

## RESEARCH ARTICLE

# MPV (MEAN PLATELET VOLUME) IS A NEGATIVE ACUTE PHASE REACTANT IN INFLAMMATORY DERMATOPHYTE INFECTION (KERION CELSI)

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### ABSTRACT

Kerion celsi is an inflammatory form of tinea capitis. It is a kind of id reaction due to immunologic reaction to circulate antibodies or activate T lymphocytes that are directed against dermatophytes. In kerion celsi early diagnosis is important because a delay in treatment can lead to bacterial superinfection, resulting cicatrization and permanent alopecia. Mean Platelet volume (MPV) is an easily available parameter in hemogram related with thrombocyte activation and inflammation. It acts as a negative or positive acute phase reactant in different inflammatory conditions. This study evaluated MPV in kerion which has never been reported before. It is a retrospective study of 47 patients and 47 healthy controls. MPV and the other laboratory tests were recorded. MPV levels in children with kerion celsi were investigated.

**KEY WORDS:** Kerion Celsi, Inflammatory Tinea Capitis, Laboratory Analysis, MPV, RDW.

### INTRODUCTION

Tinea capitis is a dermatophyte infection of the hair and scalp. It is most commonly seen in preadolescent children, especially in developing countries (Elewski, 2000). The disorder can be divided into four clinical types (Zhan *et al.*, 2015); 1. Grey patch tinea capitis 2. Black dot tinea capitis 3. Favus, which is the most contagious type, and 4. Kerion. Kerion is the inflammatory form of the dermatophyte infection, presenting as: pustular folliculitis, painful plaques – nodules, and deep abscesses, caused by T cell mediated host response (Proudfoot *et al.*, 2011). The most frequent causes of Kerion are *Trichophyton mentagrophytes*, *Trichophyton verrucosum*, *Microsporum canis*, *Microsporum gypseum*, *Trichophyton tonsurans*, *Trichophyton violaceum*, and *Trichophyton soudanense* (Proudfoot *et al.*, 2011). Furthermore, *T. Violaceum* now has the highest incidence in Belgium, Netherlands, Sweden and Turkey (Kieliger *et al.*, 2015). Most tinea capitis infections in the United States are caused by *T. Tonsurans*, after which the next common is *Microsporum canis* (Castelo-Soccio, 2014). If it is not treated follicle damage occurs, and permanent hair loss and scarring then becomes the most important problem among school-aged children who are affected. Mean platelet volume (MPV) is a parameter that indicates the average size of platelets and reflects the platelet production rate as well as stimulation (Ekiz *et al.*, 2011). It is now understood that platelets play an important role in diseases associated with inflammation (Gasparyan *et al.*, 2011). Furthermore, MPV has been demonstrated to be a marker of platelet function in various systemic, hematologic, gastrointestinal, cardiac, and rheumatologic disorders. Minimal research has been conducted to investigate the kerion celsi and its laboratory parameters, in addition to this, the study of evaluating MPV in kerion has never been reported before.

Therefore, the aim of the present study was to investigate the MPV levels in children with kerion celsi and evaluate the other laboratory parameters.

### METHODS

This was a retrospective study of patients who had been diagnosed with kerion celsi by direct microscopic examination and clinic examination in Dermatology Department between May 2010 and May 2014. 47 patients (mean age 6.1±4.06 years, 1 year to 12 years) and 47 healthy controls (mean age 7.74±3.8 1 year to 15 years) were enrolled in this study. Patients who had infection, malnutrition, immunodeficiency, chronic disease, rheumatologic disease, hematologic disease, cardiac disease, and who used medication were excluded from the study. Direct microscopic examination was made with scalp scrapings, pustule liquid, and plucked hairs by mounting in 20% potassium hydroxide and examination by light microscopy. The presence of hyphae and arthroconidia supported the diagnosis. Clinical and laboratory information were retrieved from the database of the center. Age, sex, mean platelet volume (MPV), red blood cell count (RBC), white blood cell count (WBC), hemoglobin (Hb; g/dL), mean corpuscular volume (MCV; fL), red blood cell distribution width (RDW), C-reactive protein (CRP; mg/L) erythrocyte sedimentation rate (ESR), leukocyte and thrombocyte counts, blood urea nitrogen (BUN), creatinine, hematocrite, and eosinophil levels were recorded. In addition to the aforementioned items, Liver enzymes (AST; Aspartate aminotransferase, ALT; Alanine aminotransferase) neutrophil, and red blood cell levels of patients and controls were compared. The control group was selected from among healthy individuals who were admitted to the pediatric clinic for medical control. None had a history of chronic disease or medication usage. Bacteriological cultures were performed from the scalp of the kerion patients. The complete blood count was performed in the same analyzer, mindray BC-6800,

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which is routinely checked every month. Standard tubes with a constant amount of K3-EDTA were used for complete blood count analyses.

### Statistical Analysis

Statistical analysis was performed using the Statistical Package for social sciences (SPSS) version 15.0 (SPSS, Inc., Chicago, IL, USA). Data were expressed as mean  $\pm$  standard deviation (SD) or as median inter-quartile range (IQR). Student t test and Mann-Whitney U-test were used for comparing values of patients and healthy controls. The level of statistical significance was set at  $p = 0.05$ . Pearson's Chi-square test was used to compare the categorical variables between groups.

## RESULTS

47 patients and 47 controls were enrolled in our retrospective analysis. The mean ages of the kerion subjects were  $6.1 \pm 4.06$  years, while the mean ages of controls were  $7.74 \pm 3.8$ . The age of the patients and controls was similar and no statistical difference was found ( $p = 0.033$ ). WBC, eosinophil, and neutrophil count were higher than those of the controls ( $p = 0.000$ ,  $p = 0.001$ ,  $p = 0.000$ ).

Kerion celsi is an inflammatory form of tinea capitis which is an intense, localized hypersensitivity reaction to the presence of a dermatophyte infection. It is a kind of id reaction due to immunologic reaction to circulate antibodies or activate T lymphocytes that are directed against dermatophytes (Aste *et al.*, 1998). Kerion celsi presents as a large, boggy, swollen, painful indurated plaque or nodule with purulent abscess formation with loss of hair throughout the lesion (Aste *et al.*, 1998; Isa-Isa *et al.*, 2010).

Misdiagnosis of a kerion can result in permanent scarring, alopecia, or unnecessary incision and drainage (Aste *et al.*, 1998; Isa-Isa *et al.*, 2010; Aderibigbe and Castelo-Soccio, 2015). The treatment methods include systemic antifungal agents, (griseofulvin, 20 mg / kg/day or terbinafine, weight based dosing), antifungal shampoos, and corticosteroids (6 - 8 weeks oral or topical) that are suggested to combat intense inflammation (Stein *et al.*, 2013). The diagnosis was made with scalp scrapings, pustule liquid, and plucked hairs by mounting in 20% potassium hydroxide and examination by light microscopy. The presence of hyphae and arthroconidia supported diagnosis. Specimens were cultured on sabouraud agar plate containing cycloheximide and incubated for at least 2 weeks. However, we couldn't isolate the causative organism with the culture.

**Table 1. Summary of the laboratory parameters**

	Patient (mean $\pm$ SD)	Control (mean $\pm$ SD)	P
Age ( mean $\pm$ SD )	6.1 $\pm$ 4.06	7.74 $\pm$ 3.8	0.033
WBC ( mean $\pm$ SD )	12.28 $\pm$ 4.1	8.27 $\pm$ 1.86	0.000
Hb ( g/dl ) ( mean $\pm$ SD )	12.44 $\pm$ 1.14	12.47 $\pm$ 0.9	0.735
Htc ( mean $\pm$ SD )	37.1 $\pm$ 3.02	37.75 $\pm$ 2.15	0.218
Plt (count/mm3) ( mean $\pm$ SD )	354.7 $\pm$ 81.7	316.94 $\pm$ 73.69	0.19
MPV (fL) ( mean $\pm$ SD )	7.63 $\pm$ 0.9	8.56 $\pm$ 0.7	0.000
Eosinophil, median ( IQR )	2 ( 0.8 - 3.2 )	0.6 ( 0.1-1.4 )	0.001
Sedim, median ( IQR )	20.5 ( 10.5 - 25.5 )	9 ( 7 - 10 )	0.000
CRP mg/dL, median ( IQR )	1.76 ( 0.7 - 1.98 )	0.3 ( 0.01 - 2 )	0.007
AST ( mean $\pm$ SD )	28.9 $\pm$ 7.0	25.82 $\pm$ 8.17	0.025
ALT median ( IQR )	28.5 ( 24 - 34.2 )	22 ( 20 - 31 )	0.007
Neutrophil ( mean $\pm$ SD )	62.76 $\pm$ 12.9	48.33 $\pm$ 13.59	0.000
RBC ( mean $\pm$ SD )	4.72 $\pm$ 0.44	4.74 $\pm$ 0.4	0.875
RDW median ( IQR )	13.6 ( 12.9 - 14.82 )	13.45 ( 12.7 - 13.8 )	0.223
BUN mg/dL ( mean $\pm$ SD )	22.38 $\pm$ 7.8	23.8 $\pm$ 7.09	0.321
Creatinin mg/dL median ( IQR )	0.5 ( 0.4 - 0.7 )	0.4 ( 0.4 - 0.5 )	0.27

Sedimentation ( $p = 0.000$ ) and ALT level were also statistically higher ( $p = 0.05$ ). There were no significant differences found between the patient group and healthy controls in terms of hemoglobine, hematocrite, platelet, CRP, AST, RBC, RDW, BUN, and creatinine parameters ( $p > 0.05$ ). MPV levels of patients with kerion were significantly lower than those of the levels of the control children ( $7.63 \pm 0.9$  and  $8.56 \pm 0.7$ ,  $p = 0.000$ ). MPV levels were not correlated with ESR and CRP. Furthermore, all study parameters are presented in Table 1. Cultures were also performed from all of the patients' abscess formation and only 5 of them revealed a positive culture. The isolated organism was found to be staphylococcus aureus. All isolated cultures demonstrated sensitivity to all of the antibiotics in the antibiogram.

## DISCUSSION

In this study, we have shown that MPV values are significantly lower in patients with kerion when compared with healthy controls. To our knowledge, this is the first study showing that MPV is a negative, acute phase reactant in kerion patients.

Kerion is an inflammatory disease; several indicators (cytokines and proteins) of inflammation are known as acute phase reactants that are studied among inflammatory diseases. Several cytokines and proteins play roles at the inflammatory sites. Levels of all inflammatory indicators, which are called acute phase proteins, change during this reaction. Those that are increasing are called positive while those that are decreasing are called negative acute phase reactants. The most popular ones are ESR, CRP (Maras and Kiraz, 2006). Albumin, Ferritin, Fibrinogen, C3, C4, RDW, and MPV. MPV is an easily available parameter in hemogram related with thrombocyte activation and inflammation (Uluca *et al.*, 2014). It acts as a negative or positive acute phase reactant in different inflammatory conditions. Çelik *et al.*, (2014) studied MPV in Rotavirus Gastroenteritis and found acute appendicitis, acute gastroenteritis, and intestinal tuberculosis to be negative markers. Aktaş *et al.*, (2014) reported increased RDW and MPV levels in irritable bowel syndrome. Furthermore, MPV was studied in psoriasis and Kim *et al* investigated its relationship between disease severity. In conclusion, a positive correlation was determined (Kim *et al.*, 2015). Hu *et al.*,

(2014) revealed increased MPV levels in the Hepatitis B virus infection. Mean platelet volume has also been studied in rheumatologic, cardiac, and hematologic disorders. Gasparyan et al., (2011) suggested that when the inflammation is greater, large platelets find a way to go out from the vascular region to the inflammatory area and MPV consequently decreases. In contrast of this, low grade inflammation with large platelets in circulation resulted in higher MPV levels. From this point of view we hypothesized that in spite of the great inflammation in kerion, MPV levels were statistically lower than the control group ( $p = 0.000$ ) and acts as a negative acute phase reactant in kerion celsi patients. This result was distinguished from infection because only five of the patients detected superinfection with staph aureus colonization by culture.

The value of oral steroids continues to be debated (Hussain et al., 1999; Proudfoot et al., 2011). Some authors have advocated the use of oral corticosteroids to inhibit inflammation and scarring (Hussain et al., 1999; Proudfoot et al., 2011) while the others do not. This study could assist in whether to use oral steroids or not in kerion patients under the guidance of MPV levels in order to avoid scarring alopecia. In light of this study, further well designed large investigations will be required in all terms of the tinea infections. RDW is an index expressing variation in the size of the red blood cells and has been studied as an inflammatory marker for heart failure, cutaneous vasculitis, rheumatoid arthritis, and inflammatory bowel disease (Lippi et al., 2009; Song et al., 2012; Kim et al., 2015). In this study RBC count and RDW levels were evaluated, and a statistical difference was not obtained in kerion. RDW can increase or decrease in systemic inflammatory disorders. The exact reason is unknown and it is thought to be resulting from the different inflammatory cytokines playing a role in these diseases (Lippi et al., 2009). However we were unable to evaluate the kind of cytokines playing a role in kerion. Further information is needed about the correlation between inflammatory cytokines and RDW levels. We compared CRP, ESR, neutrophil levels, and white blood cell count between kerion and control subjects, which showed statistically significant elevation. ( $p = 0.007$ ,  $p = 0.000$ ,  $p = 0.000$ ,  $p = 0.000$ ). All of these parameters strongly supported the fact that kerion is a severe inflammatory disorder. The other laboratory parameters (hemoglobin, hematocrit, platelet, AST, BUN, and creatine) were normal and no statistical difference was found with the control group. We recognize a slight elevation in the AST levels ( $p = 0.007$ ).

## Conclusion

Kerion is an inflammatory disease that affects the childhood group in developing countries and is one of the causes of scarring alopecia if not treated. Therefore all of the information about this cosmetically serious problem is important in treatment. Our work is the first report to address the relationship between MPV and kerion, and we suggest that MPV can be used as a negative acute phase reactant in kerion celsi. We know kerion has a long treatment process (6-8 weeks), MPV could be an indicator while finishing the treatment. MPV is a simple parameter and can be a useful laboratory indicator about the occurrence of kerion celsi inflammatory response or id reaction in monitoring tinea capitis patients while treating. However, prospective studies

with a large number of patients need to be done to confirm our claims.

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