

EVALUATION OF MEAN PLATELET VOLUME LEVEL AS A BIOMARKER IN ACUTE APPENDICITIS IN CHILDREN AND ADOLESCENT: A RETROSPECTIVE STUDYASHISH JAWARKAR^{1*}, HIREN VAGHELA¹, KETAN MANGUKIYA²¹Department of Pathology, Parul Institute of Medical Science and Research, Parul University, Vadodara, Gujarat, India. ²Department of Biochemistry, Kiran Medical College, Surat, Gujarat, India.

*Corresponding author: Ashish Jawarkar; Email: pathology22222@gmail.com

Received: 24 March 2023, Revised and Accepted: 05 May 2023

ABSTRACT**Objective:** This study aims to investigate the diagnostic value of mean platelet volume (MPV) in early diagnosis of acute appendicitis cases in children and adolescents.**Methods:** 50 patients with the age of ≤ 20 years were chosen retrospectively from the case files of the patients admitted to the hospital between May 2021 and May 2022 in whom the definite diagnosis of acute appendicitis was confirmed with postoperative pathological examination. This group was labeled as case group. The control group consists of 50 patients with the age of ≤ 20 years who came for the regular health checkups at our institute. All blood samples were analyzed for complete blood count that includes MPV also in a fully automated 6-part hematology cell counter. These data of both the groups were analyzed statically to calculate p value using the online Student's *t*-test calculator. The value $p < 0.05$ is considered to be statistically significant.**Results:** Majority of acute Appendicitis cases ($n=30$, 60%) belong to 16–20 years, followed by 24% in 11–15-year-age group. The mean age was 14.96 ± 2.75 years. According to gender, 66% ($n=33$) were male. The mean platelet count in the case of group was 3.10 ± 0.5 Lakhs/ml whereas in the case of Group was 2.86 ± 0.7 lakhs/mL. There was no statistically significant difference among the group with respect to platelet count ($p=0.188 > 0.05$). The MPV in the case of case Group was 7.92 ± 0.3 fL whereas in the case of the control group was 8.62 ± 0.4 fL. There was a statistically significant difference among the in terms of MPV ($p=0.04 < 0.05$).**Conclusion:** The diagnosis of acute appendicitis in children and adolescents is aided by a decrease in MPV. The rate of negative appendectomy in children and adolescents with suspected acute appendicitis may decrease if the clinician pays attention to the MPV (which is determined routinely as a part of automated count) alongside other parameters and clinical evaluations.**Keywords:** Acute appendicitis, MPV, Platelet.© 2023 The Authors. Published by Innovare Academic Sciences Pvt Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>) DOI: <http://dx.doi.org/10.22159/ajpcr.2023v16i9.47930>. Journal homepage: <https://innovareacademics.in/journals/index.php/ajpcr>**INTRODUCTION**

A rapid identification of acute appendicitis, a common surgical illness of the abdomen, results in a significant drop in morbidity and death [1,2]. Acute appendicitis is typically diagnosed based on a brief history of stomach pain, nausea, pain that has moved to the right iliac fossa, and evidence of local peritonitis. Diagnostic accuracy based on these symptoms ranges from 70% to 80% [3]. As a result, diagnostic mistakes are frequent, leading to a median incidence of perforation of 20% and a range of 2–30% for negative laparotomies [1].

During normal blood counts, automatic blood count equipment calculates and provides a metric called mean platelet volume (MPV). MPV may be a sign of platelet activation, despite the fact that doctors rarely take it into account because big platelets are more reactive, release more prothrombotic factors, and aggregate more readily [4]. Since the 1970s, researchers have been examining how MPV affects thrombocyte activation and function [5]. Acute ischemic stroke, acute myocardial infarction, and pulmonary thromboembolism are examples of ischemic diseases, as are infectious endocarditis, helicobacter pylori gastritis, Behcet disease, ulcerative colitis (UC), rheumatoid arthritis, psoriatic arthritis, and Henoch-Schönlein purpura progressing with inflammation [6,7].

The aim of this study is the investigation of the diagnostic value of MPV in the early diagnosis of acute appendicitis cases in the pediatric age group.

METHODS

From May 2021 to May 2022, this retrospective study was carried out at the Parul Sevashram Hospital's Department of Pathology, Parul Institute of Medical Science and Research, Vadodara, Gujarat.

Fifty individuals under the age of 20 years were selected retrospectively from the case files of those who were admitted to the hospital between May 2021 and May 2022 and whose postoperative pathological examination verified their definitive diagnosis of acute appendicitis. The name of this group was case group.

Fifty patients under the age of 20 years who visited our hospital for routine health checks make up the control group.

Exclusion criteria

Patients suffering from bleeding disorders, other genetic disorders, diabetes mellitus, active infections, and other comorbidities were excluded from the study.

The venous blood sample was collected from both Group participants in EDTA Vacutainer and all samples were analyzed for complete blood count that includes MPV also in a fully automated 6-part hematology cell counter along with QC material.

Data recorded from the groups included age, gender, platelet count, and MPV. These data of both the groups were analyzed statically to calculate

p value using online Student's *t* test calculator. The value $p < 0.05$ is considered to be statistically significant.

RESULTS

Study includes a total of 100 participants among them 50 were in the case group and 50 were in the control group of the age group <20 years.

Age- and sex-wise distribution of participants is shown in Tables 1 and 2.

Majority of acute appendicitis cases (n=30, 60%) belong to 16–20 years, followed by 24% in 11–15 years of age group. The mean age was 14.96 ± 2.75 years.

According to gender, 66% (n=33) were male.

Male: Female ratio was 1.9:1 (Table 2).

The mean platelet count in the case of group was 3.10 ± 0.5 Lakhs/mL whereas in the Control Group was 2.86 ± 0.7 lakhs/mL. There was no statistically significant difference among the Group with respect to platelet count ($p = 0.188 > 0.05$) (Table 3).

The MPV in the case of case Group was 7.92 ± 0.3 fL whereas in the case of control group was 8.62 ± 0.4 fL. There was a statistically significant difference among the in terms of MPV ($p = 0.04 < 0.05$) (Table 4 and Graph 1).

DISCUSSION

The pathophysiology 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 flow vascular congestion and engorgement of the appendix become manifest. Infection is added to the inflammation of appendicitis [8].

A link in the pathophysiology of illnesses that are prone to thrombosis and inflammation is platelet activation. MPV, among other platelet indicators, has been studied in relation to both thrombosis and inflammation. Low-grade inflammatory diseases predisposed to arterial and venous thromboses, cardio-and cerebrovascular illnesses and high MPV are all associated with a number of known risk factors. Low levels of MPV are observed in high-grade inflammatory disorders such as active rheumatoid arthritis or bouts of familial Mediterranean fever, but these levels rise with anti-inflammatory medication [9,10]. MPV rises in chronic events as opposed to falling in acute ones.

In active cases of ankylosing spondylitis and rheumatoid arthritis, Kisacik *et al.* discovered that the platelet volume was low; however, with treatment, MPV values rose and returned to normal [11]. According to several types of research, MPV declines in response to inflammation. For instance, it has been noted that MPV declines during the active stage of UC [12,13]. Makay *et al.* observed that MPV drops during the attacks significantly when compared to the control group in Familial Mediterranean fever. Similarly, Akelma *et al.* [14] shown that in children with chronic spontaneous urticaria, a drop in MPV may be taken into account as a sign of inflammation. The release of bioactive chemicals from inflammatory active platelets at the time of inflammation is likely to have been connected to this disorder. Danese *et al.* speculated that the decrease in the MPV value could be because of the consumption and sequestration of large active platelets in the vascular segments of the inflamed bowel [15].

In the current study, it was discovered that the MPV values were statistically lower in the group with acute appendicitis when compared to the control group, with a p value of 0.04 (< 0.05). These data are consistent with research by Albayrak *et al.* on adult acute appendicitis

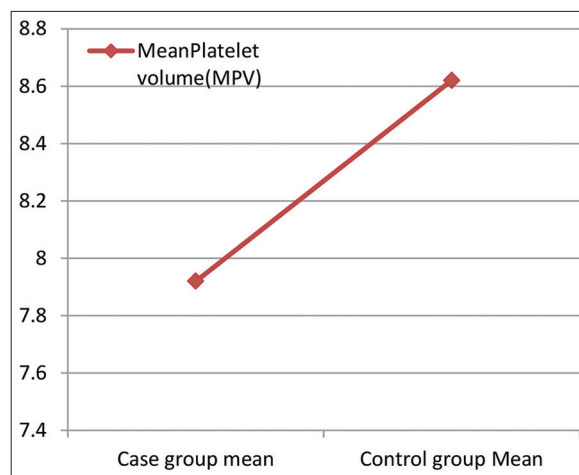


Fig. 1: Graphical presentation of mean platelet volume of case and control groups

Table 1: Age-wise distribution of acute appendicitis case group

Age group	Number	Percentage
0–5	-	-
6–10	08	16
11–15	12	24
16-20	30	60
Total	50	100

Table 2: Sex-wise distribution of acute appendicitis case group

Gender	Number	Percentage
Male	33	66
Female	17	34

Table 3: Hematological marker comparison between case and control groups

Biomarker	Normal range	Case group mean	Control group Mean
WBC count	4.0– $11.0 \times 10^9/L$	$12.5 \pm 0.4 \times 10^9/L$	$8.5 \pm 0.4 \times 10^9/L$
Platelet count (Lakhs/mL)	1.5–4.5 Lakhs/mL	3.10 ± 0.5 Lakhs/mL	2.86 ± 0.7 Lakhs/mL
Mean platelet volume	7.2–9.2	7.92 ± 0.3	8.62 ± 0.4

Table 4: Comparison of MPV between case and control group by calculating p-value (*Significant)

Biomarker	Case group mean	Control group mean	p-value
Mean platelet volume (fl)	7.92 ± 0.3	8.62 ± 0.4	0.04*

patients and Bilici *et al.* on pediatric acute appendicitis patients [16]. However, the results of Uyanik *et al.* in kids with acute appendicitis are different from those of all the research mentioned above, including our own [17]. The MPV values in the research by Albayrak *et al.*, Bilici *et al.*, and Uyanik *et al.* were, in that order, 77.6, 7.55, and 7.6 fL. The new finding of 7.48fL is closely supported by the first two numbers, but the last one will not agree as mentioned above because of its statistically insignificant p value. These findings of our study depict the lowered MPV values in the group case.

CONCLUSION

The diagnosis of acute appendicitis in children and adolescents is aided by a decrease in MPV. The rate of negative appendectomy in children and adolescents with suspected acute appendicitis may decrease if the clinician pays attention to the MPV (which is determined routinely as a part of automated count) alongside other parameters and clinical evaluations.

ACKNOWLEDGMENTS

We would like to acknowledge the whole department of our institute.

CONFLICT OF INTEREST

None.

FUNDING

Nil.

REFERENCES

- Humes DJ, Simpson J. Acute appendicitis. *BMJ* 2006;333:530-4. doi: 10.1136/bmj.38940.664363.AE, PMID 16960208
- Andersson RE. Meta-analysis of the clinical and laboratory diagnosis of appendicitis. *Br J Surg* 2004;91:28-37. doi: 10.1002/bjs.4464, PMID 14716790
- 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 Crescent Med J* 2013;15:e11934. doi: 10.5812/ircmj.11934, PMID 24693387
- Erdem H, Aktimur R, Cetinkunar S, Reyhan E, Gokler C, Irkorucu O, et al. Evaluation of mean platelet volume as a diagnostic biomarker in acute appendicitis. *Int J Clin Exp Med* 2015;8:1291-5. PMID 25785128
- Park Y, Schoene N, Harris W. Mean platelet volume as an indicator of platelet activation: Methodological issues. *Platelets* 2002;13:301-6. doi: 10.1080/095371002220148332, PMID 12189016
- Ozdemir O, Soylu 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 over activity. *Exp Clin Cardiol* 2004;9:243-7. PMID 19641715
- Shannon O. Platelets interact with bacterial pathogens. *Thromb Haemost* 2009;102:613-4. doi: 10.1160/TH09-08-0561, PMID 19806244
- Yeaman MR. Bacterial-platelet interactions: Virulence meets host defense. *Future Microbiol* 2010;5:471-506. doi: 10.2217/fmb.09.112, PMID 20210555
- Scholer SJ, Pituch K, Orr DP, Dittus RS. Clinical outcomes of children with acute abdominal pain. *Pediatrics* 1996;98:680-5. doi: 10.1542/peds.98.4.680, PMID 8885946
- Rothrock SG, Skeoch G, Rush JJ, Johnson NE. Clinical features of misdiagnosed appendicitis in children. *Ann Emerg Med* 1991;20:45-50. doi: 10.1016/s0196-0644(05)81117-5, PMID 1984727
- 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;75:291-94. doi: 10.1016/j.jbspin.2007.06.016, PMID 18403245
- Makay B, Turkyilmaz Z, Unsal E. Mean platelet volume in children suffering with familial Mediterranean fever. *Clin Rheumatoid* 2009;28:975-8.
- Gasparyan AY, Sandoo A, Stavropoulos-Kalinoglou A, Kitis GD. Mean platelet volume in patients with rheumatoid arthritis: the effect of anti-TNF-alpha therapy. *Rheumatol Int* 2010;30:1125-9. doi: 10.1007/s00296-009-1345-1, PMID 20066426
- Akelma D, de la Motte CD, Fiocchi C. Platelets in inflammatory bowel disease: Clinical, pathogenic and therapeutic implications. *Am J Gastroenterol* 2004;99:938-45.
- Danese J, Siegel MJ, Applegate KE, Newman KD. When appendicitis is suspected in children. *Radiographics* 2001;21:247-62; questionnaire 288. doi: 10.1148/radiographics.21.1.g01ja17247, PMID 11158659
- Bilici 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 Thromb Hemost* 2011;17:362-6. doi: 10.1177/1076029610364520, PMID 20460349
- 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* 2012;2012:823095.