Original Article / Çalışma - Araştırma

Evaluation of platelet indices in patients with deep neck space infection as a complication of acute tonsillitis

Bademcik iltihabı komplikasyonu olarak derin boyun enfeksiyonlu hastalarda trombosit indekslerinin değerlendirilmesi

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ABSTRACT

Objectives: This study aims to evaluate whether platelet indices are helpful to identify deep neck space infections (DNSIs) secondary to acute tonsillitis.

Patients and Methods: A total of 321 patients diagnosed with acute tonsillitis with or without DNSI admitted to the Otolaryngology Department of Marmara University Pendik Training and Research Hospital between August 2010 and January 2014 were retrospectively reviewed. Patients underwent full otolaryngologic examination and radiological imaging studies including computed tomography (CT) or magnetic resonance imaging (MRI) in cases of suspected DNSI. Mean platelet volume (MPV), platelet distribution width (PDW), and platelet count (PC) were calculated in all subjects and these were compared between the patients with or without DNSI secondary to acute tonsillitis.

Results: With respect to DNSI complications of tonsillitis, 25 of the patients had peritonsillar abscesses (7.8%), 11 had parapharyngeal abscesses (3.4%), and six had retropharyngeal abscesses (1.9%). The MPV, PDW, and PC values were significantly higher in patients with acute tonsillitis and DNSI ($p<0.05$). The optimum cut-off values for MPV, PDW, and PC were 8.75, 16.65, 278 and 500, respectively.

Conclusion: This study is the first to evaluate the relationship between platelet indices and DNSI complications of acute tonsillitis. Our results demonstrate that MPV, PDW, and PC values are potential laboratory parameters for diagnosing DNSIs.

Keywords: Acute tonsillitis; deep neck infection; inflammation; mean platelet volume; platelets; platelet distribution width.

ÖZ

Amaç: Bu çalışmada trombosit indekslerinin bademcik iltihabı sonrası derin boyun enfeksiyonu (DBE) tanımlamada yararlı olup olmadığı değerlendirildi.

Hastalar ve Yöntemler: Ağustos 2010 - Ocak 2014 tarihleri arasında bademcik iltihabı tanısı ile DBE olan ve olmayan Marmara Üniversitesi Pendik Eğitim ve Araştırma Hastanesi Kulak Burun Boğaz Bölümü'ne başvuran toplam 321 hasta geriye dönük olarak incelendi. Hastalara, DBE şüphesi olan durumlarda bilgisayarlı tomografi (BT) veya manyetik rezonans görüntüleme (MRI) de dahil olmak üzere, tam kulak-burun-boğaz muayenesi ve radyolojik görüntüleme çalışmaları yapıldı. Tüm bireylerin ortalama trombosit hacmi (OTH), trombosit dağılım genişliği (TDG) ve trombosit sayısı (PC) hesaplandı ve bademcik iltihabı sonrası DBE olan ile olmayan hastalar arasında karşılaştırıldı.

Bulgular: Bademcik iltihabının DBE komplikasyonları ile ilgili olarak, hastaların 25'inde peritonsiller apse (%7.8), 11'inde parafarengeal apse (%3.4) ve altısında retrofarengeal apse (%1.9) vardı. OTH, TDG ve PC değerleri akut bademcik iltihabı ve DBE olan hastalarda belirgin olarak daha yüksekti ($p<0.05$). OTH, TDG ve PC için optimum eşik değerleri sırasıyla 8.75, 16.65, 278 ve 500 idi.

Sonuç: Bu çalışma, akut bademcik iltihabının trombosit indeksleri ile DBE komplikasyonları arasındaki ilişkiyi değerlendiren ilk çalışmadır. Sonuçlarımız, OTH, TDG ve PC değerlerinin DBE tanısında potansiyel laboratuvar parametrelerini göstermektedir.

Anahtar Sözcükler: Akut bademcik iltihabı; derin boyun enfeksiyonu; enflamasyon; ortalama trombosit hacmi; trombosit; trombosit dağılım genişliği.

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Acute tonsillitis is characterized by inflammation of tonsillar tissue as a result of infection. The etiology is usually viral and accompanied by secondary bacterial infections. The microbiology of acute bacterial tonsillitis is mainly polymicrobial infection, because of the interaction between the normal oropharyngeal flora and the extrinsic flora.[1-4] The presenting symptoms of acute tonsillitis include sore throat, fever, dysphagia, odynophagia, fetid breath, drooling, salivation, neck mass due to cervical lymph node involvement, and headache. On physical examination, catarrhal exudates over the tonsillar tissue or discharge of suppurative material from the tonsillar crypts can be seen. Other classical findings of acute tonsillitis consist of dehydration, tachycardia, cervical lymphadenopathy in the anterior chain, hoarseness, muffled voice, exanthematous rashes, conjunctivitis, keratitis, diarrhea, hematuria, and hepatosplenomegaly in cases of infectious mononucleosis.

The diagnosis of acute tonsillitis requires a detailed medical history, physical examination, and laboratory studies consisting of complete blood count, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) level, rapid antigen detection test (RADT), serological tests, and cultures for bacterial and viral agents. If there are alarming signs, such as fever that is unresponsive to antibiotic therapy, inferior and medial displacement of the tonsillar tissue, contralateral deviation of the uvula, a fluctuating mass pushing the posterior pharyngeal wall anteriorly, trismus, and torticollis, these could be indicative of deep neck space infections (DNSIs). Complications of DNSIs consist of peritonsillar (49%), retropharyngeal (22%), submandibular (14%), buccal (11%), parapharyngeal space (2%), and canine space (2%) infections and these mostly result from local spread from adjacent sites like tonsillar tissue.[5-9] Acute tonsillitis management includes adequate fluid replacement, antipyretics for elevated temperature, analgesia for pain control, empirical antibiotic therapy, and surgical drainage in cases complicated with DNSI. If treatment is delayed or inadequate, acute tonsillitis may lead to life-threatening complications associated with DNSI, that cause increased rates of hospitalization and morbidity.

Platelets play indispensable roles in many different functions, such as hemostasis, thrombosis, stimulation of the immune system, inflammation, protection of vascular integrity, and wound healing processes.[10] Increased platelet activation plays an active role in the development of inflammation.[11-18] It was found that platelets significantly contribute to the inflammatory process, such that platelet indices, including mean platelet volume (MPV), platelet distribution width (PDW), and platelet count (PC), may be used as an index for inflammatory conditions caused by autoimmune conditions or infection.[11-18]

Sometimes, it may be difficult to diagnose patients with DNSI early during the course of acute tonsillitis. Imaging techniques, such as computed tomography (CT) or magnetic resonance imaging (MRI) are helpful for accurate diagnosis of such complications. But if platelet indices of MPV, PC and PDW could be used as an index of inflammation, the severity of the tonsillitis, and presence of complications, it would contribute to early diagnosis. To date, there are no data available for platelet indices of MPV, PC, and PDW for predicting DNSI in cases of acute tonsillitis. Therefore, we aimed to analyze whether there is a relationship between platelet indices and DNSI complications secondary to acute tonsillitis.

PATIENTS AND METHODS

This study was approved by the Ethical Committee of Marmara University Faculty of Medicine (ID number: 09.2014.0265, Issue date: 18.12.2014). The study was conducted in accordance with the principles of the Declaration of Helsinki. In total, 321 patients admitted to the Otolaryngology Department of Marmara University Pendik Training and Research Hospital between August 2010 and January 2014 and diagnosed with acute tonsillitis with or without DNSI were retrospectively reviewed. Informed consent was obtained from all patients. The diagnosis was made considering detailed patient history; physical examination; laboratory tests, including white blood cell (WBC) count, CRP, and RADT; and throat and abscess culture and radiological testing (CT or MRI) if DNSI was suspected. Patients with tonsillitis caused by viral agents were excluded.

Laboratory tests were performed on blood samples obtained on admission to the hospital. Mean platelet volume, PDW, and PCs were measured using an automated hematology

analyzer (Coulter® LH 780 Hematology Analyzer, Beckman Coulter Inc., Brea, CA, USA). Based on the presence of DNSI, patients were divided into two groups: acute tonsillitis without complications (n=279; group 1) and acute tonsillitis with DNSI (n=42; group 2). The two groups were evaluated according to platelet indices of MPV, PC, and PDW values.

Statistical analysis

Statistical analyses were carried out using the Statistical Package for the Social Sciences (SPSS) 15.0 for Windows (SPSS Inc., Chicago, IL, USA). The distribution of variables was assessed using the normality test. Differences between the two groups were analyzed using the Student t-test (variables with parametric distribution) and the Mann-Whitney U test (variables with non-parametric distribution). Receiver operating characteristic curve analysis was used to assess the sensitivity and specificity of platelet indices of MPV, PC, and PDW for predicting the presence of complications. P<0.05 was considered to indicate statistical significance.

RESULTS

Patient characteristics and DNSI incidence

Data from a total of 321 patients were analyzed. The median age of the patients was six years (range, 6 months to 87 years). Of the 321 patients, 180 were children (56.1%) and 141 were adults (43.9%). The female/male ratios in groups 1 and 2 were 127/152 and 17/25, respectively. In total, 156 of 279 were children (55.9%), 123 of 279 were adults (44.1%) in group 1; and 24 of 42 were children (57.1%), 18 of 42 were adults (42.9%) in group 2.

There were no significant differences between the groups with respect to age and gender (p=0.077 and p=0.54, respectively). Twenty-five patients had peritonsillar abscesses (7.8%); 11 had parapharyngeal abscesses (3.4%); and six had retropharyngeal abscesses (1.9%). No other DNSI was found.

Treatment and outcomes

Patients with acute tonsillitis who did not have any complications (n=279) were treated with antibiotics alone (86.9%). Patients with acute tonsillitis who had DNSI (n=42) were treated with surgical drainage and antibiotic therapy (13.1%). Of the 279 patients who did not have DNSI, 250 were not hospitalized. The remaining 29 patients were hospitalized for 1.3 days because of inadequate oral intake. The average period of hospitalization was 3.5 days (range, 1-8 days) for peritonsillar abscesses, 13 days (range, 7-19 days) for parapharyngeal abscesses, and 11 days (range, 8-11 days) for retopharyngeal abscesses. There was a significant correlation between DNSI and the hospitalization period (p<0.05). All 279 patients were alive at the end of the treatment. Twenty-nine of the 279 acute tonsillitis patients without DNSI and all 42 acute tonsillitis patients with DNSI complications lacked adequate oral intake (10.4% and 100%, respectively). There was a statistically significant correlation between DNSI complications and oral intake in patients with acute tonsillitis (p<0.05).

Mean platelet volume, PDW, and PC measurements

Mean platelet volume, PDW, and PCs were higher in acute tonsillitis with DNSI infections than acute tonsillitis without complications (p=0.0001, p=0.005, and p=0.006, respectively). The mean MPV values in groups 1 and 2 were 7.77±1.06 and 9.35±1.16, respectively. The mean PDW values of the two groups were 16.590.78 and 16.93±0.76, respectively.

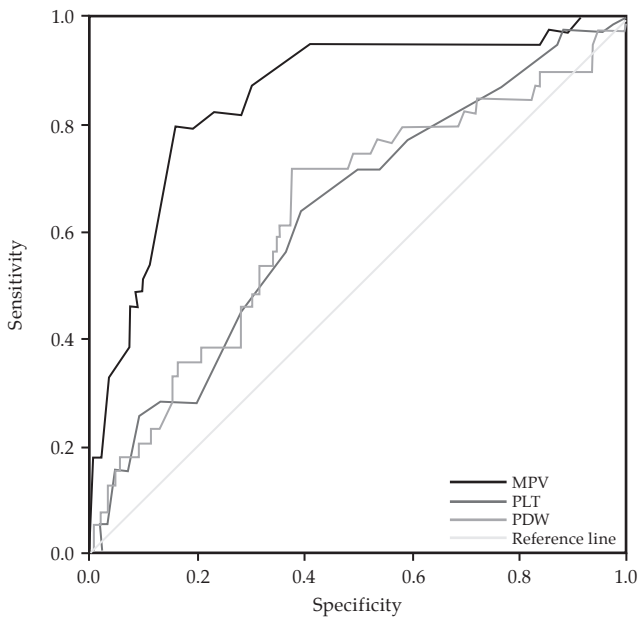

Figure 1. *Receiver operating characteristic curve for acute tonsillitis with and without deep neck space infection in terms of platelet indices mean platelet volume, platelet count, and platelet distribution width.*

The mean PC values of the two groups were 266,000±73,000 and 299,000±84,000, respectively. There were statistically significant differences between the two groups according to MPV, PDW, and PCs (p=0.0001, p=0.005, and p=0.006, respectively). Receiver operating characteristic curves were used to determine the predictive performance of MPV, PDW, and PCs for the existence of complications. The optimum cut-off value for MPV was 8.75. With respect to this value, the sensitivity and specificity of MPV for predicting tonsillitis complications were 79% and 84%, respectively (area under the curve [AUC]: 0.850). The optimum PDW cut-off value was 16.65. For this value, the sensitivity and specificity for predicting tonsillitis complications were 64% and 61%, respectively (AUC: 0.633). The optimum PC cut-off value was 278,500. With this value, the sensitivity and specificity of platelet count for predicting tonsillitis complications were 71% and 62%, respectively (AUC: 0.636; Figure 1).

DISCUSSION

In this study, we assessed whether platelet indices, including MPV, PDW, and PC, could be used as an index for diagnosing DNSI in patients with acute tonsillitis. We showed that these platelet indices were significantly higher in patients with DNSI compared to those without DNSI. Furthermore, their elevated values were associated with disease severity. Peritonsillar abscess is traditionally the most common complication of acute tonsillitis, which was consistent with our study, followed by parapharyngeal and retropharyngeal abscess.[19] In our child cohort, 24 had DNSI complications (13.3%); in 141 adult patients, 18 had DNSI complications (12.7%). This result demonstrates that children are affected by DNSI complications at approximately the same rate as adults. Interestingly, peritonsillar and parapharyngeal abscesses were present more frequently (n=25, 60% and n=11, 26%, respectively) than reported in previous studies with rates of 49% and 2%, respectively. In contrast, retropharyngeal abscess (n=6, 14%) in our study was less prevalent than previously reported (22%).[1-5]

Although the main function of platelets is to form clots during hemostasis, recent studies have reported that platelets have pro-inflammatory actions when stimulated by certain chemokines and cytokines. MPV, PDW, and PC are indicators of platelet size, volume, and number. Larger platelets, indicative of high MPV in complete blood count, contain more granules and release more cytokines and chemokines including platelet-activating factor during inflammatory conditions.[20]

Recently, it was reported that platelets have a role in diseases characterized by systemic inflammation, and increased MPV may be used as a marker of inflammation.[21-26] In recent years, several studies have reported that MPV may be used as marker of inflammation in several disorders.[11-16]

Sansanayudh et al.[27] investigated 40 studies in a systematic review and meta-analysis comparing mean differences in high versus low MPV between patients with coronary artery disease (CAD). They reported that patients with CAD and patients with slow coronary blood flow had larger MPV compared to the control group. In patients with high MPV, the risk of having CAD was about twice as high as patients with low MPV. These findings suggest that MPV may be used for risk stratification or add diagnostic accuracy to traditional risk stratification markers in patients with CAD.

Yazici et al.[28] studied 97 patients with rheumatoid arthritis and concluded that MPV levels were positively correlated with Disease Activity Score 28, which reflects disease activity. They also stated that markers of inflammation and MPV were substantially decreased after anti-tumor necrosis factor alpha therapy. Oncel et al.[29] studied 100 patients with neonatal sepsis and demonstrated a statistically significant difference with regard to baseline MPV values between patients with sepsis (proven or clinical) and healthy controls. Ceylan et al.[30] studied 238 patients with chronic hepatitis B virus infection and found a significant correlation between chronic hepatitis B virus infection and liver fibrosis and inflammation on the basis of MPV value. Furthermore, MPV increased as the severity of liver fibrosis and inflammation increased.

With regards to neutrophil lymphocyte ratio, MPV, and infections, a recent study by Tekin et al.[31] also assessed their relationship with acute pyelonephritis based on analysis of 43 patients with acute pyelonephritis. They found that MPV is a fast and reliable measurement with

considerable predictive value for the diagnosis of acute pyelonephritis and renal scars, and its predictive capacity is better than that of CRP, ESR, and WBC values. It has also been shown that high MPV at admission is an independent predictor of embolic events in patients with infective endocarditis.[32] Thus, these results further illustrate the usefulness of MPV as a marker of inflammation, especially for predicting infectious complications associated with acute tonsillitis.

Platelet distribution width is an indicator of platelet size heterogeneity. A high PDW value suggests a large range of platelet sizes due to swelling, destruction, immaturity, and high reactivity. Ozturk et al.[33] studied 175 patients with inflammatory bowel disease and found that there was a statistically significant decrease in PDW levels during disease exacerbation compared to healthy control subjects. Conversely, Gao et al.[34] investigated a total of 124 septic shock patients and stated that PDW showed increasing trends in the non-survivor group, which means that disease is more severe in this group. Thus, there are discrepancies in recent studies regarding levels of PDW in terms of inflammation and infection. However, our results show that PDW is increased in DNSI patients compared to patients of acute tonsillitis alone. Reactive thrombocytosis is part of the natural course of underlying inflammatory conditions, such as infection, malignancy, or tissue damage, but under conditions of severe infections, such as sepsis, it tends to decrease.

Kitazawa et al.[35] conducted a four-year retrospective study to assess trends in platelet indices and the clinical features of blood stream infection (BSI). They enrolled 350 patients with positive blood cultures and measured platelet indices during successive time periods and found that the average PC decreased during BSI. Also, Guclu et al.[36] studied MPV, PDW and PC in a total of 145 patients diagnosed with sepsis. They concluded that platelet count in sepsis patients was lower than the control group, but this difference was not significant.

Our results show that PC is increased in patients with DNSI compared to patients with acute tonsillitis alone, but the cases of acute tonsillitis complicated with DNSI were not sufficiently severe to cause bone marrow suppression and thrombocytopenia, which is a laboratory parameter of sepsis. Therefore, increased levels of PC without sepsis are correlated with disease severity and DNSI complications. To the best of our knowledge, this is the first study of the role of the platelet indices MPV, PDW, and PC in acute tonsillitis patients with DNSI complications.

In conclusion, MPV, PDW, and PC values were higher in patients with acute tonsillitis with DNSI than in those with acute tonsillitis without DNSI. With regards to clinical and laboratory findings, it appears that MPV, PDW, and PC values may be used as simple, inexpensive, and easily assessable laboratory markers of systemic inflammation with cut-off values of 8.75, 16.65, and 278,500 respectively. Therefore, these can be useful tools for the early diagnosis and evaluation of DNSI complications secondary to acute tonsillitis.

Declaration of conflicting interests

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