Research Article

A Study of Mean Platelet Volume as the Diagnostic Predictor for Cases of Acute Appendicitis

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A B S T R A C T

Introduction: Acute appendicitis is a frequent cause of abdominal pain, affecting about 6-7% of people during their lifetime. Diagnosing it typically involves physical exam findings, lab tests, and imaging, but even with all these tools negative surgeries (i.e. removal of a non-inflamed appendix) still occur in up to ~20% of cases. Clinical scoring systems like the Alvarado score are used, but their reliability is variable. To improve diagnostic accuracy, new methods are being explored — one of them is using biomarkers related to platelet activation (such as mean platelet volume and platelet distribution width). The available evidence on these biomarkers is mixed, and my study aims to add more data on how accurate they are in diagnosing acute appendicitis.

Objectives: To study the diagnostic accuracy of mean platelet volume in diagnosing acute appendicitis patients compared to histopathology as gold standard and to study the diagnostic accuracy of platelet distribution width in diagnosing acute appendicitis patients compared to histopathology as gold standard.

Methodology: This was a diagnostic test evaluation study conducted among inpatients of the Department of General Surgery. A total of 43 patients were included. Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW) were analysed from blood samples of patients undergoing emergency appendicectomy. Histopathology reports of the appendicectomy specimens were used as the reference standard, and the diagnostic accuracy, sensitivity, and specificity of MPV and PDW were assessed through statistical analysis.

Results: Mean Platelet Volume (MPV) was evaluated in 53 patients. With a cutoff of 8.75, the ROC AUC was 0.768 (95% CI: 0.596-0.940; SE = 0.088; p = 0.002). At that cutoff MPV had a sensitivity of 83.33%, specificity 76.47%, positive predictive value 23.54%, negative predictive value 98.14%, positive likelihood ratio 3.54, negative likelihood ratio 0.21, and overall diagnostic accuracy of 81.13%. Platelet Distribution Width (PDW) had AUC of 0.787 (CI 0.609 – 0.965; SE 0.091; p < 0.001). With a cutoff of 12.35, PDW achieved sensitivity 92%, specificity 73.33%, PPV 23.09%, NPV 99.07%, positive likelihood ratio 3.45, negative likelihood ratio 0.10, but a lower diagnostic accuracy of 56.8%.

Conclusion: From the current study it is concluded that platelet indices, Mean platelet volume and platelet distribution width might have a role in the diagnosis of acute appendicitis and might help to avoid possible negative appendicectomies.

Keywords: Acute appendicitis, Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), Appendicitis diagnosis, Platelet indices.

INTRODUCTION

Acute appendicitis is a frequent surgical emergency with a lifetime risk of about 7-8% in both children and adults. Despite combining clinical signs, laboratory tests, and imaging, the diagnosis can still be uncertain, with negative surgery/exploration rates reaching 20-30%. Because of this, there is interest in novel diagnostic tools—particularly

biomarkers of platelet activation such as Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW). Early studies suggest MPV and PDW may help improve diagnostic accuracy and could potentially reduce reliance on more expensive or time-consuming tests. However, results have been mixed—MPV seems promising in adults, but in pediatric populations its utility is unclear.[1,2]

Acute appendicitis is a very common condition encountered by general surgeons. The first documented appendectomy was performed in 1735 by Claudius Amyand, who removed an inflamed appendix from an 11-year-old boy inside an inguinal hernia sac. The term "appendicitis" and a formal description of the disease were popularized by Reginald Heber Fitz in 1886, when he published his seminal paper "Perforating Inflammation of the Vermiform Appendix; With Special Reference to Its Early Diagnosis and Treatment." Though the appendix is often dismissed as functionless, it frequently causes complications, some of them severe. Diagnosing acute appendicitis remains a challenge, even for experienced surgeons, and depends largely on the clinical presentation. Signs and symptoms may strongly suggest appendicitis when present, but their absence does not reliably exclude the disease.[3,4]

The Alvarado score, introduced in 1986, is one of the most widely used clinical scoring systems for suspected acute appendicitis, but by itself it cannot reliably confirm or exclude the diagnosis. Other methods such as imaging are also used, although not all patients with suspected appendicitis require imaging. Platelets play a key role in hemostasis, and emerging evidence suggests they also have regulatory roles in inflammation. Mean Platelet Volume (MPV) indicates platelet size and activation, is inexpensive, and has been studied as a marker of inflammatory disease activity. Some studies suggest MPV and platelet count may help in diagnosing acute inflammatory conditions like appendicitis.[5,6]

METHODOLOGY

This diagnostic test evaluation was conducted in the Department of General Surgery, in a tertiary care hospital, over a period of one year following approval from the Institutional Ethics Committee. The aim of this study was to evaluate the diagnostic accuracy of Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW) in diagnosing acute appendicitis, using histopathological findings as the gold standard.

Patients with a clinical diagnosis of acute appendicitis who underwent emergency appendicectomy were included in the study. Exclusion criteria were patients receiving antiplatelet therapy, as well as those with diabetes mellitus, thyroid disorders, malignancy, immobilization, or peripheral arterial disease. Informed consent was obtained from all participants. Consecutive cases fulfilling the eligibility criteria were recruited until the required sample size was achieved. The sample size was calculated based on a previous study by Fan Z et al., with a minimum of 43 patients estimated to be necessary.[2]

Patients presenting with acute appendicitis were evaluated in the surgery casualty and surgical wards of the hospital. Following clinical examination and relevant radiological and biochemical investigations, patients with a clinical diagnosis of acute appendicitis—whether managed conservatively or taken up for emergency appendicectomy—were included. Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW) values were obtained from the automated complete blood count performed in the clinical pathology laboratory. The data were entered into Microsoft Excel spreadsheets and analyzed using appropriate statistical software.

RESULTS

Table 1: Descriptive statistics regarding MPV and PDW

	MPV	PDW
Mean ± SD	8.3 ± 1.1	14.2 ± 2.1
Median (IQR)	7.9 (7.4 - 9.15)	14.9 (12.2 - 16)
Minimum	6.8	9.0
Maximum	11.0	16.9

The mean MPV observed in the study population was 8.3 ± 1.1 fl, with values ranging from 6.8 fL to 11 fL. For PDW, the mean value was 14.2 ± 2.1 fL, with a minimum of 9 fL and a maximum of 16.9 fL.
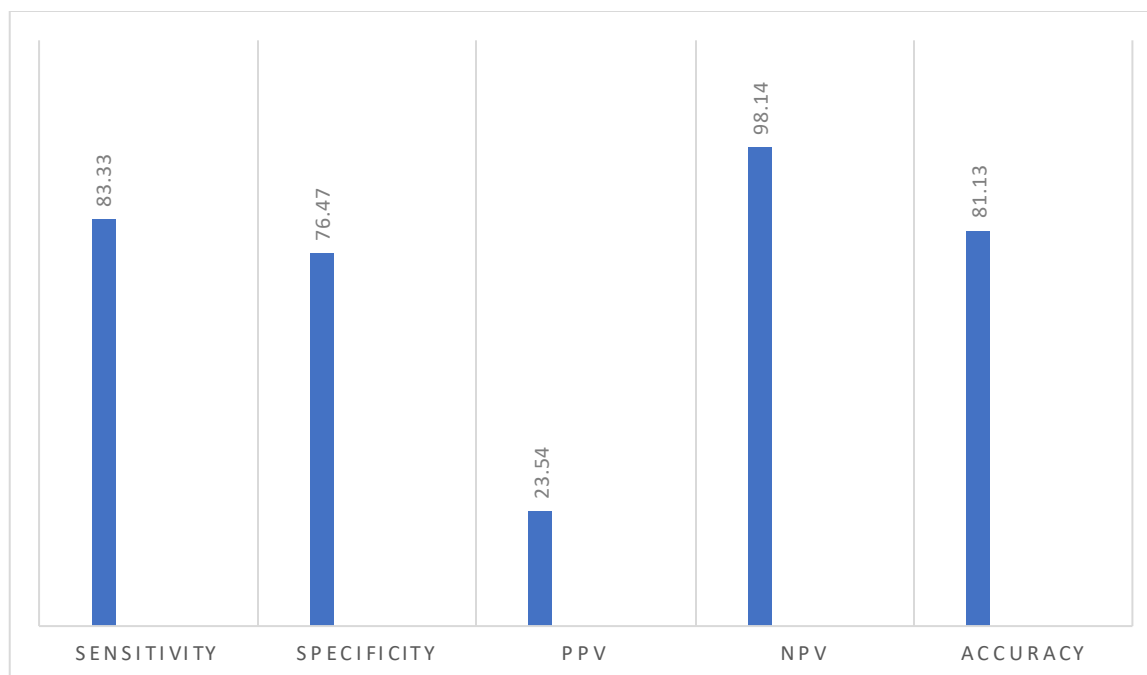
Figure 1: Diagnostic accuracy of mean platelet volume in diagnosing acute appendicitis compared to histopathology as gold standard

On evaluation, MPV demonstrated a specificity of 76.47% and a sensitivity of 83.33% in diagnosing acute appendicitis. The positive predictive value was 23.54%, while the negative predictive value was 98.14%. The overall diagnostic accuracy was 81.13%.
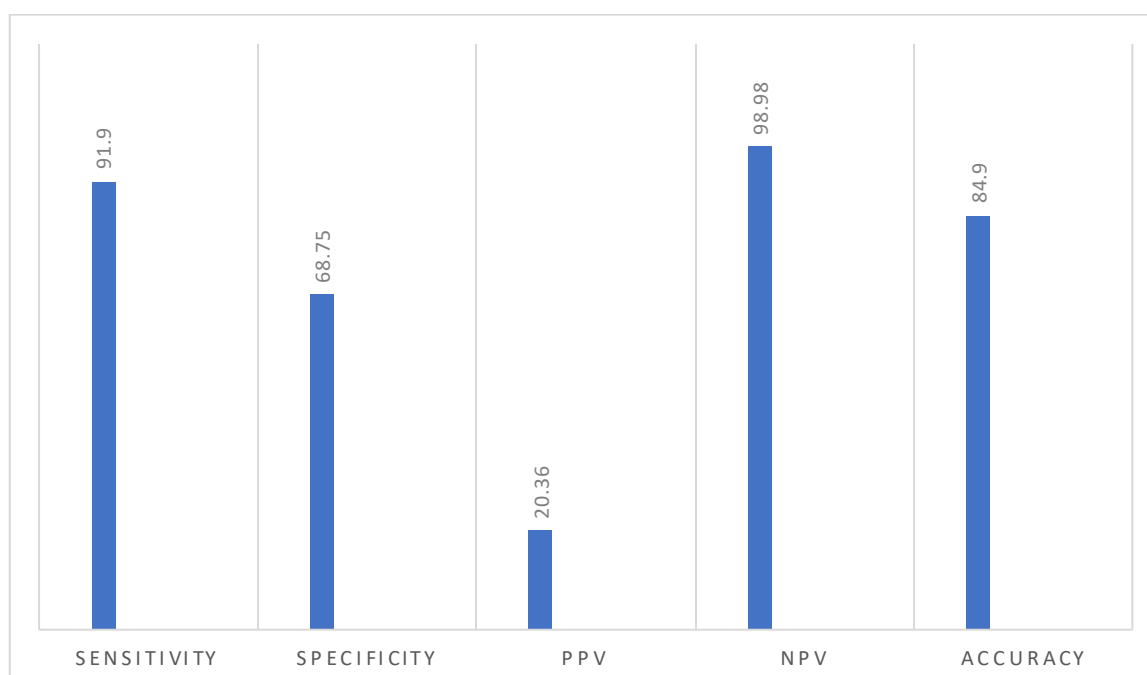

Figure 2: Diagnostic accuracy of Platelet distribution width in diagnosing acute appendicitis compared to histopathology as gold standard

On evaluation, PDW was found to have a sensitivity of 91.9% and a specificity of 68.75%. The positive predictive value was 20.36%, while the negative predictive value was 98.98%. The overall diagnostic accuracy was 84.9%.

DISCUSSION

The present study was conducted to evaluate the diagnostic accuracy of mean platelet volume (MPV) in detecting acute appendicitis, using histopathology as the reference standard. A total of 53 patients who underwent emergency appendicectomy were included. Among them, 30 patients with histopathologically confirmed acute appendicitis had an MPV value ≤ 8.75 (true positives). Thirteen patients without appendicitis on histopathology showed MPV values > 8.75

(true negatives). Four patients without appendicitis had MPV ≤ 8.75 (false positives), while six patients with histopathologically proven appendicitis had MPV > 8.75 (false negatives).

A receiver operating characteristic (ROC) curve was constructed, yielding an area under the curve (AUC) of 0.768 (95% CI: 0.596–0.940) with a standard error of 0.088 and a p-value of 0.002. The optimal cutoff for mean platelet volume (MPV) was determined to be 8.75. At this threshold, the sensitivity of MPV as a diagnostic marker for acute appendicitis was 83.33%, while the specificity was 76.47%. The positive predictive value (PPV), indicating the probability that patients with a positive test truly had the disease, was 88.23%, and the negative predictive value (NPV), reflecting the probability that patients with a negative test truly did not have the disease, was 68.42%. The positive likelihood ratio (LR+) was calculated as 3.54, and the negative likelihood ratio (LR−) as 0.21. The overall diagnostic accuracy of MPV in identifying acute appendicitis was 81.13%.

Kucuk et al. (2015) reported that mean platelet volume (MPV) in the diagnosis of acute appendicitis demonstrated a sensitivity of 83% and a specificity of 42%, with an area under the curve (AUC) of 0.69 (39).[7] In the present study, platelet distribution width (PDW) was also assessed as a potential diagnostic marker for acute appendicitis. The ROC analysis yielded an AUC of 0.787 (95% CI: 0.609–0.965), with a standard error of 0.091 and p < 0.001. At the cutoff value of 12.35, PDW showed a sensitivity of 92%, specificity of 73.33%, positive predictive value (PPV) of 23.09%, negative predictive value (NPV) of 99.07%, positive likelihood ratio (LR+) of 3.45, and negative likelihood ratio (LR−) of 0.10, with an overall diagnostic accuracy of 56.8%. In comparison, Boshnak et al. reported PDW to have a sensitivity of 89.66%, specificity of 63.64%, and diagnostic accuracy of 76.65% (53).[8]

Bozkurt et al. (2015) investigated the role of MPV and other inflammatory markers in the diagnosis of acute appendicitis in a cohort of 275 patients who underwent appendicectomy.[9] Their retrospective analysis reported that MPV had a sensitivity of 74.76%, specificity of 35.38%, positive predictive value (PPV) of 78.89%, and negative predictive value (NPV) of 30.26%. In comparison, the present study demonstrated higher diagnostic performance for MPV, with a sensitivity of 83.33% and specificity of 76.47%. For PDW, the sensitivity was 92% and specificity 73.33%. The PPV and NPV were 23.54% and 98.14% for MPV, and 23.09% and 99.07% for PDW, respectively. Both parameters showed excellent NPV, indicating that when these indices are negative, the likelihood of the patient not having acute appendicitis is high. This may aid surgeons in identifying patients who could be managed conservatively, thereby reducing the incidence of negative appendicectomy. Based on these findings, a cutoff value of 8.75 for MPV and 12.35 for PDW may be applied in clinical practice.

An important limitation in the potential use of mean platelet volume (MPV) as a diagnostic marker for acute appendicitis is its variation in the presence of comorbid conditions. Previous studies have reported elevated MPV levels in patients with chronic obstructive pulmonary disease, systemic lupus erythematosus, diabetes mellitus, and myocardial infarction. Therefore, individuals with such systemic diseases should be excluded when interpreting MPV values for the diagnosis of acute appendicitis.[10,11,12]

CONCLUSION
Acute appendicitis remains one of the most common surgical emergencies, yet its diagnosis can be challenging due to overlapping clinical presentations and limitations of current laboratory and imaging modalities. Negative appendectomy, defined as the removal of a non-inflamed appendix, still occurs despite advances in diagnostic strategies, leading to unnecessary morbidity and healthcare costs. In recent years, platelet indices including mean platelet volume (MPV) and platelet distribution width (PDW) have attracted interest as potential adjunctive biomarkers. Alterations in platelet morphology reflect systemic inflammatory activity, and several studies have suggested that changes in MPV and PDW may aid in differentiating acute appendicitis from other causes of abdominal pain. Incorporating these parameters into diagnostic evaluation may therefore enhance accuracy and contribute to reducing the rate of negative appendectomies."

LIMITATIONS
Mean platelet volume can be changed with the presence of comorbidities and comorbidities were not excluded in the study.

RECOMMENDATIONS
Since the study is pointing towards the better accuracy of platelet indices for the diagnosis of acute appendicitis it is recommended to include in the diagnostic criteria of acute appendicitis along with clinical and other biochemical parameters because of its easy availability and less cost.

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