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Original Research Article

Total leucocyte count and platelet indices: novel, early diagnostic markers of acute appendicitis

Rithu Ravikkumar*, Kuladeep Vaidya, Aashish Sharma, Sukesh

Department of Pathology, Srinivas Institute of Medical Sciences, Mangalore, Karnataka, India

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***Correspondence:**
Dr. Rithu Ravikkumar,
E-mail: riturrrj@gmail.com

ABSTRACT

Background: Among the plethora of causes for patients presenting with an acute abdomen, appendicitis is the most common conclusive diagnosis. Known being controversial for its etiology and pathogenesis, diagnosis of acute appendicitis has been challenging despite the development of various clinical and laboratory studies. Inflammatory markers of hematological origin-total leucocyte count (TLC), platelet indices viz. mean platelet count (MPV), plateletcrit (PCT), and platelet distribution width (PDW), have long been preferred as rudimentary diagnostic parameters for acute appendicitis despite being contentious.
Methods: An analytical and cross-sectional study among 100 individuals. Statistical evaluation of TLC, MPV, PCT and PDW of 21 appendicitis cases and 70 healthy individuals were complied.
Results: Compared to the control group, cases showed significantly higher values of TLC and MPV while the PCT and PDW were normally distributed and showed no significant statistics. The sensitivity of TLC and MPV was determined to be 95.2%, 71.4%, and specificity 100%, 73.8% respectively.
Conclusions: With equitable results, the routine and cost-effective TLC and MPV play a novel role in the early diagnosis of acute appendicitis.

Keywords: Acute appendicitis, Mean platelet count, Plateletcrit, Platelet distribution width, Total leucocyte count

INTRODUCTION

Appendicitis has always known to be controversial for its etiopathogenesis or diagnosis. Recent literature has been a boon to solve the perplexity of the pathogenesis. Contradictory to previously believed etiology of appendicitis being caused by luminal obstruction followed by secondary bacterial proliferation, studies now have determined that one of the following numerous pathogenic pathways lead to appendicitis: Obstruction caused immoderately by fibrous bands, fecolith and hyperplasia of lymphoid follicles; Infections by enterovirus and coxsackie B virus, followed by a secondary bacterial invasion; poor hygiene, low-fiber diet, trauma, and foreign bodies.[1]

Acute appendicitis (AA) has an estimated life risk of 8%, is the most common cause among the patients presenting to the emergency room with pain abdomen.[2] Numerous diseases mimic the presentation of appendicitis; hence the diagnosis is challenging even though patients present classical symptoms and examination findings. Radiological investigations and inflammatory markers aid the dismissal of other simulations and diagnose appendicitis.[3]

Easily available and affordable diagnostic markers of inflammation are the platelets indices along with the total leucocyte count and neutrophil count (absolute/relative), which were considered decisive in diagnosis of AA.[3]

Aim was to determine the role and efficacy of hematological parameters- total leucocyte count (TLC), platelet indices viz. mean platelet volume (MPV), plateletcrit (PCT), and platelet distribution width (PDW) in the triumphant and early diagnosis of acute appendicitis.

METHODS

This was analytical, cross-sectional study. A total of 100 available in the Srinivas Institute of Medical sciences and Research center, (Tertiary care hospital), Mangalore, Karnataka were used for the study. 21 cases who were diagnosed with AA and 79 healthy controls were included in the study. This study was conducted for 4 months from July 2022 to October 2022.

Inclusion criteria

Patients presenting with acute abdominal pain diagnosed as AA and subjected to appendicectomy. Followed by histopathological confirmation of specimen were included.

Exclusion criteria

Cases of varied etiopathological origin were excluded.

Confirmation of acute appendicitis in cases was made based on the histopathological features of congested subserosal vessels, peri-vascular neutrophilic infiltrate in all layers of appendiceal wall, especially in the muscularis propria.

Peripheral blood from study subjects were collected in EDTA vacutainers and complete blood count was analyzed in Yumizen 550 hemolytic analyzer. Hematologic parameters TLC, MPV, PCT and PDW of patients with appendicitis were measured for potential correlation with histopathological diagnosis.

The normal values were defined as TLC 4.0 to 10.0 $X10^3/\mu L$, MPV 6 to 11 fL, PCT 0.2 to 0.5% and PDW 8 to 18 fL.

Statistical analysis

Procured data was analyzed using the IBM SPSS (Statistical package for Social Sciences) software for Windows (v29.0.0.0(241)- student version. Individual and composite data was summarized using descriptive statistics including mean, standard deviations, frequency distributions and percentages. Kolmogorov-Smirnov test was done for normality assessment. For comparison between cases and controls, Mann Whitney-U test was performed for the parameters MPV and TL count and Unpaired-t test for the parameters PCT and PDW. P values <0.05 was considered statistically significant. Using Youden index, cut-off point for maximum sensitivity and specificity was estimated for total WBC count and MPV.

RESULTS

Out of 21 cases, 11 were male and 10 were female. Their mean age (±SD) was 31.8 (±11.7) years. Among the controls, 42 were male, 37 were female, with mean age was 32.2 (±10.8) (Table 1).

Table 1: Distribution of cases and controls with according to the mean age.

	Cases	Healthy controls	Total
Female	11	42	53
Male	10	37	47
Total	21	79	100
Mean age	31.8095±11.69880 (min: 13.00, max: 52.00)	32.1625±20.82127 (min: 10.00, max: 56.00)	

The mean TL count in cases of acute appendicitis was 16.54x103/µL(SD:±3.8; ranged: 8.10 to 21.80X103/µL) and 7.13x103/µL(SD:±2.06; ranged: 3.50 to 10.60 X103/µL) in healthy controls. TL count was found to be statistically higher in cases than that on healthy controls (p<0.001).

The mean MPV of appendicitis was 9.7±2.36 fL and healthy controls was 9.04±1.01 fL. There is significant statistical difference between the MPV of cases and controls (p=0.003). The mean PCT was 0.248±0.076% for cases and 0.228±0.0571% for the controls. Mean PDW for cases was 13.64±3.05 fL and 12.89±2.599 fL for the healthy controls. There was no statistically significant difference between the PCT and PDW values among cases and controls, the two-sided p value was recorded to be 0.185 and 0.259, respectively (p>0.05) (Table 2).

With cut-off value at 10.75X103/µL, TLC had a sensitivity of 95.2% and specificity of 100%. MPV value

with cut-off of 9.45fL was found to have a sensitivity of 71.4% and a specificity of 73.8% (Table 3).

Table 2: Hematological parameters among the controls and cases.

	Cases (n=21)	Controls (n=79)	P value
TLC	16.54±3.76	7.13±2.05	<0.001*
MPV	9.70±2.36	9.04±1.01	0.003*
PCT	0.25±0.08	0.23±0.06	0.185
PDW	13.64±3.05	12.89±2.60	0.259

*Significant

Table 3: Results of receiver operating characteristic analysis for TLC and MPV.

Parameter	Cut off value	Sensitivity (%)	Specificity (%)
TLC	$10.75X10^3$/ML	95.2	100
MPV	9.45FL	71.4	73.8

DISCUSSION

In emergency settings, appendicitis is the most commonly presenting cause of acute abdomen.[4] Number of risks with ill-fated sequelae can occur as a result of delayed diagnosis of acute appendicitis.[5]

With growing number of negative appendectomies, and unnecessary risks and costs to patients associated with surgical procedures, an intervention of preliminary diagnosis is of the utmost requirement.[4,6]

Literature points that appendicitis is seen more commonly in males, with a male to female ratio of 1.4:1. Incidence is predominant in the late third decade and early fourth decade.[7] The results of our study was concordant, with mean age of 31.8 (±11.7) in the case group. The gender ratio was also found to be similar (1.3:1) as said in the literature.

White blood/total leucocyte count is been a venerable parameter in early diagnosis of acute appendicitis.[8] Several studies defined the sensitivity of TLC in diagnosing acute appendicitis to be higher, 65-80% and specificity to be 86-100%.[8,5] Concomitantly, our study showed a high sensitivity of 95.2% and specificity of 100%.

Tendency of platelets to adhere and accumulate in sites of damaged areas, along with leucocyte produces a platelet-granulocyte aggregate triggering further inflammatory response.[9-11]

MPV, PCT and PDW which are related to platelet morphology and proliferation kinetics benefit early diagnosis of appendicitis.

MPV is determined by progenitor cell, megakaryocytes are a measure of thrombocytopenia volume and acts as an acute phase reactant in various inflammatory conditions.[3] Narci et al suggested higher MPV values to guide diagnosis of acute appendicitis with sensitivity of 66% and specificity of 51%.[12] Fan et al and Sucu et al states there is a reduced MPV in cases of acute appendicitis.[13,14] With MPV cut off value for AA 9.6, 9.35 fL, a sensitivity of 66.25 %, 78.1% and specificity of 91.19%, 81.1% was recorded. In our study, MPV cut off for AA being 9.45 fL, analogous sensitivity of 71.4% and a slightly reduced specificity of 73.8% was achieved.

PDW measures the discrepancy in platelet volume and size.[15] PCT is the measure of volume occupied by platelets in blood, hence can assess platelet consumption by body.[3] Albayrak et al and Aydogan et al state that PDW has a significant rise in PDW in AA and can be a new bio-marker for AA.[5,16] Contradictorily, another study Kostakis et al reported no significant difference in MPV, PDW and platelet count among AA cases and healthy controls.[17] Yilmaz et al yet another study showed no supportive value of PCT to diagnose AA.[18]

Our study showed normal distribution in PCT and PDW values among cases and healthy controls. Similar to our study, numerous previous studies have reported increased TLC as a strong supportive value in diagnosis of AA. There are a few conflicting studies on platelet indicators as a good bio-marker for diagnosing AA, as compared to our study where PCT and PDW showed no significant difference. A meta-analysis with larger study groups has to be conducted to outdo this discrepancy.

This study has some limitations. No significant values of PCT and PDW can be attributed to the limited sample size currently at this tertiary health care center and a less comprehensive evaluation.

CONCLUSION

With a sensitivity of 95.2%, 71.4%, and specificity of 100%, 73.8% easily available tests such as TLC and MPV can be utilized as parameters in conjunction with clinical features to guide early diagnosis and appropriate therapy in patients of acute appendicitis. PCT and PDW have not been valuable markers in diagnosing AA in our study. A multi-center prospective study with larger patient populations is required to elucidate the discordance.

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