



## Original Article

# Role of Mean Platelet Volume (MPV) as a Diagnostic Biomarker in Acute Appendicitis

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## Abstract

**Objectives:** *Diagnosis of acute appendicitis remains to be challenging with up to 30% negative exploration rates. In addition to careful clinical history and physical examination, we still need easily applicable, cheap and effective biomarker. The aim of present study was to know that whether MPV has a role in the diagnosis of acute appendicitis. It was also aimed to show the relationship of MPV with leukocyte count and C-reactive protein (CRP) level.*

**Materials and Methods:** *This study was a retrospective case control study. A total of 45 patients in the acute appendicitis group (adult patients who were operated for acute appendicitis and had a pathology report that confirmed the diagnosis of acute appendicitis) and 20 patients in the control group (healthy adults of similar age) were studied. Age, gender, leukocyte count, CRP, and MPV values were recorded.*

**Results:** *The median MPV levels were  $7.68 \pm 1.42$  fL in the acute appendicitis group, while  $7.13 \pm 1.14$  fL in the control group. CRP, leukocyte count, and MPV level were significantly higher in the acute appendicitis group. MPV, leukocyte count, and CRP had a sensitivity and specificity of 67% and 52%; 92% and 73%; and 97.4% and 42%, respectively. No correlation was found between MPV, CRP, and leukocyte count.*

**Conclusions:** *MPV level was higher in patients with acute appendicitis. MPV may guide the diagnostic process of acute appendicitis. However, we detected that the sensitivity and specificity of leukocyte count were superior to those of MPV in the diagnosis of acute appendicitis. We believe that further research is needed to be done to find more specific and more reliable biomarker or biomarker combination for their utilization in the diagnosis of acute appendicitis besides studies focused on MPV.*

**Keywords:** *Acute appendicitis, mean platelet volume, sensitivity, specificity.*

## Introduction

Acute appendicitis is one of the most frequent cause of emergent exploration due to acute

surgical abdomen. Despite, the improvements in diagnostic techniques, negative laparotomy or laparoscopy rates can be reached up to 30%.

Efforts to avoid unnecessary explorations were enforced surgeons to find reliable biomarkers for accurate diagnosis of acute appendicitis. Although, the value of careful clinical history, physical examination and commonly used laboratory parameters (white blood cell count, neutrophil percentage and C-reactive protein) are up most important, a reliable biomarker could help the physician to make a clear final decision. Up to date, a lot of markers have been proposed, but none of them were commonly accepted, so we still need easily applicable, cheap and effective biomarker for helping the diagnosis of acute appendicitis. The mean platelet volume (MPV) is a routinely reported parameter in complete blood count (CBC). CBC, was generally thought to unimportant by physicians for the diagnosis of acute appendicitis, except white blood cell (WBC) count and neutrophil predominance. MPV is a commonly used marker of platelet production and function, and it has been shown to reflect inflammatory burden. Detected value of MPV has been shown to be affected in many clinical scenarios and reflects disease activity in systemic inflammation, acute pancreatitis, unstable angina and myocardial infarction. Changes in the value of MPV was found to be significant in cardiovascular, cerebrovascular and rheumatoid joint diseases and in some other inflammatory disorders. Once it was recognized that, an inflammatory condition can alter the MPV value, the thoughts arise that it could be used for the diagnosis of acute appendicitis as a biomarker.

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-1 2, 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. 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. 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.

### Materials and Methods

Present study was a retrospective case control study conducted in the Department of Pathology, and with the help of Department of Microbiology, Medicine, Surgery and Pediatrics, Sri Krishna Medical College, Muzaffarpur during the period of October 2017 to March 2018. A total of 45 patients in the acute appendicitis group (adult patients who were operated for acute appendicitis and had a pathology report that confirmed the diagnosis of acute appendicitis) and 20 patients in the control group (healthy adults of similar age group and had no active complains) were studied. Inclusion criteria involved that all patients were adults, and their pathology reports confirmed the diagnosis of acute appendicitis. The exclusion criteria in the acute appendicitis group included heart failure, hematological disease, cancer, chronic infections, hepatic disease, and vascular disease. The patients in the control group were selected from healthy adults of similar age group and had no active complaint, chronic disease, or abnormal physical examination. Age, gender, leukocyte count, and CRP and MPV levels were recorded. CBC (Complete Blood count) is done by fully automated CBC machine supplied by Horiba and CRP were measured by fully automated architect machine supplied by Rosch pharma.

## Results

The median leukocyte count was  $13800 \pm 4200$  mm<sup>3</sup> in the acute appendicitis group and  $6840 \pm 2380$  mm<sup>3</sup> in the control group. The leukocyte count was significantly higher in the acute appendicitis group. The median CRP level was  $16.28 \pm 57.52$  mg/dL in the acute appendicitis group and  $2.4 \pm 4.08$  mg/dL in the control group. CRP level in the acute appendicitis group was

significantly higher compared with the control group. The median MPV level was  $7.68 \pm 1.42$  fL in the acute appendicitis group and  $7.13 \pm 1.14$  fL in the control group. MPV, leukocyte count, and CRP had a sensitivity and specificity of 67% and 52%; 92% and 73%; and 97.4% and 42%, respectively. No correlation was found between MPV, CRP, and leukocyte levels.

## Comparison of Mean Platelet Volume, Leukocyte Count & C-Reactive Protein

Biomarker	Acute Appendicitis Group	Control Group	Sensitivity (in %)	Specificity (in %)
Mean Platelet Volume(fL)	$7.68 \pm 1.42$	$7.13 \pm 1.14$	67	52
Leukocyte Count (mm <sup>3</sup> )	$13800 \pm 4200$	$6840 \pm 2380$	92	73
C-Reactive Protein (mg/dL)	$16.28 \pm 57.52$	$2.4 \pm 4.08$	97.4	42

## Discussion

The patho-physiology of acute appendicitis is characterized by the mucosal ischemia of the appendix that results from ongoing mucus secretion from the appendiceal mucosa distal to an obstruction of the lumen, elevating intraluminal and, in turn, venous pressures. Once luminal pressure exceeds 85 mmHg, venules that drain the appendix become thrombosed and, in the setting of continued arteriolar in flow, vascular congestion and engorgement of the appendix become manifest. Infection is added to the inflammation of appendicitis. WBC count is most frequently used to laboratory test for diagnosis acute appendicitis. Several reports have suggested that an elevated WBC count is usually the earliest laboratory measure to indicate inflammation of the appendix, and most patients with acute appendicitis present with leukocytosis. We found that WBC count was significantly higher in acute appendicitis. In various studies, the range of sensitivity and specificity of WBC in the diagnosis of acute appendicitis have been reported 67-97.8% and 31.9-80%, respectively. Similar to the literature, the present study found that the sensitivity and specificity of leukocyte level were 92 and 73%, respectively. CRP is a sensitive acute phase protein that lacks specificity due to increased levels in all acute inflammatory processes. Its concentration increases with the

duration and extent of the inflammation. In a meta-analysis examining the accuracy of CRP levels in the diagnosis of acute appendicitis, a wide range of sensitivity (40 - 99%) and specificity (27 - 90%) was found in literature. Similar to the literature, this study found a sensitivity of 97.4% and a specificity of 42% for CRP in the diagnosis of acute appendicitis. Among the assessed parameters, CRP had the highest sensitivity and the lowest specificity. MPV is a simple and accurate marker of the functional status of platelets. Higher MPV values usually reflect augmented production of young platelets and increased number of large hyperaggregable platelets. Thus, MPV has been considered a suitable indicator of platelet activation. As described previously, larger platelets are more reactive. Platelet size is determined at the level of the progenitor cell (i.e. the megakaryocyte), and studies have reported that cytokines, such as interleukin-3 or interleukin-6, influence megakaryocyte ploidy and can lead to the production of more reactive, larger platelets. Thus, platelet volume has been proposed as an indirect marker of increased platelet reactivity. Additionally, activated platelets release antibacterial peptides; however, some evidence indicates that certain pathogens may have developed a means to exploit activated platelets by binding to their surfaces to establish or

propagate infection. In addition, previous studies have reported an association between changes in the levels of MPV and various non-infectious inflammatory processes, which may suggest that MPV changes reflect disease activity in inflammation. Albayrak et al. in a 226-patient study, found a significantly lower MPV level in patients with acute appendicitis compared to the control group. They suggested that MPV level may guide the management of patients suspected to have acute appendicitis. They found a cutoff level of below 7.6 fL for MPV. We found a cutoff level of above 7.89 fL in patients with acute appendicitis. In a pediatric age group, Bilici et al. found that the MPV level significantly decreased in acute appendicitis compared with the control group. Uyanik et al. on the other hand, reported that the MPV level was not predictive in the diagnosis of acute appendicitis in pediatric patients. Unlike these studies, we found a significantly higher MPV level in the acute appendicitis group than the control group. In contrast, Albayrak et al. and Bilici et al. reported lower MPV levels in the appendicitis group compared to controls. Those studies reported a sensitivity level of 73 and 87%, and a specificity level of 84 and 54 %, respectively. In our study MPV's sensitivity was 67%, a value lower than previously reported ones, and its specificity was 52%. Based on these findings, it can be suggested that leukocyte count and CRP levels may be superior to MPV in diagnosis acute appendicitis.

### Conclusion

In conclusion, MPV level was higher in patients with acute appendicitis compared to the control group in a retrospective case-controlled our study. MPV may guide the diagnostic process of acute appendicitis. However, our study revealed that the sensitivity and specificity of leukocyte count and CRP were superior to those of MPV in diagnosis of acute appendicitis. We think that further prospective, multicenter studies with a large sample size are needed in this field.

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