

Complete Blood Count in Preoperative Assessment of Acute Appendicitis -A Different Aspect

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ABSTRACT

Objective: To study the role of neutrophils to lymphocytes ratio in predicting the severity of acute appendicitis among patients managed at tertiary care hospital.

Study design: Cross-sectional study.

Place and Duration of Study: Department of Surgery Combined Military Hospital Rawalpindi, from Jan to Jun 2021.

Methodology: Three hundred patients diagnosed with acute appendicitis by a consultant surgeon were included in the study. The neutrophil to lymphocyte ratio was calculated at the time of diagnosis. The severity of the appendix was assessed at the time of surgery and graded between grades 0 and IV, depending upon the gross clinical findings. The severity grade of acute appendicitis and other factors was associated with the neutrophil-to-lymphocytes ratio in all the patients.

Results: Out of 300 operated patients with the clinical diagnosis of acute appendicitis, 169 (56.3%) were males, while 131 (43.7%) were females. The mean age of the study participants was 31.21 ± 2.127 years. Based on severity, 60 (20%) had grade 0, 100 (33.3%) had Grade-I, 86 (28.7%) had Grade-2, 35 (11.7%) had Grade-III, while 19 (6.3%) had a Grade-IV appendicitis. 192 (64%) had neutrophil-to-lymphocyte ratio < 4.6 while 108 (36%) had more than 4.6. Chi-square test revealed that severity of acute appendicitis and raised C-reactive protein had a statistically significant correlation with raised neutrophil to lymphocyte ratio (p -value <0.05).

Conclusion: Neutrophil to lymphocyte ratio was significantly raised in patients presenting with acute appendicitis. Raised C reactive protein and high grade of appendicitis were found significantly more in patients with raised neutrophil to lymphocyte ratio.

Keywords: Acute appendicitis, Neutrophils to lymphocyte ratio, Severity.

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INTRODUCTION

Acute appendicitis has been a common condition diagnosed by surgeons in the emergency departments of hospitals across the globe.¹ Surgeon worldwide performs the procedure of appendectomy on a routine basis, more than any other surgery.² Acute appendicitis is a clinical diagnosis in most cases supported by relevant laboratory and radiological investigations.³ Neutrophil to lymphocyte ratio has been important in diagnostic and prognostic work-up of acute appendicitis, renal colic, peptic ulcer disease, acute pancreatitis, ruptured ovarian cyst, chronic obstructive airway disease, septic conditions, cerebral haemorrhage, metastatic diseases and even COVID 19.⁴⁻⁶ This ratio may not be diagnostic for any specific condition but may alert the clinicians regarding the severity of condition and requirement of early intervention particular in surgical emergencies.

The neutrophils to lymphocytes ratio has been correlated with the severity of appendicitis in various

populations. Ahmad *et al*, published a study in Malaka in 2019, revealing that this parameter is useful in diagnosing acute appendicitis and can help reduce the number of negative appendectomies.⁷ Celik *et al*, conducted a study on the pediatric population published in 2019 regarding the predictive accuracy of neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio for diagnosing complicated appendicitis in the emergency department. They concluded that both these haematological ratios, if higher, predict complicated appendicitis. They advocated using these parameters along with clinical and other relevant laboratory and radiological findings to diagnose severe and complicated diseases early.⁸ Chen *et al*, in 2020 published an interesting study comparing various haematological ratios to differentiate between acute appendicitis and ureterolithiasis. They found that Leukocytes, neutrophils, and neutrophils to lymphocytes ratio were better markers to differentiate between the two clinical conditions than platelets to lymphocytes ratio. They encouraged routine use of these biomarkers by clinicians in order to potentiate their diagnosis.⁹

Emergency care physicians and surgeons have used conventional clinical and laboratory parameters

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to diagnose acute appendicitis and decide on immediate surgical management. However, epidemiological data suggest that acute appendicitis is a common clinical condition in our part of the world,¹⁰ and clinicians here need to equip themselves with adequate knowledge regarding the new biomarkers which may be used to assess the severity of illness. Therefore, we planned this study to study the role of neutrophils to lymphocytes ratio in predicting the severity of acute appendicitis among patients managed at tertiary care hospitals.

METHODOLOGY

This cross-sectional study was conducted at the Department of Surgery Combined Military hospital Rawalpindi Pakistan from January 2021 to June 2021. WHO calculator was used to calculate the sample size with population proportion of sensitivity of neutrophils to lymphocyte ratio in diagnosing acute appendicitis as 75%.¹¹ Non-probability consecutive sampling was done to recruit the patients for this study.

Inclusion Criteria: All the patients of age of 18 to 60 years, presented with symptoms of acute appendicitis and were diagnosed and operated at the surgical unit by the consultant surgeon were included in the study.

Exclusion Criteria: Patients with a past or current history of any abdominal surgery were excluded. Patients with any recent viral illness, autoimmune disorder or haematological or lymphoid malignancy were also excluded from the study. Patients with comorbid sepsis or suspected appendicular abscess on ultrasound were also excluded.

Ethical approval (IREB letter number: 207/10/21) was granted by the Ethical Committee before the start of the study. Patients diagnosed with acute appendicitis based on clinical and laboratory findings after applying inclusion/exclusion criteria were included in the study. The consultant surgeon examined patients in detail for clinical signs of acute appendicitis. They underwent basic laboratory investigations, including a full blood count. 5 ml Blood was withdrawn by a trained phlebotomist from all the patients and sent to the laboratory of our hospital, where a consultant haematologist carried out a blood complete picture examination from which the treating team calculated the neutrophil to lymphocyte ratio. Neutrophil-to-lymphocyte ratio was calculated in all the patients with a cut-off value of 4.6.^{12,13} Severity of acute appendicitis was graded from grade 0 to IV as per the grading system devised by Gomes *et al*, in 2015 based upon the clinical, imaging and laparoscopic findings.¹⁴

Descriptive statistics were used in the study to describe the variables of the study. Qualitative variables like patients with and without raised neutrophil to lymphocyte ratio, gender and grades of acute appendicitis were mentioned in frequency and percentage. In addition, the mean and standard deviation was calculated for the age of the patients included in the study. Pearson chi-square analysis and Fischer exact test was used to establishing the association between variables. Statistical Package for the social sciences (SPSS-23.0) was the software used to process all the data and perform the analysis. Differences between groups were considered significant if *p*-value was ≤0.05.

RESULTS

Out of 300 patients operated on with a clinical diagnosis of acute appendicitis, 169 (56.3%) were male, while 131 (43.7%) were female. The mean age of the study participants was 31.21 ± 2.127 years. Based on severity, 60 (20%) had grade 0, 100 (33.3%) had Grade-I, 86 (28.7%) had Grade-II, 35 (11.7%) had Grade-III, while 19 (6.3%) had Grade-IV appendicitis. Table-I summarized the main demographic findings of this study. 192 (64%) had neutrophil-to-lymphocyte ratio <4.6 while 108 (36%) had more than 4.6.

Table-I: Characteristics of study participants included in our analysis.

Study Parameters	n (%)
Age (years)	
Mean ± SD	31.21 ± 2.127
Range (min-max)	19 years - 59 years
Gender	
Male	169 (56.3%)
Female	131 (43.7%)
Severity of Appendicitis	
Grade 0	60 (20%)
Grade I	100 (33.3%)
Grade II	86 (28.7%)
Grade III	35 (11.7%)
Grade IV	19 (6.3%)
Neutrophil to Lymphocyte Ratio	
4.6 or less	192 (64%)
>4.6	108 (36%)
C-reactive Protein	
<5	161 (53.7%)
>5	139 (46.3%)

One hundred and sixty-one (53.7%) patients had c-reactive protein less than five while 139 (46.3%) had C-reactive protein levels more than 5.199 (66.3%) patients had raised total leukocyte count while 101 (33.7%) had total leucocyte count within range.

Table-II revealed that severity of acute appendicitis (*p*-value<0.001) and raised C-reactive protein

(p -value <0.004) had a statistically significant correlation with raised neutrophil-to-lymphocyte ratio. In contrast, age (p -value=0.890) and gender (p -value 0.600) had no such relationship with raised neutrophil-to-lymphocyte ratio.

Table-II: Severity of acute appendicitis and other factors related to neutrophil-lymphocytes ratio: Pearson chi-square and Fishers exact test.

Factors	Neutrophillymphocytes Ratio <4.6	Neutrophillymphocytes Ratio >4.6	Pearson Chi-square	p -value
Age				
<40 years	123 (64.1%)	70 (64.8%)	0.017	0.896
>40 years	69 (35.9%)	38 (35.2%)		
Gender				
Male	106 (55.2%)	63 (58.3%)	0.274	0.600
Female	86 (44.8%)	45 (41.7%)		
C-reactive Protein				
<5	115 (59.9%)	46 (42.6%)	8.323	0.004
>5	77 (40.1%)	62 (57.4%)		
Grades of Appendicitis				
I	127 (66.1%)	33 (30.5%)	41.001	<0.001
II	46 (23.9%)	40 (37.1%)		
III	14 (7.2%)	21 (19.4%)		
IV	05 (2.6%)	14 (12.9%)		

DISCUSSION

The severity of appendicitis and raised C-reactive protein were associated with raised neutrophil to lymphocyte ratio in our analysis. Acute appendicitis is a common surgical condition across the globe.¹ Pakistan is no exception to this, and many patients, especially the young population, suffer from acute appendicitis each year.¹⁰ It would be of utmost importance if clinicians find a reliable, cost-effective and widely available biomarker which could predict the severity of this condition at the time of presentation. This would enable them to prioritize the patient for definitive management and clear the diagnostic ambiguities. Various haematological indices have been in practice for this purpose, but there is still ongoing research on this aspect. Therefore, we planned this study to study the role of neutrophils to lymphocytes ratio in predicting the severity of acute appendicitis among patients managed at tertiary care hospitals.

Yardımcı *et al*,¹⁵ published a study on the Turkish population in 2016 regarding the use of blood indices like Neutrophil-lymphocyte ratio and mean platelet volume for determining the severity of acute appendicitis. They came up with the findings that both these biomarkers can be useful to ascertain the severity of illness in acute appendicitis. We did not study mean platelet volume in our analysis, but our results

supported the findings of Yardımcı *et al*, in terms of neutrophil to lymphocyte ratio.

Hajibandeh *et al*,¹⁶ published a systemic review and meta-analysis to assess the role of the Neutrophil-to-lymphocyte ratio (NLR) in predicting acute appendicitis and differentiating between complicated and uncomplicated appendicitis. Using 4.7 as a cut-off for NLR and including seventeen studies, they concluded that NLR could be used to diagnose acute appendicitis and predict the severity of illness in diagnosed patients. It can be used effectively to prioritise surgery cases, monitor conservatively treated patients and for patients who could not routinely undergo CT scans. Our findings were similar as NLR was statistically significantly high among patients with a high severity grade on per operative findings.

Sevinç *et al*,¹⁷ in 2016 published an analysis of 3392 cases on the diagnostic value of various haematological markers for diagnosing simple and perforated acute appendicitis. They concluded that serum bilirubin >1.0 mg/dl or neutrophil to lymphocyte ratio >4.8 were significantly associated with the presence of perforation among patients operated on for acute appendicitis. Therefore, we used a cut-off value of 4.6 and studied 5 grades of acute appendicitis and found out that a high neutrophil to lymphocyte ratio predicted more severe illness in these patients.

Jung *et al*,¹⁸ in 2017 studied similar parameters in an elderly population presenting at the emergency department suspected of acute appendicitis. They concluded that the neutrophil to lymphocyte ratio in the elderly patient is the most powerful predictive factor for diagnosing acute appendicitis perforation in the emergency department. Unfortunately, we did not compare the biomarkers, so we could not conclude that NLR is the most powerful predictor, but we can infer from our data that this parameter can predict the severity of illness among patients suffering from acute appendicitis.

Our study results were helpful for the surgeons to adopt a non-invasive and cost-effective method to assess the severity of one of the most common surgical emergencies in our set-up. In addition, incorporating neutrophil to lymphocyte ratio in predicting the severity of appendicitis and prioritizing patients may be helpful for patients.

LIMITATIONS OF STUDY

The lack of comparison of various parameters was the main limitation of our study. Addressing these limitations may generate better results and equip emergency physicians

and surgeons with an effective tool for assessing the severity of acute appendicitis.

CONCLUSION

Neutrophil to lymphocyte ratio was significantly raised in patients presenting with acute appendicitis. Raised C reactive protein and high grade of appendicitis were found significantly more in patients with neutrophil to lymphocyte ratios of more than 4.6.

Conflict of interest: None.

Author's Contribution

FGK: Direct contribution, KM:, UUS:, MUF:, MA:, AN: Intellectual contribution.

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