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Original Research Article

Analysis of Platelet Incides in the Diagnosis of Acute Appendicitis: An Observational Study

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Abstract:

Background: One surgical emergency that casualties commonly encounter is acute appendicitis. Ignoring acute appendicitis can have several potentially deadly repercussions. Appendiceal perforation or abscess formation may occur when diagnostic difficulties result in missed appendicitis or negative appendicectomies. Clinical professionals often miss the mean platelet volume (MPV) during a routine blood count. The Aim of this study is to evaluate the diagnostic value of platelet indices (mean platelet volume and platelet distribution width) and its predictive value in determining the complication/severity of acute appendicitis.

Methods: This study comprised of 126 adult patients of Acute Appendicitis who were operated in the department of Surgery, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar during the period of 6 months starting from February 2024 to October 2024. Patients below 12 years, pregnant female, patients on steroid/chemotherapy, immuno-compromised patients and those who are not willing to participate were excluded.

Results: The Mean Platelet Volume (MVP) of less than 7.6 was found in 73 (57.9%). The mean MPV was 7.98+/-1.29. Platelet Distribution Width (PDW) was more than 18 patients (23.7%). Out of which 16 and 14 were females and males respectively. The mean PDW was 16.99±2.30. Total Leucocyte Count (TLC) was raised (taking 1100 as cut-off value) in 82 patients (65.1%). 11 patients were associated with perforated appendix and 10 patients had intraoperative finding of periappendiceal collection. Gangrenous appendix was found in 16 (12.7%) patients.

Conclusion: MVP did not have higher sensitivity compared with TLC in the diagnosis of acute appendicitis but PDW have higher sensitivity than TLC and is found higher in complicated appendicitis. Therefore, PDW may be used in the diagnosis of acute appendicitis and has a significant role in predicting complicated appendicitis.

Keywords: Mean Platelet Volume, Appendicitis, Appendicectomy, Platelet Distribution Width, Total Leucocyte Count, Perforated Appendix.

Introduction

Acute appendicitis is a common surgical condition of the abdomen, the prompt diagnosis of which is rewarded by a marked decrease in morbidity and mortality [1]. Classically, the diagnosis of acute appendicitis is based on a brief history of abdominal pain, nausea, migration of pain to the right iliac fossa, and signs of local peritonitis; diagnostic accuracy based on these symptoms ranges from 70% to 80% [1,2]. Therefore, diagnostic errors are common, resulting in a median incidence of perforation of 20% and a negative laparotomy rate ranging from 2% to 30% [1]. The preoperative laboratory tests can be performed easily in primary healthcare settings and often aid primary clinicians with decision making about patients with clinically suspected acute appendicitis. Several parameters (i.e. C-reactive protein (CRP), white blood cell count, lymphocyte/leukocyte rate, interleukin-6, interleukin-10, interleukin-4, interleukin-5, interleukin-12, tumor necrosis factor alpha, endotoxin, erythrocyte sedimentation rate, procalcitonin, fibrinogen, alpha 2 - macroglobulin, alpha 1-antitrypsin, D-Lactate) for the diagnosis of acute appendicitis have been investigated in the literature [2]. Mean platelet volume (MPV) is a

measure of platelet size, generated by full blood count analyzers as part of the routine complete blood count test cycle which is commonly overlooked by clinicians [3]. MPV is one of the most widely used surrogate markers of platelet function and has been shown to reflect inflammatory burden and disease activity in several diseases including pre-eclampsia, acute pancreatitis, unstable angina, myocardial infarction, and systemic inflammation such as ulcerative colitis and Crohn's disease [4].

Materials and Methods

The study was conducted in the department of General Surgery, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar during the period of February 2024 to October 2024. It is an observational (cross sectional) study of 126 patients with acute appendicitis who underwent Appendicectomy. Patients of more than 12 years attending hospital with a clinical diagnosis of acute appendicitis and undergoing appendectomy, those who are willing to participate were included. Exclusion criteria were pregnant female, patients on steroid, immuno-compromised patients, patients on chemotherapy for malignancy those who are not willing to participate. The study was conducted under some variables such as age, sex, MPV and PDW, duration of symptom and diagnosis (clinical/operative). All patients admitted with clinical diagnosis of "Acute Appendicitis" or "Appendicular Perforation" under General Surgery were taken as Subjects for this study. Informed Consent was collected using the questionnaire / proforma. The primary data for this study was the blood investigations of the patients viz. Routine blood investigations (i.e. complete blood count, platelet count, reticulocyte count etc.), Platelet indices; MPV and PDW, Urine examination (routine & microscopy). Data collected included age, sex, duration of symptoms, clinical operative diagnosis and platelet indices. Clinical diagnosis was confirmed by histopathology. Clinical and investigative data was compiled and analyzed, and observed. Routine MPV and PDW results were compared with laboratory reference values. All the data was entered in a proforma and data analysis was performed using SPSS software 21 version (IBM Corp., Armonk, NY, United States). Statistical analyses was performed with Student's t-test and the chi square test. A P value of 0.05 or less was considered significant. After obtaining consent, patients were operated, and the appendectomy specimen was sent for histopathological examination. The histopathology report was considered as the final diagnosis. All blood samples were obtained from the venous system and stored in tubes containing EDTA and assayed automatically. The reference values are 7.6-11.0 fL for MPV and 10%-18% for PDW. All results were approved by an independent pathologist expert who was blind to the patient's histories.

Results

Out of 126 patients, 46 (36.5%) were males and 80 (63.5%) were females. The mean age of patient was 31.67±12.66, ranging from 15-64 years. The highest number of patients was found in 21-30 age groups (39.7). (Table 1)

Table 1: Age and Sex distribution of patients studied

Age in years	Gender		Total (%)
	Male (%)	Female (%)	
11-20	6(13%)	18(22.5%)	24(19%)
21-30	19(41.3%)	31(38.8%)	50(39.7%)
31-40	13(28.3%)	13(16.3%)	26(20.6%)
41-50	6(13%)	5(6.3%)	11(8.7%)
51-60	1(2.2%)	9(11.3%)	10(7.9%)
>60	1(2.2%)	4(5%)	5(4%)
Total	46(100%)	80(100%)	126(100%)

P=0.128, Not Significant, Fisher Exact Test

Out of 126 cases studied, 11 patients of all acute appendicitis were associated with perforated appendix (AP) and 10 patients had intra-operative finding of periappendiceal collection (AC). Gangrenous appendix (AG) was found in 16 (12.7) patients. All the patients diagnosed with acute appendicitis were proven with positive histopathological examination (HPE). (Table 2-5)

Table 2: Peri appendiceal collection distribution of patients studied

Peri appendiceal collection	Gender		Total (%)
	Male (%)	Female (%)	
Non-Collection	41(89.1%)	75(93.8%)	116(92.1%)
Collection	5(10.9%)	5(6.3%)	10(7.9%)
Total	46(100%)	80(100%)	126(100%)

P=0.356, NotSignificant, Chi-Square Test

Table 3: Perforated appendix distribution of patients studied

Perforated appendix	Gender		Total (%)
	Male (%)	Female (%)	
Non-Perforated	41(89.1%)	74(92.5%)	115(91.3%)
Perforated	5(10.9%)	6(7.5%)	11(8.7%)
Total	46(100%)	80(100%)	126(100%)

P=0.519, Not Significant, Chi-Square Test

Table 4: Gangrenous appendix distribution of patients studied

Gangrenous appendix	Gender		Total (%)
	Male (%)	Female (%)	
Non-Gangrene	38(82.6%)	72(90%)	110(87.3%)
Gangrene	8(17.4%)	8(10%)	16(12.7%)
Total	46(100%)	80(100%)	126(100%)

P=0.230, Not Significant, Chi-Square Test

Table 5: Positive histopathological examination (HPE) distribution of patients studied

HPE	Gender		Total (%)
	Male (%)	Female (%)	
Negative	0(0%)	0(0%)	0(0%)
Positive	46(100%)	80(100%)	126(100%)
Total	46(100%)	80(100%)	126(100%)

P=1.000, Not Significant, Fisher Exact Test

Out of 126 patients, TLC was raised (taking 1100 as cut-off value) in 82 patients i.e. 65.1%.

The mean TLC was 1335.56±625.18, out of which 33 and 49 were males and females respectively. MPV of less than 7.6 was found in 73 i.e. 57.9%. The mean MPV was7.98±1.29. PDW was more than 18 in 30 patients i.e. 23.7%, out of which 16 and 14 were females and males respectively. The mean PDW was 16.99±2.30. (Table 6-9)

Table 6: Total leucocyte count (TLC) distribution of patients studied

Total leucocyte count	Gender		Total (%)
	Male (%)	Female (%)	
<400	0(0%)	0(0%)	0(0%)
400-1100	13(28.3%)	31(38.8%)	44(34.9%)
>1100	33(71.7%)	49(61.3%)	82(65.1%)
Total	46(100%)	80(100%)	126(100%)

P=0.252, Not Significant, Fisher Exact Test

Table 7: Total Platelet Count (TLC) distribution of patients studied

Total Platelet Count	Gender		Total (%)
	Male (%)	Female (%)	
<1.5	1(2.2%)	1(1.3%)	2(1.6%)
1.5-4	45(97.8%)	79(98.8%)	124(98.4%)
>4	0(0%)	0(0%)	0(0%)
Total	46(100%)	80(100%)	126(100%)

P=1.000, Not Significant, Fisher Exact Test

Table 8: Mean Platelet Volume (MPV) distribution of patients studied

Mean Platelet Volume	Gender		Total (%)
	Male (%)	Female (%)	
<7.6	28(60.9%)	45(56.3%)	73(57.9%)
7.6-11	18(39.1%)	35(43.8%)	53(42.1%)
>11	0(0%)	0(0%)	0(0%)
Total	46(100%)	80(100%)	126(100%)

P=0.709, Not Significant, Fisher Exact Test

Table 9: Platelet Distribution Width (PDW) distribution of patients studied

Platelet Distribution Width	Gender		Total (%)
	Male	Female	
<10	0(0%)	0(0%)	0(0%)
10-18	32(69.6%)	64(80%)	96(76.2%)
>18	14(30.4%)	16(20%)	30(23.7%)
Total	46(100%)	80(100%)	126(100%)

P=0.199, Not Significant, Fisher Exact Test

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance.

Discussion

Even though the Acute Appendicitis (AA) presents with the classical symptomatology, it is still considered among one of the difficult entities to diagnose. There are many diagnostic entities which are being studied extensively in relation to AA and others. One of such parameters is Mean platelet volume (MVP) and Platelet distribution width (PDW). MVP has been studied as an inflammatory marker in several diseases. MPV represents an index of platelet function. An increase in young platelets and an aggregation of large platelets could lead to higher MPV values. Platelets size and activity are influenced by cytokines, such as IL-3 or IL-6. In many chronic diseases, the MPV increases, while in many acute diseases the MPV decreases. Specifically, the MPV decreases in patients with ulcerative colitis, rheumatoid arthritis, and ankylosing spondylitis, land the MPV increases in patients with ankylosing spondylitis, familial Mediterranean fever, Behcet's disease and Psoriasis. [6]

Makay B et.al found no significantly different MPV levels in control and patient groups but a decreased MPV level was detected at the time of attack, in patent group in a pediatric patient cohort of familial Mediterranean fever. [7]Albayrak Y et.al detected a significantly lower MPV level in patients with AA, compared to the control group. [8] Another study by Bilici S et. al. found similar result in children. [9]

This study investigated diagnostic value of MPV and PDW in acute appendicitis, taking TLC as a standard value, sensitivity and specificity for MPV is 64.38% and 35.9% respectively, and taking less than 7.6 as a cut-off value for MPV. And also sensitivity and specificity for PDW is 86.2% and 46.15% respectively, and taking more than 18 as a cut-off value for PDW. In study conducted by Albayrak Y et al [8] and Aydogan A et al [10] MPV was significantly lower in the AA group, and with a sensitivity and specificity of 73-84% and 54-84% respectively in children. The values of sensitivity and specificity of MPV in our study are 64.3% and 35.9% respectively and lower as compared to te literature. Our study detects a higher sensitivity and lower specificity of MPV, compared to the finding of Albayrak Y et al study. Albayrak Y et al [8] and Aydogan A et al [10] in their previous study had shown the increase in PDW in acute appendicitis. In our study, there is also increase in PDW value taking more than 18 as a cut-off value. Sensitivity and specificity of PDW were 86.2% and 46.15% respectively, which was comparable with literatures and previous study. In the study conducted by Zhe F et al [11] PDW was significantly raised in Acute gangrenous appendicitis. And also Dinc B et al [5] in their study confirmed that PDW was significantly higher in perforated appendicitis. Also Aydogan A et al [10] found that MPV and PDW was important markers for the early detection of perforation risk in acute appendicitis.

Conclusion

We found that the MPV with sensitivity and specificity of 64.38% and 35.9% respectively did not have higher sensitivity compared with TLC in the diagnosis of acute appendicitis. But interestingly, PDW with a sensitivity and specificity of 86.2% and 46.15% have higher sensitivity than TLC. And also PDW level with sensitivity of 90.91% and specificity of 93.91% is found higher in complicated appendicitis like perforated appendix and gangrenous appendix. So, we concluded that MPV is not significant, while PDW may be used in diagnosis of acute appendicitis and has a significant role in predicting complicated appendicitis.

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