

Mean Platelet Volume (MPV) in Children with Acute Appendicitis

Ali Arian Nia¹, Parisa Zareifar²

¹Hircania Cancer Research Center, Golestan University of Medical Sciences, Gorgan, Iran

²M.D, Golestan University of Medical Sciences, Gorgan, Iran

ABSTRACT

BACKGROUND: Acute appendicitis is one of the causes of acute pediatric abdominal pain, requiring quick diagnosis with most cases requiring emergency surgery. Often another cause of acute abdominal pain is identified during surgery and this rate is significantly higher in children than adults. Mean platelet volume (MPV) has been suggested as a biomarker of inflammation. Therefore, we examined the association of MPV with acute appendicitis in children.

METHODS: This case-control study was conducted in 120 children. Sixty cases of acute appendicitis were identified, and 60 controls were identified who presented with abdominal pain but did not have acute appendicitis. Data on demographic and clinical characteristics and final diagnosis were extracted. Chi-square and t-tests were

used to determine statistical significance.

RESULTS: The mean age of the study participants was 7.18 years (standard deviation 3.37). There were 72 males (61%) and 46 females (39%). Mean±SD of MPV was 8.2±0.1 fl, ESR was 24.8±2.0 mm/hour, white blood cell count was 11.5±4.1 x 10³ per mL, neutrophils were 72%±1.6%, and lymphocytes were 26.5%±1.6%. There was no difference in MPV between patients with and without acute appendicitis as final diagnosis (8.27±0.13 fl vs. 8.22±0.13 fl, P>0.05).

CONCLUSION: We found no association between MPV and acute appendicitis in children. Other biomarkers need to be evaluated to support clinicians in making a diagnosis of acute appendicitis.

Keywords: Acute Appendicitis; Mean Platelet Volume; Leukocytes; Gangrenous Appendicitis

INTRODUCTION

Acute appendicitis is one of the causes of acute pediatric abdominal pain in which most cases require emergency surgery [1-2]. Often another cause of acute abdominal pain is identified during surgery and this rate is significantly higher in children than adults. This is because of the disease causing abdominal pain that does not require surgery to treat at early ages, such as gastroenteritis, constipation, baby colic, drug toxicity, uremia, diabetic ketoacidosis, mesenteric lymphadenopathy, respiratory infection and urinary tract infections that all mimic the symptoms of acute abdominal pain [3-4].

Although the medical history taking, clinical examination and routine laboratory tests are important in the diagnosis, these are limited in making a diagnosis with high accuracy [5].

Moreover, delay in diagnosis and treatment of this disease can lead to complications such as ruptured appendix, abscess formation, inflammation of the peritoneum, sepsis and intestinal obstruction [2]. While CT scan of the abdomen is often used in developed countries to aid in the diagnosis of acute appendicitis, timely CT scan facilities are not available in most developing countries. Thus, a biomarker is needed that may help physicians to make a correct and proper decision [3, 6-7].

The mean platelet volume (MPV) is a laboratory parameter that is usually measured by blood cell counting devices during the complete blood count (CBC) [8-10]. MPV can be an indicator of platelet activity because the larger activated platelets can produce higher levels of prothrombotic factors, and can easily aggregate together [7, 11]. Recently, MPV has attracted particular attention by researchers due to its

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Correspondence to: Dr Ali Arian Nia

Address: Hircania Cancer Research Center, Golestan University of Medical Sciences, Gorgan, Iran

Email: aliariannia@gmail.com

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association with several diseases such as infectious endocarditis, gastritis caused by *Helicobacter pylori*, Behcet's syndrome, ulcerative colitis, rheumatoid arthritis, psoriatic arthritis, Henoch-Schonlein purpura (HSP) and ischemic diseases (such as ischemic stroke, myocardial infarction and pulmonary thromboembolism) [12-16]. Therefore, in the present study, we aimed to investigate association of MPV in children with acute appendicitis.

METHODS

Research ethics committee of Golestan University of Medical Sciences, Iran, approved the study proposal. This case-control study was conducted on patients admitted to 5-Azar-Taleghani Teaching Hospital in 2016. Patients between the ages of 1 and 15 were eligible for enrollment in the study. Medical records were reviewed for children referred to the hospital with complain of abdominal pain and who underwent operation with a provisional diagnosis of acute appendicitis based on clinical and laboratory findings. We excluded patients with other provisional diagnoses, age of more than 15 years, diabetes, hypertension, obesity and inflammatory or other infectious diseases. Data on demographic variables such as age and gender, and clinical variables such as physical exam and laboratory parameters were collected from medical records.

Sample size determination: According to a study of Erdam [7], the mean MPV level was 7.4 in children with acute appendicitis, and 9.1 in the control group; the standard deviation of MPV was 1.2 in participants. Considering power of 90% and confidence level of 95%, the sample size of each group was calculated 30 and with inclusion of the coefficient of error in each group was finally estimated at 60 subjects.

Statistical analysis: Mean, standard deviation, frequency, percentage, median and range were used in order to describe the data. Kolmogorov-Smirnov analysis indicated that continuous variables had a normal distribution. Chi-square and t-test were applied for each variable to determine statistical significance. P value < 0.05 was considered statistically significant. SPSS version 18 was used for statistical analyses.

RESULTS

This study was conducted at the 5-Azar-Taleghani Teaching Hospital. Of the 120 participants who presented with abdominal pain, the youngest participants was 1 year old and the oldest was 15 years old; median age was 7 years (interquartile range 5 years) and mean age was 7.18 years (standard deviation 3.37). There were 72 males (61%) and 46 females (39%). Mean \pm SD of MPV was 8.2 ± 0.1 fl, ESR was 24.8 ± 2.0 mm/hr, white blood cell count was $11.5 \pm 4.1 \times 10^3$ per mL, neutrophils were $72\% \pm 1.6\%$, and lymphocytes were $26.5\% \pm 1.6\%$. Appendicitis was diagnosed in 58 patients (60 were enrolled but two patients were excluded due to incomplete records) while another diagnosis was made in 60 children (follicular hyperplasia = 33, non-specific changes = 27). There was no difference in the MPV between patients with appendicitis and those without the diagnosis of appendicitis (Table 1). However, we did find a significantly higher white blood cell count and neutrophil percentage and significantly lower lymphocyte percentage in patients with appendicitis than in patients without appendicitis (Table 1).

DISCUSSION

In this study, we found no association between MPV and final diagnosis of acute appendicitis in children between the ages of 1 and 15 years. We specifically examined patients who underwent an operation with a provisional diagnosis of acute appendicitis in our study to examine if MPV is associated with final diagnosis. Hence, our study attempted to examine if presence of higher MPV levels adds to the clinical diagnosis. Our study results find no such association.

In contrast to our findings, Bilici et al [1] found that the mean MPV was 8.9 ± 1.29 fl in healthy group and 7.57 ± 0.89 fl in appendicitis group and the difference was statistically significant ($P=0.001$), a finding not in line with the present study. The difference in the two studies may stem from the fact that the enrollment of patients was different between the two studies. In addition, there were large differences between the white blood cell count, platelet count and neutrophil percentage between the two groups in the study by Bilici et al. Erdem et al also had results similar to those of the Bilici et al; MPV in Erdem et al study was 7.4 ± 0.9 fl in the appendicitis group and 9.1 ± 1.6 fl in the control group [7]. Similarly Fan et al reported that the MPV value in gangrenous appendicitis group was

Table 1: Comparison of mean of laboratory indices in patients with and without appendicitis

Variable	Average (\pm SD)		P-Value
	Non Appendicitis Group	Appendicitis Group	
MPV	8.22 \pm 0.13	8.27 \pm 0.13	0.788
ESR	20.73 \pm 2.01	28.98 \pm 3.39	0.039
WBC	8950 \pm 410	14246 \pm 552	0.001
PMN	64.38 \pm 2.39	80.56 \pm 1.68	0.001
Lymphocyte	34.46 \pm 2.31	18.34 \pm 1.63	0.001

significantly lower than in the controls group [17]. On the other hand, the study by Uyanik et al. supports the findings from our study. They found that the mean MPV was 7.9 ± 0.9 fl in the appendicitis group and 7.7 ± 0.8 fl in the control group and that there was no statistically significant difference between the two groups [4].

CONCLUSION

The results obtained from the current study showed that the MPV is not effective in the diagnosis of acute appendicitis and cannot be involved as a reliable index in making decision. The decision about acute appendicitis in resource-poor settings will continue to be based on physical examination and use of clinical diagnostic aid in patients suspected to acute appendicitis. Alvarado score can also be a tool to aid in the diagnosis of acute appendicitis disease. An appropriate sample size and accurate follow-up of the patients were the strengths of this study. Moreover, regarding dependence on the operator and pathology tool in the study, we used only the findings of pathologies performed by specialists in Talghani Teaching Hospital; this minimized the tool and operator errors so that it is another strength of the current study.

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