

Is mean platelet volume a diagnostic parameter in acute appendicitis? Retrospective review of 1790 patients

Akut apandisit tanısında ortalama trombosit hacmi tanısal parametre olarak kullanılabilir mi? 1790 olgunun retrospektif değerlendirilmesi

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ABSTRACT

Acute appendicitis is currently the most common cause of emergency surgical interventions and it is important to form an early diagnosis. The mean platelet volume (MPV), which is a marker that reflects the dimensions and activation of platelets, has been shown to be a parameter in inflammatory responses, reflecting the activity of the disease in conditions. This retrospective study aims to define the values of MPV in acute appendicitis compared with the MPVs of a control group selected from among individuals with no inflammatory process.

Patients who had undergone emergency surgery having been diagnosed with acute appendicitis between January 2008 and January 2015 were retrospectively evaluated. The control group consisted of patients who had presented to the General Surgery Clinic with a diagnosis of inguinal hernia, pilonidal sinus, nodular goitre and soft tissue mass (lipoma) at the extremities and who were planned to undergo elective surgery. Patients in the control group were defined as Group 1. The study groups planned as Group 2: Acute (non-complicated) appendicitis; Group 3: Complicated (presence of an abscess and/or appendiceal perforation); Group 4: Normal appendix (negative laparotomy). Once the data from all the groups had been obtained, cross comparisons were made between the groups in terms of age, gender, WBC level, and mean MPV, and the results were then statistically evaluated.

In total, 1.790 patients were enrolled in this study. The mean MPVs in Groups 1 and 4 were very close, they were significantly higher than the values in Groups 2 and 3 ($p < 0.05$). In the comparison of Groups 2 and 3, while the mean MPV in Group 2 was found to be lower than the value in Groups 1 and 4 ($p < 0.05$), no overall significant difference was determined between Groups 2 and 3 ($p = 0.11$).

MPV is a marker that is evaluated during routine hemograms (CBC). It incurs no additional cost and defines the platelet functions and activation. An increase in MPV can be used as a marker of increased platelet activation secondary to inflammation in the chronic phase. These results demonstrate that the MPV might be useful for, and significant in, diagnosing acute appendicitis. However, MPV is not significant in defining groups with and without perforation.

Keywords: Acute appendicitis, hemogram, mean platelet volume.

ÖZET

Akut apandisit halen dünyada acil cerrahi girişimlerin en sık nedenidir. Akut apandisit tanısı klasik olarak fizik muayene bulguları ile koyulabilmekle birlikte, zaman zaman deneyimli cerrahlar için bile zor bir tanı olabilmektedir. Bu çalışmada; tüm hemogram incelemelerinde rutin olarak bakılan bir parametre olan MPV'nin akut apandisit tanısındaki değeri araştırılmıştır.

Ocak 2008 - Ocak 2015 tarihleri arasında Sakarya Üniversitesi Eğitim ve Araştırma Hastanesi Acil Servisi'nde akut apandisit tanısı koyularak acil şartlarda ameliyata alınan hastaların kayıtları retrospektif olarak değerlendirildi. Çalışma kapsamında 1790 hasta değerlendirildi. Kontrol grubundaki hastalar Grup-1 olarak tanımlandı. Çalışma grubu olarak değerlendirilen ve apandisit tanısı ile ameliyat edilmiş olan hastalar ameliyat bulgularına ve histopatolojik inceleme sonuçlarına göre; Grup 2: Akut (non-komplike) apandisit; Grup 3: Komplike (abse mevcudiyeti ve/veya apendiks perforasyonu); Grup 4: Normal apendiks (negatif laparotomi) olarak tanımlandı.

MPV değerleri açısından yapılan karşılaştırmada; en yüksek ortalama MPV değeri kontrol grubunda bulundu. Grup 1 ve Grup 4'ün ortalama MPV değerleri birbirine yakın olmakla birlikte Grup-2 ve Grup 3'den istatistiksel olarak anlamlı düzeyde daha yüksekti ($p<0.05$). Grup 2 ve Grup 3'ün karşılaştırılmasında ise; Grup 2'de de ortalama MPV değerinin Grup 1 ve Grup 4'den düşük ($p<0.05$) olduğu bulunmakla birlikte Grup 3 ile arasındaki fark anlamlı değildi ($p=0.11$)

Bizim çalışmamızın sonuçları, akut apandisit ön tanısı düşünülen fakat atipik klinik ve radyolojik bulgular nedeniyle arada kalınan hastalarda MPV değerinin yardımcı bir parametre olarak kullanılabileceğini göstermektedir.

Anahtar kelimeler: Akut apandisit, ortalama trombosit hacmi

INTRODUCTION

Acute appendicitis is currently the most common cause of emergency surgical interventions (1). Normally, acute appendicitis is diagnosed through physical examination. However, it can occasionally be difficult to form such a diagnosis, even for the most experienced of surgeons. It is well known that an abscess, perforation of the appendix, or peritonitis, might be encountered in patients who have a delayed diagnosis (2). On the other hand, negative laparotomy rates varying between 5–34% have been reported in cases where early surgical intervention has taken place (3). Delays caused by waiting for clinical findings to be clarified in patients who have an unclear diagnosis can lead to the development of complicated appendicitis. Therefore, it is extremely important to form an early diagnosis in cases of acute appendicitis where there is the least chance of error. For this reason, various imaging modalities and laboratory data are employed (4).

The mean platelet volume (MPV) is a marker that reflects the dimensions and activation of platelets. For example, a raised MPV indicates high rates of platelet production and activation. MPV has been shown to be a parameter in inflammatory responses, reflecting the activity of the disease in conditions such as preeclampsia, acute pancreatitis, unstable angina, myocardial infarction, and inflammatory bowel disease (5-9). Studies aiming to define the MPV in acute appendicitis have been conducted, with varying results (10-14).

The MPVs of patients with a diagnosis of appendicitis who have undergone surgery were compared with the MPVs of a control group selected from among individuals with no inflammatory process. Values for the MPV, which is a routinely-checked parameter during hemogram tests as part of the diagnosis of acute appendicitis, were evaluated in this study.

MATERIAL AND METHOD

The medical records of patients who presented to the Emergency Service of the Teaching and Research Hospital of Sakarya University with abdominal pain between January 2008 and January 2015, and who had undergone emergency surgery having been diagnosed with acute appendicitis following clinical and laboratory examinations, were retrospectively evaluated.

Patients who were aged less than 18 years, pregnant women, women who had given birth in the preceding 3 months, patients with chronic comorbidities (such as cardiovascular disease, atherosclerosis, chronic lung disease, and renal diseases) and any other inflammatory process at the time of presentation (such as tonsillitis and pneumonia), cases that were diagnosed with a carcinoid tumor of the appendix on histopathological examination, and patients who had experienced prior major trauma in the previous month, were excluded from the study.

The patients' medical records, including the demographics, presence of co-morbidities, and complaints at presentation, as well as the laboratory findings at the time of presentation, exploration findings, and the results of a histopathological examination, were evaluated in detail.

The control group, which had the same exclusion criteria, consisted of patients who had presented to the General Surgery Clinic with a diagnosis of inguinal hernia, pilonidal sinus (non-infected, and had not been infected in the recent past), nodular goitre (had not received medical treatment or radioactive iodine treatment) and soft tissue mass (lipoma) at the extremities and who were planned to undergo elective surgery. The records of these patients were evaluated for white blood cell (WBC) count and MPV values. Patients in the control group were defined as Group 1.

Patients who were enrolled in the study group, with a diagnosis of acute appendicitis and who had undergone surgery, were further grouped according to the surgical findings and histopathological results, as follows:

Group 2: Acute (non-complicated) appendicitis;

Group 3: Complicated (presence of an abscess and/or appendiceal perforation);

Group 4: Normal appendix (negative laparotomy).

Once the data from all the groups had been obtained, cross comparisons were made between the groups in terms of age, gender, WBC level, and mean MPV, and the results were then statistically evaluated. SPSS for Windows software (ver. 11.5; IBM Corp., Armonk, NY, USA) was used for statistical comparisons. One-way analysis of variance test used to compare the groups with respect to age, WBC level, MPV, and histopathological findings, with mean values obtained. Means $\pm$ standard deviation are provided for the descriptive statistics. A value of $p < 0.05$ was accepted to be statistically significant.

RESULTS

In total, 1,790 patients were enrolled in this study. Following the exclusion of 164 patients due to various reasons (50 patients due to a history of trauma, 77 patients due to chronic vascular and coronary artery diseases, 7 patients due to pregnancy, 7 patients due to appendiceal carcinoid tumor, 21 patients due to pregnancy, and 2 patients due to a period of lactation), the remaining 1,626 patients were included in the study. Among them, 880 were males (54.1%) and 746 were females (45.9%), with a mean age of 27.2 years (range: 18–76 years). The control group (Group 1) consisted of 310 patients (110 patients with inguinal hernia, 90 patients with nodular goitre, 80 patients with pilonidal sinus, and 30 patients with lipoma) (Table 1).

Table 1: Distribution of control group.	
Disease	Grup 1 (Control) n=310
Inguinal hernia	110 (35.4%)
Nodular goitre	90 (29.03%)
Pilonidal sinus	80 (25.8%)
Lipoma	30 (9.67%)

A comparison of the mean ages of the groups revealed that mean age of Group 3 was significantly higher compared with the other groups ($p < 0.001$).

When the WBC values were compared, the mean WBC levels in Groups 2 and 3 were significantly higher than those in Groups 1 and 4 ($p < 0.05$), while no statistically significant difference was found between Groups 1 and 4 ($p = 0.246$). In addition, the mean WBC level of Group 3 was found to be higher than that of Group 2. This finding was expected; how-

ever, the difference was not statistically significant ($p = 0.08$).

When the MPV values were compared, Group 1 was found to have the highest mean MPV. Although the mean MPVs in Groups 1 and 4 were very close, they were significantly higher than the values in Groups 2 and 3 ($p < 0.05$). In the comparison of Groups 2 and 3, while the mean MPV in Group 2 was found to be lower than the value in Groups 1 and 4 ($p < 0.05$), no overall significant difference was determined between Groups 2 and 3 ($p = 0.11$).

DISCUSSION

In global terms, acute appendicitis is currently the most common aetiology of acute abdominal syndrome necessitating emergency surgical intervention and still comprises 7% of all emergency surgery (15,16). Various physical examination findings for acute appendicitis have been classically defined, and all textbooks on surgery emphasise physical examination as the most important parameter for the diagnosis of acute appendicitis. Additionally, “negative appendectomy or negative laparotomy” is mentioned in these same textbooks under sections relating to acute appendicitis. The accepted prevalence of this condition worldwide is reported to be 5-34% (17,18).

Although the concept of negative appendectomy is well known, in the diagnosis of acute appendicitis no physician is generally content with physical examination alone and will thus seek support for the diagnosis through the use of different diagnostic methods. This is due to the possible development of intra-abdominal adhesions, and the various medico-legal problems that might result from a negative laparotomy (19-21).

Various methods have been developed for this aim (such as scales, radiological examinations, and diagnostic laparoscopy) and conflicting rates of detection for a pathological diagnosis have been reported. Laparoscopy, various scoring systems (such as the Alvarado, Lintula, Ohmann, and RIPASA scores), ultrasonography, computed tomography, and magnetic resonance imaging can all be used. The number of unnecessary operations, perforation rates, and duration of hospitalisation might all be decreased by using such diagnostic aids (15,22).

The most important bases for a parameter to be used as a diagnostic marker are that it confers no additional cost, is non-invasive, and can be used under any physical condition.

MPV is a marker that is evaluated during routine hemograms (CBC). It incurs no additional cost and defines the platelet functions and activation. Increased MPV points to an increase in the young platelets in the blood. The main cause of this condition is the release of cytokines such as IL-3 and IL-6 and the inclusion in the circulation of platelets with a more reactive specification (such as megakaryocytes) (23). Therefore, an increase in MPV can be used as a

marker of increased platelet activation secondary to inflammation in the chronic phase. Nevertheless, an increasing number of studies have recently been published that have reported the efficacy of changes in MPV levels in demonstrating the presence of some non-infectious diseases coursing with systemic inflammation (such as chronic obstructive lung disease, diabetes mellitus, myocardial infarction, rheumatoid arthritis, ulcerative colitis, and familial Mediterranean fever) (5-9,24).

A limited number of studies exist in the literature evaluating MPV levels in acute appendicitis, but with controversial results. According to Albayrak et al., decreased MPV values might be an important marker in the diagnosis of suspicious acute appendicitis (10). In the same study, the sensitivity and specificity of MPV values in acute appendicitis were reported to be 73% and 84%, respectively (10). In a study by Bilici et al. the sensitivity and specificity of MPV values in the paediatric age group in cases of acute appendicitis was reported to be 73% and 54%, respectively, and the authors concluded that the MPV values were significantly lower in cases with acute appendicitis compared to the control group (11). On the other hand, Uyanik et al. reported that MPV values had no predictive value in the diagnosis of acute appendicitis in the pediatric age group (12). In addition, Tanrikulu et al., in their case series of 260 patients, reported significantly lower MPV values in cases with acute appendicitis compared with the control group (13). By contrast, Narci et al., in a series of 121 cases, detected significantly increased MPV values in cases with acute appendicitis (14).

This present study is important because it is one of the largest case series in the literature. We observed significant differences in the MPV between the groups with acute appendicitis and the control group. The MPV was found to be significantly lower in the groups with acute appendicitis (Groups 2 and 3) compared to the control and negative laparotomy groups (Groups 1 and 4). However, no significant differences were identified in the MPV levels between Groups 2 and 3. These results demonstrate that the MPV might be useful for, and significant in, diagnosing this disease. However, MPV is not significant in defining groups with and without perforation.

In conclusion, the importance of a timely and accurate diagnosis of acute appendicitis is well known. We suggest that the MPV can be a useful parameter in patients with a preliminary diagnosis of acute appendicitis but with atypical clinical and radiological findings. We further suggest that, in these circumstances, the decision to explore surgically would be understandable in patients with a high MPV.

Conflict of interest: Enis Dikicier, Güner Çakmak, Fatih Altıntoprak, Yusuf Arslan and Mustafa Yener Uzunoğlu declare that they have no conflict of interest.

Compliance with Ethical Requirements:

This study was conducted by the approval of the local ethics committee.

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