



ACUTE APPENDICITIS MEAN PLATELET VOLUME

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INTRODUCTION

Acute appendicitis is one of most common surgical procedure of abdominal cavity. A prompt diagnosis is rewarded by a marked reduction in morbidity and mortality.¹ Acute appendicitis is characterized by the mucosal ischemia of the appendix. The ischemia results from ongoing mucus secretion distal to an obstruction of the lumen of appendix. The collection of mucus increases intraluminal which compresses the veins. As luminal pressure exceeds 85 mmHg, appendiceal venules become thrombosed. On the other hand, a continued arteriolar in flow further aggravates venous congestion and engorgement of the appendiceal vessels becomes manifest.²

Classically, the diagnosis of acute appendicitis is based on a brief history of abdominal pain, nausea, migration of pain to right iliac fossa, and signs of local peritonitis. The diagnostic accuracy based on clinical symptoms varies from 70% to

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ABSTRACT...Objectives: To study mean platelet volume (MPV) in acute appendicitis and its correlation with leukocyte count. **Study Design:** Case control study **Place and Duration:** Department of Surgery, Liaquat University of Medical and Health Sciences Jamshoro/Hyderabad from January 2013 to February 2014. **Subjects and Methods:** Subjects with clinical suspicion of acute appendicitis were selected according inclusion and exclusion criteria. A sample of 49 acute appendicitis patients and 37 controls were studied. The Blood samples were collected in sodium citrate vacutainers and processed on Sysmex KX 21 analyzers. The main analysis was the comparison of the difference of MPV between acute appendicitis and controls. Data was analyzed on SPSS version 21.0 by student's t-test, Chi-square test and Pearson's correlation (r) was used to evaluate association of MPV with platelet counts and leukocytes. A p-value of ≤ 0.05 was taken significant. **Results:** The mean platelet volume and leukocytes were significantly elevated in patients with acute appendicitis. MPV and leukocytosis in controls and cases were noted as 7.93 ± 2.1 vs. 9.10 ± 2.9 fl ($p=0.0001$) and 6980 ± 120 vs. $13980 \pm 340 \mu L^{-1}$ respectively. MPV was positively correlated with leukocytosis ($r=0.419$) ($p=0.0001$), while Platelets showed a negative correlation. **Conclusion:** Elevated MPV and leukocytosis are observed in acute appendicitis. MPV may be exploited for clinical diagnosis of acute appendicitis but in a proper clinical context along with leukocytosis.

Key words: Mean Platelet Volume, Leukocytosis, Acute Appendicitis

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80%.^{1,2} Hence, diagnostic errors are common. This results in perforation in 20% of appendicitis and a negative laparotomy rate is reported in 2%-30%.¹

The pre-operative blood tests may be performed easily in primary healthcare settings, which may help clinicians for making decision of suspected acute appendicitis. Several parameters have been reported for diagnosis of acute appendicitis such as; leukocytosis, lymphocyte-leukocyte rate, erythrocyte sedimentation rate, Interleukins 4,5,6,10 and 12, endotoxin, α -2-macroglobulin, fibrinogen, procalcitonin, α -1 antitrypsin, TNF- α , D-Lactate.^{2,3}

Mean platelet volume (MPV) is a measure of platelet size. MPV is generated hematology analyzers as part of complete blood count test. MPV is one of the most is commonly overlooked parameter.⁴ MPV is a measure of average size

and function of platelets.⁵ MPV is one of the most widely used surrogate markers of platelet function. MPV reflects inflammatory burden various clinical conditions like ischemic heart disease, unstable angina, acute pancreatitis, pre-eclampsia, ulcerative colitis and Crohn's disease.⁶

The MPV is easy, inexpensive and generated promptly by hematoanalyzers and is free of observer's bias⁷. Hence; it may prove a useful marker for disease activity of acute appendicitis. The present study was designed to evaluate MPV in patients with acute appendicitis and its correlation with leukocytes surgical wards of our tertiary care hospital.

SUBJECTS AND METHODS

A case control study was conducted at Department of Surgery, Liaquat University Hospital Jamshoro/Hyderabad from January 2013-February 2014. The study was approved by the Ethical review committee of institute. Volunteer subjects were asked to sign the consent form. The diagnosis of acute appendicitis was made on the basis of clinical history and examination aided by leukocytosis. Young patients with complaint of pain in right iliac fossa, nausea and vomiting presenting in emergency department were included. Patients with diabetes mellitus, blood disorders and iron deficiency anemia were excluded. Study population comprised of 37 normal healthy age and sex matched controls (Group I) and 49 patients of acute appendicitis (Group II).

The Blood samples were collected in bottles containing sodium citrate as anticoagulant and processed on automated hematoanalyzer, Sysmex KX 21. The MPV was defined as an average size of platelet and 8–12 fl was taken as normal range. The main analysis in this study was the comparison of the difference of MPV measurements between acute appendicitis and control groups.

The Data was analyzed using SPSS version 21.0 for Windows release (IBS, incorporation, USA). The distribution of data was checked by

Kolmogorov-Smirnov tests before analyzing the data. The continuous and categorical variables were analyzed using students t-test and Chi-square tests respectively. The continuous variables were presented as mean±S.D, while categorical variables as frequency and percentage. Pearson's correlation (r) was used to investigate correlation of MPV with platelet counts and leukocytes. A p-value of ≤0.05 was taken statistically significant.

RESULTS

Mean age noted in controls and cases was 19.3±2.1 and 18.9±3.1 years respectively (p=0.07). The age and gender distribution of acute appendicitis patients is shown in table. I. Abdominal and right iliac fossa pain, nausea and vomiting were the common complaints (table.II). The mean platelet volume, platelet and leukocytes counts are shown in table III. Statistically significant differences were observed among three variables with p-value ≤0.01. Mean platelet volume showed a positive correlation with leukocytes (r=0.419, p=0.001) in patients of acute appendicitis. Platelet counts negative correlation with mean platelet volume and leukocyte counts as shown in table IV. Graph 1 shows correlation of mean platelet volume, platelet and leukocyte counts at sub-group levels. Table IV shows positive correlation co-efficient (r=0.419) of mean platelet volume with leukocyte counts (p=0.001).

	Group I. Controls (n=37)	Group II. Cases (n=49)	p-value
Age (years)	19.3±2.1	18.9±3.1	0.07
Male	26 (70.2%)	39 (79.5%)	0.08
Female	11 (29.7%)	10 (20.4%)	0.09

Table. I. Demographic characteristics of study population

	No.	%
Abdominal Pain	31	63.2
Right iliac Pain	49	100
Nausea	13	26.5
Vomiting	23	46.9
Fever	19	38.7

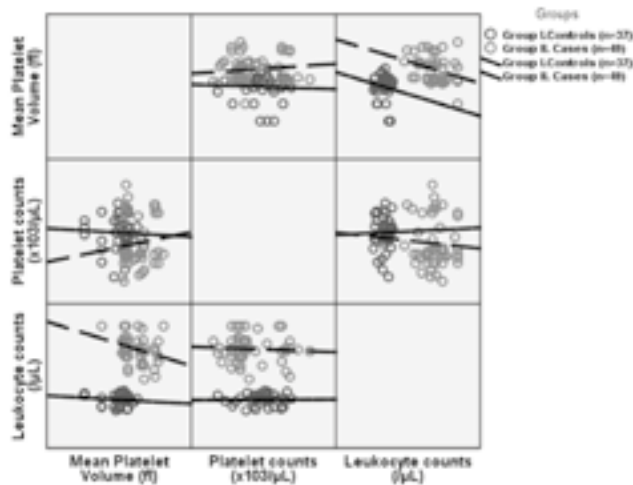
Table II. Clinical presentation of acute appendicitis cases (n=49)

	Group I. Controls (n=37)	Group II. Cases (n=49)	p-value
MPV (fL)	7.93±2.1	9.10±2.9	0.0001
Platelet counts (x10 ⁶ µL ⁻¹)	3.11±0.67	4.19±0.12	0.01
Leukocyte counts (µL ⁻¹)	6980±120	13980±340	0.001

Table. III. Mean Platelet volume (MPV) and leukocyte counts

	r-value	p-value
MPV-Platelet	-0.087	0.02
MPV-Leukocyte	0.419	0.0001
Platelets-Leukocyte	-0.248	0.02

Table. III. Mean Platelet volume (MPV) and leukocyte counts



Graph.1. Scatter plot of mean platelet volume, platelet and leukocyte counts.

DISCUSSION

Leukocyte count is widely used as marker of acute appendicitis but in a proper clinical context. Several studies have suggested that an elevated leukocytosis is an earliest finding. Leukocytosis is considered as a measure of acute inflammation of appendicitis.^{1,8} Leukocytosis observed in present study is consistent with previous studies.^{1,8,9} MPV was found elevated in patients of acute appendicitis as shown in table III. The MPV is an emerging marker being studied in acute inflammatory disease, cardiovascular diseases, bone marrow disorders and diabetes mellitus,

etc.^{11,15}

MPV is a marker of platelet consumption and rate of production by bone marrow. MPV is a simple and reliable marker of platelet aggregation. Newly produced young platelets show hyperaggregation. MPV is an indicator of hyperaggregability. Thus MPV is a marker of platelet activation at the site of injury, inflammation and infections.^{16,17} The MPV is directly proportional to rate of production, which in turn, is related to the rate of platelet consumption. Acute appendicitis causes release of interleukins 3 and 6 and other cytokines which influence the thrombopoiesis. The accelerated thrombopoiesis in turn produces fresh platelets which are over reactive because of large size, rich granules, and hyperaggregability.^{6,10,18-19} The platelets release certain antibacterial peptides during infections.²⁰ On the contrary, it is proved that bacterial pathogens may exploit activated platelets to spread by binding on platelet surfaces, thus platelet serving for them as vehicle for trafficking.^{21,24}

The findings of present study of elevated MPV are in keeping with previous study³ but contrary to others.^{10,18} The Narci et³ al had reported a retrospective case control study comprising very large sample of 503 cases of acute appendicitis. Narci et³ al reported elevated MPV in acute appendicitis, is an important finding in clinical diagnosis.

While previous studies^{10,18} have reported controversial results on MPV values in acute appendicitis. Both of studies^{10,18} had reported a lower MPV values which are in contradiction to present and previous studies.^{3,6} The contradictory results of Albayrak et al¹⁰ and Bilici et al¹⁸ are in serious contradiction to various previous studies including acute appendicitis. The results of Albayrak et al.¹⁰ and Bilici et al.¹⁸ are misleading and this may be because of systemic bias introduced at some point in study design, data collection, MPV measurement within proper time duration and moreover anticoagulant used. It is reported that the EDTA reduces MPV

values if sample is delayed. Such errors might had produced controversial results of previous studies.^{10,18}

Finding of elevated MPV are consistent with previous study of Uyanik et al.¹⁹ The previous study reported elevated MPV in children suffering from acute appendicitis, but the predictive significant of MPV was not proved. The present study reports a positive correlation of MPV with leukocytes which is consistent with previous studies.^{3,19} The limitation of present study is that the sample size was small. The cause effect relationship cannot be ascertained as present study is case control study of cross sectional type. However, we are of opinion that the elevated MPV is a cause, not a consequence of inflammatory process of acute appendicitis. The present study suggests that the MPV is elevated in patients with acute appendicitis.

CONCLUSION

Present study reports elevated MPV and leukocytosis in acute appendicitis. The MPV is a simple, accurate and reliable indicator which may be exploited for clinical diagnosis and surgical management of acute appendicitis when interpreted in a proper clinical context.

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REFERENCES

1. Andersson RE. **Meta-analysis of the clinical and laboratory diagnosis of appendicitis.** Br J Surg. 2004; 91(1):28–37.
2. Karagulle E, Turk E, Ezer A, Nursal TZ, Kulaksizoglu S, Moray G. **Value of Plasma Viscosity in Acute Appendicitis: a Preliminary Study.** J Med Med Sci. 2010; 1(9):423–5.
3. Narci H, Turk E, Karagulle E, Togan T, Karabulut K. **The Role of Mean Platelet Volume in the Diagnosis of Acute Appendicitis: A Retrospective Case-Controlled Study.** Iran Red Cres Med J 2013; 15(12): e11934.
4. Sandhaus LM, Meyer P. **How useful are CBC and reticulocyte reports to clinicians? Am J Clin Pathol.** 2002; 118(5):787–93.
5. Kaito K, Otsubo H, Usui N, Yoshida M, Tanno J, Kurihar E. **Platelet size deviation width, platelet large cell ratio, and mean platelet volume have sufficient sensitivity and specificity in the diagnosis of immune thrombocytopenia.** British J Hematol 2004; 128:698-702.
6. Beyazit Y, Sayilir A, Torun S, Suvak B, Yesil Y, Purnak T, et al. **Mean platelet volume as an indicator of disease severity in patients with acute pancreatitis.** Clin Res Hepatol Gastroenterol. 2012; 36(2):162–8.
7. Khoharo HK, Nizamani GS, Shaikh DM. **Mean platelet volume in type 2 Diabetes mellitus.** Elixir Int'l J 2014;71: 25017-20
8. Birchley D. **Patients with clinical acute appendicitis should have pre-operative full blood count and C-reactive protein assays.** Ann R Coll Surg Engl 2006; 88(1):27–32.
9. Yu CW, Juan LI, Wu MH, Shen CJ, Wu JY, Lee CC. **Systematic review and meta-analysis of the diagnostic accuracy of procalcitonin, C reactive protein and white blood cell count for suspected acute appendicitis.** British Journal of Surgery. 2013; 100(3):322–329.
10. Albayrak Y, Albayrak A, Albayrak F, Yildirim R, Aylu B, Uyanik A, et al. **Mean Platelet Volume: A New Predictor in Confirming Acute Appendicitis Diagnosis.** Clin Appl Throm Hemo. 2011; 17(4):362–366.
11. Kaito K, Otsubo H, Usui N, Yoshida M, Tanno J, Kurihar E. **Platelet size deviation width, platelet large cell ratio, and mean platelet volume have sufficient sensitivity and specificity in the diagnosis of immune thrombocytopenia.** British J Hematol 2004; 128:698-702.
12. Kodiatte TA, Kanikyam UK, Rao SB, Jadadish TM, Reddy M, Lingaiah HKM, et al. **Mean platelet volume in type 2 diabetes mellitus.** J Lab Physicians 2012; 1: 5-9.
13. Cheng H, Huang HS, Park HK, Chun MY, Sung JY. **The Role of Mean Platelet Volume as a Predicting Factor of Asymptomatic Coronary Artery Disease.** Korean J Fam Med 2010; 8:600-6.
14. Targutalp K, Ozhan O, Akbay E, Tiftik N, Yilmaz S, Kiykim A. **Mean platelet volume and related factors in patients at different stages of diabetic nephropathy.** Nephro Dial Transplantation 2012; 27(2):167-77.
15. Korus A, Korus N, Duran M, Turhan NO. **Assessment of mean platelet volume of pregnant women with gestational diabetes mellitus and impaired glucose tolerance as a marker of future cardiovascular disease risk.** British J Diabet Vas Dis 2010; 10:233-37.
16. Park Y, Schoene N, Harris W. **Mean platelet volume**


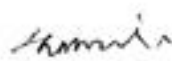

- as indicator of platelet activation: methodological issues.** Platelets 2002; 13(5-6):301-6.
17. Ozdemir O, Soyly M, Alyan O, Geyik B, Demir AD, Aras D, et al. **Association between mean platelet volume and autonomic nervous system functions: Increased mean platelet volume reflects sympathetic overactivity.** Exp Clin Cardiol. 2004;9(4):243-7.
 18. Bilici S, Sekmenli T, Goksu M, Melek M, Avci V. **Mean platelet volume in diagnosis of acute appendicitis in children.** Afr Health Sci. 2011; 11(3):427-32.
 19. Uyanik B, Kavalci C, Arslan ED, Yilmaz F, Aslan O, Dede S, et al. **Role of Mean Platelet Volume in Diagnosis of Childhood Acute Appendicitis.** Emerg Med Int'l 2012; 12:4.
 20. Shannon O. **Platelets interact with bacterial pathogens.** Thromb Haemost. 2009; 102(4):613-4.
 21. Yeaman Michael R. **Bacterial-platelet interactions: virulence meets host defense.** Future Microbiol 2010; 5(3):471-506.
 22. Kisacik B, Tufan A, Kalyoncu U, Karadag O, Akdogan A, Ozturk MA, et al. **Mean platelet volume (MPV) as an inflammatory marker in ankylosing spondylitis and rheumatoid arthritis.** Joint Bone Spine. 2008; 75(3):291-4.
 23. Yazici S, Yazici M, Erer B, Erer B, Calik Y, Ozhan H, et al. **The platelet indices in patients with rheumatoid arthritis: Mean platelet volume reflects disease activity.** Platelets 2010; 21(2):122-5.
 24. Kapsoritakis AN, Koukourakis MI, Sfiridaki A, Potamianos SP, Kosmadaki MG, Koutroubakis IE, et al. **Mean platelet volume: a useful marker of inflammatory bowel disease activity.** Am J Gastroenterol 2001; 96(3):776-81.

PREVIOUS RELATED STUDY

Lubna Habib, Masoom Raza Mirza. ACUTE APPENDICITIS IN PREGNANCY; MATERNAL AND FOETAL OUTCOME. (Original) Prof Med Jour 16(3) 341-345 Jul, Aug, Sep, 2009.

Syed Waris Ali Shah, Chaudhry Ahmed Khan, Sikander Ali Malik, Ahmed Waqas, Ajmel Munir Tarrar, Irtiza Ahmed Bhutta. MODIFIED ALVARDO SCORE; ACCURACY IN DIAGNOSIS OF ACUTE APPENDICITIS IN ADULTS (Original) Prof Med Jour 17(4) 546-550 Oct, Nov, Dec 2010.

AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Dr. Abdul Salam Memon	Concept of study, data collection, data analysis and mnscription writing and checking.	
2	Dr. Shahida Khatoon	Concept of study, data collection, data analysis and mnscription writing and checking.	
3	Dr. Riaz Ahmed Memon	Concept of study, data collection, data analysis and mnscription writing and checking.	
4	Dr. Afzal Junejo	Concept of study, data collection, data analysis and mnscription writing and checking.	