



RESEARCH

Emergency versus interval appendectomy in patients with plastron appendicitis: a comparative analysis of clinical outcomes

Plastron apandisiti olan hastalarda acil ve aralıklı apendektomi: klinik sonuçların karşılaştırmalı analizi

Cumhur Özcan¹, Simge Tuna¹, Zafer Can Kesikminare¹, Mustafa Yılmaz¹,
Tahsin Çolak¹

¹Mersin University, Mersin, Türkiye

Abstract

Purpose: This study aims to investigate the clinical results of emergency and interval appendectomy in adult patients diagnosed with plastron.

Materials and Methods: Patients with plastron appendicitis who underwent either emergency appendectomy (within 24 hours of admission) or interval appendectomy (4-16 weeks after initial conservative treatment) were included in this study. The primary outcome was length of hospital stay, with secondary outcomes including ICU admission, postoperative complications, and appendectomy completion rate in emergency appendectomy.

Results: Among the 77 patients, 55 were planned to have an emergency appendectomy performed; however, only 36 of these patients actually underwent emergency appendectomy, and 19 (34.5%) were unable to have an appendectomy and were instead scheduled for interval appendectomy. Including these patients, a total of 41 patients underwent interval appendectomy. Total hospital stay was significantly longer in the interval group (6.3 ± 5.7 vs. 9.1 ± 5.1). In the interval group, the mean time from initial presentation to surgery was 70.0 ± 27.5 days (25-134 days). Laparoscopy was more frequent in the interval group (8.3% vs. 73.2%), and the complication rate was higher in emergency appendectomies.

Conclusion: Emergency appendectomy was associated with higher rates of incomplete appendectomy. Although the hospital stay is longer in interval appendectomies, interval appendectomy may be preferred in patients with suspected plastron appendicitis to avoid a second operation.

Keywords: Plastron appendicitis, interval appendectomy, emergency operation

Öz

Amaç: Bu çalışma, plastron tanısı konulan yetişkin hastalarda acil ve aralıklı apendektominin klinik sonuçlarını araştırmayı amaçlamaktadır.

Gereç ve Yöntem: Acil apendektomi (kabulden itibaren 24 saat içinde) veya interval apendektomi (konservatif tedaviden 4-16 hafta sonra) geçen plastron apandisiti hastalar çalışmaya dahil edildi. Birincil sonuç hastanede kalış süresiydi, ikincil sonuçlar arasında yoğun bakım ünitesine yatış, ameliyat sonrası komplikasyonlar ve acil apendektomide apendektomi tamamlanma oranı yer aldı.

Bulgular: 77 hastadan 55'ine acil apendektomi yapılması planlandı; ancak bu hastalardan sadece 36'sına acil apendektomi yapıldı. 19'una (%34,5) apendektomi yapılmadı ve interval apendektomi planlandı. Bu hastalar dahil olmak üzere toplam 41 hastaya interval apendektomi yapıldı. Toplam hastanede kalış süresi interval apendektomilerde önemli ölçüde daha uzundu ($6,3 \pm 5,7$ ye karşı $9,1 \pm 5,1$). İnterval apendektomilerde, ilk başvurudan ameliyatı kadar geçen ortalama süre $70,0 \pm 27,5$ gündü (25-134 gün). Laparoskopik operasyon interval apendektomilerde daha sıklı (%8,3'e karşı %73,2) ve acil apendektomilerde komplikasyon oranı daha yükseldi.

Sonuç: Acil apendektomi daha yüksek oranda tamamlanmamış apendektomi ile ilişkilendirilmiştir. Hastanede kalış süresi interval apendektomilerde daha uzun olsa da, plastrone apandisit şüphesi olan hastalarda ikinci bir operasyondan kaçınmak için interval apendektomi tercih edilebilir.

Anahtar kelimeler: Plastron apandisit, interval apendektomi, acil cerrahi

Address for Correspondence: Simge Tuna, Mersin University School of Medicine, Department of General Surgery, Mersin, Türkiye E-mail: simgetuna996@gmail.com
Received: 02.06.2025 Accepted: 23.08.2025

INTRODUCTION

The most prevalent cause of acute abdominal pain is acute appendicitis, and the most common abdominal surgical procedure performed overall is appendectomy¹. The management of uncomplicated appendicitis is clearly established; however, the management of complicated cases, including plastron appendicitis, remains controversial². The term "plastron appendicitis" refers to an inflammatory mass in the right lower quadrant that is difficult for imaging tests to differentiate from the appendix³.

Plastron appendicitis appears in approximately 10% of acute appendicitis cases^{2,4}. This condition presents specific challenges, as emergency surgery in these patients may be technically complex due to distorted anatomy, inflammatory changes, and dense adhesions, potentially resulting in increased morbidity⁵. The risk of injury to adjacent organs is elevated, and the procedure may sometimes require larger resections, such as ileocecal resection or right hemicolectomy^{2,5,6}. There are now three main approaches to treating plastron appendicitis: conservative management alone without additional surgery, conservative management followed by an appendectomy at a 6-8 week interval, and primary surgical treatment⁴⁻⁶. There is still no clear consensus on the most effective course of treatment for plastron appendicitis, despite the fact that considerable amount of studies has been conducted on the subject.

While recent literature compares conservative management versus surgical intervention, this study addresses this critical knowledge gap by directly compare emergency appendectomy versus interval appendectomy in patient population. We hypothesize that interval appendectomy following initial conservative management will demonstrate superior outcomes compared to emergency appendectomy in terms of operative complexity, complication rates, and patient recovery, while maintaining equivalent efficacy in definitive treatment and malignancy detection. The novelty lies in providing definitive comparative data to guide clinical decision-making in this controversial area, particularly from a tertiary care perspective.

MATERIALS AND METHODS

This retrospective cohort study was conducted at the Department of General Surgery, Mersin University

Faculty of Medicine. The study protocol was approved by the Ethics Committee of Mersin University in 09/04/2025 (approval no: 2025/399).

Sample

Hospital medical records and operation notes of patients who underwent appendectomy between January 2020 and December 2024 for plastron appendicitis were retrospectively reviewed. Plastron appendicitis was defined as radiologically or clinically confirmed appendiceal inflammation with surrounding inflammatory mass formation, without signs of generalized peritonitis. Patients were classified into two groups based on their treatment approach: emergency appendectomy (performed within 24 hours of admission) or interval appendectomy following initial conservative treatment (performed 6-8 weeks after the initial episode).

Adult patients (≥ 18 years of age) who had radiologically confirmed or clinically diagnosed plastron appendicitis were included in this study. Radiological diagnosis was based on the presence of an inflammatory mass in the right lower quadrant identified by ultrasound or CT scan, with CT showing appendiceal wall thickening >2 mm, periappendiceal fat stranding, and/or fluid collection without free intraperitoneal fluid suggesting generalized peritonitis. Clinical diagnosis relied on the presence of a palpable mass in the right iliac fossa combined with clinical signs of localized peritonitis lasting >72 hours from symptom onset. while clinical diagnosis relied on the clinician's evaluation.

Only patients who underwent either emergency appendectomy or interval appendectomy following initial conservative management were considered eligible for inclusion. The choice of treatment approach was based on surgeon preference and patient clinical status at presentation, with emergency surgery generally reserved for patients with signs of clinical deterioration.

The study excluded patients under 18 years of age and cases of non-complicated appendicitis. Patients with pre-surgically diagnosed appendiceal tumors were also excluded to eliminate confounding factors that might affect management decisions and outcomes. Furthermore, patients who were lost to follow-up or had insufficient medical data were eliminated from the study.

Procedure

Data were systematically collected from hospital medical records and operation notes for all eligible patients by two independent investigators, both general surgery residents. The hospital maintains a comprehensive electronic health record system (nucleus), which all surgical procedures are documented including operative notes, outpatient clinic appointments, additional procedures, pathology results, medical imaging. Hospital record reliability is ensured through the institution's comprehensive quality management system.

The documented variables included demographic data (age, gender, and comorbidities), surgical technique (open, laparoscopic, or conversion), and intensive care unit (ICU) admission requirements.

Postoperative outcomes, including length of hospital stay measured in days and any postoperative complications according to the Clavien-Dindo classification, were documented. All pathology results were recorded to verify the diagnosis and identify any additional findings of clinical significance.

Each patient's comorbidity burden was objectively evaluated using the Charlson Comorbidity Index (CCI), a validated prognostic tool that assigns weighted scores to 19 medical conditions based on their impact on 1-year mortality risk⁷. Higher comorbidity burden is indicated by higher scores on the CCI, a proven approach for categorizing comorbidities that predict long-term mortality, intensive care unit (ICU), in-hospital mortality⁸.

The assessment of postoperative complications was conducted using the Clavien-Dindo classification, a standardized 5-grade framework that categorizes surgical complications based on the therapeutic intervention required for treatment, which provides an organized method of categorizing problems by severity, from small recovery deviations to mortality, depending on the intervention required to manage the condition⁹.

All patients were followed for 3 months postoperatively. Follow-up data were collected from outpatient clinic records. The primary outcome measure was appendectomy completion rate.

Secondary outcomes included mean interval time, length of hospital stay, ICU requirement, and postoperative complications.

Statistical analysis

In this study, statistical analyses were performed using SPSS software. In the evaluation of the data, the normality of continuous variables was assessed with the Shapiro-Wilk test. Since the data conformed to the normal distribution, independent means t-test was used for comparisons according to operation. In the analysis of categorical data, the chi-Square test and the Fisher's exact test were used if more than 20% of the expected values were less than 5. A Z-test (comparison of two ratios) was applied to assess statistical significance in tables larger than 2x2. A p-value of less than 0.05 was considered statistically significant.

Sample size calculation was performed based on an expected 20% difference in complication rates between groups, with 80% power and $\alpha=0.05$, requiring a minimum of 25 patients per group. Post-hoc power analysis revealed >95% power to detect differences in appendectomy completion rates (primary outcome), ~75% power for hospital stay differences, and moderate power (~57%) for detecting differences in major complications. The study achieved adequate power for the primary research question and key secondary outcomes.

RESULTS

Among 109 patients diagnosed with plastrone appendicitis, 55 were initially scheduled for emergency appendectomy; however, only 36 (65.5%) of these patients successfully underwent the emergency procedure. The remaining 19 patients (34.5%) were taken to emergency operation, but since the plastrone mass in the right quadrant could not be overcome and appendectomy could not be performed, it was decided to place a drain in the operation, and interval appendectomy was planned. Of the 54 patients who were given antibiotic treatment and planned interval appendectomy, 13 did not reapply for appendectomy during the interval period and were therefore excluded from the study. The study flow chart is shown in Figure 1.

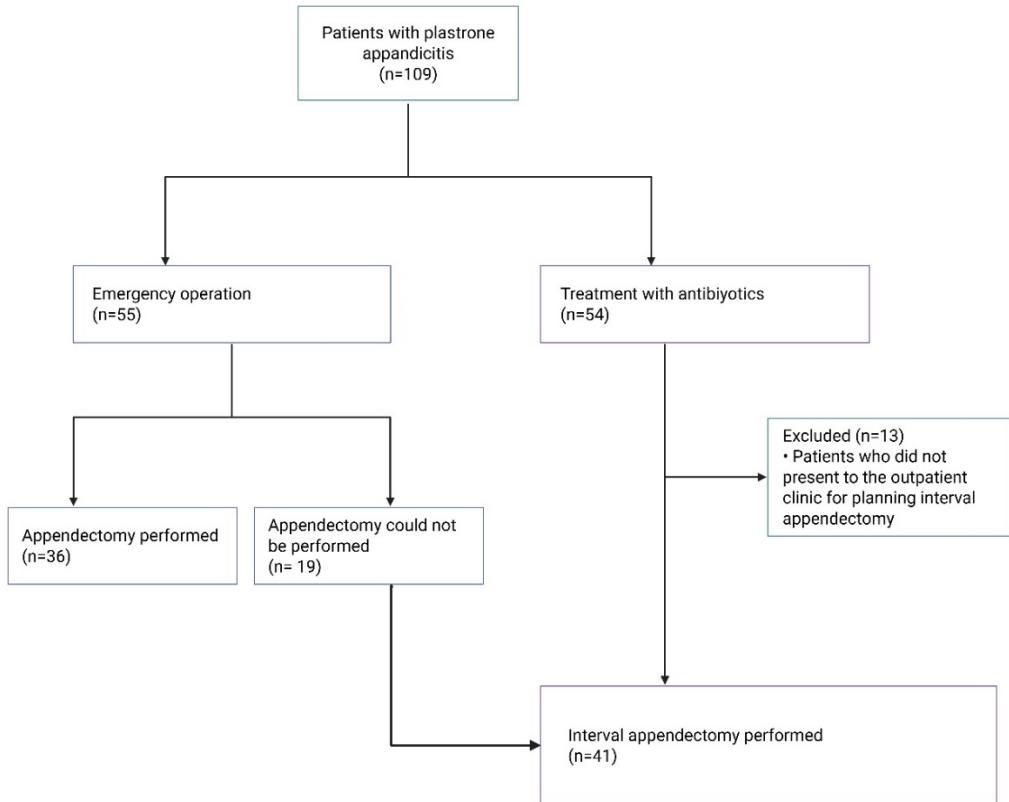


Figure 1. Flow chart of study patients.

A total of 77 patients were included in the study, with 36 patients in the emergency surgery group and 41 patients in the interval surgery group. The analyses of the groups are shown in table 1. The mean age was comparable between groups (47.8 ± 19.9 years vs. 51.2 ± 16.3 years; $p=0.406$). The gender distribution was similar in both groups ($p=0.321$). The Charlson Comorbidity Index (CCI) was similar between the emergency and interval groups (1.8 ± 1.7 vs. 1.5 ± 1.4 ; $p=0.544$), indicating a similar baseline health condition.

There was a significant difference in the operative technique ($p<0.001$). Open surgery was more frequent in the emergency group (26 patients, 72.2%) compared to the interval group (11 patients, 26.8%). In contrast, the laparoscopic approach was predominantly used in the interval group (30 patients, 73.2%) compared to the emergency group (3 patients, 8.3%). Notably, conversion from laparoscopic to

open technique was necessary in 7 patients (19.4%) in the emergency group, while no conversion was required in the interval group.

Hospital stay analysis revealed significant differences between the emergency and interval appendectomy groups. Patients who underwent emergency appendectomy had a significantly longer postoperative hospital stay compared to the interval appendectomy group (6.3 ± 5.7 days vs. 3.1 ± 3.11 days, $p=0.003$). However, when considering the total length of hospitalization, the interval appendectomy group demonstrated a significantly longer overall hospital stay (9.1 ± 5.1 days vs. 6.3 ± 5.7 days, $p=0.026$). This longer total stay in the interval group was due to the initial hospitalization period (6.1 ± 4.03 days) required for the conservative management before the delayed surgical intervention. The need for ICU admission was similar between groups (9 vs. 10 patients; $p=0.951$).

Although not statistically significant, some differences in complications were observed between the two groups according to the Clavien-Dindo scoring system ($p=0.083$). Grade 1 complications were more common in the interval group (32 vs. 20 patients), while more severe complications (grades 3 and 4) were more frequent in the emergency group (11 and 1 patients vs. 5 and 0 patients, respectively). Mortality was observed only in the emergency group (1 patient), but this difference was not statistically significant ($p=0.468$).

Pathological examination revealed no significant differences in the rates of benign and malignant findings between the two groups ($p=1.000$), with similar proportions in both emergency and interval surgery patients.

The average time interval between initial hospitalization and definitive surgery in the interval appendectomy group ($n=41$) was 70.0 ± 27.5 days (range: 25-134 days).

Table 1. Characteristics of study patients. (CCI: charlson comorbidity index, ICU: intensive care unit)

Characteristics	Emergency (n=36)	Interval (n=41)	p-value
Age (years)	47.8 ± 19.9 (18-86)	51.2 ± 16.3 (21-80)	0.406
Sex, (%)			0.321
Female	19 (52.8)	17 (47.2)	
Male	17 (41.5)	24 (58.5)	
CCI	1.8 ± 1.7 (0-6)	1.5 ± 1.4 (0-4)	0.544
Operation technique, %			<0.001
Open	26 (72.2)	11 (26.8)	
Laparoscopic	3 (8.3)	30 (73.2)	
Conversion	7 (19.4)	0	
Hospital stay (days)			
Postoperative	6.3 ± 5.7 (2-23)	3.1 ± 3.11 (1-17)	0.003
First hospitalisation	-	6.1 ± 4.03 (2-26)	-
Total length of hospitalisation	6.3 ± 5.7 (2-23)	9.1 ± 5.1 (4-26)	0.026
Need for ICU, (%)	9 (25)	10 (24.3)	0.951
Operative complications, (%) (Clavien-Dindo)			0.083
Grade 1	20 (55.5)	32 (78)	
Grade 2	3 (8.3)	4 (9.7)	
Grade 3	11 (30.5)	5 (12.1)	
Grade 4	1 (2.7)	0	
Mortality, (%)	1 (2.7)	0	0.468
Pathology, (%)			1,000
Benign	34 (94.4)	38 (92.6)	
Malignant	2 (5.5)	3 (7.3)	

DISCUSSION

The management of plastrone appendicitis was compared between emergency and interval appendectomy strategies in this study, which produced some notable findings about surgical methods, results, and resource use. Based on the data of our study, interval appendectomy was shown to have better operative results in selected cases.

Plastron appendicitis is a complication of acute appendicitis in which the patient's immune response may enclose the inflammation, leading to the development of a limited abscess or inflammatory

phlegmon, typically presenting as a palpable mass⁵. Although appendicular masses are common in clinical practice, significant controversy exists on the best therapeutic strategies. The traditional approach is initial conservative treatment with antibiotics, followed by interval appendectomy approximately 6-8 weeks later¹⁰. This approach aims to permit the inflammatory process to decrease before surgical intervention, which could reduce operation time and complications. However, emergency surgery aims to solve the problem during a single admission, eliminates the risk of recurrence, and may identify unexpected pathology such as malignancy^{4,11}.

Additionally, emergency surgery may be required when conservative therapy is ineffective or complications develop.

Our data revealed that among the patients initially scheduled for emergency appendectomy, only 65.5% successfully completed the operation, with 34.5% of the patients necessitating rescheduling for interval appendectomy. An ileocecal resection or a right-sided hemicolectomy are common outcomes of emergency appendectomy since the technique might be technically challenging due to deformed anatomy and difficulties sealing the appendiceal stump because of inflammatory tissues². To prevent these outcomes and decrease postoperative problems, a drain was strategically placed in our study.

Studies report conversion rates from laparoscopic to open appendectomy in complicated appendicitis between 6% and 27.5%, with higher rates seen in cases involving perforation, abscess, or severe inflammation^{12,13}. In our study, 72.2% of emergency appendectomy patients underwent open appendectomy, 8.3% were completed laparoscopically, and 19.4% had to be converted from laparoscopic to open appendectomy. In contrast, 73.2% of patients in the interval appendectomy group were taken laparoscopically, and there were no conversions. Mejri et al. identified the predictors of difficult dissection that led to conversion as radiological abscess of more than 5 cm diameter in CT scan (70.7% conversion rate), delay of consultation of more than 7 days (71.4% conversion rate), presence of appendicular mass (75% conversion rate), and retro-cecal appendix position (71.1% conversion rate)¹⁴.

Ozdemir et al. found interval surgery resulted in significantly shorter postoperative hospital stays (8.1 vs. 10.4 days, $p=0.009$) compared to emergency surgery in patients with plastron appendicitis¹⁰. Similarly, Kanaka et al. reported hospital stays of 9.4 ± 5.8 days for emergency appendectomy versus 6.2 ± 4.8 days for interval appendectomy⁶. In our study, although postoperative hospital stay in emergency appendectomy was significantly longer (6.3 ± 5.7 vs. 3.1 ± 3.11 days; $p=0.003$), when considering total hospitalization, the interval appendectomy group demonstrated significantly longer overall stays (9.1 ± 5.1 vs. 6.3 ± 5.7 days; $p=0.026$), due to the initial hospitalization period (6.1 ± 4.03 days) required for conservative management. These findings support staged management of complicated appendicitis to reduce

overall hospital stays. Although the hospital stay is shorter in interval appendectomies, considering the length of hospitalization during conservative treatment, it requires patient-based consideration when choosing the surgical plan for plastrone appendicitis.

Studies in the literature show that interval appendectomies similarly have a lower complication rate than early appendectomies^{3,10,15}. Interval appendectomy, performed after inflammation has resolved with conservative treatment, offers a technically more straightforward procedure with clearer anatomy, decreased vascularity, and fewer adhesions, likely explaining the lower complication rates consistently observed across multiple studies in the literature. Although not reaching statistical significance ($p=0.083$), our study revealed a trend toward more complications in the emergency group according to the Clavien-Dindo classification. Furthermore, the sole mortality case occurred in the emergency group.

This study has several important limitations that should be considered when interpreting the results. Selection bias represents a primary concern as treatment allocation (emergency vs. interval appendectomy) was based on surgeon preference and patient clinical status rather than randomization, potentially introducing systematic differences between groups that could confound outcomes. Furthermore, the retrospective design inherently limits data quality and completeness, as information was dependent on the accuracy and comprehensiveness of medical record documentation, making both groups appear to have better outcomes than reality, though this would likely affect both groups equally. These limitations collectively suggest that while our findings provide valuable insights into comparative outcomes of different surgical approaches for plastron appendicitis, they should be interpreted cautiously and ideally confirmed through prospective randomized controlled trials in diverse healthcare settings.

In conclusion, emergency appendectomy was associated with higher rates of incomplete appendectomy, increased postoperative complication rates, and longer initial hospital stays compared to interval appendectomy. Based on the findings of this study, interval appendectomy may be preferred in the clinical practice of surgeons in patients with

suspected plastron appendicitis to avoid a second operation.

Author Contributions: Concept/Design : CÖ, ST; Data acquisition: ST, ZCK; Data analysis and interpretation: ST, ZCK; Drafting manuscript: CÖ, ST, ZCK; Critical revision of manuscript: CÖ, MY; Final approval and accountability: CÖ, ST, ZCK, MY, TC; Technical or material support: CÖ; Supervision: ST; Securing funding (if available): n/a.

Ethical Approval: Ethical approval was obtained from Çukurova University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee for this study. (With the date 6.3.2020 and the number 97/1).

Peer-review: Externally peer-reviewed.

Conflict of Interest: The authors declare no conflicts of interest.

Financial Disclosure: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

REFERENCES

1. Borruel Nacenta S, Ibáñez Sanz L, Sanz Lucas R, Depetris MA, Martínez Chamorro E, García Espinosa J. Update on acute appendicitis: typical and untypical findings. *Radiología (Engl Ed)*. 2023;65:81-91.
2. Karakaş DÖ, Yeşiltaş M, Gökçek B, Eğin S, Hot S. Periappendicular inflammatory masses. *Turk J Colorectal Dis*. 2020;30:191-97.
3. Zhou S, Cheng Y, Cheng N, Gong J, Tu B. Early versus delayed appendicectomy for appendiceal phlegmon or abscess. *Cochrane Database Syst Rev*. 2024;5:CD011670.
4. Kumar HR, Soma M, Ganesh R. Current management of appendicular mas - a narrative review. *Med J Malaysia*. 2023;78:669-74.
5. Tannoury J, Abboud B. Treatment options of inflammatory appendiceal masses in adults. *World J Gastroenterol*. 2013;19:3942-950.
6. Kanaka S, Mizutani S, Yokoyama Y, Matsutani T, Chihara N, Katsuno A et al. Periappendiceal fluid collection on preoperative computed tomography can be an indication for interval appendectomy: a retrospective study. *World J Emerg Surg*. 2022;17:30.
7. MDCalc [Internet]. Charlson Comorbidity Index (CCI). <https://www.mdcalc.com/calc/3917/charlson-comorbidity-index-cci>. (Accessed 1.1.2025)
8. Charlson ME, Carrozzino D, Guidi J, Patierno C. Charlson comorbidity index: a critical review of clinimetric properties. *Psychother Psychosom*. 2022;91:8-35.
9. Bolliger M, Kroehnert JA, Molineus F, Kandioler D, Schindl M, Riss P. Experiences with the standardized classification of surgical complications (Clavien-Dindo) in general surgery patients. *Eur Surg*. 2018;50:256-61.
10. Ozdemir K, Harmantepe AT, Dulger UC, Gonullu E, Dikici E, Bayhan Z et al. Comparison of treatment methods in plastron appendicitis: a tertiary center experience. *Malawi Med J*. 2023;35:224-27.
11. Kimura T, Toyoki Y, Ichisawa A, Miyata H, Inoue Y, Kitta T et al. Aiming for minimally invasive treatment of pediatric acute appendicitis in a district hospital. *Ann Pediatr Surg*. 2021;17:18.
12. Azılı C, Tokgöz S, Chousein B, Tamam S, Benk MŞ, Culcu S et al. Determination of risk factors for conversion from laparoscopic to open appendectomy in patients with acute appendicitis. *Ulus Travma Acil Cerrahi Derg*. 2023;29:1103-8.
13. Pushpanathan NR, Hashim MNM, Zahari Z, Aziz SHSA, Zain WZW, Ramely R et al. Conversion rate and risk factors of conversion to open in laparoscopic appendicectomy. *Ann Coloproctol*. 2022;38:409-14.
14. Mejri A, Arfaoui K, Mseddi MA, Slima MB, Saad S, Yahyaoui M. The management of appendicular abscesses in a Tunisian tertiary care hospital. *BMC Surg*. 2021;21:427.
15. Suzuki T, Matsumoto A, Akao T, Matsumoto H. Interval appendectomy as a safe and feasible treatment approach after conservative treatment for appendicitis with abscess: a retrospective, single-center cohort study. *Updates Surg*. 2023;75:2257-65.