



ROLE OF MEAN PLATELET VOLUME IN THE DIAGNOSIS OF ACUTE APPENDICITIS IN GOVERNMENT MEDICAL COLLEGE THIRUVANANTHAPURAM- A CASE CONTROL STUDY

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ABSTRACT

Introduction: Acute appendicitis is a common surgical emergency encountered in the casualty. Delay in diagnosis of acute appendicitis may cause a variety of life threatening complications. Diagnostic difficulties may lead to negative appendicectomies or cases of missed appendicitis resulting in complications such as appendiceal perforation or abscess formation. The mean platelet volume (MPV) is a parameter detected during routine blood count and to which clinicians do not usually pay attention. The aim of the study is to assess role of mean platelet volume in the diagnosis of acute appendicitis. **Objectives:** To assess the role of Mean Platelet Volume as an inflammatory marker in the diagnosis of Acute Appendicitis in patients whose post- appendicectomy histopathology reports were confirmatory of acute appendicitis and to determine the relationship between Mean Platelet Volume and Total White Blood Cell count and Neutrophil count in patients with acute appendicitis. **Methodology Study Design:** It was a Case control study conducted in Government Medical College Thiruvananthapuram involving 82 patients who underwent emergency open appendicectomy and 82 patients posted for elective open appendicectomy. **Results:** Platelet count was measured in all 164 patients. The sensitivity was 37.8%, specificity 78.05%. Positive predictive value 63.3 and Negative predictive value 55.7, positive likelihood ratio of 1.72 and a negative likelihood ratio of 0.8. Youden Index J is 0.1585. **Conclusion:** From the current study it is concluded that platelet indices, Mean platelet volume might have a role in the diagnosis of acute appendicitis and might help to avoid possible negative appendicectomies.

KEYWORDS

Mean Platelet Volume, Appendicitis, Appendicectomy

INTRODUCTION

Acute appendicitis is one of the common causes of acute abdominal pain with approximately 6-7% of the general population will develop the same during their lifetime. ^[1] Appendicectomy was 1st done by Claudius Amyand who identified and successfully removed an appendix in a hernia of a 11 year old child, but the entity of appendicitis was described by Reginald Fitz in 1886. ^[1] Despite being so common and being known for quite a long time, the clinical diagnosis of acute appendicitis is based on variables, included in the Alvarado score which are of ill-defined values, and which may often result in negative appendectomy when surgical intervention is taken, especially when not supported by imaging findings. ^{[2][3]}

Historically, an acceptable negative appendectomy rate (NAR)—defined as pathologically normal appendices removed surgically in patients suspected of having acute appendicitis has been between 15% and 25% with an even higher rate considered acceptable in women, for whom making the diagnosis is thought to be more difficult. ^{[4][5]} The incidence of acute appendicitis ranges from 8.6 to 11 cases per 10,000 person-years. ^{[6][7]}

The disease is more common in males, although perforated cases have no gender predilection. ^[8] In a lifetime, 8.6% of males and 6.7% of females can be expected to develop acute appendicitis. Young age is a risk factor; nearly 70% of patients are younger than 30 years of age when diagnosed with acute appendicitis.

The highest incidence of appendicitis in males is in the 10- to 14-year-old age group (27.6 cases per 10,000 person years), while the highest female incidence is in the 15- to 19-year-old age group (20.5 cases per 10,000 person-years). Perforation occurs in 19% of cases of acute appendicitis. Perforated appendicitis has a bimodal distribution, with the ratio of perforated to non-perforated appendicitis is significantly higher among patients younger than 5 and older than 65 years, in comparison to those between 5 and 65 years of age.

This has been attributed to the poorly developed greater omentum in children and atrophic greater omentum in old age. ^[9] Although acute appendicitis is relatively uncommon in people older than 65 years, the elderly has perforated disease up to 50% of the time. ^[6] Studies have shown that MPV is decreased in cases of acute appendicitis which clinicians usually miss. ^[10] There are studies performed on adults available indicating that MPV values may be a valuable method in the diagnosis of acute appendicitis. In this study, we are to investigate the diagnostic value of MPV in acute appendicitis.

The study sample consisted of 82 patients who presented with acute appendicitis and treated with emergency appendicectomy and 82 patients admitted for interval appendicectomy in the Dept. of General Surgery Govt. Medical College Thiruvananthapuram.

Patients who had been operated upon based on preliminary diagnosis of Acute appendicitis depending on the clinical, laboratory and imaging reports and in whom definitive diagnosis were confirmed with histopathology reports were selected as Cases and patients who had been admitted for interval appendicectomy in whom there was no evidence of active inflammation were selected as control group. The Mean Platelet Volume, Total White Blood Cell count and neutrophil count of these 2 groups are compared.

RESULTS

Table 1: Table showing the different variables used in the study and the corresponding statistical significance

Sample size		164	
Positive group :	HPR (Acute appendicitis)	82	
Negative group :	HPR (No evidence of appendicitis)	82	
	AUC	SE	95% CI
MPV	0.959	0.0151	0.916 to 0.984
Neutrophils	0.898	0.0254	0.841 to 0.940
Platelet	0.526	0.0461	0.447 to 0.604
TC	0.972	0.0134	0.934 to 0.991

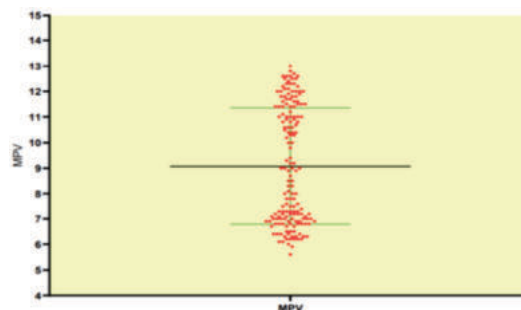


Figure 1- SCATTERED DOT PLOT

MATERIALS AND METHODS

mean value of 9 with maximum value of 13 and minimum value of 5.6

Table2. AUC with SE and CI for MPV,N,TC and platelet count

	N	Mean	Std. Deviation	min	max	Median	Q1	Q3
Age	164	15.48	1.7	13	18	15	14	17
TC	164	11156.3	4406.6	3400	20100	12300	6817.5	14700
Neutrophils	164	69.5	11.3	48	90	67	61.25	78
Platelet	164	3.5	0.8	1.3	5.6	3.6	2.925	4
MPV	164	9.1	2.3	5.6	13	8.6	7	11.4

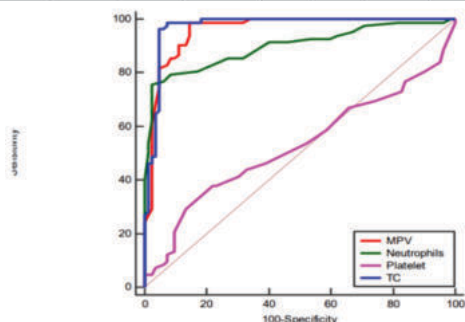


Figure 2: ROC curve for the variables in the study

Table 3: Youden Index

	MPV	Neutrophils	Platelet	TC
Youden index J	0.8415	0.7317	0.1585	0.9146
Optimum cut off	≤9.4	>70	≤3	>10900
Sensitivity	98.78	75.61	37.8	98.78
Specificity	85.37	97.56	78.05	92.68

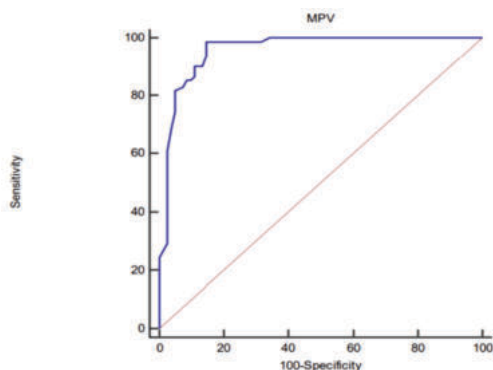


Figure 3. ROC curve for MPV in the study

Table 4- Comparison Of Age ,TC, % Of Neutrophils, Platelet And MPV Between No Evidence group and AA Group

	HPR	N	Mean	sd	T	
Age	No evidence of appendicitis	82	15.59	1.749	0.78	0.437
	Acute appendicitis	82	15.38	1.653		
TC	No evidence of appendicitis	82	7404.63	2529.012	20.891	<0.001
	Acute appendicitis	82	14908.05	2045.058		
Neutrophils	No evidence of appendicitis	82	61.74	6.098	12.153	<0.001
	Acute appendicitis	82	77.32	9.873		
Platelet	No evidence of appendicitis	82	3.517	0.6672	0.839	0.403
	Acute appendicitis	82	3.415	0.8818		
MPV	No evidence of appendicitis	82	10.97	1.5129	19.239	<0.001
	Acute appendicitis	82	7.174	0.9497		

DISCUSSION

The current study aimed to study the diagnostic accuracy of mean platelet volume in diagnosing acute appendicitis patients compared to histopathology as the gold standard. The diagnostic test evaluation study conducted among 164 patients as a case control study with 82 cases who are undergoing emergency appendectomy and 82 controls where they are undergoing interval appendectomy. 82 participants with histopathological diagnosis of acute appendicitis(cases) had MPV less than or equal to 7.17. 82 patients with no appendicitis in histopathology had Mean platelet value >10.97. ROC curve was plotted. Area under the curve was 0.959 (95% confidence interval 0.916-0.984) with standard error 0.0153. Cut off was taken as ≤9.4. Analysis of the data gave the sensitivity (measure of the proportion of true positives that are correctly identified) of mean platelet volume as a diagnostic marker for acute appendicitis to be 98.78% when the cut off value was taken as 8.75. Mean platelet volume was observed to have a positive likelihood ratio of 6.75 and a negative likelihood ratio of 0.014 (The Likelihood Ratio (LR) is the likelihood that a given test result would be expected in a patient with the target disorder compared to the likelihood that that same result would be expected in a patient without the target disorder). The Youden index J was found to be 0.8415. Albayrak et al. found MPV values to be statistically significantly lower in the group who presented late while there was no difference in terms of WBC and neutrophil counts in patients who had presented within 24 hours and 24 hours after onset of symptoms. The specificity was found as 54% and sensitivity was found as 87% for the MPV decrease.^[10] Bozkurt et al in 2015 had studied role of MPV and other inflammatory markers in diagnosing acute appendicitis. This study which assessed nearly 275 patients who underwent appendectomy had found that retrospective mean platelet volume level had sensitivity 74.76%, specificity 35.38%, positive predictive value 78.89%, and negative predictive value 30.26%.^[11] An important issue with the potential use of mean platelet volume as a diagnostic marker of acute appendicitis is the change in mean platelet volume with comorbidities. Previous studies had demonstrated higher MPV values in chronic obstructive pulmonary disease, systemic lupus erythematosus, diabetes mellitus and myocardial infarction, myocarditis. Hence patients with such systemic diseases need to be excluded before interpreting the levels of mean platelet volume values.^[10]

Hence from the current study the mean platelet volume had a sensitivity 98.78% while TC and N was found to have a sensitivity of 98.78% and 75.61%, specificity for mean platelet volume was 85.37% while TC and N has a specificity of 92.68% and 97.56%. Positive and negative predictive value for mean platelet volume was 87.1 and 98.6 respectively. For TC the PPV and NPV were 93.1 and 98.7. For N the PPV and NPV were 96.9 and 80. Both the indices can be seen to have good negative predictive value, which means that if the following indices were found to be negative then the probability that the patient does not really have the appendicitis is high. This can help the surgeons to identify those patients in whom conservative management could be done, and thus avoid negative appendectomy. A cut off value for ≤9.4 for mean platelet volume and >10,900 for TC and >70% for percentage of Neutrophils can be used.

CONCLUSION

Acute appendicitis is a common cause of acute abdomen in general surgery which causes diagnostic dilemma in many cases. Along with history and clinical examination, many diagnostic tests are used for confirming the diagnosis of appendicitis and many of those tests are expensive, time consuming and are with less diagnostic accuracies. Platelet indices are considered to be markers of inflammation and studies are being conducted worldwide. Because of the easy availability of the tests and low cost it would be highly useful in aiding the diagnosis of acute appendicitis. The test is less time consuming as compared to other diagnostic tests for acute appendicitis, unnecessary delay in the diagnosis can be avoided and decision on treatment of cases of AA can be done at the earliest. 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.

Summary

A case control study was conducted in 164 patients who underwent appendectomy in groups of two each consisting of 82 patients, one presenting with appendicitis and underwent emergency appendectomy against a control group who underwent interval

appendicectomy. Mean platelet volume was compared in each group for its diagnostic significance. The study showed a decrease in MPV in post op patients who underwent emergency appendicectomy against those who underwent interval appendicectomy. An important issue with the potential use of mean platelet volume as a diagnostic marker of acute appendicitis is the change in mean platelet volume with comorbidities. Platelet indices are considered to be markers of inflammation. They are easily available, less time consuming and are of low cost and therefore, it would be highly useful in aiding the diagnosis of acute appendicitis. The unnecessary delay in the diagnosis can be avoided and decision on treatment of cases of AA can be done at the earliest.

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