ORIGINAL ARTICLE

Diagnostic accuracy of mean platelet volume in acute appendicitis patients: A single center experience

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Abstract:

Objective: To evaluate diagnostic accuracy of mean platelet volume in acute appendicitis

Study design: Cross sectional study

Study duration and settings: Study was conducted at department of surgery, CMH, Muzaffarabad. Study duration was 6 months (June 2018-November 2018).

Material and Methods: A sample size of 195 patients was calculated using WHO calculator. Non probability consecutive sampling was used. Ethical approval and consent forms were taken. Patients were undergone through laboratory measurement and evaluated for diagnostic accuracy. Data was analyzed using SPSS version 24. Chi-square and ROC curve analysis was done. P-value ≤0.05 was considered significant.

Results: There were 195 patients included in present study. There were 97(49.7%) male and 98(50.3%) female in study. Mean age of patients was 34.4 years±7.7SD. Acute appendicitis is significantly associated with variation in mean platelet volume value (p=0.00). Mean platelet volume had 94% sensitivity, 87% specificity, positive predictive value 86% and negative predictive value 92%.Accuracy of mean platelet volume for acute appendicitis diagnosis is 87%.

Conclusion: Mean platelet volume is an effective parameter for acute appendicitis diagnosis in developing world. MPV had high diagnostic accuracy in adults as compare to other diagnostic parameters (leukocyte count and netrophil percentage) in acute appendicitis.

Keywords: Mean platelet volume, acute appendicitis, diagnostic accuracy, leukocyte count

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Introduction:

Acute appendicitis is an important surgical emergency accounting 7% of lifetime incidence worldwide.[1] Acute appendicitis is very common in young age between 10-20 years. In United States, an estimated 250,000 acute appendicitis cases were reported annually.[2] However, acute appendicitis is responsible for 1 million hospital days per years in United States.[3] Acute appendicitis is 1.5 times more common in non-whites as compare to white.[4] Moreover, appendectomy incidence is 12.1 times higher in female than male (43.8/10,000 population per year).[5] Prevalence of acute appendicitis is 48% among teenagers in Peshawar, Pakistan.[6]

Acute appendicitis can be caused by multi-fac-

tors including dietary, luminal obstruction and familial factors. Acute appendicitis diagnosis is difficult due to multiple factors including poor predictive value of associated laboratory testing and absence of pathological sign symptoms. Inflammation significantly attributes acute appendicitis pathology. Acute appendicitis laboratory indicators include erythrocyte sedimentation rate, elevated inflammation markers, C-reactive protein, left shift and leukocytosis.[7]

Mean platelet volume (MPV) measure is a platelet size estimation generated by blood count test measured through full blood count analyzers.[8] MPV is considered as platelet activation estimator. Literature reported that large platelets are more easily aggregated, more reactive and asso-

Table-1: Association between mean platelet volume value and acute appendicitis

MPV value (according to standard criteria)	Acute appendicitis		Total	P value
	Yes	No		
Yes	85(92.3%)	13(12.6%)	98(50.2%)	0.000
No	7(7.7%)	90(87.4%)	97(49.8%)	
Total	92(40%)	103(60%)	195(100%)	

Table-2: Diagnostic parameters of MPV in acute appendicitis patients

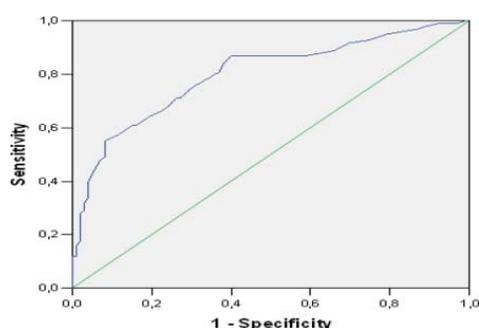| Sensitivity	94%	Positive predictive value	86%
Specificity	87%	Negative predictive value	92%
Likelihood ratio for positive test	7.2	Likelihood ratio for negative test	14.5

Figure-1: ROC curve analysis of MPV

ciated with production of more pro-thrombotic factors.[9] MPV is significant surrogate markers of patients platelet function. MPV is associated with reflection of inflammatory burden and disease activity including myocardial infarction, pre-aclampsia, unstable angina, acute pancreatitis and systemic inflammation (Crohn's disease and ulcerative colitis).[10]

Limited data is available on diagnostic accuracy of mean platelet volume in acute appendicitis patients. Present study will provide knowledge to revise diagnostic guidelines of acute appendicitis in developing world. Present study aims to evaluate diagnostic accuracy of mean platelet volume in acute appendicitis.

Material and Methods:
A cross sectional study was conducted at department of surgery, CMH, Muzaffarabad. Study duration was 6 months (June 2018-November 2018). Ethical approval was taken from ethical review board. A sample of 195 patients was calculated with 95% confidence interval, prevalence 48%,[11] significance level 7% using WHO calculator. Non probability consecutive sampling was used for patient's recruitment. Patient inclusion criteria was based upon age > 20 years, both genders and diagnosed clinically with acute appendicitis. Exclusion criteria were pregnancy, cardiovascular diseases, respiratory disorders, immunodeficiency syndrome, hepatic diseases and cancer. Consent forms were taken from all participants. Patients were undergone through laboratory measurement including blood count (with automatic blood count in 2 hours after 4.5ml blood drawn from antecubital vein), neutrophil count, white blood cell, platelet count and MPV values. Hematology laboratory values were considered as reference for normal WBC ($4-11\times10^9$/L), platelet count ($150-400\times10^9$/L), neutrophil ($2-8\times10^9$/L) and MPV value (8.9 ± 1.29 fL).

Data was analyzed using SPSS version 24. Mean and standard deviation was calculated for descriptive data and frequency, percentage was calculated for qualitative data. Effect modifiers like age, gender and comorbidities were controlled through stratification. Post-stratification chi-square and ROC curve analysis was done. P-value$\leq$0.05 was considered significant.

Results:
There were 195 patients included in present study. There were 97(49.7%) male and 98(50.3%) female in study. Mean age of patients was 34.4 years$\pm$7.7SD. There were 102(52.3%) patients in age group 21-35 years and 92(47.7%) patients in age group >35 years. There were 34(17.4%) patients diagnosed with hypertension while 161(82.6%) patients found non hypertensive. Among all 195(100%) patients, there were 27(13.8%) diabetic and 168(86.2%) were non-diabetic.

Among all those who were not diagnosed with acute appendicitis 103(60%), 13(12.6%) had MPV normal standard value and 90(87.4%) had above standard value. Among all those who were diagnosed with acute appendicitis 90(40%), 85(92.3%) had normal MPV values while 7(7.7%) had above or below normal MPV value (p=0.000). as shown in table-1.

Mean platelet volume had 94% sensitivity, 87% specificity, positive predictive value 86%, negative predictive value 92%, positive likelihood ratio 7.2 and negative likelihood ratio 14.5 as shown in table-2.

ROC curve analysis showed that area under curve is 0.87. Accuracy of mean platelet volume for acute appendicitis diagnosis is 87% as shown in figure-1.

Discussion:

Mean platelet volume is an emerging issue in inflammatory bowel diseases. Mean platelet volume alterations in children and adults during acute appendicitis are very common. MPV is considered as platelet activation and function indicator with complete blood count measurement. An estimated increase in platelet production is seen in human body with significant platelet count reduction. During this process platelets become more reactive, larger and high MPV values are shown.[12] Literature reported that MPV is significantly altered in inflammatory diseases, however, an increase in MPV value was seen in sepsis, cerebrovascular disease, myocardial infarction, chronic pulmonary diseases and arthritis.[13]

In present study 195 patients were included. Among all those who were not diagnosed with acute appendicitis 103(60%), 13(12.6%) had MPV normal standard value and 90(87.4%) had above standard value. Among all those who were diagnosed with acute appendicitis 90(40%), 85(92.3%) had normal MPV values while 7(7.7%) had above or below normal MPV value (p=0.000). Slavka et al reported that acute appendicitis is associated with high MPV values (p=0.00).[14] Kapsoritakis et al reported that patients diagnosed with acute appendicitis are more prone to have altered MPV value as compare to controls (RR: 1.2, 95% C.I, P=0.01).[15]

In present study, mean platelet volume had 94% sensitivity, 87% specificity. Yuksel et al reported that mean platelet volume had high sensitivity and specificity for acute appendicitis diagnosis (90% and 89%).[16] Another similar study report-

ed that MPV is standard measurement for acute appendicitis with accurate diagnostic efficacy (sensitivity=95% and specificity =89%).[17]

In present study, positive predictive value was 86% and negative predictive value was 92% for acute appendicitis patients. Jaremo et al reported that MPV is a significant biomarker of inflammatory diseases. They had significant diagnostic attributes (74% specificity, 88% sensitivity, 79% positive predictive value and 90% negative predictive value).[18]

In present study, positive likelihood ratio was +7.2 and negative likelihood ratio was-14.5. However, Danese et al reported that MPV had 6.1 and 12.5 positive and negative likelihood ratio respectively for acute appendicitis in patients above 18-years.[19] Current study shown high MPV diagnostic accuracy 87% similar Birchley et al(80%).[20]

Limitation: Short duration and conduction of study at single center limits generlizability of study.

Conclusion:

Mean platelet volume is an effective parameter for acute appendicitis diagnosis in developing world. MPV had high diagnostic accuracy in adults as compare to other diagnostic parameters (leukocyte count and netrophil percentage) in acute appendicitis. Further research is required for detail evaluation of MPV impact on acute appendicitis diagnosis.

Role and contribution of authors:
Dr Shafiq Ur Rahman, Data analysis

Dr Farzana Sabir, study designing, acquisition and data analysis

Dr. Naheed Akhtar

Dr Naila Rahman, Data collection

Dr Ishtiaq Anwar, final review and write ups

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