ARAŞTIRMA MAKALESİ / RESEARCH ARTICLE

Nötrofil-Lenfosit Oranı: Akut Apandisitin Ciddiyeti için Bir Biyobelirteç

Neutrophil-to-Lymphocyte Ratio: A Biomarker for Severity of Acute Appendicitis

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ÖZ

Giriş: Akut apandisit, akut karın ağrısının yaygın nedenlerinden biridir ve dünya çapında acil karın cerrahisinin en yaygın nedenidir. Nötrofil-lenfosit oranı (NLR), iki farklı immün ve inflamatuar yolak hakkında bilgi veren sistemik bir inflamatuar değişkendir. Bu çalışmada, histopatoloji sonuçlarına göre, komplike ve komplike olmayan apandisitin ayırıcı tanısında NLR'nin prediktif değerini değerlendirmeyi amaçladık.

Yöntem: Eylül 2016 ve Eylül 2022 tarihleri arasında kliniğimizde apendektomi ameliyatı geçiren hastalar çalışmaya dahil edildi. Hastaların ameliyat öncesi beyaz kan hücresi (WBC), nötrofil ve lenfosit sayıları analiz edildi ve nötrofil-lenfosit oranları hesaplandı. Patolojisinde perforasyon ve gangrenöz apandisit olan hastalar komplike olarak kabul edildi. Hastalar komplike ve komplike olmayan apandisit gruplarına ayrıldı ve karşılaştırıldı.

Bulgular: 171 komplike apandisit hastası ile 1309 komplike olmayan apandisit hastası karşılaştırıldı. Komplike apandisit grubunda ameliyat öncesi WBC, nötrofil sayısı ve NLR değerleri istatistiksel olarak anlamlı derecede yüksek bulunurken, lenfosit sayısı daha düşük bulundu. NLR değerleri açısından komplike ve komplike olmayan apandisitler arasında anlamlı fark saptandı, sırasıyla 8.78 ± 5.87 ve 6.33 ± 4.34, p<0.001.

Sonuç: Akut apandisitte perforasyon veya gangren gibi bir komplikasyonu öngörmek için cerrah kişisel deneyiminden, radyolojik görüntüleme yöntemlerinden ve laboratuvar parametrelerinden yararlanabilir. NLR, nötrofil ve lenfosit sayıları bu konuda oldukça yararlı görünmektedir.

Anahtar Kelimeler: apandisit, nötrofil lenfosit oranı, perfore apandisit

ABSTRACT

Objective: Acute appendicitis is one of the common causes of acute abdominal pain and is the most common cause of emergency abdominal surgery worldwide. The neutrophil-to-lymphocyte ratio (NLR) is a systemic inflammatory variable that provides information about two different immune and inflammatory pathways. In this study, according to histopathology results, we aimed to evaluate the predictive value of NLR in the differential diagnosis of complicated and uncomplicated appendicitis.

Method: We included patients who underwent appendectomy surgery in our clinic between September 2016 and September 2022. The white blood cell (WBC), neutrophil, and lymphocyte count of the patients before the surgery were analyzed and the neutrophil-lymphocyte ratios were calculated. Patients with perforation and gangrenous appendicitis on pathology were considered complicated. Patients were divided into complicated and uncomplicated appendicitis groups and were compared.

Results: 171 patients with complicated appendicitis and 1309 patients with uncomplicated appendicitis were compared. In the complicated appendicitis group, preoperative WBC, neutrophil count and NLR values were found to be statistically significantly higher, while the lymphocyte count was lower. There was a significant difference between complicated and uncomplicated appendicitis in terms of NLR values, 8.78 ± 5.87 and 6.33 ± 4.34, respectively, p<0.001.

Conclusion: To predict a complication such as perforation or gangrene in acute appendicitis, the surgeon can benefit from personal experience, radiological imaging methods, and laboratory parameters. NLR, neutrophil, and lymphocyte counts seem to be very helpful in this regard.

Keywords: appendicitis, neutrophil lymphocyte ratio, perforated appendicitis

INTRODUCTION

Acute appendicitis is one of the common causes of acute abdominal pain and is the most common cause of emergency abdominal surgery worldwide. The annual incidence is approximately 100 cases per 100,000 adult population. Despite the symptoms and signs of acute appendicitis, it can sometimes be difficult to diagnose in non-classical cases. It can present as complicated appendicitis with perforation, intra-abdominal abscess, and peritonitis. These complications increase the risk of morbidity and mortality, so early diagnosis and treatment of appendicitis are important to prevent complications. History, physical examination, laboratory, and imaging methods are used in the diagnosis (1-4).

Because of the need for more sensitivity and specificity of many existing screening and scoring tools that help diagnose acute appendicitis, additional blood tests are needed. Some of them are hemogram parameters, serum bilirubin level, and C-reactive protein (CRP). The neutrophil-to-lymphocyte ratio (NLR) is a systemic inflammatory variable that provides information about two different immune and inflammatory pathways. Studies have shown that NLR can be used as a marker in the preoperative diagnosis and prognosis of acute appendicitis. These markers are important in predicting the severity of appendicitis in the preoperative period and the treatment plan to follow (2, 5-7).

In this study, according to histopathology results, we aimed to evaluate the predictive value of NLR in the differential diagnosis of complicated and uncomplicated appendicitis.

MATERIALS AND METHODS

We evaluated patients who underwent appendectomy surgery in Istanbul Sultanbeyli State Hospital between September 2016 and September 2022. We examined the patients' pathology results and included those defined as acute appendicitis in our study. Patients with a normal appendix, appendicular diverticulitis, mucinous neoplasm, fibrous obliteration, foreign body reaction, mucocele, and Enterobius vermicularis infestation were excluded. We also excluded patients with missing data.

The patient's demographic data, length of hospital stay, laparoscopic and open operation type, and complete blood count parameters were examined. The white blood cell (WBC), neutrophil, and lymphocyte count of the patients before the surgery were analyzed and the neutrophil-lymphocyte ratios were calculated. Patients with perforation and gangrenous appendicitis on pathology were considered complicated.

This study was performed in line with the principles of the Declaration of Helsinki and approved by the University of Health Sciences, Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital Scientific Research Ethics Committee (Number: 2023/20)

Statistical analysis

The statistical analysis was conducted using two software packages: the Statistical Package for Social Sciences (Version 25.0, IBM Corp., Armonk, NY) and Jamovi (The jamovi project (2022), Sydney, Australia, Jamovi Version 2.3, Computer Software, retrieved from https://www.jamovi.org). Descriptive measures such as mean and standard deviation were employed for continuous variables, while frequency was utilized for categorical variables. To assess data homogeneity, the Kolmogorov-Smirnov test was employed. Student's t-test was applied to compare two groups during data processing, while the Chi-square test was used for comparing categorical variables. For the characterization and comparison of the accuracy of the hematological ratios, a receiver operating characteristic (ROC) curve was employed. The accuracy of the marker in distinguishing between complicated and uncomplicated appendicitis was evaluated using the area under the curve (AUC). Cut-off values for parameters were calculated using Youden's index. The acceptable confidence interval for statistical significance is 95%, and the bilateral p-value is 0.05.

RESULTS

Between September 2016 and September 2022, 1641 patients underwent appendectomy surgery in our clinic. We excluded 23 patients with missing data, 99 with pathology results reported as a normal appendix, and 39 with pathologies other than appendicitis (e.g., appendicular diverticulitis, mucinous neoplasm, fibrous obliteration, foreign body reaction, Enterobius vermicularis, mucocele). We analyzed 1480 patients whose pathology showed appendicitis.

The mean age of the patients was 29.8 ± 10.4 years, with 1017 (68.7%) males and 463 (31.3%) females (Table 1).

Table 1. Demographic and Perioperative Clinical Characteristics of Appendectomy Patients			
Parameters		**N = 1480**	**Percent**
Age (years, mean ± SD)		29.8±10.4	
Sex	Male	1017	68.7%
	Female	463	31.3%
Complicated appendicitis		171	11.6%
Uncomplicated appendicitis		1309	88.4%
Length of hospital stay (days, mean ± SD)		1.9 ± 1.4	
Type of surgery	Open appendectomy	1392	94.1%
	Laparoscopic appendectomy	88	5.9%
White Blood Cell Count (mean ± SD)		13.95±3.78	
Neutrophil (mean ± SD)		10.88±3.76	
Lymphocyte (mean ± SD)		2.06±0.87	
Neutrophil-lymphocyte Ratio (NLR) (mean ± SD)		6.61±4.61	

Patients were divided into complicated and uncomplicated appendicitis groups according to pathology reports. 171 patients with complicated appendicitis and 1309 patients with uncomplicated appendicitis were compared. In the complicated appendicitis group, preoperative WBC, neutrophil count and NLR values were found to be statistically significantly higher, while the lymphocyte count was lower. There was a significant difference between complicated and uncomplicated appendicitis in terms of NLR values, 8.78 ± 5.87 and 6.33 ± 4.34, respectively, p<0.001 (Table 2).

Table 2. Comparison of Perioperative Parameters of Complicated and Uncomplicated Appendicitis

Parameters		Complicated appendicitis n = 171 (%)	Uncomplicated appendicitis n = 1309 (%)	P-value
Age (years, mean ± SD)		31.17±11.69	29.59±10.27	0.064
Sex	Male	127 (8.6%)	890 (60.1%)	0.096
	Female	44 (3%)	419 (28.3%)	
Length of hospital stay (days, mean ± SD)		2.94±2.56	1.86±1.14	< 0.001
Type of surgery	Open appendectomy	163 (11%)	1229 (83.1%)	0.456
	Laparoscopic appendectomy	8 (0.5%)	80 (5.4%)	
White Blood Cell Count (mean ± SD)		15.45±3.72	13.76±3.75	< 0.001
Neutrophil (mean ± SD)		12.54±3.67	10.67±3.72	< 0.001
Lymphocyte (mean ± SD)		1.84±0.81	2.09±0.87	< 0.001
Neutrophil-lymphocyte Ratio (NLR) (mean ± SD)		8.78±5.87	6.33±.34	< 0.001

Receiver operating characteristic (ROC) analysis was performed to define the cut-off value of NLR to specify patients with complicated appendicitis (Cut point: 4.54, AUC: 0.635; sensitivity: 77.1%; specificity: 40.5%; positive predictive value (PPV): 14.51%; negative predictive value (NPV): 93.16%; p<0.001) (Figure 1).
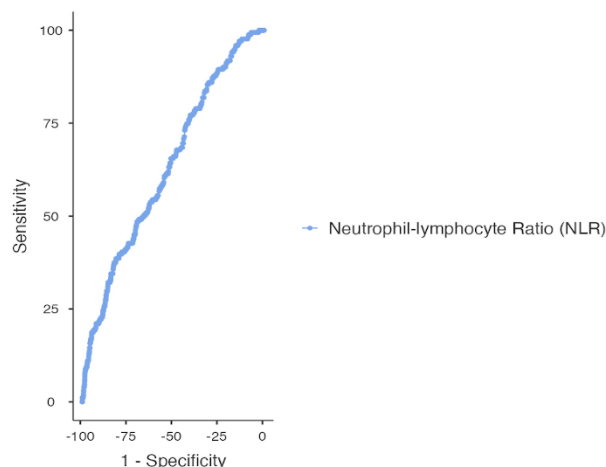
Figure 1. Receiver operating characteristic (ROC) curves of Neutrophil-to-Lymphocyte Ratio to set cut-off value for complicated and uncomplicated appendicitis

DISCUSSION

The overall complication rates for appendicitis range from 8-31%. It is very important to diagnose these complications before they occur (8). Despite the surgeon's physical examination experience and radiological facilities, it can be difficult to identify cases that may develop problems in advance. Therefore, cheap and widely used blood parameters are utilized.

In many studies, WBC has been measured higher in complicated acute appendicitis compared to uncomplicated appendicitis, although some studies have shown that WBC elevation in complicated acute appendicitis is not significant (9-11). Our study found that WBC was statistically significantly higher in complicated acute appendicitis.

In the literature, it has been shown that the number of isolated lymphocytes is lower in complicated acute appendicitis, and its sensitivity and specificity are higher than WBC and NLR in the diagnosis of complicated acute appendicitis (9, 12). In this study, the number of isolated lymphocytes was significantly lower in the complicated acute appendicitis group, in consistent with previous studies.

Various studies have shown that the NLR effectively differentiates complicated acute appendicitis from uncomplicated (2, 13). A meta-analysis in this field showed that NLR could be used to prioritize surgery cases, follow up conservatively treated patients, and evaluate patients who did not undergo routine tomography screening. Again, in this meta-analysis, NLR > 4.7 was an independent predictor of appendicitis, and NLR > 8.8 was an independent predictor of complicated appendicitis (2). In our study, NLR was statistically significantly higher in complicated acute appendicitis, in consistent with the literature. NLR is a reasonable marker because it is simple to compute from the parameters of a complete blood count. This reduces dependence on more complicated scoring methods, which typically call for the use of online calculators or text-based scoring systems, and has practical consequences for simplicity of use (14).

The limitation of our study is that it is retrospective and single-centered. However, the high number of patients increases its reliability.

Conclusion

To predict a complication such as perforation or gangrene in acute appendicitis, the surgeon can benefit from personal experience, radiological imaging methods, and laboratory parameters. NLR, neutrophil, and lymphocyte counts seem to be very helpful in this regard.

Ethics Committee Approval: This study was performed in line with the principles of the Declaration of Helsinki. This study was approved by the University of Health Sciences, Sancaktepe Şehit Prof. Dr. İlhan Varank Training and Research Hospital Scientific Research Ethics Committee (Number: 2023/20)

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Informed Consent Was not required due to the retrospective design.

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