episodes (recurrence) after PC at the follow-up, the presence/absence of cholecystectomy, and complications were recorded. The length of follow-up was five years.

The IBM SPSS Statistics version 22 (IBM SPSS, Turkey) software package was used for the statistical analyses of the study data. The normality of the parameters was tested using the Shapiro-Wilk test. In addition to the descriptive statistical methods (mean, standard deviation, and frequency), the Mann-Whitney U test was used to compare quantitative data and non-normally distributed parameters between two groups. A $p<0.05$ was considered statistically significant.

Table 1. Distribution of general characteristics.

		Mean±SD	Min–Max
Age (years)		71.81±12.81	32–96
Length of hospital stay (median)		10.64±7.45 (8)	1–44
Duration of complaints (days) (median)		3±1.09 (3)	1–10
The day of hospital stay for PC		2.52±2.26 (2)	0–17
Duration of catheter (n=160)		39.12±37 (30)	1–270
Timing of cholecystectomy (n=54)		72.33±61.61 (55.5)	7–365
		n	%
Sex	Male	100	61.3
	Female	63	38.7
ASA	2	20	12.3
	3	37	22.7
	4	106	65
Tokyo grading	2	143	87.7
	3	20	12.3
Comorbidities	No	10	6.1
	Yes	153	93.9

ASA: American Society of Anesthesiologists; PC: percutaneous cholecystostomy; SD: standard deviation.

RESULTS

The mean length of hospital stay was 10.64±7.45 days, and the mean time from the onset of complaints to presentation to healthcare facility was 3±1.09 days. Of a total of 163 patients, 61.3% were males. The mean age was 71.81 years. There was at least one comorbidity, and mostly multiple comorbidities, in 153 of the patients. PC was performed by a transhepatic approach in 111 (68.1%) patients and by a transperitoneal approach in the remaining patients. The most commonly used one was 8F (71.8%) catheters in the procedure. General characteristics and comorbidities of the patients are presented in Table 1.

The most frequently administered IV antibiotic was ceftriaxone+metronidazole with a rate of 45.4%. Antibiotic changes were made in 29 patients. A growth rate of 40.5% (n=66) was detected in the culture performed during the procedure, and the most common microorganism was *Escherichia coli* with a rate of 43.9% (n=29). In patients with recurrence, the duration of IV antibiotic use before the procedure was statistically significantly shorter than those without any recurrent episodes ($p=0.030$ and $p<0.05$, respectively).

According to TG18, 143 patients had grade 2 disease and 20 patients had grade 3 disease. The ASA score was 3 or 4 in 143 patients and two in 20 patients. Cholecystectomy was performed in 54 (33.1%) patients at follow-up, and the mean time from PC to cholecystectomy was 72.33±61.61 days. Post-cholecystectomy complication rate was 12.9%. Wound site infection was the most common complication (4/7). Two patients had postoperative bile leakage and were treated with Endoscopic Retrograde Cholangio-Pancreatography (ERCP). One patient was re-operated for intra-abdominal abscess. The perioperative duodenal injury that occurred in two patients was repaired primarily.

The PC is technically 100% successful. Minimal bile leakage into the peritoneum was noted in 3 (1.8%) patients during the procedure. The rate of catheterization-related complications during follow-up of the patients was 6.9% (n=11); catheter revision was performed for the catheter dislocation in seven patients.

The timing of percutaneous cholecystostomy tube (PCT=percutaneous drainage tube) removal was 39.12±37 days, and three patients with failed recording of the exact catheter removal time were not included in the calculation. In our study, recurrent acute calculous cholecystitis at follow-up was considered recurrence and the recurrence rate was found to be 5.5% (9/163) (Table 2).

Table 2. Relationship between recurrence (acute cholecystitis episode) and parameters.

	Recurrence Absent	Recurrence Present	p-value
Duration of catheter			
<21	36 (23.4)	6 (66.7)	0.004
≥21	118 (76.6)	3 (33.3)	
Duration of catheter			
<100	143 (92.9)	9 (100)	0.406
≥100	11 (7.1)	0 (0)	
Duration of catheter			
<7	9 (5.8)	0 (0)	0.456
≥7	145 (94.2)	9 (100)	
Tokyo grading			
2	134 (87)	9 (100)	0.248
3	20 (13)	0 (0)	
Preoperative WBC (cells/μL)			
<18000	104 (67.5)	5 (55.6)	0.458
≥18000	50 (32.5)	4 (44.4)	
Antibiotic resistance			
No	127 (82.5)	7 (77.8)	0.721
Yes	27 (17.5)	2 (22.2)	
Positive growth culture			
No	90 (58.4)	7 (77.8)	0.251
Yes	64 (41.6)	2 (22.2)	

WBC: White blood cells. Bold values denote statistical significance at p<0.05.

There were no significant differences between cases with and without recurrences regarding CRP, duration of hospital stay, and WBC counts. The duration of PCT was statistically significantly shorter in patients with recurrent episodes than in those without any recurrent episodes (p=0.014). When the effect of catheter duration on recurrence was examined for 7, 21, and 100 days, there was a significant effect on recurrence only for the duration of <21 days (p=0.004) (Tables 2 and 3).

The mortality rate was 1.8% and the mortality was calculated for the postoperative 60 days. All three patients who died were at very high risk, had grade 3 disease, had an ASA score of 4, and were directly admitted to intensive care unit upon presentation to the hospital.

Table 3. Comparison of duration of antibiotic use and duration of catheter between patients with and without recurrence.

	Recurrence		p-value
	No	Yes	
	Mean±SD (median)	Mean±SD (median)	
Pre-PC duration of intravenous antibiotic use (days)	2.71±2.31 (2)	1.56±1.33 (1)	0.030*
Post-PC duration of intravenous antibiotic use (days)	7.62±5.05 (6)	6.22±3.15 (6)	0.562
Duration of catheter (days)	39.12±37 (30)	21.89±16.8 (16)	0.014*

PC: percutaneous cholecystostomy; SD: standard deviation. *Mann-Whitney U test, p<0.05. Bold values denote statistical significance at p<0.05.

DISCUSSION

The main treatment of patients with grade 1 acute cholecystitis is early laparoscopic cholecystectomy[6]. When patients with acute cholecystitis are treated conservatively, gallbladder and bile duct complications may develop in only 30%[7]. We believe that PC is the most important weapon in nonsurgical treatment instead of cholecystectomy in selected grades 2 and three patients.

The most common microorganism was *E. coli*, and the growth rates were found to be consistent with the literature (growth rate of 29–54% in the literature)[6,8]. There was no significant difference in recurrence between patients with and without growth in their cultures. Despite the significantly shorter duration of preoperative IV antibiotic use in patients with recurrence than those without recurrence, there was growth in the bile cultures of only two (22.2%) patients with recurrence, and *Enterococcus faecium* was isolated in both. We believe that further research with more recurrence cases is required to better understand or confirm this relationship.

In the study by Wise et al., the timing for the catheter tract formation was determined as 20 days[9]. Studies on the timing of tube removal in patients undergoing PC could not establish a clear relationship[10,11]. Bhatt et al.[12] analyzed 145 patients and found no significant relationship between the duration of catheter and recurrent episodes. In this study, however, there was a significant number of patients with acute calculous cholecystitis and acalculous cholecystitis (n=47), and the mean duration of catheter was relatively long (mean: 57 days, 30–86 days) due to the presence of these patients and short durations of catheter could not be fully evaluated[12].

For patients with very high mortality and morbidity, some studies suggest permanent follow-up upon PC without cholecystectomy or follow-up with PCT until cholecystectomy[13,14,15]. Accordingly, our study also performed PCT immediately before or during cholecystectomy in 22 of 54 patients undergoing cholecystectomy. Regardless of cholecystectomy, the catheter remained for a long time in some patients, exceeding 100 days in 11 patients. All of these patients had multiple morbidities, had a high ASA score, did not accept surgery, or were planned to be followed up by the clinician without surgery due to the risks, and none of them had recurrence. Of course, living with a tube for a long time will negatively affect the quality of life.

The study by Bundy et al. on 324 patients reported similar culture growth rates (39.5%) to our study, while the mean duration of catheter was 89 days, and recurrence was not evaluated. The mortality rate was higher compared to our study (6.8%). However, this study included patients with acalculous cholecystitis and calculated long-term mortality[16].

While Hsieh et al. found that PCT remained for >2 weeks and high CRP levels were associated with early recurrence, our study showed that early PCT removal have a significant relationship with recurrence, but no significant relationship between high CRP levels and recurrence. This study recommended the removal of the PC tube immediately after recovery from acute illness. Although recurrence rates were similar to our study, the said study calculated recurrence for a two-month period. Furthermore, since the mean duration of catheter was relatively short, it did not provide information on long-term outcomes. (Recurrence was observed in 11/126 patients, the duration of catheter was 16.6±14.00)[17]. Another cohort study found the timing of <7 days for catheter removal to be associated with recurrent episodes, whereas our study could not establish such relationship[18].

Loozen et al. reported that the rate of recurrent episodes was 22%, whereas other studies report rates ranging from 3% to 47%. In our study, the rate was 5.5%. This difference is attributed to the different acute episode definition made by each study. While some studies recorded every gallstone-related complication as an acute episode, most studies, like our study, recorded acute calculous cholecystitis episode as an episode[19].

One of the three non-surviving patients died one day after PCT placement. It is controversial whether there is a true mortality rate for PC, as PC was performed after this patient developed permanent septic shock[20]. We believe that it was too late to administer PC to the patient.

Due to its retrospective design, the benefits of our study are limited. PC is a promising method considering the CHOCOLATE[21] trial, which found no difference in mortality rates and showed a lower rate of major complications in PC when compared the outcomes of high-risk acute cholecystitis patients treated with either laparoscopic cholecystectomy or PC.

CONCLUSIONS

Approximately two-thirds of the recurrent episodes were observed in patients who underwent PCT before 21 days. There was a significant correlation between the timing of <21 days for catheter removal and experiencing a recurrent episode of acute cholecystitis.

AUTHORS' CONTRIBUTIONS

SAK: Conceptualization, Data curation, Writing – original draft, Writing – review & editing. **MT:** Conceptualization, Data curation, Writing – review & editing.

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