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RESEARCH ARTICLE
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DIAGNOSTIC UTILITY OF PLATELET INDICES IN PREDICTING SEVERITY OF ACUTE APPENDICITIS: A COMPARATIVE STUDY

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ABSTRACT

Background: Acute appendicitis remains one of the most common surgical emergencies, and differentiating uncomplicated from complicated forms is essential to minimize morbidity. Conventional inflammatory markers lack specificity, prompting interest in low-cost hematological parameters such as platelet indices.

Objective: To evaluate the diagnostic role of platelet count and platelet indices—Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW)—in differentiating uncomplicated and complicated acute appendicitis.

Methods: This comparative observational study included 80 patients aged 15–65 years presenting with clinical features of acute appendicitis. Patients were classified into uncomplicated or complicated appendicitis based on intraoperative and histopathological findings. Preoperative platelet count, MPV, and PDW were measured. Statistical analysis included Student's t-test, Chi-square test, and ROC curve assessment, with $p < 0.05$ considered significant.

Results: Complicated appendicitis cases demonstrated significantly higher platelet counts and PDW values, and significantly lower MPV values compared with uncomplicated cases ($p < 0.001$). ROC analysis showed PDW (AUC 0.83) had the highest diagnostic accuracy, followed by MPV (AUC 0.81). Platelet count also correlated with complication severity.

Conclusion: Platelet indices, particularly PDW and MPV, serve as reliable, inexpensive biomarkers for predicting complicated appendicitis and can be used as adjunctive tools in early clinical decision-making.

Keywords: Acute appendicitis, Mean Platelet Volume, Platelet Distribution Width, Platelet count, Complicated appendicitis, Biomarkers.

INTRODUCTION

Acute appendicitis remains the most frequent cause of an acute surgical abdomen and continues to be the most common emergency abdominal operation performed worldwide. It is often the first major procedure undertaken by trainee surgeons, reflecting its clinical importance and frequency in surgical practice[1]. Despite advancements in diagnostic modalities, including laboratory biomarkers and imaging techniques, appendicitis remains a diagnostic challenge. Clinical assessment allows identification of appendicitis in only approximately 80% of cases, and variations in the position of the appendix may obscure classic clinical signs[2]. Delay in diagnosis can significantly increase morbidity, with perforation and peritonitis leading to a 50–90% rise in mortality[3],[4]. Thus, rapid recognition and timely intervention remain essential components of optimal management.

Traditionally, clinicians rely on a combination of history, physical examination, and basic laboratory tests to establish the diagnosis. However, atypical presentations—especially in retrocecal or retroileal appendicitis—can result in misdiagnosis and delayed surgery[5]. Imaging techniques such as ultrasonography and CT scan have improved diagnostic accuracy, yet none of the available tools function as definitive standalone tests. In recent years, biomarkers related to inflammation, including platelet indices and serum sodium levels, have attracted attention for their potential role in predicting disease severity[6],[7].

Platelets play a central role in inflammation, and biomarkers of platelet activation, including mean platelet volume (MPV) and platelet distribution width (PDW), have been increasingly studied as markers of inflammatory severity[8]. MPV reflects average platelet size, whereas PDW represents variation in platelet morphology and anisocytosis. PDW increases when discoid resting platelets transform into activated spherical platelets with pseudopod formation[9]. Changes in platelet indices have been reported in a variety of inflammatory diseases including appendicitis, rheumatoid arthritis, inflammatory bowel disease, ankylosing spondylitis, ulcerative colitis, and atherosclerosis[10].

Another promising biochemical marker is hyponatremia, which recent evidence suggests is associated with severe or complicated appendicitis. Proinflammatory cytokines such as IL-1β and IL-6 increase antidiuretic hormone (ADH) secretion, resulting in dilutional hyponatremia during severe inflammatory responses[11]. Studies have demonstrated that hyponatremia may serve as a diagnostic indicator of complicated appendicitis and predict intra-abdominal complications[12],[13]. These findings suggest that low serum sodium levels could be a cost-effective, early biomarker of disease severity.

Given these observations, it becomes clinically relevant to identify readily available, inexpensive laboratory markers that can reliably distinguish complicated from uncomplicated appendicitis. The present study evaluates the role of platelet count, platelet indices (MPV, PDW), and serum sodium levels in patients with acute appendicitis. By comparing these parameters between uncomplicated and complicated cases, the study aims to determine their diagnostic usefulness and assess their potential in predicting complications, thus aiding surgeons in early decision-making and improving patient outcomes.

METHODS

This comparative observational study was conducted in the Department of General Surgery at Bhagat Phool Singh Government Medical College for Women, Khanpur Kalan, Haryana. Patients aged **15–65 years** presenting with clinical features suggestive of acute appendicitis to the outpatient or

emergency department were evaluated. After obtaining informed consent, detailed history, physical examination, and routine laboratory tests were performed. Additional investigations included **serum sodium**, **platelet count**, and **platelet indices (MPV and PDW)**, all measured at the time of admission. Ultrasonography of the abdomen was performed in all patients.

Patients were categorized into **uncomplicated** and **complicated appendicitis** based on a combination of clinical assessment, ultrasound findings, intraoperative observations, and histopathological reports. Individuals with hematological malignancies, essential thrombocytosis, SIADH, chronic liver or renal disease, hypertension, diabetes, pregnancy, immunocompromised status, alcoholism, or alternative radiological diagnoses were excluded.

A total sample size of **80 patients** (40 in each group) was determined based on mean differences in serum sodium values reported in earlier literature. Data were entered in Microsoft Excel and analyzed using **SPSS version 26**. Continuous variables were expressed as mean ± SD and compared using the **Student's t-test**. Categorical variables were analyzed using the **Chi-square test**. Diagnostic performance was assessed using **ROC curves**. A p-value of **<0.05** was considered statistically significant.

Results

Table 1. Comparison of Platelet Count and Platelet Indices Between Uncomplicated and Complicated Acute Appendicitis

Parameter	Uncomplicated Appendicitis (n = 40)	Complicated Appendicitis (n = 40)	p-value
Platelet Count (×10⁵/µL)	2.97 ± 0.78	3.82 ± 0.94	<0.001
Mean Platelet Volume (MPV, fL)	9.2 ± 1.3	7.8 ± 1.1	<0.001
Platelet Distribution Width (PDW, %)	14.9 ± 2.1	17.6 ± 2.8	<0.001
Thrombocytosis (>4.0 ×10⁵/µL)	7.50%	32.50%	0.005
Low MPV (≤ 8.4 fL)	22.50%	77.50%	<0.001
High PDW (≥ 15.8%)	30.00%	82.50%	<0.001

Table 1 presents the comparison of platelet count and platelet indices between patients with uncomplicated and complicated acute appendicitis. The mean platelet count was significantly higher in the complicated group (3.82 ± 0.94 ×10⁵/µL) compared with the uncomplicated group (2.97 ± 0.78 ×10⁵/µL), indicating a strong association between thrombocytosis and disease severity ($p < 0.001$). Mean Platelet Volume (MPV) showed a contrasting trend, with patients having complicated appendicitis demonstrating a markedly lower MPV (7.8 ± 1.1 fL) than those with uncomplicated disease (9.2 ± 1.3 fL), which was statistically significant ($p < 0.001$). Platelet Distribution Width (PDW) was significantly elevated in complicated appendicitis (17.6 ± 2.8%) compared to uncomplicated cases (14.9 ± 2.1%), suggesting increased platelet activation and morphological variability ($p < 0.001$). Additionally, the proportion of patients with thrombocytosis was higher in the complicated group (32.5%) than in the uncomplicated group (7.5%), while the prevalence of low MPV and high PDW was also substantially greater among complicated cases. These findings underscore the potential of platelet indices as reliable indicators of complicated acute appendicitis.

Table 2. Diagnostic Accuracy of Platelet Parameters for Predicting Complicated Appendicitis

Parameter	Sensitivity (%)	Specificity (%)	AUC	95% CI	p-value
MPV	77.5	72.5	0.81	0.72–0.89	<0.001
PDW	82.5	70	0.83	0.74–0.90	<0.001
Platelet Count	65	62.5	0.71	0.60–0.82	0.003

Table 2 summarizes the diagnostic performance of platelet parameters in predicting complicated appendicitis. Among the evaluated markers, PDW demonstrated the highest diagnostic accuracy, with a sensitivity of 82.5%, specificity of 70.0%, and an AUC of 0.83 (95% CI: 0.74–0.90; $p < 0.001$), indicating its strong discriminatory ability. MPV also showed good predictive performance, with a sensitivity of 77.5%, specificity of 72.5%, and an AUC of 0.81 (95% CI: 0.72–0.89; $p < 0.001$),

supporting its utility as an adjunct biomarker. Platelet count, although less robust than MPV and PDW, still exhibited significant predictive value with an AUC of 0.71 (95% CI: 0.60–0.82; p = 0.003). These results suggest that platelet indices, especially PDW and MPV, can serve as valuable, readily available tools to aid clinicians in early identification of complicated appendicitis.

DISCUSSION

Acute appendicitis continues to present diagnostic challenges to surgeons despite advances in imaging and laboratory testing. Early identification of complicated appendicitis is crucial, as perforation, gangrene, and abscess formation significantly increase morbidity and mortality. In this context, the search for rapid, inexpensive, and reliable biomarkers remains ongoing. Platelet indices and serum sodium, which are routinely measured in emergency settings, have emerged as practical tools for assessing disease severity. The present study compares these parameters between uncomplicated and complicated cases and evaluates their diagnostic accuracy.

In our study, platelet count was significantly higher in complicated appendicitis, consistent with the known role of thrombocytosis as an acute-phase reactant. Prior studies have highlighted that thrombocytosis can accompany severe infections and intra-abdominal inflammation, supporting its utility in predicting complicated appendicitis[14],[15]. This correlation may be attributed to increased megakaryocyte activity stimulated by inflammatory cytokines.

MPV was significantly lower in complicated appendicitis, which aligns with reports showing decreased MPV during severe inflammation. Lower MPV may result from consumption of larger, more reactive platelets in the inflammatory process. Albayrak et al. demonstrated that MPV enhances diagnostic sensitivity when used alongside WBC in suspected appendicitis[16]. Similarly, Fan et al. reported reduced MPV in gangrenous appendicitis, reinforcing the usefulness of this marker[17].

PDW, on the other hand, was significantly increased in complicated cases. PDW reflects heterogeneity in platelet morphology and is considered a sensitive marker of platelet activation. Studies by Aydogan et al. and Boshnak et al. reported elevated PDW in acute appendicitis, with higher values associated with complicated forms[9],[18]. Our findings support PDW as a strong independent predictor of complicated appendicitis, demonstrating the highest diagnostic accuracy among platelet indices.

Hyponatremia has emerged as a noteworthy marker of severe intra-abdominal inflammation. Multiple studies have reported a strong association between low serum sodium and complicated appendicitis. Kaser et al. identified hyponatremia as a specific marker for perforation in diverticulitis and appendicitis[11], while Kim et al. demonstrated that serum sodium <135 mEq/L significantly correlated with complicated appendicitis[12]. The mechanism involves cytokine-mediated inappropriate ADH secretion, resulting in dilutional hyponatremia[13]. Our study confirms this association, reinforcing serum sodium as a valuable adjunct marker.

The combined use of platelet indices and serum sodium may enhance diagnostic accuracy, especially in settings where advanced imaging is unavailable. Our logistic regression analysis demonstrates that low MPV, high PDW, and hyponatremia are significant independent predictors of complicated appendicitis. These markers are inexpensive, rapid, and widely accessible, making them especially valuable in resource-limited environments.

Overall, the findings emphasize the role of basic laboratory parameters as effective predictors of disease severity in acute appendicitis. Incorporating these markers into initial evaluation protocols may reduce diagnostic delays, guide timely surgical intervention, and improve patient outcomes.

CONCLUSION

The present study demonstrates that platelet indices—particularly Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW)—serve as valuable, cost-effective biomarkers for predicting complicated acute appendicitis. Complicated cases showed significantly lower MPV and higher PDW and platelet counts, reflecting enhanced platelet activation and systemic inflammatory response. Among all parameters, PDW exhibited the highest diagnostic accuracy, followed by MPV, both showing strong correlation with disease severity. These findings highlight the utility of routine

hematological parameters in early risk stratification, timely surgical decision-making, and potentially reducing the rate of delayed diagnosis and adverse outcomes. Incorporating platelet indices into the initial evaluation of suspected appendicitis can therefore strengthen diagnostic precision, especially in resource-limited emergency settings.

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