ORIGINAL ARTICLE

A Case Control Study to Determine the Effectiveness of Mean Platelet Volume (MPV) in Acute Appendicitis Diagnosis among Children

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ABSTRACT

Aim: To access the diagnostic value of the mean platelet volume in children with acute appendicitis.

Study design: A case control study

Place and duration: In the Surgical department of Bilawal Medical College for Boys LUMHS, Jamshoro and Sheikh Zayed Medical College/ Hospital Rahim Yar Khan for six-months duration from July 2021 to December 2021.

Methods: 150 total patients were selected with the WHO formula with SD 1.09, 80% power, 5% significance level with cases to control ratio of 1:1 and expected populace 7.55. The patients were selected with simple random technique of sampling (lottery method). The continuous variables of both groups were compared by means of the t-test. To determine the association of MPV with other variables; correlation test was applied.

Results: The study included 150 patients; 35 (46.7%) are men and 40 (53.3%) are women in the study group and 34 (45.3%) men and 41 (54.7%) women in the control group. 8.21 ± 3.51 (1-15 years) was the mean age of the patients in the study group and the mean age of the controls was 8.69 ± 3.51 (1-15 years). The specificity for raised neutrophil and WBC values was 91% and 89%, and the sensitivity was 77% and 84%, respectively. The sensitivity and specificity to MPV reduction was 87% and 54%.

Conclusion: The increase in the leukocytes and neutrophils is significantly associated with acute appendicitis diagnosis. It is less costly and less time-consuming which cause more attention to MPV values during complete blood counts in the acute appendicitis diagnosis among pediatric patients. The low MPV levels are encountered in children with acute appendicitis.

Keywords: High white blood cell count, acute appendicitis, specificity, mean platelet volume (MPV).

INTRODUCTION

The diagnosis of acute appendicitis in children remains problematic. A postponement in the acute appendicitis diagnosis among children results in serious problems, counting perforation[1-2]. In contrast, the rate of negative tests is 20-30% in children. Evidence has emerged in recent years that the history, clinical examination, and routine laboratory tests are not sufficient to confirm the acute appendicitis diagnosis among children[3-4]. Acute appendicitis is related with increase proportion of mortality and morbidity. It is most communal operative procedure that necessitates diagnosis on urgent basis[5-6]. The acute appendicitis diagnosis is typically based on a history of pain migration to the right iliac fossa, abdominal pain, symptoms of peritonitis and nausea. In general, the analytical accurateness of these indications in children varies from 75% to 85%[7]. Diagnostic errors are common, with an average perforation rate of 25% with 2% to 30% negative laparotomy rate. Under primary care setting, pre-operative laboratory testing is easy to perform and helps your GP to make a suspicious diagnosis of acute appendicitis[8]. For acute appendicitis diagnosis; lymphocytes, C-reactive protein, WBC, interleukin-4, interleukin-6, interleukin-5, interleukin-10, endotoxin, interleukin-12, ESR, fibrinogen, alpha 2 macroglobulin, D-lactate and alpha 1 antitrypsin[9-10]. Therefore, new methods are needed to differentiate abdominal pain which is non-specific from acute appendicitis and to reduce the incidence of undesirable laparotomies[11]. There are many studies on the laboratory inflammatory markers which assess their diagnostic value, but the outcomes are highly contradictory. MPV is a clinical parameter cast-off to measure size of platelets during normal complete blood counts[12]. Regrettably, the physician did not consider to this parameter, despite its known importance in the activation and function of platelets. Platelet volume has been found to be a marker of megakaryocytes during platelet production[13]. In Pakistan, limited data are available in which mean platelet volume is used to diagnose acute appendicitis. This test will aid understand the correct acute appendicitis analysis in children based on the average platelet volume. The aim of the study is to access the diagnostic value of the MPV in children with acute appendicitis.

METHODS

The case-control study held in the Surgical department of Bilawal Medical College for Boys LUMHS, Jamshoro and Sheikh Zayed Medical College/ Hospital Rahim Yar Khan for six-months duration from July 2021 to December 2021.for six-months duration from July 2021 to December 2021. The study included 150 patients; 35 (46.7%) are men and 40 (53.3%) are women in the study group and 34 (45.3%) men and 41 (54.7%) women in the control group. 8.21 ± 3.51 (1-15 years) was the mean age of the patients in the study group and the mean age of the controls was 8.69 ± 3.51 (1-15 years). The patients were selected with simple random technique of sampling (lottery method). The study included all confirmed cases of acute appendicitis that were made on the basis of an initial diagnosis based on the results of laboratory tests and imaging methods, and whose gender and age ranged from 1 to 15 years. The healthy control group was selected from the 1-15 age group. Patients with heart failure, haematological diseases, peripheral vascular disease, liver disease, acute or chronic disease, using steroids or anticoagulants were not included. All tests were sent for analysis in the laboratory of hospital. Complete blood count was examined after 4.5 ml of blood was taken from the antecubital vein into a test tube containing 15% ethylenediaminetetraacetic acid. Patient registries include white blood cells, neutrophils, MPV values, and platelet counts. Normal values for platelets, white blood cells, MPV and neutrophils are 150–400 × 109 / L, 4–11 × 109 / L, 8.9±1.29 f L and 2–8 × 109 / L, correspondingly. Ethical approval was obtained from the Ethics Committee and consent forms were signed from guardians of the children. Both groups were followed for 4 months. A pre-designed questionnaire was used for data collection. The questionnaire reliability was evaluated afterwards the pre-tested exercise of ten questionnaires.

Statistical analysis: SPSS version 20.0 was applied for analysis of data. Descriptive statics (mean, SD and percentages) were applied to define the data. The results are presented as tables, charts and percentages for various variables depending on the variable nature. The t-test was applied for both groups comparison for variables which are continuous. The correlation test was performed for the relationship of MPV with other variables.

RESULTS

The study included 150 patients; 35 (43%) are men and 45 (57%) are women in the study group and 33 (47%) men and 37 (53%) women in the control group. 8.17 ± 3.47 (1-15 years) was the mean age of the patients in the study group and the mean age of the control group was 8.77 ± 3.62 (1-15 years). It was found that both groups were similar, with no significant relationship in terms of sex and age (p = 0.360). Mean ± SD, maximum and minimum WBC, neutrophil counts, platelet count and MPV are given in Table 1.

Table 1: Neutrophil, WBC count and MPV among cases and controls

Parameters		Controls			Study cases			
	Mean SD		Minimum	Maximum	Mean SD		Minimum	Maximum	P - Value
WBC (×10^9/L)	8.20	0.5	3.80	15.01	16.50	4.8	6.35	32.50	0.001
Neutrophil (×10^9/L)	4.10	2.1	1.10	9.08	11.5	3.8	4.21	21.40	0.001
PLT (×10^9/L)	375	84	170.12	670.02	301	87	89.00	549.00	0.001
MPV (fL)	8.85	1.1	6.52	12.50	7.21	0.7	5.91	11.10	0.001

While higher WBC and neutrophil counts were found in 34 and 25 patients, correspondingly, the values were lower than normal and normal in 11 and 5 cases, correspondingly in the study group. While the neutrophil counts and white blood cell were high in 10 and 9 patients in the control group, correspondingly, the values were lower than normal and normal in 26 and 30 cases. There was a statistically significant correlation between neutrophils, white blood cells in comparison to the control group (p <0.001). The study showed a linear association between platelet counts and MPV amid patients as assessed by Pearson's correlation coefficient analysis. Therefore, as the number of platelets declines, the average volume of platelets decreases. No such link was found between the controls. The specificity for raised neutrophil and WBC values was 91% and 89%, and the sensitivity was 77% and 84%, respectively. The sensitivity and specificity to MPV reduction was 87% and 54%.

MPV, WBC and Neutrphill values than among cases and control
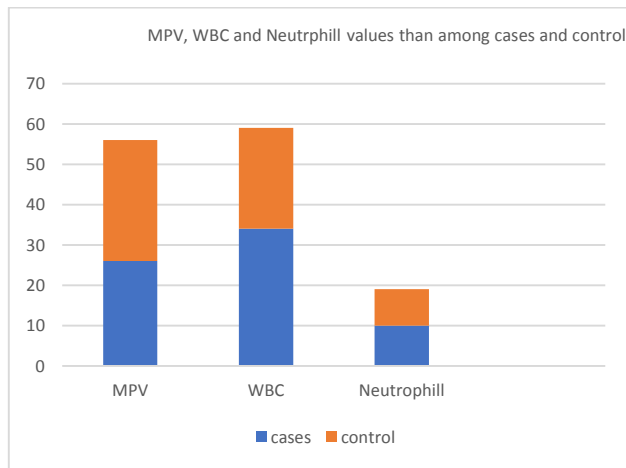
DISCUSSION

The average volume of platelets is a significant analytical step in many inflammatory diseases. No studies have been reported on the diagnostic relevance of MPV in pediatric acute appendicitis in Pakistan, most of the studies have been conducted in the adult population[14-15]. In this analysis, we institute MPV to be a complete blood count marker and related with platelet activation and function. Comparable analysis has shown the similar phenomenon regarding platelet activation and function[16-17]. The study showed that with a reduced platelet count, the MPV values dropped in cases as compared to controls. Similar studies have shown a decrease in MPV values as the platelet count increases as young platelets become more reactive and increase in size[18-19]. This study showed that the MPV values were lower among the cases than in the control group[20]. A similar study reported a decrease in MPV among the cases, but only in the patients who are adult[21]. Though, the MPV pathogenesis cannot be fully elucidated, but

Danese et al. stated with sequestration and consumption of large activated platelets in the inflamed intestine[22]. While the research showed specificity for WBC, neutrophils and MPV among the cases at 89%, 91% and 54%, comparable researches found a WBC specificity elevation of 31.9%. The sensitivity of WBC elevation was 85.8%. In this study, although the sensitivity was 84% and 77%, respectively, there was specificity for increases in neutrophils (91%) (> 8 × 109 / L) and white blood cells (89%) (> 11 × 109 / L) correspondingly. These outcomes turned out to be unreliable with the study[23-24].

Limitations: Because of the small number of patients, the study results could not be generalized to the entire populace.

CONCLUSION

The increase in the leukocytes and neutrophils is significantly associated with acute appendicitis diagnosis. It is less costly and less time-consuming which cause more attention to MPV values during complete blood counts in the acute appendicitis diagnosis among pediatric patients. The low MPV levels are encountered in children with acute appendicitis.

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