Cukurova Medical Journal
ÇUKUROVA ÜNİVERSİTESİ TIP FAKÜLTESİ

Cukurova Med J 2024;49(4):1067-1074
DOI: 10.17826/cumj.1551514

RESEARCH

Assessing the necessity of routine control cholecystography for improved clinical outcomes in patients with acute cholecystitis following percutaneous cholecystostomy

Perkütan kolesistostomi sonrası akut kolesistitli hastalarda klinik sonuçların iyileştirilmesi için rutin kontrol kolesistografisinin gerekliliğinin değerlendirilmesi

Mustafa Mazıcan[1], İsmail Karluka[1], İlker Murat Arer[1]

[1]Başkent University, Adana, Türkiye

Abstract

Purpose: This study evaluated whether routine control cholecystography is necessary after percutaneous cholecystostomy (PC) in patients with acute cholecystitis (AC) to improve patient care and optimize resource utilization.

Materials and Methods: This retrospective study included 202 out of 248 patients treated with PC for AC between 2011 and 2022, excluding cases with malignancy, biliary strictures, insufficient follow-up (<6 months), unrelated mortality, or acalculous cholecystitis. Patients were divided into two groups: Group 1 (no routine cholecystography, n=90) and Group 2 (routine cholecystography, n=112). Data on demographics, hospital stay, readmissions, recurrence, surgical procedures, mortality, and complications were analyzed.

Results: Group 1 included 90 patients (52% male, 48% female; mean age 69.2 years), and Group 2 included 112 patients with similar demographics and comorbidities. The mean hospital stay was 5.4 days in Group 1 and 5.6 days in Group 2. The readmission rate after catheter removal was 30.7%, and the recurrence rate of AC was 19.3%. Secondary interventions were significantly higher in Group 2, with 24 patients (11.9%) requiring additional cholecystostomy catheter placement during follow-up, compared to 11 (5.4%) in Group 1.

Conclusion: Routine control cholecystography does not improve patient outcomes following PC. Performing cholecystography without clinical indications may increase unnecessary interventions and result in inefficient resource utilization.

Keywords: Acute cholecystitis, percutaneous cholecystostomy, cholecystography, biliary management, patient outcomes

Öz

Amaç: Bu çalışma, akut kolesistit (AK) hastalarında perkütan kolesistostomi (PK) sonrası rutin kontrol kolesistografinin gerekli olup olmadığını değerlendirerek hasta bakımını iyileştirme ve kaynak kullanımını optimize etme üzerindeki etkilerini incelemeyi amaçlamıştır.

Gereç ve Yöntem: Bu retrospektif çalışmada, 2011-2022 yılları arasında AK nedeniyle PK uygulanan 248 hastadan 202'si dahil edildi. Malignite, biliyer darlık, yetersiz takip (<6 ay), AK ile ilişkili olmayan ölümler ve akalküloz kolesistit vakaları çalışma dışı bırakıldı. Hastalar, rutin kontrol kolesistografi yapılmayan (Grup 1, n=90) ve yapılan (Grup 2, n=112) olmak üzere iki gruba ayrıldı. Demografik veriler, hastane yatış süresi, tekrar başvurular, nüks oranları, cerrahi işlemler, mortalite ve komplikasyonlar analiz edildi.

Bulgular: Grup 1'de 90 hasta (%52 erkek, %48 kadın; ortalama yaş 69,2 yıl), Grup 2'de 112 hasta benzer demografik ve ek hastalık özellikleriyle yer aldı. Ortalama hastanede kalış süresi Grup 1'de 5,4 gün, Grup 2'de 5,6 gün olarak belirlendi. Kateter çekimi sonrası tekrar başvuru oranı %30,7, AK nüks oranı %19,3 olarak tespit edildi. Sekonder girişimler Grup 2'de anlamlı olarak daha yüksekti; takip sırasında 24 hasta (%11,9) ek kolesistostomi kateteri gerektirirken, Grup 1'de bu sayı 11 hasta (%5,4) olarak bulundu.

Sonuç: Rutin kontrol kolesistografi, PK sonrası hasta sonuçlarına katkı sağlamamıştır. Klinikten bağımsız kolesistografi kararı, gereksiz girişimlerin ve kaynakların israfında artışa yol açabilir.

Anahtar kelimeler: Akut kolesistit, perkütan kolesistostomi, kolesistografi, biliyer yönetim, hasta sonuçları

Address for Correspondence: Ismail Karluka, Interventional Radiology Department, Adana Dr. Turgut Noyan Application and Research Center, Faculty of Medicine, Başkent University, Adana, Türkiye
E-mail: drismailkarluka.ik@gmail.com
Received: 17.09.2024 Accepted: 20.12.2024

INTRODUCTION

Gallstones are the most common cause of acute cholecystitis (AC), with symptoms occurring in approximately 20% of cases[1]. After Mouret introduced laparoscopic cholecystectomy (LC) in 1987, its initial use in patients with AC was limited due to concerns over high complication rates and technical challenges in severe cases[2]. However, in recent years, LC has become the standard of care for patients with AC[3]. Despite its advantages, urgent LC may not be appropriate for some patients, such as the elderly and patients at high surgical risk. In these patients, interval LC may be a better treatment option. According to the Tokyo Guidelines (TG13), patients with severe AC (Grade 3) leading to organ dysfunction should be treated with organ support, intravenous antibiotic therapy, and percutaneous cholecystostomy (PC), followed by interval LC[4].

PC is a minimally invasive procedure used to manage acute cholecystitis AC in patients at high surgical risk or those unsuitable for emergency surgery[5]. This approach facilitates gallbladder drainage, infection control, and patient condition stabilization[5]. The procedure boasts a high technical success rate of 95-100% and carries a low risk of complications[5]. PC is highly effective in providing immediate symptom relief and serves as a temporary measure until cholecystectomy can be performed [5]. Its minimally invasive nature ensures tolerability, making it a safe and effective option for high-risk patients [5]. While the technical aspects of the procedure are well standardized, post-PC management protocols are not uniform, with varying practices reported across different centers[6].

A systematic review found that 92.7% of PC patients underwent routine cholangiography to assess tube patency. Among these imaging procedures, 35% were conducted before tube removal, while 30% occurred within the first two weeks[6]. In addition, there is no consensus on whether the tube should be used as a permanent drainage method or when it should be removed[6]. While 56% of studies recommend tube removal, the average time for removal ranges from 4 to 8 weeks[6]. Some studies, however, suggest leaving the tube in place for a minimum of 3 weeks to allow for tract maturation[7]. The existence of these discrepancies represents a substantial obstacle to the formulation of a unified management protocol[6]. Following PC, critical decisions such as the timing of tube removal, the necessity of routine cholecystography, the potential use of the tube as a permanent drainage method, and preoperative preparation vary considerably between centres[6]. The absence of a uniform standard in the literature may result in inconsistent patient outcomes and inefficiencies in resource utilization[6]. Therefore, an individualized, patient-centred approach should be adopted, and management processes be tailored to each patient[6]. The establishment of standardized post-PC management protocols is crucial for improving treatment outcomes and minimizing the risk of complications[6].

Few studies have investigated the need for routine cholecystography to evaluate bile flow through the cystic duct before catheter removal[8-10]. While some studies suggest that this procedure is useful for early diagnosis of biliary diseases, others state that its routine use does not provide a clinical benefit and may lead to unnecessary resource utilization. Therefore, there is yet to be a clear consensus on whether cholecystography should be performed routinely or only in clinical symptoms[9,11].

Despite its routine use, there is a limited number of studies in the literature evaluating the impact of routine cholecystography on clinical outcomes in large patient cohorts. We hypothesize that routine follow-up cholecystography may offer limited clinical benefit, increase the rate of unnecessary interventions, and contribute to inefficiencies in resource utilization. Therefore, this study aims to assess the necessity of routine follow-up cholecystography in patients undergoing percutaneous cholecystostomy for acute cholecystitis. By addressing this gap in the literature, our study seeks to highlight the importance of individualized patient management in optimizing clinical outcomes and resource allocation.

MATERIALS AND METHODS

Sample

This retrospective cohort study included 248 patients who underwent PC catheter placement for AC between January 2011 and December 2022. The procedures were performed at the Başkent University Adana Dr Turgut Noyan Application and Research Center by interventional radiologists with at least five years of experience, adhering to standardized

protocols to ensure consistency and reliable outcomes.

Patients aged 18 years or older with AC who had undergone PC were included in the study. Exclusion criteria were malignancy, biliary stenosis, insufficient follow-up (defined as less than six months), unrelated causes of death, and acalculous cholecystitis. The diagnosis of AC was made using the TG13 Tokyo criteria, which combined clinical findings (such as right upper quadrant pain and tenderness), laboratory results (e.g., elevated leukocyte count and C-reactive protein), and imaging studies (e.g., gallbladder wall thickening or pericholecystic fluid) [12].

Out of the 202 patients who met the inclusion criteria, 90 patients were placed in Group 1, which did not undergo routine cholecystography before catheter closure. In comparison, 112 patients were placed in Group 2, which underwent routine cholecystography on day seven post-procedure. Randomization was not performed; the assignment to groups reflected clinical practices during two different periods, reflecting efforts to optimize patient outcomes and resource utilization.

Procedure

All procedures were performed according to the ethical standards of the institutional and national research committees and the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Institutional Review Board of Başkent University (Project No: KA19/114) (approval date: 19 March 2019) and supported by the Başkent University Research Fund. Informed consent was obtained from each patient prior to their inclusion in the study

All suspected cases of AC were evaluated clinically and radiologically. Ultrasound was the primary imaging modality, while MRI and MRCP were utilized for selected cases requiring additional evaluation.

Treatment approach

Treatment was administered following the Tokyo guidelines, a set of widely accepted and comprehensive recommendations for managing acute cholecystitis. These guidelines recommend either medical therapy or PC for patients who are unresponsive to medical treatment or at high surgical risk. Indications for PC included a lack of response to therapy, severe sepsis or systemic inflammatory response syndrome, advanced age, gallbladder empyema, suspected necrosis or perforation, systemic anticoagulation, and late presentation beyond 72 hours after the onset of symptoms [13].

PC procedure and catheter management

The PC procedure was performed using a transhepatic approach under ultrasound guidance. An 18- or 19-gauge needle was used to puncture the gallbladder, followed by the placement of an 8-French pigtail catheter, with its position confirmed by ultrasound. Regular saline flushing was used to maintain catheter patency. In Group 2, routine cholecystography was conducted on day seven to confirm bile passage through the cystic duct. For Group 1, catheter closure was guided by clinical stability, defined as the resolution of symptoms and normalization of laboratory values such as AST, ALT, and bilirubin levels. Catheters remained in place for at least three weeks to allow tract maturation. They were removed approximately two weeks after closure.

Data collection and outcome measures

Data collected for this study included demographics, timing of diagnosis, hospital stay, recurrence rates, surgical interventions, mortality, and complications. This data was collected from patient records and verified for accuracy and completeness to ensure the reliability of our findings.

Statistical analysis

In this study, statistical analyses were performed to compare the two patient groups using the SPSS program (IBM Corp, SPSS V.23, Armonk, N.Y., USA). The methods included frequency and crosstab analysis for categorical data, Pearson chi-square, likelihood ratio, and Fisher's exact test for assessing statistical significance, with a p-value of less than 0.05 considered significant. Continuous variables such as age and hospital stay were analyzed using means and the Mann-Whitney U test for non-normally distributed data. The Kruskal-Wallis test was used to compare hospital stays and catheter removal times across Tokyo grades. ANOVA was employed to analyze the impact of mortality on catheter removal times.

RESULTS

A total of 202 patients were included in the study, of

whom 106 (52%) were male and 96 (48%) were female. The mean age of the participants was 69.2 ± 14 years. Group 1 consisted of 90 patients, while Group 2 included 112 patients. The characteristics of the patients are presented in Table 1.

Table 1. Demographic features of patients

Feature	Group 1 (n:90)	Group 2 (n:112)	P Value
Age (years)*	69.4 ± 13.9	69 ± 14.1	0.841
Sex (Male/Female)	50/40	56/56	0.432
Comorbidity			0.132
- None	9	9	
- HT (Hypertension)	14	13	
- DM (Diabetes)	3	5	
- COPD	2	25	
- CAD (Coronary Artery Disease)	18	13	
- Cancer	5	11	
- Hematological	1	6	
- CRF (Chronic Renal Failure)	3	3	
- Other (Multiple)	35	27	
ASA Score			0.836
- 1	1	1	
- 2	8	8	
- 3	58	79	
- 4	23	24	
Tokyo Criteria			0.175
- Grade 1	38	40	
- Grade 2	39	44	
- Grade 3	13	28	
Hospital Stay (days)*	5.4 ± 4.1	5.6 ± 4.4	0.945
Follow-up (months)*	13.3 ± 19.5	9.6 ± 15.1	0.311

*: Values are mean ± standard deviation.
Abbreviations: ASA: American Society of Anesthesiologists; CAD: Coronary artery disease; COPD: Chronic obstructive pulmonary disease; CRF: Chronic renal failure; HT: Hypertension; DM: Diabetes Mellitus

No statistically significant differences were observed between the groups regarding their demographic data. The majority of patients (91.1%) had at least one additional medical condition, with coronary artery disease being the most prevalent. The mean hospital stay following cholecystostomy placement was 5.4 ± 4.1 days in Group 1 and 5.6 ± 4.4 days in Group 2 (p = 0.945). Most patients (81.6%) were classified as Grade 1 or 2 according to the Tokyo criteria upon admission. The mean follow-up period for patients in Group 1 was 13.3 ± 19.5 months, while that for Group 2 was 9.6 ± 15.1 months (p = 0.311). Most patients (88.6%) were experiencing their first episode of AC. Table 2 illustrates that only 62 patients (30.7%) were readmitted to the hospital following the removal of the catheter.

Of the total patients, only 39 (19.3%) experienced a recurrence of AC. A total of 24 patients (11.9%) underwent another cholecystostomy placement during their other episodes of AC, which was a statistically significant difference between the groups (p = 0.04). Table 3 presents the characteristics of patients with cholecystostomy catheters. The catheter was placed at a mean of 4.7 ± 3.8 days after diagnosis in Group 1 and 4.3 ± 4 days in Group 2 (p = 0.214). Following hospital admission, placement occurred in 2.1 ± 1.8 days in Group 1 and 1.6 ± 1.4 days in Group 2 (p = 0.026). Catheter removal occurred at a mean of 35.6 ± 22.6 days in Group 1 and 38.7 ± 37.6 days in Group 2 (p = 0.793). In Group 2, the passage of contrast medium via the cystic duct was observed in 85 patients (75.9%).

A cholecystectomy was performed on 62 patients (30.6%). Of these, the most common approach was laparoscopic cholecystectomy, accounting for 54.8% of the procedures. The utilization of cholecystostomy catheters did not result in a statistically significant difference in the incidence of complications between Groups 1 and 2 (p = 0.056). In Group 1, 85 patients exhibited no major complications, while minor

complications included catheter displacement (n = 2), bile fistula (n = 2), and cholangitis (n = 1). No abscess or haemorrhage cases were observed. Conversely, Group 2 demonstrated a slightly broader spectrum of complications, with catheter displacement being the most prevalent (n = 12).

Table 2. Characteristics of patients with acute cholecystitis

Feature	Group 1 (n:90)	Group 2 (n:112)	P Value
Number of episodes of AC			0.463
- 0	78	101	
- 1	9	9	
- 2	2	0	
- 3	1	1	
- 4	0	1	
Readmission to hospital			0.266
- Yes	24	38	
- No	66	74	
Recurrence of AC			0.394
- Yes	15	24	
- No	75	88	
Secondary intervention			0.04
- Yes	6	18	
- No	84	94	

Abbreviations: AC: Acute cholecystitis.

Table 3. Characteristics of patients with cholecystostomy catheter

Feature	Group 1 (n:90)	Group 2 (n:112)	P Value
Catheter placement (Day)*			
- After the beginning of the episode	4.7 ± 3.8	4.3 ± 4	0.216
- After admittance	2.1 ± 1.8	1.6 ± 1.4	0.026
Catheter pull (Day)*	35.6 ± 22.6	38.7 ± 37.6	0.793
Passage via the cystic duct			N/A
- Yes	90	85	
- No		24	
- Unknown		3	
Cholecystectomy			0.156
- Yes	23	39	
- No	67	73	
Type of cholecystectomy			0.209
- Open	9	19	
- Laparoscopic	14	20	
Operation with catheter			0.695
- Yes	6	12	
- No	17	27	
Complication			0.056
- None	85	98	
- Displacement	2	12	
- Bile fistula	2	0	
- Cholangitis	1	0	
- Abscess	0	1	
- Hemorrhage	0	1	

*: Values are mean ± standard deviation.

DISCUSSION

Our research findings indicate that routine control cholecystography may not be necessary for patients with AC who have undergone PC. The analysis yielded no statistically significant distinction in outcomes between patients who received cholecystography and those who did not, encompassing both recurrence rates and symptom resolution. Although distinct contrast medium passage through the cystic duct was observed in 75.9% of patients, indicating its potential for confirming biliary patency, the effect on clinical outcomes such as length of hospital stay (LOS), rates of readmission, and complications was negligible. The results of our study provide significant contributions to the management of AC, particularly in those who are not suitable candidates for urgent laparoscopic cholecystectomy.

The findings indicated that secondary interventions were markedly more prevalent in patients undergoing routine cholecystography. This increase is primarily the result of the identification of catheter dislocations through routine imaging, even in asymptomatic patients, which has led to the necessity of catheter revisions. Other researchers in the field have reached a similar conclusion. For instance, Loftus et al.[9] demonstrated that routine cholecystography frequently results in superfluous interventions in asymptomatic patients, which has a deleterious impact on the utilization of resources. Additionally, the study observed increased supplementary procedures, including ERCP, prompted by bile or cystic duct filling defects identified during cholecystography. Furthermore, routine imaging was linked to prolonged drain removal times and the necessity for repeated imaging. Our findings align with these observations and indicate that routine cholecystography elevates intervention rates without conferring substantial clinical benefits. Consequently, limiting cholecystography to symptomatic patients may enhance resource efficiency by reducing unnecessary procedures.

A study by Yeuda et al.[11] demonstrated that routine cholangiography plays a significant role in the management of AC patients following PC, resulting in a change of treatment in approximately one-third of cases. However, this study was conducted by performing routine cholangiography in all patients under a standardized protocol, which reflects a design that does not take into account individual patient characteristics. While this method allows for a generalized assessment of the effect of routine cholangiography in all patient groups, its necessity in asymptomatic and low-risk patients is open to question. Our study offers an alternative perspective to this approach, dividing patients into two groups based on whether they underwent routine cholangiography or not. We evaluated the necessity of intervention according to individual patient characteristics and clinical findings. Routine cholangiography was not used in asymptomatic and low-risk patients to optimize resource utilization and prevent unnecessary interventions. This design difference allows for a different interpretation of the findings and the development of recommendations for clinical practice.

Spota et al.[6] revealed that routine cholecystography following percutaneous cholecystostomy is conducted in over 90% of medical centres. However, the authors emphasized that this pervasive practice offers only limited clinical benefit and does not markedly enhance patient outcomes. Additionally, a notable lack of standardization in cholecystography protocols across institutions was identified, which could result in unnecessary interventions, increased secondary procedure rates, and inefficient resource utilization. Moreover, Spota et al.[6] highlighted that routine cholecystography is frequently conducted without symptoms, compromising patient comfort and placing an unwarranted burden on healthcare systems without offering meaningful clinical benefits. Following these findings, our study observed that while routine control cholecystography increased secondary intervention rates, it did not significantly reduce recurrence or complication rates. These results further support the view that a patient-focused approach is optimal, whereby cholecystography is reserved for symptomatic patients, thus minimizing superfluous interventions and optimizing the allocation of resources. Collectively, these findings highlight the importance of re-evaluating routine practices, such as cholecystography, in order to prioritize patient outcomes and enhance the efficiency of care delivery.

While our study aligns with other research in the field that has questioned the necessity of routine control cholecystography, it differs in terms of methodology and focal points. In the study by Loftus et al.[9] routine control cholangiography and symptom-oriented cholangiography were retrospectively evaluated in two different centres, with the results primarily

compared in terms of their impact on drainage time and cholecystectomy timing. In contrast, our study was conducted on a large patient population with a longer follow-up period. It evaluated a more comprehensive range of clinical outcomes, including the effects of routine cholecystography on length of hospitalization, recurrence rates, and mortality. Moreover, the patient classification based on the Tokyo criteria employed in our study offered a significant advantage in standardizing the results. These methodological differences imply that routine imaging practices should be re-evaluated by considering both studies. Our study indicates that individualized patient management is a more appropriate and practical approach.

Furthermore, our findings corroborate those of the broader literature, indicating that despite the routine use of cholangiography or cholecystography in clinical practice, these imaging modalities are not a prerequisite for managing AC in all patients who have undergone percutaneous cholecystostomy. The data demonstrate that standardizing these imaging practices has no significant impact on recurrence rates, length of hospitalization, or complication rates. This conclusion aligns with the perspective put forth by Hung et al.[14] which advocates for patient-specific strategies over universal standards. The existing evidence supports the findings of our study, further validating the importance of a personalized approach to patient management.

This study is subject to several limitations. Firstly, as a retrospective analysis, it is susceptible to inherent biases associated with data collection and the accuracy of medical records. Secondly, the study was conducted at a single institution, which may limit the generalisability of the findings to other settings or populations. Thirdly, although the sample size is relatively large, it may still be insufficient to detect subtle differences in outcomes or complications. Additionally, a priori power analysis was not conducted, as the sample size was determined based on the availability of retrospective data, which may limit the ability to draw definitive conclusions. Finally, the lack of randomization in the trial prevented complete control of the effects of any differences between the groups. This may limit the objectivity and generalisability of the results.

In conclusion, the findings of this study demonstrate that routine cholecystography following percutaneous cholecystostomy is an unnecessary procedure for patients with AC. This procedure has no significant impact on clinical outcomes, including recurrence rates, LOS, or the incidence of complications. Therefore, reserving cholecystography for symptomatic patients allows for more individualized and resource-efficient patient management strategies.

Further research must identify specific patient groups that may benefit from routine imaging, particularly those with atypical presentations or high-risk profiles. Additionally, investigating targeted imaging protocols based on patient risk factors or symptoms is essential, as this could help streamline the management of AC and reduce unnecessary interventions. Conducting prospective, multicenter, and randomized trials will be crucial for validating these approaches and refining clinical guidelines for AC.

Author Contributions: Concept/Design : MM, İK, İMA; Data acquisition: İK, İMA; Data analysis and interpretation: MM. İK; Drafting manuscript: MM, İK, İMA; Critical revision of manuscript: -; Final approval and accountability: MM, İK, İMA; Technical or material support: İMA; Supervision: MM, İMA; Securing funding (if available): n/a.
Ethical Approval: The research project dated 19.03.2019 and numbered KA19/114 has been approved by Başkent University Medical and Health Sciences Research Board.
Peer-review: Externally peer-reviewed.
Conflict of Interest: Authors declared no conflict of interest.
Financial Disclosure: This study was supported by Başkent University Research Fund.
Acknowledgments: We thank all the healthcare professionals at the Interventional Radiology and General Surgery Clinic of the Adana Dr Turgut Noyan Training and Research Hospital, Baskent University.

REFERENCES

1. Strasberg SM. Acute calculous cholecystitis. New England J Med. 2008;358:2804-11.
2. Cuschieri A, Dubois F, Mouiel J, Mouret P, Becker H, Buess G, et al The European experience with laparoscopic cholecystectomy. Am J Surg. 1991;161:385-7.
3. Csikesz NG, Tseng JF, Shah SA. Trends in surgical management for acute cholecystitis. Surgery. 2008;144:283-9.
4. Yamashita Y, Takada T, Strasberg SM, Pitt HA, Gouma DJ, Garden OJ, et al TG13 surgical management of acute cholecystitis. J Hepatobiliary Pancreat Sci. 2013;20:89-96.
5. Gulaya K, Desai SS, Sato K. Percutaneous cholecystostomy: evidence-based current clinical practice. Semin Intervent Radiol. 2016;33:291-6.
6. Spota A, Shahabi A, Mizdrak E, Englesakis M, Mahbub F, Shlomovitz E, et al Postinsertion management of cholecystostomy tubes for acute cholecystitis: a systematic review. Surg Laparosc Endosc Percutan Tech. 2024:10.1097.
7. D'Agostino H, VanSonnenberg E, Sanchez R, Goodacre B, Casola G. Imaging of the percutaneous

cholecystostomy tract: observations and utility. Radiol. 1991;181:675-8.
8. Bakkaloglu H, Yanar H, Guloglu R, Taviloglu K, Tunca F, Aksoy M, et al Ultrasound guided percutaneous cholecystostomy in high-risk patients for surgical intervention. World J Gastroenterol. 2006;12:7179.
9. Loftus TJ, Brakenridge SC, Moore FA, Dessaigne CG, Sarosi Jr GA, Zingarelli WJ et al Routine surveillance cholangiography following percutaneous cholecystostomy delays drain removal and cholecystectomy. J Trauma Acute Care Surg. 2017;82:351.
10. Wise JN, Gervais DA, Akman A, Harisinghani M, Hahn PF, Mueller PR. Percutaneous cholecystostomy catheter removal and incidence of clinically significant bile leaks: a clinical approach to catheter management. AJR Am J Roentgenol. 2005;184:1647-51.
11. Yehuda AB, Markov E, Jeroukhimov I, Lavy R, Hershkovitz Y. Should cholangiography be part of the management of every patient with percutaneous cholecystostomy? Am J Surg. 2022;224:987-9.
12. Yokoe M, Hata J, Takada T, Strasberg SM, Asbun HJ, Wakabayashi G, et al Tokyo Guidelines 2018: diagnostic criteria and severity grading of acute cholecystitis (with videos). J Hepatobiliary Pancreat Sci. 2018;25:41-54.
13. Doğrul AB. Current state of percutaneous cholecystostomy: indications and management. Egypt J Surg. 2022;41:1447-53.
14. Hung Y-L, Sung C-M, Fu C-Y, Liao C-H, Wang S-Y, Hsu J-T et al Management of patients with acute cholecystitis after percutaneous cholecystostomy: from the acute stage to definitive surgical treatment. Front Surg. 2021;8:616320.