

# Predictive Value of Mean Platelet Volume and Platelet Distribution Width in Diagnosis of Acute Appendicitis: A Cost Effective Tool

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## ABSTRACT

**Objective** To evaluate the role of mean platelet volume (MPV) and platelet distribution width (PDW) in the diagnosis of acute appendicitis.

**Study design** Prospective cross-sectional observational study.

**Place & Duration of study** Department of Surgery, Sandeman (Prov.) Hospital Quetta and Shaheed Mohtarma Benazir Bhutto Teaching Hospital Quetta, from January 2021 to December 2021.

**Methodology** Patients aged 16 years and above were enrolled. The data collected included age, gender, total WBC, RBC and platelet counts and their indices and histopathology findings of specimen of appendix removed. The statistical analysis was performed using SPSS version 20. The results were analyzed by Chi-square test and  $p < 0.05$  considered significant.

**Results** Total 227 cases were analyzed. The age range was from 16 - 70 years. There were 119 male and 108 female patients. Male to female ratio was 1.1:1. There were 120 patients of simple acute appendicitis, 93 complicated appendicitis and 14 normal appendix removed. In complicated cases WBC, percentage of neutrophil count, and PDW were found raised while MPV was lower than reference range. The sensitivity and specificity for WBC, neutrophils and PDW was high while low for MPV. On statistical analysis MPV and PWD were highly significant ( $p < 0.001$ ). Other hematological parameters were significant in over all cases while at group wise analysis there was no significant differences between the uncomplicated and normal cases.

**Conclusion** Low MPV and high PDW found in almost all cases of complicated appendicitis. Analysis of MPV, PDW along with other hematological markers in routine CBC could be valuable diagnostic tool when acute appendicitis is suspected clinically.

**Key words** Acute appendicitis, Mean platelet volume, Platelet distribution width, Diagnostic value.

## INTRODUCTION:

Acute appendicitis is the most common surgical emergency.<sup>1</sup> It is usually diagnosed on clinical

grounds, however an atypical presentation mimics many acute abdominal conditions and leads to negative exploration in many cases.<sup>2</sup> Negative exploration and late diagnosis leads to unnecessary complications which could be easily avoided by making a correct diagnosis.<sup>3</sup> Various studies reported that decisions for appendectomy based on clinical and routine hematological markers like elevated white blood cell count leads to negative appendectomy in significant number of cases.<sup>4</sup> In about 55% of the patients positive clinical signs and/or raised white cells count may not be present.<sup>5</sup>

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Several Inflammatory and hematological markers are found associated with presence of acute

appendicitis.<sup>6,7</sup> In practice majority of clinicians look at leukocyte count only and disregard platelets indices which are also valuable markers for the diagnosis of acute appendicitis. Some studies reported high MPV in acute appendicitis, while others did not.<sup>7,8</sup> A meta-analysis and systemic reviews reported decreased MPV as potential marker for the diagnosis of acute appendicitis.<sup>9, 10</sup> The present study was aimed to evaluate the relationship of MPV and PDW with presence of acute appendicitis in adult patients.

**METHODOLOGY:**

This prospective cross-sectional observational study was conducted in the Department of Surgery, Sandeman (Prov.) Hospital Quetta and Mohtarma Shaheed Benazir Bhutto General Hospital Quetta, from January 2021 to December 2021. After permission from institutional review committee patients of both genders aged 16 years and above, with clinical diagnosis of acute appendicitis (AA) using Alvarado’s scoring system and supported by ultrasound findings were included. Patients with co-morbid conditions affecting platelet count and function, those on antiplatelet drugs, pregnant women, and generalized peritonitis were excluded. Informed consent was taken from patients.

Venous blood samples of all patients were sent to laboratory for complete blood count including the platelet count and their indices (MPV, reference range 7-11fl, PDW reference range 9-17, Plateletcrit (PCT 0.108-0.282) and platelet larger cell ratio (P-LCR). Patients were divided in two groups; group 1 uncomplicated AA and group 2 complicated AA. Uncomplicated AA was defined as catarrhal and suppurative AA, while complicated AA as gangrenous, perforated AA and appendicular abscess. The data were collected on pre designed form included age, gender, total WBC, RBC, platelet counts and their indices, gross and histopathology findings of specimen of appendix.

The statistical analysis was performed using SPSS

version 20. The results of continuous variables were presented as numbers and mean± standard deviation. The results of categorical variables were analyzed by Chi-square test and p <0.05 was considered as significant. The cut-off value of laboratory parameters and sensitivity and specificity were calculated using receiver operating characteristic (ROC) curve analysis. The confidence interval (CI) was set at 95%.

**RESULTS:**

A total of 227 cases were enrolled for final analysis. The age of the patients was from 16 - 70 years. Majority (73.6%) of the patients were under 30 years. There were 119 (52.4%) male and 108 (47.6%) female patients. Male to female ratio was 1.1:1. Fourteen appendix specimens were reported as normal on histopathological examination. There were 120 uncomplicated cases of acute appendicitis and 93 complicated AA. In complicated cases WBCs, neutrophil percentage, and PDW were found raised while MPV was lower than reference rage. In uncomplicated AA WBCs were higher than reference range in 50.2% patients and neutrophils were within reference rage in majority (59.9%) of cases. Details of other parameters is given in table I.

The age and gender were not found significant. MPV, and PWD were highly significant (p <0.001). Other hematological parameters; WBCs and neutrophils, overall were also found significant while group wise there was no significant differences between uncomplicated and normal cases (table II). Receiver operating characteristic curve analysis showed sensitivity, specificity and 95% confidence interval of hematological parameters and are given in table III, and Fig I and II.

**DISCUSSION:**

Complete blood count is an integral part of routine preoperative assessment in emergency admissions. Platelet indices especially mean platelet volume and platelet distribution width may be a simple and cost-effective tool to give valuable diagnostic

**Table I: Details of Numerical Data On Study Variables**

Age (n)	Gender (n)	WBC (n)	Neu (n)	Plt (n)	MPV (n)	PDW (n)	Diagnosis (n)
16-30 years (167)	Male (119)	<4000 (6)	<50% (5)	<15000 (7)	<7.5 (116)	<13 (5)	Normal (14)
31-50 years (49)	Female (108)	4000-11000 (107)	50-70% (136)	150000-400000 (195)	7.5-12 (105)	13-17 (41)	Uncomplicated AA (120)
51-70 years (11)		>12000 (114)	>70% (86)	>400000 (25)	>12 (6)	>17 (181)	Complicated AA (93)

\*AA-Acute appendicitis, WBC-white blood cells, Neu-Neutrophils, MPV-mean platelet volume, PDW-platelet distribution width.

**Table II: Hematological Parameters In Various Types of Cases of Acute Appendicitis**

Diagnosis	No. of cases	WBC (10 <sup>3</sup> /ul)			Neu (%)			MPV (fl)			PDW (fl)			Over all P- value
		<4	4-11	>11	<50	50-70	>70	<7	7.1-12	>12	<13	13>17	>17	
Normal	14	2	11	1	2	11	1	0	13	1	0	13	1	0.001
Uncomplicated AA	120	2	62	56	3	86	31	45	70	5	1	20	99	0.001
Complicated AA	93	2	34	57	0	39	56	71	22	0	4	8	81	0.001
Total	227	6	107	114	5	136	88	116	105	6	5	41	181	

\*AA-Acute appendicitis, WBC-white blood cells, Neu-Neutrophils, MPV-mean platelet volume, PDW-platelet distribution width.

**Table III: Statistical Analysis of Hematological Parameters According to the Type of Acute Appendicitis**

Variables	AUC (std)	Sensitivity	Specificity	95% CI		Significance (p-value)	
				Lower	Upper		
Uncomplicated acute appendicitis	WBC	.468 (.038)	98%	96%	.393	.544	.412
	Neutrophils	.373(037)	97%	99%	.300	.446	.001
	MPV	.648(037)	62%	33%	.577	.720	<.001
	PDW	.532(038)	99%	96%	.411	.456	.411
Complicated acute appendicitis	WBC	.593(038)	97%	97%	.518	.656	.017
	Neutrophils	.679(037)	100%	96%	.607	.750	<.001
	MPV	.281(034)	23%	64%	.213	.348	<.001
	PDW	.557(038)	95%	99%	.482	.633	.142

\* AUC=area under the curve, WBC-white blood cells, MPV-mean platelet volume, PDW-platelet distribution width.

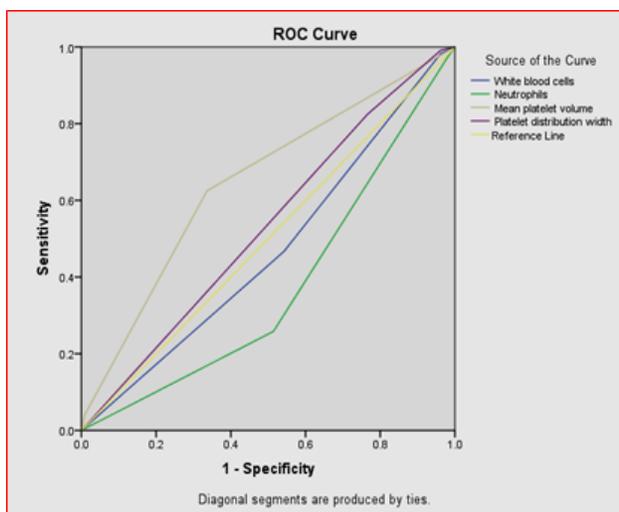


Fig.1; Uncomplicated AA

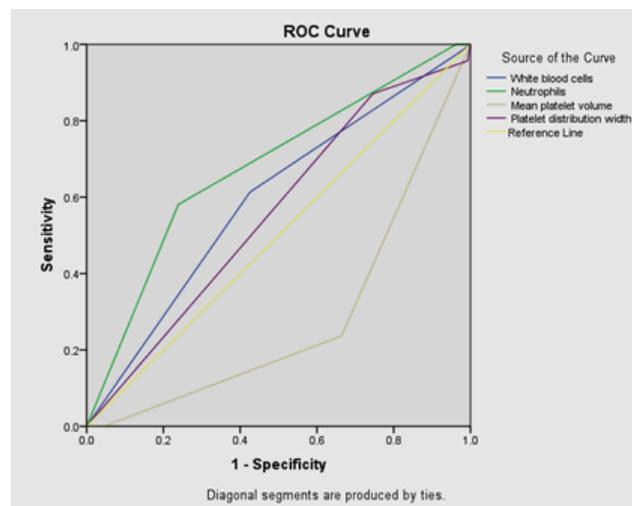


Fig II: Complicated AA

information in acute abdominal condition.<sup>11</sup> Platelets not only regulate hemostasis but has an established role in inflammatory processes by activation and release of inflammatory mediators. Changes in platelet activation and function leads to alteration in MPV and PDW and give important clue in diagnosis. Inflammatory mediators like interleukins (IL-3 and IL-6) affect the size and activity of platelets and hence mean platelet volume decreases in acute and increases in chronic pathologies.<sup>12-14</sup> MPV and

PDW are markers of platelet activation and function respectively. In present study statistically significant low levels of MPV were observed in majority of the cases. Similarly, high levels of PDW found over all in majority cases and in almost all complicated cases.

Raised levels of WBC and neutrophils are reported in complicated AA cases. Rastgoo et al observed statistically significant low MPV values in their

study.<sup>15</sup> In a study conducted by Lalhruaitluanga et al statistically significant low values of MPV and high levels of PDW were noted in cases of acute appendicitis.<sup>3</sup> These findings were similar to our study. Other researchers did not find any significant value of MPV and PDW as compared to other hemoparameters.<sup>13,16</sup>

Few studies reported increased MPV values,<sup>17,18</sup> while others did not.<sup>19</sup> In present study low sensitivity and specificity for MPV and high for PDW was observed which is consistent with other studies.<sup>16,20</sup> The normal or high MPV values may be due to early presentation of patients with acute appendicitis in which inflammatory process not yet initiated.<sup>9,11,12</sup> In our study low MPV may be due to late presentation. In this study mean duration of presentation was 3.5 days from onset of symptoms, which suggest commencement of inflammatory process leading to low MPV values. Differential perspectives of different studies on the subject highlights the need of more studies.

#### CONCLUSION:

Low MPV below reference range was found in almost all cases of complicated appendicitis and within normal range in uncomplicated acute appendicitis. High PDW above reference range was noted in complicated and upper limit of reference range in uncomplicated appendicitis. When the diagnosis of acute appendicitis is suspected clinically, analysis of MPV and PDW in addition to other hematological parameters in routine CBC, could be used as diagnostic tool.

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