Diagnostic Value of Mean Platelet Volume in Acute Appendicitis

Akut Apandisitte Ortalama Trombosit Hacminin Tanısal Değeri

Mean Platelet Volume in Acute Appendicitis

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Özet

Amaç: Acil servise karın ağrısı şikayeti ile başvuran hastalarda akut apandisit tanısının konulması zordur. Biz bu çalışma ile ortalama trombosit hacminin akut apandisitteki tanısal değerini araştırdık. Gereç ve Yöntem: Araştırmaya 2013 yılında acil servise başvurup operasyona alınan ve patolojik tanısı akut apansisit olan 14 yaş ve üzeri hastalar dahil edildi. Akut apandisitli hastalar patoloji sonuçlarına göre komplike ve non-komplike olarak iki gruba ayrıldı. Devemlı değişkenlerin karşılaştırılmasında Mann-Whitney U testi, gruplanmış verilerin karşılaştırılmasında ki kare testi kullanıldı. Bulgular: Çalışma 316 akut apandisit ve eşit sayıda kontrol hastası ile yapıdı. Akut apandisit hastalarının 67'si komplike akut apandisit idi. Akut apandisit ve kontrol hastalarının medyan ortalama trombosit hacim değerleri sırası ile 8.03 fL (IQR:1.86; min:5.53, maks:14.40) ve 8.10 fL (IQR:1.38; min:5.70, maks:13.90) idi (p=0.193). Komplike ve komplike olmayan grupta medyan trombosit sayısı sırasıyla 235 K/µL (IQR:70; min:116, maks:649) ve 261 K/µL (IQR:87; min:124, maks:537) idi (p<0.001). Tartışma: Acil servise karın ağrısı şikayeti ile başvuran hastalarda akut apandisit tanısı konulmasında ortalama trombosit hacmi yararlı bir gösterge değildir.

Anahtar Kelimeler

Ortalama Trombosit Hacmi; Cerrahi; Akut Apandisit; Acil Servis

Abstract

Aim: The diagnosis of acute appendicitis for patients referred to the emergency department with the complaint of abdominal pain remains challenging. In this study, we investigated the diagnostic value of mean platelet volume in acute appendicitis. Material and Method: This clinical research study was performed retrospectively and included patients referred to the emergency department between January 1 and December 31, 2013, with the complaint of abdominal pain and were then discharged without a specific diagnosis in comparison to patients with a proven diagnosis of acute appendicitis. Control patients were selected using a randomization method from among patients of the same age and gender as acute appendicitis patients. The acute appendicitis group was subdivided into complicated and noncomplicated cases according to the pathology results. The Mann-Whitney U test for continuous variables and the chi-square test for categorical data were used. Results: This clinical research study was performed with 316 acute appendicitis patients and an equal number of control patients; 188 of the patients were male. Among the acute appendicitis patients, 67 presented with complicated acute appendicitis and 249 with noncomplicated acute appendicitis. The median mean platelet volume of the acute appendicitis versus control patients was 8.03 fL (IQR: 1.86; min: 5.53, max: 14.40) and 8.10 fL (IQR: 1.38; min: 5.70, max: 13.90), respectively (p=0.193). The platelet counts in the complicated and noncomplicated groups were 235 K/µL (IQR: 70; min: 116, max: 649) and 261 K/µL (IQR: 87; min: 124, max: 537), respectively (p<0.001). Discussion: Mean platelet volume is not a useful guide in the diagnosis of acute appendicitis for patients referred to the emergency department with the complaint of abdominal pain.

Keywords

Mean Platelet Volume; Acute Appendicitis; Surgery; Emergency Department

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Introduction

Acute appendicitis (AA) is one of the most common non-traumatic indications for emergent abdominal surgical procedures. However, it may be difficult to make an accurate diagnosis for all cases. Physical examination, biochemical markers, and imaging techniques can be insufficient for diagnosis. Misdiagnosis may result in life-threatening complications. In recent years, the rate of negative appendectomy has been reported as 11.8% despite developments in diagnostic procedures, particularly those in imaging procedures [1].

Mean platelet volume (MPV) is a parameter that is automatically measured when obtaining a complete blood count. In the literature, studies have investigated the relationships between MPV and many diseases such as stroke, myocardial infarction, pulmonary embolus, pancreatitis, diabetes mellitus, cancer, sepsis, hypertensive crisis, ulcerative colitis, ankylosing spondylitis and rheumatoid arthritis [2-11]. Recently, MPV has been reported to be helpful in the diagnosis of AA [12-17]. In this study, we examined the diagnostic value of MPV for AA.

Material and Method

Our study was performed retrospectively in the emergency department (ED) of a tertiary level education and research hospital, which admits approximately 200,000 patients per year. The study was approved by the local ethics committee. Patients with an age of 14 years and older who were admitted to the ED within the year 2013 and were operated on and revealed to have a histopathological diagnosis of AA were included in the study. Patients whose white blood cell (WBC) count, platelet (PLT) count and MPV could not be obtained from the medical records were excluded. Patients with a history of hypertension, diabetes mellitus, liver disease, peripheral vascular disease, hematological disease, cancer, or steroid or anticoagulant usage were also excluded. The included patients were categorized as having complicated AA (reported as gangrenous or perforated) or non-complicated AA (reported as phlegmonous).

Patients who were referred to the ED with the complaint of abdominal pain and then discharged after appropriate evaluation and consultations were identified. Control group patients were selected in a randomized manner from among patients who were age and gender matched to those in the AA group. Similar to the AA group, patients who had comorbid diseases were excluded from the control group MPV analyses.

The WBC and PLT counts and MPV were determined by a technical hematological cell counter (LH 780 Analyzer, Beckman Coulter Inc., Miami, FL, USA). All samples were analyzed within 2 hours using ethylenediaminetetraacetic acid containing bottles.

Statistical Analyses

All statistical analyses were performed with the IBM SPSS software package (v. 22.0, SPSS Inc., Chicago IL. USA). Qualitative data are expressed as the frequency and percentage. Continuous data are expressed as the median, interquartile range (IQR), minimum (min) and maximum (max). The Mann-Whitney U test was used for continuous variables and the chi-square test for categorical data. All data were analyzed using the 95% confidence interval (CI). Statistical significance was defined as $p<0.05$.

Results

In total, 360 patients were identified who met the inclusion criteria; 40 patients with a history of diabetes mellitus and 4 patients whose MPV values were not recorded in the system were excluded. As a result, analyses were conducted using 316 AA patients and 316 controls matched for age and gender.

In the AA group, 59.5% (n=188) were male, and the median age was 27 (IQR: 17; min: 14, max: 76) years. The median WBC count, PLT count and MPV of the AA patients are shown in table 1, and the distribution of the median WBC count, PLT count and MPV of patients with a diagnosis of AA according to gender are shown in table 2. The median MPV of the male and female control patients was 8.0 fL (IQR: 1.3; min: 5.70, max: 13.0) and 8.41 fL (IQR: 8.0; min: 5.90, max: 13.90), respectively. There was no statistically significant difference in MPV between the AA and control groups with respect to gender (for male patients, p=0.872; for female patients, p=0.082, respectively).

Table 1. The median WBC count, PLT count and MPV values of the acute appendicitis and the control groups

	AA patients (n=316)	Control patients (n=316)	p value
WBC (K/μL)	13.8 (IQR: 6; min: 4.9, max: 26.1)	9.8 (IQR: 5.6; min: 3.0, max: 29.3)	<0.001
PLT (K/μL)	255 (IQR: 86; min: 116, max: 649)	250 (IQR: 88; min: 113, max: 661)	0.174
MPV (fL)	8.03 (IQR: 1.86; min: 5.53, max: 14.40)	8.10 (IQR: 1.38; min: 5.70, max: 13.90)	0.193

WBC=white blood cell; PLT=platelet; MPV=mean platelet volume; AA=acute appendicitis; IQR=interquartile range; min=minimum, max=maximum

Table 2. The median WBC counts, PLT count and MPV values of the acute appendicitis patients according to gender.

	Male (n=188)	Female (n=128)	p value
WBC (K/μL)	14.1 (IQR: 5.9; min: 4.9, max: 25.5)	12.8 (IQR: 6.1; min: 5.3, max: 26.1)	0.120
PLT (K/μL)	246 (IQR: 79; min: 116, max: 537)	271 (IQR: 93; min: 124, max: 649)	<0.001
MPV (fL)	8.0 (IQR: 1.70; min: 5.53, max: 14.40)	8.10 (IQR: 2.03; min: 6.04, max: 12.30)	0.787

WBC=white blood cell; PLT=platelet; MPV=mean platelet volume; IQR=interquartile range; min=minimum; max=maximum.

The complicated AA group comprised 21.2% (n=67) of the included cases; 44 of the 188 male patients and 23 of the 128 female patients had complicated AA. There was no significant difference in the gender distribution between the complicated and noncomplicated AA patients (p=0.264). The median ages were 26 (IQR: 16; min: 14, max: 70) years and 25 (IQR: 24; min: 14, max: 76) years in the complicated and noncomplicated AA groups, respectively (p=0.347). The median WBC count, PLT count and MPV of these two groups are shown in table 3.

Discussion

Abdominal pain is a frequent complaint encountered in EDs, and it requires a laborious pathway to reach a diagnosis. Among this group of patients, AA is one of the most frequent diagnoses that require emergent surgical treatment. Mean platelet volume is known to be a marker determined from megakaryocytes during platelet production, which is an indicator of platelet

Table 3. The median WBC counts, PLT count and MPV values of the complicated and noncomplicated acute appendicitis patients.

	Complicated AA patients (n=67)	Non-complicated AA patients (n=249)	p value
WBC (K/μL)	15.2 (IQR: 6.5; min: 4.9, max: 25.2)	13.6 (IQR: 6.2; min: 5.3, max: 26.1)	0.037
PLT (K/μL)	235 (IQR: 70; min: 116, max: 649)	261 (IQR: 87; min: 124, max: 537)	<0.001
MPV (fL)	8.29 (IQR: 2.28; min: 5.53, max: 14.40)	8.0 (IQR: 1.86; min: 5.66, max: 13.60)	0.168

WBC=white blood cell; PLT=platelet, MPV=mean platelet volume; AA=acute appendicitis; IQR=interquartile range; min=minimum; max=maximum.

function and activation [3,4]. Recent studies have reported that MPV can be used in the diagnosis of AA [12-15,17].

In our study, we found no significant difference between the MPVs of AA patients and the control group (p=0.193).

An electronic database (PubMed, Google Scholar, EMBASE) search identified six studies investigating the diagnostic value of MPV in AA. Four studies stated that the MPV was lower in AA patients than in controls, whereas one study reported the opposite finding [12-15,17]. Furthermore, the sixth study showed no significant difference between the 2 groups [16]. The general properties of these studies are shown in table 4. In all of these studies, the control group was selected from among healthy individuals referred for check-up. MPV shows variability during the inflammatory processes [8,18]. In our control group, MPV could have been affected by an inflammatory process other than appendicitis. We consider this the most important factor resulting in no significant difference in the MPV between AA patients and controls in our study.

Yang et al stated that the difference in the MPV of AA patients and controls could be affected by gender. In that study, they found a significant difference only among male patients [17]. In our study, we detected no significant difference in MPV in either male or female patients.

We also found that the WBC counts were higher in the AA group than in the control group (p<0.001). When complicated AA cases were compared with the noncomplicated group, WBC counts were higher and PLT counts were lower (p=0.037 and p<0.001, respectively). These differences likely occurred as a result of a more aggressive inflammatory process in the complicated group. WBC count is known to be a part of the inflammatory response and to increase in direct proportion to its severity. In contrast, there are studies showing that the PLT count can decrease in inverse proportion to the severity of the inflammatory response [19].

Limitations

The limitation of this study was the fact that diagnostic methods such as computed tomography, ultrasonography, consecutive physical examination and detailed tests were not used in a standardized manner for all of the control group patients.

Conclusion

MPV is not supported for use in the diagnosis of AA in patients referred to the ED with the complaint of abdominal pain. However, among patients with the diagnosis of AA, low platelet count may be helpful for predicting complicated AA.

Authors' contributions

TYK, MY and SS contributed to study design. TYK, ODA and SS collected data. MY and ODA performed data analysis. TYK and MY wrote the final manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

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