

Evaluation of the Contribution of Computed Tomography Findings and Neutrophil/Lymphocyte and Neutrophil/Platelet Ratios in the Diagnosis of Acute Epiploic Appendagitis

Akut Epiploik Apandajit Tanısında Bilgisayarlı Tomografi Bulguları ile Nötrofil/Lenfosit ve Nötrofil/Platelet Oranlarının Katkısının Değerlendirilmesi

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Öz

Akut epiploik apandisit (AEA) kolon çevresindeki yağla dolu keselerin enfeksiyonu veya iskemisi ile karakterize nadir bir hastalıktır. Teşhis edilmesi zordur ve ameliyat gerektiren diğer akut karın ağrısı ile karıştırılabilir. Bilgisayarlı tomografi (BT), akut epiploik apandisit tanısında altın standart tekniktir. Çalışmamız, karın ağrısı ile başvuran hastalarda AEA BT bulgularını ve tam kan sayımından elde edilen nötrofil-lenfosit ve nötrofil-trombosit oranlarının tanısal değerini değerlendirmeyi amaçlamaktadır. AEA tanısı konulan 40 hasta ve benzer karın ağrısı şikayeti olan ve tedavi için acil ameliyat gerektiren 80 hasta olmak üzere toplam 120 hastayı çalışmaya dahil ettik. Öncelikle kontrol grubundaki hasta sayısını belirlemek için güç analizi yapıldı. Kontrol grubu hastaları, akut cerrahi girişim gerektiren karın ağrısı olan hastalar arasından kura programı ile belirlendi. Kontrol grubunda akut apandisit, peptik ülser perforasyonu, kolon perforasyonu, mezenter iskemisi, üreter taşı, over torsiyonu, over kisti rüptürü ve ektopik gebelik rüptürü tespit edilen patolojiler idi. AEA grubundaki ortalama yaş 41.6 idi ve grubun çoğunluğu erkekti (%70) ve bu grupta en sık görülen şikayet karın ağrısı (%80.1) idi. Nötrofil/lenfosit ve nötrofil/platelet oranları, AEA grubunda, ameliyat gerektiren akut karın ağrısı grubuna göre anlamlı derecede düşüktü ($p<0.001$). Nötrofil/lenfosit oranı ve nötrofil/platelet oranı için kesim değerleri sırasıyla 5.80 ve 6.96 idi. Bu bulgular, nötrofil/lenfosit oranı ve nötrofil/platelet oranının akut epiploik apandisit tanısı koymaya ve onu acil cerrahi gerektiren çeşitli karın ağrısı nedenlerinden ayırmaya yardımcı olabileceğini ve potansiyel olarak gereksiz cerrahi müdahaleyi önleyebileceğini göstermektedir.

Anahtar Kelimeler: Akut Epiploik Apandisit, Akut Karın Ağrısı, Nötrofil-Lenfosit Oranı, Nötrofil-Trombosit Oranı

Abstract

Acute epiploic appendicitis (AEA) is a rare disease characterized by infection or ischemia of fat-filled sacs around the colon. It is difficult to diagnose and can be confused with other acute abdominal pain requiring surgery. Computed tomography (CT) is the gold standard technique for acute epiploic appendicitis. Our study aims to evaluate the CT findings of acute epiploic appendicitis and the diagnostic value of neutrophil-lymphocyte ratios (NLR) and neutrophil-platelet ratios (NPR). We included one hundred twenty patients, 40 of whom were diagnosed with acute epiploic appendicitis, and 80 had similar complaints of abdominal pain and needed urgent surgery for treatment. First of all, power analysis was performed to determine the number of patients in the control group. Control group patients were determined by a lottery program. Pathologies detected in the control group were acute appendicitis, peptic ulcer perforation, colon perforation, mesenteric ischemia, ureteral stone, ovarian torsion, ovarian cyst rupture, and ectopic pregnancy rupture. The mean age in the AEA group was 41.6 years, and the group was predominantly male (70%). The most common complaint of the AEA group was abdominal pain (80.1%). NLR and NPR were significantly lower in the AEA group compared to the acute abdominal pain requiring surgery group ($p<0.001$). The cut-off values for NLR and NPR were 5.80 and 6.96, respectively. These findings suggest that neutrophil/lymphocyte ratio and neutrophil/platelet ratio may help diagnose AEA and distinguish it from various causes of abdominal pain that need urgent surgery, potentially preventing unnecessary surgical intervention.

Keywords: Acute Epiploic Appendicitis, Acute Abdominal Pain, Neutrophil-Lymphocyte Ratio, Neutrophil-Platelet Ratio

Introduction

Epiploic appendages, also known as epiploic extensions, were first described by Vesalius in 1543 (1). Acute epiploic appendagitis (AEA) refers to the inflammation or ischemia of peritoneal outpouchings filled with fat located around the colon

segments from the cecum to the rectosigmoid junction and the vermiform appendix, which can occur due to torsion or spontaneous venous thrombosis (2). It is usually a self-limiting condition and most commonly affects patients in the 2nd to 5th decades and prefers women and obese individuals, probably due to larger appendages. Its frequency is approximately 1.3% of cases with abdominal pain (3). It is rare in pediatric patients since epiploic appendages are not yet fully developed (4). AEA's rarity and nonspecific clinical symptoms sometimes make its diagnosis challenging.

The patient's main presenting symptoms are abdominal pain and defense during the abdominal examination. While AEA presents with symptoms similar to the acute abdomen, it is a disease that can be effectively treated conservatively; however, it can be clinically confused with conditions requiring

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surgery (5,6). Pain may be more localized than other acute abdomen reasons like diverticulitis or acute appendicitis, as there is focal peritoneal irritation (7). For diagnosis, ultrasonography (US), computed tomography (CT), and magnetic resonance (MR) imaging may be used. The ultrasonography often reveals a moderately hyperechoic, ovoid, non-compressible mass close to the colon with considerable discomfort (8,9). CT is the gold standard imaging technique for evaluating patients with acute abdominal pain of uncertain origin (10). In modern radiology technology, the diagnosis of AEA can be reliably established using CT.

The normal epiploic appendages, which are small fatty projections on the surface of the colon, are typically not easily visualized on CT images. Their density is similar to fatty tissue in the surrounding peritoneal wall and omentum, resulting in overlapping appearances. In the case of inflammation of the epiploic appendix, CT can reveal specific findings, such as an oval-shaped lesion with fat attenuation (similar to adipose tissue) surrounded by a thin hyperdense rim on CT, known as the hyperattenuating ring sign. This lesion is typically located adjacent to the colon and is linked with adjacent mesentery inflammation (Figure 1,2). Another characteristic finding is an area of significant attenuation in the center of the fatty lesion, known as the central dot sign. This central dot represents a thrombosed vein within the AEA (Figure 3).



Figure 1. Axial sections of contrast enhanced CT, an oval-shaped inflamed fatty tissue area surrounded by a hyperdense ring at the level of the hepatic flexure (arrow).

The neutrophil-to-lymphocyte ratio (NLR) has been proposed to assess the extent of systemic inflammation, and NLR has been shown to correlate with worse outcomes in patients with infection (11). Also, the neutrophil-to-platelet ratio (NPR) is

implicated in the inflammatory response to infections; it may affect the platelet count and the thrombotic process, which might lead to thrombosis (12).

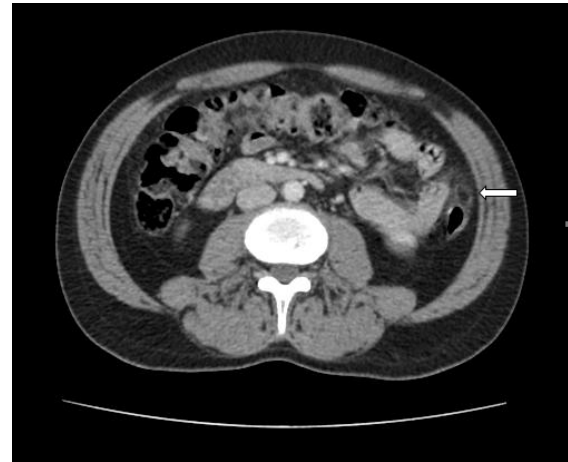


Figure 2. In axial CT scans with intravenous contrast, epiploic appendagitis is seen at the level of the descending colon. Hyperattenuated ring sign observed around inflamed fat tissue (arrow).

In this study, we aim to review the CT findings of AEA and examine the contribution of acute phase reactants, such as the neutrophil/lymphocyte ratio (NLR) and neutrophil/platelet ratio (NPR) based on complete blood count, in diagnosing the AEA. By identifying markers that can place the diagnosis of AEA among the differential diagnoses of patients presenting with AAPRS, we intend to promote conservative management and prevent unnecessary surgical procedures.



Figure 3. In axial CT scans with intravenous contrast, a hyperattenuated ring sign (big arrow) adjacent to the sigmoid colon and a focal increase in density (central dot sign) of thrombosed veins in its center (thin arrow).

Material and Method

Ethical approval

Our study was conducted according to the guidelines and regulations of the Institutional Review Board of Health Sciences University Ankara

Dışkapı Yıldırım Beyazıt Training and Research Hospital with a 36/06 approval number dated 27.03.2017.

Patient selection

By using the keywords 'epiploic appendagitis' in the abdominal CT reports from the hospital data storage system, 43 cases of epiploic appendagitis were found between January 2014 and December 2016. Since the data of 3 patients could not be accessed, they were not included in the study. The main outcome variables of the study are NLR and NPR, respectively, in terms of NLR and NPR averages between groups; In order to test the statistical significance of the differences of at least 12.52 and 278.6 at 95% power and 5% error level (two cases for each control case), it was planned to include at least 15 cases in the control group and at least 29 cases in the case group (13). For NLR, effect size $d=1.3969678$ and for NPR, effect size $d=1.1860167$ was calculated. Two control patients were taken for each case. Among the 4957 patients who applied to our hospital with acute abdominal pain between 2018-2020 and had abdominal CT for this reason, 43 people diagnosed with epiploic appendicitis were excluded. Of the 4914 patients, 3372 who did not receive acute surgical treatment were excluded, and among 1542 patients were identified. The remaining 1542 patients whose treatment resulted in acute surgery were loaded into the lottery program, and the command was given to select 80 patients for the control group.

Data collection

Demographic data, clinical characteristics, NLR, and NPR values were extracted from the patient's records. CT images of patients diagnosed with AEA were reevaluated at the location of AEA within the abdomen, lesion size, presence of linear stranding around the lesion, oval-shaped lesion with fat attenuation surrounded by a thin hyperdense rim (hyperattenuating ring sign), central hyperdensity (central dot sign), and thickening of adjacent peritoneum by radiologists. The NLR and NPR were

obtained from the hemogram results of the patients. The NLR was calculated by dividing the neutrophil count by the lymphocyte count, and the NPR was calculated by dividing the neutrophil count by the platelet count obtained from complete blood counts.

Statistical analysis

The correlation between NLR, NPR, and AEA was also assessed. The χ^2 -test, independent t-test and Mann-Whitney U test were used to compare distributions between the two groups. The diagnostic performance of NLR and NPR was evaluated by calculating sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). We used a receiver operating characteristic (ROC) curve analysis to calculate the cut-off. Statistical analysis was performed by IBM SPSS Statistics for MAC.

Results

40 patients were diagnosed with AEA, 28(70%) were male and 12(30%) were female; the mean age of the patients was 41.6 ± 9.3 . The main complaints were 80.1% abdominal pain, 9.5% groin pain, 7.8% flank pain with nausea and vomiting (2.6%), and abdominal discomfort and painful micturition.

The average time of symptoms was 4.3 days (1-15 days). In the CT scan images, AEA was located in the descending colon (28, 70%), ascending colon (3, 7.5%), cecum (2, 5%), and transverse (7, 17.5%). "hyperattenuating ring sign" was detected in 30 (75%) patients and "central dot sign" was seen in 21 (52.5%) patients. No patient underwent surgical treatment. However, 10 (25%) patients were hospitalized for medical treatments (Table 1).

42(52.5%) were male and 38(47.5%) were female of 80 patients in the AAPRS group; the mean age of the patients was 45.2 ± 8.7 . The main complaints were 65.9% abdominal pain, 15.9% groin pain, 10.2% flank pain with nausea and vomiting (8.4%), and abdominal discomfort and painful micturition. The average time of symptoms was 6.2 days (2-12 days).

Table 1. Patient Characteristics and Clinical Factors in Acute Epiploic Appendagitis (AEA) Group and Abdominal Pain Groups Requires Surgery (AAPRS) Group.

	AEA Group	AAPRS Group	Statistical Test	p-value
Number of Patients	40	80		
- Male	28 (70%)	48 (52.5%)	Chi-square test	0.104
- Female	12 (30%)	32 (47.5%)		
Mean Age	41.6±9.3	45.2±8.7	Independent t-test t value:2.124	0.048
Main Complaints			Chi-square test	0.174
- Abdominal pain	80.1%	65.9%		
- Groin pain	9.5%	15.9%		
- Flank pain with nausea and vomiting	7.8%	10.2%		
-Abdominal discomfort and painful micturition	2.6%	8.4%		
Average Time of Symptoms	4.3 days	6.2 days	Mann-Whitney U test U value: 174.5	0.065
Hospitalization	10 (45%)	80 (100%)	Chi-square test	0.02

In the CT scan images of the AAPRS group, the most common findings were consistent with usual abdominal emergencies causing abdominal pain, such as acute appendicitis, peptic ulcer perforation, colon perforation, mesenteric ischemia, ureteral stone, ovarian torsion, ovarian cyst rupture, and ectopic pregnancy rupture.

The mean age of the AEA Group was 41.6±9.3 years, whereas the AAPRS group had a slightly higher mean age of 45.2±8.7 years. There was a significant difference between the groups (p=0.048).

The distribution of other complaints, such as groin pain, flank pain with nausea and vomiting, and abdominal discomfort with painful micturition, differed slightly between the groups, and there was not a statistically significant difference between the groups (p=0.174).

The average time of symptoms in the AEA Group was 4.3 days. In contrast, the AAPRS group had an average time of 6.2 days, and there was a trend toward a shorter duration of symptoms in the AEA Group, but there was no statistical difference between the groups (p=0.065). Regarding hospitalization, ten patients in the AEA Group (25%) required hospital admission, while 80 patients

in the AAP Group (100%) were hospitalized (p=0.02) (Table 1).

We revealed a significantly lower mean NLR in patients diagnosed with AEA than the AAPRS (mean NLR±standard deviation vs. NLR in the control group, p<0.001). The mean NLR for the AEA group was 3.463, the standard deviation was 2.34, and the cut-off value for NLR was 5.80. The mean NPR for the AEA group was 4.121, the standard deviation for NPR in the CT-positive group was 2.84, and the cut-off value for NPR was 6.96 (Table 2). The mean NLR for the AAPRS group was 9.341, the standard deviation was 3.48, and the cut-off value for NLR was 11.01. The mean NPR for the AAPRS group was 11.127, the standard deviation for NPR in the CT-positive group was 3.89, and the cut-off value for NPR was 13.9. This indicates that based on the given cut-off values, NLR and NPR have a sensitivity of 26.9% and 30.8% in correctly identifying AEA cases. The specificity is 92.0%, indicating a high ability to identify AEA cases correctly. The PPV was 77.8%, and the NPV was 52.4% for NLR and the PPV was 52.4 and the NPV was 52.4 for NPR.

Table 2. Mean and Standard Deviation of Neutrophil-to-Lymphocyte Ratios (NLR) and Platelet-to-Lymphocyte Ratios (NPR) in Acute Epiploic Appendagitis (AEA) and Abdominal Pain Requires Surgery (AAPRS) groups with Cut-off Values.

	Mean	Standard Deviation	Cut-off Value
<i>AEA group NLR</i>	3.463	2.34	5.8
<i>AEA group NPR</i>	4.121	2.84	6.96
<i>AAPRS group NLR</i>	9.341	3.48	11.01
<i>AAPRS group NPR</i>	11.127	3.89	13.9

Discussion

AEA is a rare condition characterized by inflammation or ischemia of fat-filled sacs around the colon. Ischemia develops due to torsion or spontaneous venous thrombosis of the relevant epiploic appendage. AEA is more prevalent in males and typically diagnosed in males between the ages of 40 and 50. It is usually linked to hernias, colonic diverticula, obesity, and intense exercise, most commonly seen in the rectosigmoid region. Its clinical symptoms overlap with other acute abdominal conditions, making its diagnosis challenging (1,7,14). However, accurate and timely diagnosis is essential to avoiding unnecessary surgical interventions and preventing high labor and costs for diagnosis and treatment. The CT findings of AEA, including the hyperattenuating ring sign and central dot sign, are specific and can aid in accurately diagnosing the condition. These findings were observed in a significant proportion of AEA patients in our study, supporting the importance of CT imaging in diagnosing suspected cases. CT allows for the visualization of characteristic features of AEA, such as the oval-shaped lesion with fat attenuation surrounded by a thin hyperdense rim and

the central high-attenuation focus representing thrombosed veins within the fatty lesion (15,16).

In today's conditions, CT is a fast, easily accessible examination that provides remote evaluation. CT is very easily accessible in many parts of the world, but it is still not an examination that can be accessed as quickly and as early as it is thought in some parts of the world. In addition, since it is an examination involving radiation, the benefit and harm ratio should be considered when performing CT in emergency departments.

Since AEA presents with severe abdominal pain, it is a clinical condition that can easily be encountered with AAPRS. Misdiagnosis can result in unnecessary hospitalization, antibiotic use, and surgery.

Our results showed that the mean NLR and NPR values were significantly lower in patients diagnosed with AEA compared to the AAPRS group. These findings suggest that NLR and NPR could serve as diagnostic markers for AEA and help differentiate it from other causes of abdominal pain that result from surgery. NLR and NPR showed a moderate diagnostic performance in identifying AEA cases, with a sensitivity of 26.9% and a specificity of 92.0%. The PPV was 77.8%, with an NPV of 52.4%. While NLR and NPR can help identify AEA cases

with high specificity, their sensitivity was low, implying that they might not be accepted as independent diagnostic tools. However, they can provide further supportive information for diagnosing AEA when used with CT findings. With the results of our study, we think that the conservative approach can be made in a safer zone during the diagnosis, follow-up, and treatment stages of patients with low NLR and NPR levels in cases of acute abdominal pain presenting to the emergency department. NLR and NPR may indicate the presence of inflammation and indicate the severity of inflammation. In line with the results we obtained and those obtained in many studies in the literature, it was found that these two parameters were at lower levels in more localized and less severe inflammations (17).

When we looked at the results of our study, we found that the NLR and NPR cutoff values of the AEA and AAPNS groups differed significantly. In this way, we think we can use NLR and NPR as the first step to distinguish AEA cases from patients needing urgent surgery, as they are cheap, efficient, and quickly available, and changes during follow-up correlate with the prognosis of the disease.

The NLR has been shown to predict the severity of various conditions, including severe acute pancreatitis, acute appendicitis, COVID-19, and breast malignancies (18-21). NPR has also been investigated as a prognostic predictor, notably in individuals with metastatic colorectal cancer. Previous research has linked high NLR and NPR levels to esophageal, renal, and hepatocellular cancers (22-25).

Conservative management is the preferred approach for treating AEA. The main purpose of AEA treatment is pain control; anti-inflammatory drugs are prescribed for 4-7 days. Antibiotics are often not indicated. Close monitoring during treatment for AEA is not necessary. However, although very rare, some complications may develop during AEA follow-up. These complications are adhesion, abscess, peritonitis, bowel obstruction, and intussusception. In cases where pain persists or increases after diagnosis and conservative treatment, these complications should be considered. The literature recommends following the dynamic course of NLR and NPR for many clinical conditions, such as cancer and infection. Initial NLR and NPR monitoring and changes in these parameters before repeat imaging in these patients will be helpful to the clinician.

Despite the study's advantages, such as its relatively high sample size and evaluation of CT findings and hematologic markers, significant drawbacks should be noted. First, the study's retrospective approach brings limitations. Second, the study was conducted in a single center, which might limit the findings' generalizability. Future multicenter studies with larger patient populations

must confirm our findings and explore the diagnostic value of NLR and NPR in AEA. Furthermore, in our study, while the specificity values for NLR and NPR were high, the sensitivity value was not as high as expected. It is important that sensitivity and specificity values are balanced and high in order to provide distinctive features. NLR and NPR may not be reliable in terms of discrimination and should not be generalized.

Conclusion

Our study highlights the potential contribution of CT findings and hematologic parameters, specifically NLR and NPR, in diagnosing AEA. While CT remains the gold standard imaging technique, NLR and NPR can serve as supportive markers in identifying AEA cases and differentiating them from other causes of AAPRS.

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Conflict of interest statement

The authors declared no potential conflicts of interest with respect to research, authorship, and publication of this article.

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