ORIGINAL ARTICLE

Evaluation of computed tomography (CT) appendicitis score and laboratory parameters in acute appendicitis with and without CT-detected appendicolith

Tuğberk Başturk,[1] Mehmet Duran,[2] Seda Başturk[3]

[1]Department of Radiology, Uşak Training and Research Hospital, Uşak-*Türkiye*
[2]Department of Radiology, Adıyaman Training and Research Hospital, Adıyaman-*Türkiye*
[3]Department of Surgical Oncology, Uşak Training and Research Hospital, Uşak-*Türkiye*

ABSTRACT

BACKGROUND: With the growing interest in the non-operative management of acute appendicitis (AA), accurate diagnosis has become increasingly important. This study aimed to evaluate the computed tomography appendicitis score (CTAS), complete blood count (CBC), C-reactive protein (CRP), and systemic immune-inflammation index (SII) in patients diagnosed with AA with and without computed tomography-detected (CT-detected) appendicoliths. Additionally, the study compared these findings between patients with perforated and non-perforated appendicitis.

METHODS: Between January 2020 and January 2023, 294 patients diagnosed with AA were retrospectively analyzed. Of these, 140 (47.6%) had appendicoliths (Group 1), and 154 (52.4%) did not (Group 2). CT findings of AA and CTAS were evaluated. CBC parameters, CRP levels, and SII scores were compared between the groups, and the presence of appendix perforation was analyzed.

RESULTS: The mean diameter and wall thickness of the appendix, presence of intra-abdominal fluid, and severity of periappendiceal fat stranding were higher in Group 1 ($p<0.001$, $p=0.024$, $p=0.009$, $p<0.001$, respectively). The CTAS was also higher in Group 1 (7.51±2.35) compared to Group 2 (6.38±2.41; $p<0.001$). There was a positive correlation between the diameter of the appendicolith and CTAS (rho=0.450, $p<0.001$). In Group 1, CTAS was higher in patients with more than one appendicolith ($p=0.003$). Perforation was observed in 15 patients (10.7%) in Group 1 and five patients (3.2%) in Group 2, with a higher incidence in Group 1 ($p=0.011$). Among Group 1 patients, the perforation rate was higher in those with more than one appendicolith ($p=0.019$). The mean CTAS was higher in patients with appendiceal perforation (10±1.13) compared to those without perforation (7.22±2.29) ($p<0.001$). Monocyte (MONO) counts were also higher in Group 1 ($p=0.002$). Other CBC parameters, CRP levels, and SII scores did not differ significantly between Groups 1 and 2 ($p>0.05$). However, CRP levels and MONO counts were elevated in patients with perforated appendicitis ($p<0.001$ and $p=0.026$, respectively).

CONCLUSION: Acute appendicitis with appendicoliths is associated with more pronounced inflammation and a higher rate of perforation. CTAS, CRP, and MONO levels tended to be elevated in cases of appendiceal perforation. A comprehensive evaluation incorporating the presence of appendicoliths, CTAS, and laboratory parameters may provide valuable insights into the severity of inflammation in AA.

Keywords: Acute appendicitis; appendicolith; computed tomography (CT) appendicitis score; C-reactive protein; appendiceal perforation.

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Address for correspondence: Tuğberk Başturk
Department of Radiology, Uşak Training and Research Hospital, Uşak, Türkiye
E-mail: tugberk.basturk@usak.edu.tr

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INTRODUCTION

Acute appendicitis (AA) is the most common pathological condition of the appendix and the leading cause of emergency abdominal surgery. Lymphatic hyperplasia and appendicoliths are well-documented contributors to AA, primarily by causing luminal obstruction.[1,2] The importance of identifying appendicoliths in AA has increased with the growing use of conservative (non-surgical) medical management. The presence of appendicoliths is associated with a more severe inflammatory response and a higher risk of perforation.[3] However, recent reports have indicated that asymptomatic appendicoliths found incidentally on high-resolution imaging rarely progress to appendicitis.[4]

Most published research on the non-operative management of AA has been based on clinical evaluation and ultrasound findings. Only a few studies have utilized computed tomography (CT) scans to identify and exclude patients who may not be suitable for medical treatment.[5] Multidetector computed tomography (MDCT) has high sensitivity and specificity for the diagnosis of AA, and several MDCT findings are suggestive of appendicitis.[6,7] Computed tomography appendicitis scores (CTAS), derived from specific CT findings in AA, offer valuable insight into the severity of the disease.[7]

Recent studies have demonstrated that the prevalence of AA and the risk of perforation can be predicted using routine laboratory parameters such as white blood cell (WBC) count, neutrophil (NEU) count, platelet (PLT) count, and C-reactive protein (CRP) levels.[4,8-10] The systemic immune-inflammation index (SII) is a novel inflammatory marker with the potential to enhance the diagnostic accuracy of AA and may aid in distinguishing between complicated and uncomplicated cases.[9,10]

However, there are not enough studies in the literature comparing CTAS and SII in patients with AA, particularly regarding the detectability of appendicolith on CT. We believe that CTAS and SII may serve as valuable parameters for assessing the severity of periappendiceal inflammation in patients with AA and appendicoliths. These indicators may therefore aid in determining whether AA with appendicolith should be managed conservatively or surgically.

In this retrospective study, we aimed to evaluate CTAS, SII, complete blood count (CBC), and CRP levels in patients diagnosed with AA, with and without appendicoliths, and to compare findings between perforated and non-perforated cases.

MATERIALS AND METHODS

Study Group

This study was approved by the Human Research Ethics Committee of the Faculty of Medicine, Süleyman Demirel University (reference number: 4/43-06.03.2023). All procedures were conducted in accordance with the principles of the Declaration of Helsinki. The requirement for informed consent was waived due to the retrospective nature of the study. A total of 711 consecutive patients who underwent appendectomy at Isparta City Hospital between January 2020 and January 2023 were initially considered. Of these, 260 patients without preoperative abdominal or pelvic CT scans were excluded. An additional 157 patients were excluded for the following reasons: age under 18 years (n=41), non-contrast abdominal CT (n=54), absence of histopathological evidence of AA (n=35), presence of concomitant disease (n=13), missing at least one laboratory parameter (n=10), or diagnoses of endometriosis (n=2), neuroendocrine tumor in the appendiceal wall (n=1), or appendiceal mucocele (n=1) (Fig. 1). The remaining 294 patients constituted the final study population.

Demographic data, laboratory parameters, histopathology results, and surgical reports were obtained by reviewing hospital medical records. Cases of appendix perforation were recorded. Patients with CT-detected appendicoliths (140/294, 47.61%) were categorized as Group 1, while those without appendicoliths (154/294, 52.38%) were categorized as Group 2.

MDCT Technique

Computed tomography examinations were performed using a 64-row helical CT scanner (Supria Grande, Hitachi Ltd., Tokyo, Japan) following the injection of a non-ionic iodinated contrast agent (300 mg/100 mL) at a rate of 2.5 mL/s and a dose of 1-1.5 mL/kg, with a scan delay of 70 seconds. The CT scanning parameters were as follows: tube voltage, 100 kV; mA, 220; pitch, 1.25; gantry speed, 0.5 seconds per rotation. Automatic tube current modulation using CARE Dose 4D software (Hitachi Ltd., Tokyo, Japan) was used. Images were reconstructed using 5 mm section thickness with 3 mm intervals, and thin-section source images were also available for review. All images were transferred to a picture archiving and communication system (Akgün Yazılım, Ankara, Türkiye) as a separate series of images for subsequent interpretation.

Image Analysis and Study Design

Two radiologists (T. B. with 13 years of experience in abdominal imaging, and M. D. with 10 years of experience in abdominal imaging) independently evaluated the CT scans in random order. Both were blinded to patient data and final diagnoses, except for the clinical indication of suspected appendicitis. The radiologists reviewed the CT images for the presence of appendicoliths, appendix diameter, single-wall thickness, periappendiceal fat stranding, intra-abdominal free fluid, and the short axis of the largest periappendiceal lymph node. In Group 1, the number of appendicoliths (one or more than one) and the maximum diameter were recorded. Any discrepancies in CT findings between the two readers were resolved by consensus.

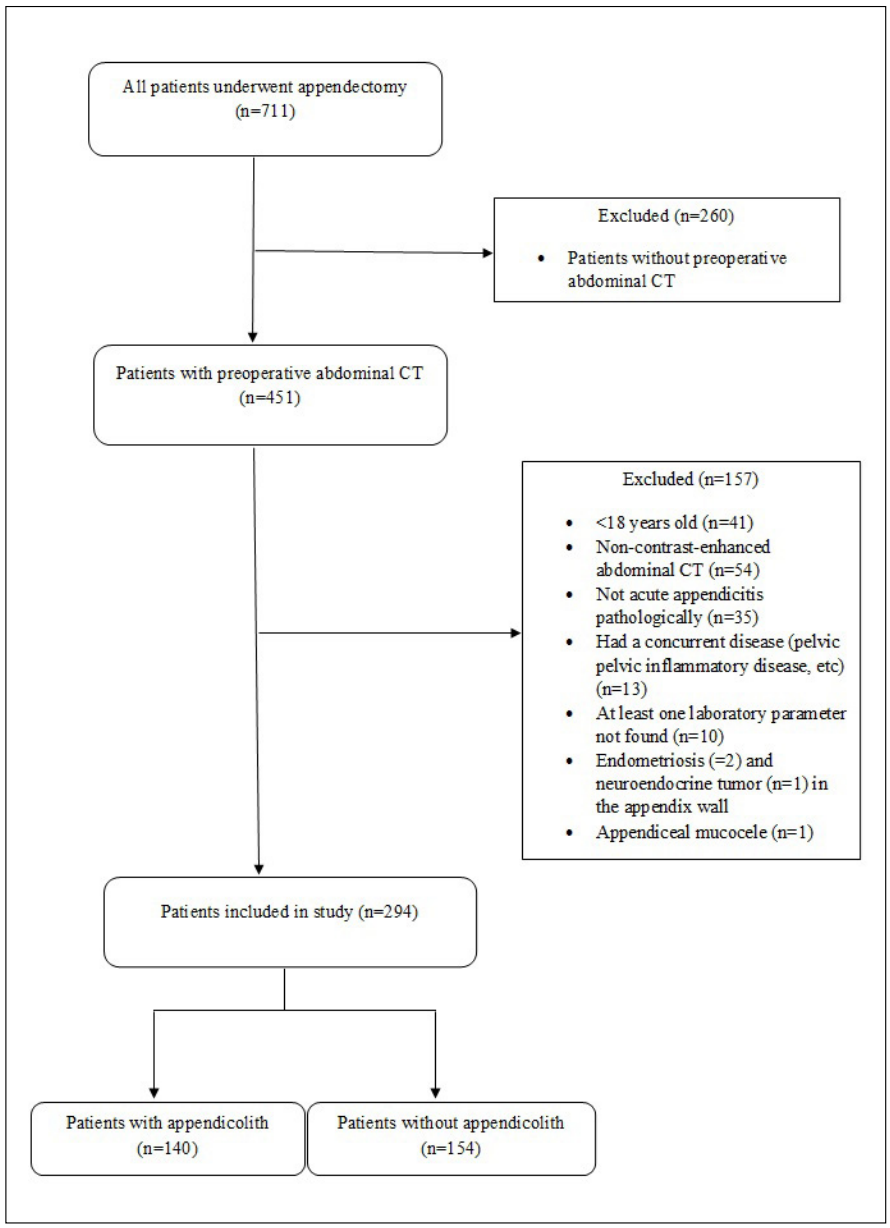

Figure 1. Derivation of the study population. CT: Computed tomography.

Appendiceal wall thickness was measured at the point of maximum thickening. The diameters of the appendix and the appendicolith (the largest one if more than one was present) were measured at their widest points in axial, coronal, and sagittal planes (Fig. 2). The short axis of the largest lymph node was measured in the axial plane. The total CTAS was calculated for each patient. The variables and scoring criteria used to calculate CTAS are listed in Table 1. Representative images are shown in Figures 3-5.

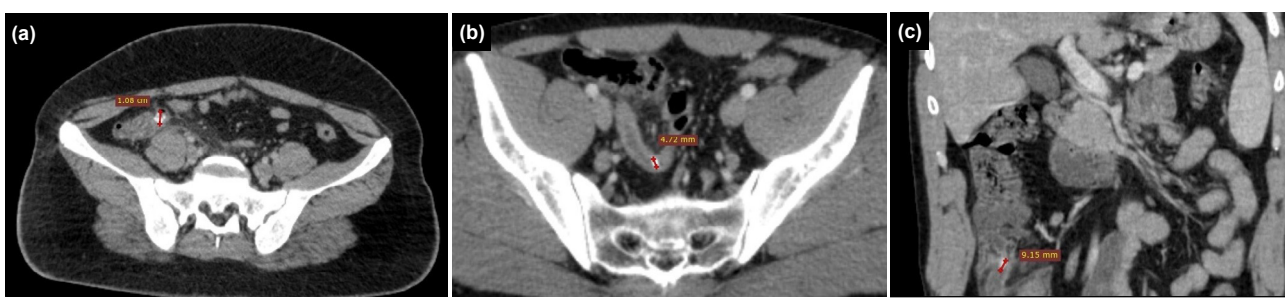

Figure 2. Measurement of the appendicolith diameter at its widest point. Axial planes **(a, b)** and coronal plane **(c)**.

Table 1. Computed tomography (CT) appendicitis scoring system

	0 Points	1 Point	2 Points	3 Points	4 Points	5 Points
Appendiceal diameter (mm)	<6	6-8	8-10	10-12	12-14	>14
Wall thickness of appendix (mm)		<3	3-4	>4		
Intra-abdominal free fluid	-	+				
Short axis of largest periappendiceal lymph node (mm)	<10	>10				
Periappendiceal fat stranding (cm)	-	<1.5	≥1.5			

CT: Computed tomography.

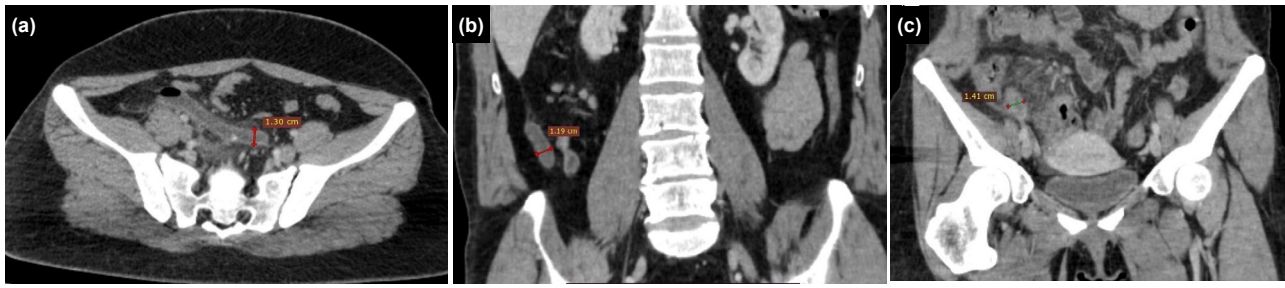

Figure 3. Examples of appendix diameter grading. On contrast-enhanced abdominal computed tomography (CT) scans, the diameter of the appendix was graded as 4 points when it measured 12-14 mm **(a)**, 3 points for 10-12 mm **(b)**, and 5 points when greater than 14 mm **(c)**.

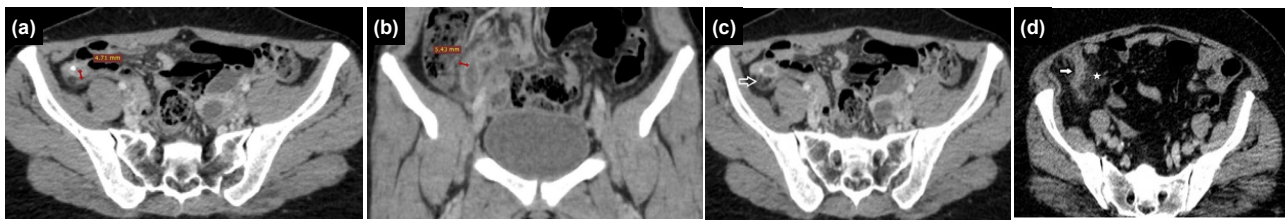

Figure 4. Examples of appendix wall thickness and severity of periappendiceal fat stranding. On contrast-enhanced abdominal computed tomography (CT) scans, wall thickness was graded as 3 points when the appendix wall was >4 mm **(a, b)**. Periappendiceal fat stranding was graded as 1 point when <1.5 cm (white arrow, c), and 2 points when ≥1.5 cm (white star). Wall thickening of the enlarged appendix is also visible (white arrow) **(d)**.

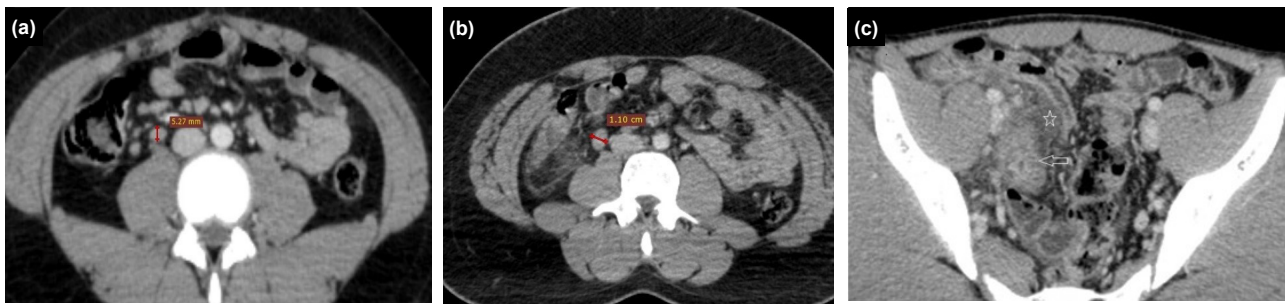

Figure 5. Examples of the short axis of the largest periappendiceal lymph node and presence of intra-abdominal free fluid. On contrast-enhanced abdominal computed tomography (CT) scans, lymph nodes were graded as 0 points when <10 mm **(a)**, and 1 point when >10 mm **(b)**. Intra-abdominal free fluid was graded as 1 point (white star), with concurrent severe wall thickening of the enlarged appendix visible (white arrow) **(c)**.

Table 2. Demographic characteristics of the study population (n=294)

Study Group	Male n (% of total)	Female n (% of total)	Total n (%)
Group 1	101 (34.4)	39 (13.3)	140 (47.6)
Age	28 (19-86)	39 (19-74)	30 (19-86)
Group 2	94 (32)	60 (20.4)	154 (52.4)
Age	30 (19-77)	37 (19-89)	35 (19-89)
Total	195 (66.3)	99 (33.7)	294 (100)

Patient data are expressed as number (n) and percentages (%). Age is reported as the median (interquartile range).

Laboratory Tests

Preoperative CBC parameters, including WBC, NEU, lymphocyte (LYM), monocyte (MONO), and PLT counts, as well as NEU percentage and serum CRP levels, were analyzed. The SII was calculated using the formula: SII = PLT × NEU / LYM.

Statistical Analysis

Data analysis was performed using SPSS Statistics for Windows, version 27.0.1 (IBM Corp., Armonk, NY, USA). Descriptive statistics were presented as mean ± standard deviation for continuous variables and as frequencies and percentages for categorical variables. The normality of data distribution was assessed using the Kolmogorov-Smirnov test. For comparison of continuous variables between two independent groups, the independent samples t-test was used for normally distributed variables, while the Mann-Whitney U test was applied for non-normally distributed variables. For categorical variables, the chi-square test or Fisher's exact test was used, depending on the data characteristics. Correlation analysis between numerical variables was conducted using Spearman's rank correlation coefficient. Specifically, the relationships between CTAS, appendicolith diameter, and inflammatory markers (CRP, MONO, and SII) were assessed. Subgroup analyses were performed to evaluate statistical differences in CT and laboratory findings based on the presence of a single versus multiple appendicoliths, as well as between perforated and non-perforated appendicitis. Statistical significance was defined as a two-tailed p value <0.05.

RESULTS

Appendicoliths were detected in 140 of 294 patients (47.6%) diagnosed with AA. The median age was 31 years (interquartile range: 19-89), and 33.7% of the study participants were female. Basic demographic characteristics are summarized in Table 2. There was no significant difference in age between the two groups (p=0.842), but the proportion of female patients was higher in Group 2 (p=0.044).

In Group 1, 58 patients (41.4%) had a single appendicolith, while 82 patients (48.6%) had more than one. The mean appendicolith diameter was 6.53± 4.03 mm (range: 1.7-21.8).

The mean diameter and wall thickness of the appendix were higher in Group 1 (p<0.001 and p=0.024, respectively). There was no significant difference in the short axis of the largest periappendiceal lymph node between the two groups (p>0.804). The average CTAS was 7.51±2.35 (range: 2-13) in Group 1 and 6.38±2.41 (range: 2-12) in Group 2, with CTAS being higher in Group 1 (p<0.001) (Table 3).

Intra-abdominal fluid was present in 71 of 140 patients (50.7%) in Group 1 and 55 of 154 patients (35.7%) in Group 2, with a higher incidence in Group 1 (p=0.009).

When periappendiceal fat stranding was scored (none=0 points, <1.5 cm=1 point, >1.5 cm=2 points), the mean score was 1.28±0.56 in Group 1 and 1.04±0.60 in Group 2. These findings indicate that the severity of periappendiceal fat stranding was higher in Group 1 (p<0.001).

A positive correlation was observed between appendicolith diameter and CTAS (r=0.450, p<0.001). Patients with a single appendicolith had a mean CTAS of 7.83±2.58 (range: 2-13), while those with more than one appendicolith had a mean CTAS of 8±2.07 (range: 4-12). CTAS was significantly higher in patients with multiple appendicoliths (p=0.003).

Appendiceal perforation was observed in 15 patients (10.7%) in Group 1 and in five patients (3.2%) in Group 2, with a higher incidence in Group 1 (p=0.011). There was no significant association between appendicolith diameter and the rate of perforation (p>0.05). However, the perforation rate was higher in patients with more than one appendicolith compared to those with a single appendicolith (p=0.019).

The mean CTAS was 10±1.13 (range: 7-12) in patients with perforation, and 7.22±2.29 (range: 2-13) in patients without perforation, with higher values in the perforated group (p<0.001).

The MONO count was significantly higher in Group 1 (p=0.002). However, no significant differences were found between Groups 1 and 2 in other CBC parameters, SII, or CRP levels (p>0.05). Laboratory parameters for both groups are presented in Table 4.

Table 3. Computed tomography (CT) appendicitis score, appendix diameter and wall thickness, and short axis of the largest periappendiceal lymph node in Groups 1 and 2

	Group	n	Mean	Std Deviation	Std Error	95% CI (Mean Lower-Upper Bound)		Min	Max	P*
Appendiceal diameter (mm)	1	140	12.85	3.40	0.29	12.29	13.42	6.5	21	<0.001
	2	154	11.23	2.89	0.23	10.77	11.69	6.2	21	
Wall thickness of appendix (mm)	1	140	3.38	0.67	0.29	3.27	3.49	2.1	6.4	0.024
	2	154	3.18	0.81	0.23	3.05	3.31	1.6	7.3	
Short axis of largest periappendiceal lymph node (mm)	1	140	5.62	1.82	0.15	5.31	5.92	2.3	11	0.804
	2	154	5.67	1.97	0.16	5.35	5.98	1.9	15	
CT appendicitis score	1	140	7.51	2.35	0.20	7.12	7.91	2	13	<0.001
	2	154	6.38	2.41	0.19	5.99	6.76	2	12	

CT: Computed tomography; Std: Standard; CI: Confidence interval; Min: Minimum; Max: Maximum. *P values indicate statistical differences between Group 1 and Group 2.

Table 4. Laboratory parameters in Group 1 and Group 2

Parameter	Group	n	Mean	Std Deviation	Std Error	95% CI (Mean Lower-Upper Bound)		Min	Max	P*
WBC (10^3 mcL)	1	140	14.11	3.97	0.34	13.45	14.78	4.34	24.73	0.261
	2	154	13.57	4.32	0.35	12.88	14.25	4.84	30.37	
NEU (10^3 mcL)	1	140	11.48	3.91	0.33	10.83	12.14	2.16	22.80	0.174
	2	154	10.83	4.31	0.35	10.14	11.51	2.71	27.51	
MONO (10^3 mcL)	1	140	0.74	0.38	0.03	0.67	0.80	0.13	2.70	0.002
	2	154	0.62	0.24	0.02	0.58	0.66	0.08	1.71	
LYM (10^3 mcL)	1	140	1.61	0.71	0.06	1.49	1.73	0.54	4.29	0.54
	2	154	1.78	0.82	0.07	1.65	1.91	0.42	4.22	
PLT (10^3 mcL)	1	140	253.49	65.25	5.51	242.59	264.40	127.00	480.00	0.493
	2	154	258.75	65.75	5.30	248.28	269.21	111.00	458.00	
CRP (mg/L)	1	140	40.93	74.61	6.31	28.46	53.40	0.31	372.00	0.133
	2	154	29.81	50.44	4.06	21.78	37.84	0.10	304.00	
SII (PLT×NEU/LYM)	1	140	2299.34	1733.77	146.53	2009.62	2589.06	234.61	11451.02	0.463
	2	154	2144.34	1873.35	150.96	1846.11	2442.57	248.21	11537.58	

Std: Standard; CI: Confidence interval; Min: Minimum; Max: Maximum; WBC: White blood cell count; NEU: Neutrophils; MONO: Monocytes; LYM: Lymphocytes; PLT: Platelets; CRP: C-reactive protein; SII: Systemic immune-inflammation index. *P values indicate statistical differences between Group 1 and Group 2.

In patients with perforated appendicitis (20/294, 6.80%), the mean CRP level was 116.23±27.38 mg/L (range: 3.34-372 mg/L), whereas in patients with non-perforated appendicitis (274/294, 93.2%), it was 29.19±3.16 mg/L (range: 0.1-365 mg/L). The mean CRP level was higher in patients with perforation (p<0.001). The MONO count was also higher in patients with perforation (p=0.026). However, no statistically significant differences were observed between perforated and non-perforated patients in other CBC parameters or SII values (p>0.05) (Table 5).

DISCUSSION

The results of the present study showed that the severity of periappendiceal inflammation on CT and the rate of appendiceal perforation were higher in patients with AA and

Table 5. Laboratory parameters in perforated and non-perforated appendicitis patients

Parameter	Group	n	Mean	Std Deviation	Std Error	95% CI (Mean Lower-Upper Bound)		Min	Max	P*
WBC	Perforated	20	13.52	4.35	0.97	11.49	15.56	7.04	24.24	0.465
(10^3 mcL)	Non-perforated	274	13.85	4.16	0.25	13.36	14.34	4.34	30.37	
NEU	Perforated	20	10.76	4.09	0.92	8.85	12.68	5.53	21.94	0.674
(10^3 mcL)	Non-perforated	274	11.17	4.14	0.25	10.67	11.66	2.16	27.51	
MONO	Perforated	20	0.83	0.52	0.12	0.59	1.07	0.31	2.52	0.026
(10^3 mcL)	Non-perforated	274	0.67	0.30	0.02	0.63	0.70	0.08	2.70	
CRP (mg/L)	Perforated	20	116.23	122.45	27.38	58.92	173.53	3.34	372.00	<0.001
	Non-perforated	274	29.19	52.28	3.16	22.97	35.40	0.10	365.00	
SII	Perforated	20	2675.95	2760.06	617.17	1384.20	3967.70	234.61	11451.02	0.226
(PLT×NEU/LYM)	Non-perforated	274	2184.73	1719.63	103.89	1980.21	2389.25	248.21	11537.58	

Std: Standard; CI: Confidence interval; Min: Minimum; Max: Maximum; WBC: White blood cell count; NEU: Neutrophils; MONO: Monocytes; CRP: C-reactive protein; SII: Systemic immune-inflammation index; PLT: Platelets; LYM: Lymphocytes. *P values represent the statistical difference between perforated and non-perforated patients.

appendicoliths compared to those without appendicoliths. A positive correlation was observed between the presence of appendicoliths and CTAS. However, there was no significant relationship between appendicolith diameter and the rate of appendiceal perforation. Patients with more than one appendicolith had a higher perforation rate than those with a single appendicolith. Among CBC parameters, the MONO count was the only value higher in patients with appendicoliths. CRP levels and SII values did not differ significantly between patients with and without appendicoliths. In contrast, patients with perforated appendicitis had higher CTAS, CRP, and MONO levels.

Recently, with the increased use of conservative medical management, the importance of identifying appendicoliths in acute appendicitis has grown. Additionally, endoscopic retrograde appendicitis therapy (ERAT) has emerged as a promising, minimally invasive alternative for managing AA. Although not statistically significant, a systematic review found that the success rate of ERAT was higher and the recurrence rate lower in patients treated with ERAT compared to those treated with antibiotics.[11] Furthermore, the same study reported that the incidence of adverse events associated with ERAT was significantly lower than with antibiotic therapy. In another study,[12] ERAT was reported to be a safe, effective, and minimally invasive alternative treatment method for chronic fecalith appendicitis.

Appendicoliths have been recognized as a major cause of acute appendicitis since the first case was reported in 1848, and their incidence in patients with symptomatic appendicitis ranges from 30% to 55%.[4] In 1949, Felson[13] reported a 33% prevalence of appendicoliths in surgically removed appendices confirmed to have AA by radiography. In contrast, autopsy specimens of non-inflamed appendices, subsequently imaged by radiography, showed a much lower prevalence of appendicoliths, with a detection rate of only 3%. A previous study[5] in adult patients reported that appendicoliths were identified in 38.7% (96/248) of patients diagnosed with appendicitis, while only 4.4% (11/248) of those without appendicitis showed appendicoliths on CT imaging. The results of this study are consistent with the literature. One or more appendicoliths were identified in 140 of 294 patients (47.6%) diagnosed with AA on CT. As our study focused solely on patients diagnosed with AA, we were unable to assess the prevalence of appendicoliths in individuals without appendicitis.

Wangensteen and Dennis[14] were the first to propose the hypothesis that luminal obstruction is the primary triggering factor in AA. This theory suggests that obstruction by an appendicolith leads to accumulation of secretions within the appendiceal lumen, resulting in increased intraluminal pressure, venous congestion, and bacterial proliferation. It has been reported that larger and more numerous appendicoliths are associated with AA.[4,15] Several studies have consistently demonstrated a correlation between the presence of appendicoliths and a higher incidence of complicated AA.[4,5,16,17] These studies show that AA with appendicoliths is associated with increased inflammatory severity, higher grades of inflammation, a greater likelihood of perforation, and a higher rate of failure in medical treatment. In the present study, appendiceal perforation was more common in patients with appendicoliths (p=0.011). Our findings align with the literature, confirming that appendicoliths are associated with a higher rate of perforation in patients with AA. In addition, similar to other studies, our data showed a positive correlation between the number of appendicoliths and the rate of appendiceal perforation. However, we did not find a significant

association between appendicolith diameter and the rate of appendiceal perforation. We believe this discrepancy from the literature may be due to the relatively low number of patients with both appendicoliths and perforation in our study.

Most published research on the non-surgical management of AA has relied on clinical and ultrasound findings to exclude patients unsuitable for medical treatment. In contrast, only a limited number of studies have utilized CT imaging to assess the severity of inflammation in AA.[5] In our study, we used CTAS derived from CT findings, to evaluate the severity of periappendiceal inflammation. This approach may be helpful in identifying patients who are appropriate candidates for non-operative management of AA in the future.

Multidetector computed tomography is a highly sensitive and specific imaging modality for diagnosing AA. Beyond its primary diagnostic role, MDCT also offers the advantage of simultaneously identifying alternative causes of abdominal pain. Major MDCT findings in appendicitis include appendiceal enlargement with increased diameter and wall thickness, periappendiceal fat stranding, intraluminal appendicoliths, intra-abdominal free fluid, and enlarged pericecal lymph nodes.[6,7] A few studies have evaluated and classified CT findings in AA to develop scoring systems, as was done in our study. These studies reported a positive correlation between higher CTAS and patients diagnosed with complicated appendicitis.[5,7] However, we found limited data in the literature comparing CT findings in patients with AA based on the detectability of appendicoliths on CT. In our study, we compared CTAS according to the presence or absence of appendicoliths.

Our findings support the association between the presence of appendicoliths and increased periappendiceal inflammation. Specifically, we observed that the mean diameter and wall thickness of the appendix, the presence of intra-abdominal fluid, and the severity of periappendiceal fat stranding were all higher in patients with appendicoliths. Consistent with the findings of Ranieri et al.,[5] our study demonstrated a significantly higher CTAS in patients with appendicoliths than in those without.

Additionally, a moderate positive correlation was observed between appendicolith diameter and CTAS (Spearman's r=0.450, p<0.001). We suggest that appendicolith size should be considered during CT interpretation, as this information may help clinicians stratify risk and tailor treatment strategies accordingly. The presence of appendicoliths, particularly larger ones, can significantly increase the suspicion of AA, especially in cases with equivocal CT findings. Similar to previous studies, we found significantly higher CTAS values in patients with more than one appendicolith compared to those with only one.

In our study, the mean CTAS was significantly higher in patients with perforated appendicitis compared to those with non-perforated appendicitis (p<0.001). We believe these findings support further research into the use of CTAS as a predictive tool for appendiceal perforation.

Complete blood count is a highly efficient and cost-effective diagnostic tool and plays a crucial role in the initial evaluation of inflammatory conditions such as AA.[18] It has been reported that patients with suspected appendicitis often exhibit elevated WBC counts, particularly NEU, even when other CBC parameters are within normal limits. However, WBC count alone may not be sufficient to predict complicated AA due to its variable sensitivity and specificity. Different WBC cut-off values have been proposed for identifying complicated cases of AA.[19,20] CRP is a well-established inflammatory marker that rises during the acute phase of various diseases, including AA. Elevated CRP levels are reliable indicators of the severity of inflammation and the risk of perforation in AA.[21]

In our study, we analyzed blood test results and CRP levels in patients with AA. Due to the retrospective design, we did not include data from healthy individuals for comparison. Among the CBC parameters, the only value that differed between patients with and without appendicolith was the MONO count, which was higher in patients with appendicoliths (p=0.002). We found no difference in CRP levels between patients with and without appendicitis. However, our study is consistent with the literature regarding CRP levels in patients with and without perforation. CRP levels were significantly higher in the perforated group (p<0.001). Additionally, the MONO count was higher in patients with perforation (p=0.026). Other laboratory parameters did not differ between the perforated and non-perforated groups in this study (p>0.05).

A recently introduced inflammatory index, SII, provides a comprehensive assessment of the balance between immune response and inflammation. Studies have shown a significant association between elevated SII values and adverse clinical outcomes.[22] In a limited number of studies, SII levels were found to be higher in patients diagnosed with AA compared to control groups. These studies emphasized that SII could be used as a supporting parameter in the diagnosis of AA.[23-26] To date, only two studies[23,24] have compared SII values in complicated versus uncomplicated AA, both reporting higher SII levels in patients with complicated appendicitis. However, no studies in the literature have compared SII levels in patients with AA based on the presence or absence of appendicoliths. In our analysis, there was no significant difference in SII between patients with appendicolith-associated AA and those without (p>0.05). Similarly, we found no difference in SII between patients with perforated and non-perforated appendicitis (p>0.05). Future studies are needed to further evaluate the potential utility of SII in diagnosing complicated and uncomplicated appendicitis and to explore its relationship with appendicoliths.

This study has several limitations. It has a retrospective design and was conducted at a single center, which may introduce selection bias and limit the generalizability of the findings. It is possible that non-mineralized luminal accretions

were present but not detected by CT; the relevance of this is unknown. The presence of minimal free fluid may have been due to ovulation in young female patients. Additionally, the time from symptom onset of acute appendicitis to MDCT and surgery was not documented. Laboratory and imaging findings may vary depending on whether they were obtained early or late after symptom onset. Since the number of patients with appendiceal perforation in our study was small, statistical evaluation of the relationship between the number and size of appendicoliths and appendiceal perforation is limited. Furthermore, the analysis was based on CT findings, so its applicability in pediatric and pregnant patients is limited. Future research with larger sample sizes and prospective designs would be beneficial to further validate the findings of this study.

CONCLUSION

Acute appendicitis with CT-detected appendicolith is associated with more pronounced inflammation and a higher risk of perforation. CT scoring systems that include inflammatory and other imaging findings may be helpful in assessing disease severity. CTAS, CRP, and MONO levels tended to be higher in cases with perforation. A comprehensive evaluation, including the presence of appendicoliths on CT, CT appendicitis score, and relevant laboratory parameters, may provide valuable insights into the severity of inflammation in acute appendicitis.

Ethics Committee Approval: This study was approved by the Süleyman Demirel University Human Research Ethics Committee Ethics Committee (Date: 06.03.2023, Decision No: 4/43).

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ORİJİNAL ÇALIŞMA - *ÖZ*

BT'de apendikolit saptanan/saptanmayan akut apandisitlerde BT apandisit skoru ve laboratuvar parametrelerinin değerlendirilmesi

AMAÇ: Akut apandisitin (AA) ameliyatsız tedavisine olan artmış ilgi, apendikoliti daha önemli bir konu haline getirmiştir. Bu çalışmada, AA tanısı alan, bilgisayarlı tomografide (BT) apendikoliti olan ve olmayan hastalarda BT apandisit skorunu (BTAS), tam kan sayımını (CBC), C-reaktif protein (CRP) değerlerini ve sistemik immün inflamasyon indeksini (SII) değerlendirmek, perfore olan ve olmayan hastalarda bulguları karşılaştırmak amaçlanmıştır.
GEREÇ VE YÖNTEM: Ocak 2020 ile Ocak 2023 tarihleri arasında AA tanısı alan apendikolitli (Grup 1, 140/294; %47.6) ve apendikoliti bulunmayan (Grup 2, 154/294; %52.4) 294 hasta retrospektif olarak tarandı. AA BT bulguları ve BTAS'ler değerlendirildi. CBC, CRP değerleri ve SII skorları gruplar arasında karşılaştırıldı ve apendiks perforasyonu incelendi.
BULGULAR: Apendiks ortalama çap ve duvar kalınlığı, batın içi serbest sıvı varlığı ve periapendisiyel yağ dokuda enflamasyon şiddeti Grup 1'de daha yüksekti (sırasıyla, $p<0.001$, $p=0.024$, $p=0.009$, $p<0.001$). BTAS (Grup 1'de 7.51±2.36 ve Grup 2'de 6.38±2.42) Grup 1'de daha yüksekti ($p=0.027$). Apendikolit çapı (6.53±4.03 mm) ile BTAS arasında pozitif bir korelasyon gözlendi ($rho=0.450$, $p<0.001$). Grup 1'de, birden fazla apendikoliti olan hastalarda BTAS daha yüksekti ($p=0.003$). Perforasyon Grup 1'de 15 hastada (%10.7) ve Grup 2'de 5 hastada (%3.2) saptanmış olup, Grup 1'de görülme sıklığı daha yüksekti ($p=0.011$). Grup 1'de birden fazla apendikoliti olan hastalarda perforasyon oranı daha yüksekti ($p=0.019$). Ortalama BTAS değerleri (perfore hastalarda 10±1.13 ve perfore olmayan hastalarda 7.22±2.29) apendiks perforasyonu olan hastalarda daha yüksekti ($p<0.001$). Monosit (MONO) sayısı Grup 1'de daha yüksekti ($p=0.002$). Diğer CBC parametrelerinde, CRP değerlerinde ve SII skorlarında Grup 1 ve 2 arasında anlamlı farklılık izlenmedi ($p>0.05$). CRP değerleri ve MONO sayıları perfore apandisitli hastalarda daha yüksekti (sırasıyla, $p<0.001$, $p=0.026$).
SONUÇ: Apendikolitin eşlik ettiği AA'da enflamasyon daha belirgindir ve perforasyon oranları yüksektir. BTAS, CRP değerleri ve MONO sayıları apendiks perforasyonlarında daha yüksek olma eğilimindedir. Apendikolit varlığını, BTAS ve laboratuvar parametrelerini içeren kapsamlı bir değerlendirme, AA'daki enflamasyon şiddeti hakkında değerli bilgiler sağlayabilir.

Anahtar sözcükler: Akut apandisit; apendiks perforasyonu; apendikolit; BT apandisit skoru; C-reaktif protein.

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