



# Is Mean Platelet Volume a Possible Marker in Acute Peritonitis?

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## ABSTRACT

MPV (mean platelet volume) is one of the determinants of the platelet function which is situated in the routine complete blood count tests and was shown to be inversely correlated with inflammation. We aimed to evaluate MPV values in patients with peritoneal dialysis and in acute peritonitis attacks. 37 patients with PD and 42 healthy subjects were included in the study. 42 peritonitis attacks of the patients were recorded. C reactive protein (CRP) levels and complete blood count tests were analyzed. Mean MPV values were significantly higher in patients with PD in the stable period compared with the control group ( $p < 0.001$ ). Mean MPV values were significantly lower and CRP values were significantly higher in peritonitis attack periods, compared with the stable period of the same PD patients, both ( $p < 0.001$ ). In the correlation analysis, MPV levels in the peritonitis attack were negatively correlated with CRP levels, hospitalization day, peritoneal fluid and plasma leukocyte count ( $r = -0.751$ ,  $p < 0.001$ ); ( $r = -0.355$ ,  $p = 0.002$ ); ( $r = -0.851$ ,  $p < 0.001$ ); ( $r = -0.579$ ,  $p < 0.001$ ) respectively. In conclusion, our results suggest that assessment of MPV in acute peritonitis in PD patients may indicate systemic inflammation. MPV may be used as an hepler marker to predict the severity of acute peritonitis.

**Key words:** Peritoneal dialysis, peritonitis, mean platelet volume, acute-phase reactant, platelet function indices

## Trombosit Hacmi Akut Peritonitde Olası Yeni Bir Markermi ?

### ÖZET

MPV (ortalama trombosit hacmi) trombosit fonksiyonu belirteçlerinden biridir ve rutin tam kan sayımı testlerinde yer alır. İnflamasyon ile aralarında negatif korelasyon olduğu gösterilmiştir. Biz de periton diyalizi (PD) hastalarında ve akut peritonit ataklarında MPV değerlerinde değişim olup olmadığını değerlendirmeyi amaçladık. 37 periton diyalizi hastası ve 42 sağlıklı birey çalışmaya dahil edildi. Hastaların geçirdiği toplam 42 peritonit atağı, C reaktif protein (CRP) düzeyleri ve tam kan sayımı testleri kaydedildi. Ortalama MPV değerleri kontrol grubu ile karşılaştırıldığında PD hastalarında anlamlı derecede yüksek bulundu ( $p < 0.001$ ). Hastaların peritonit atak dönemlerindeki değerleri stabil dönem ile karşılaştırıldığında; ortalama MPV değerleri anlamlı derecede düşük ve CRP değerleri anlamlı derecede yüksek bulundu, her ikisi de ( $p < 0.001$ ). Korelasyon analizinde, peritonit atak dönemindeki MPV değerleri, CRP düzeyleri ile, hastanede yatış günü, periton sıvısı ve plazma lökosit sayımı ile negatif korele idi ( $r = -0.751$ ,  $p < 0.001$ ); ( $r = -0.355$ ,  $p = 0.002$ ); ( $r = -0.851$ ,  $p < 0.001$ ); ( $r = -0.579$ ,  $p < 0.001$ ) sırasıyla. Sonuç olarak, PD hastalarında akut peritonit ataklarında MPV düzeylerinin değerlendirilmesi, hastalardaki sistemik inflamasyonu gösterir. Bu hastalarda, akut peritonit tanısında ve şiddeti tahmininde MPV, yardımcı bir belirteç olarak değerlendirilebilir.

**Anahtar kelimeler:** Periton diyalizi, peritonit, ortalama trombosit hacmi, akut faz reaktanı, trombosit fonksiyon indeksleri

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## INTRODUCTION

Peritoneal dialysis (PD) is a type of renal replacement therapy which reduces the patient's dependency on dialysis center. The most important complication of PD is peritonitis, which is responsible for deaths with a rate of 1-6% (1). Acute peritonitis attacks are associated with increased systemic inflammation beside peritoneal membrane inflammation (2). Mean platelet volume (MPV), is one of the platelet function indices (3). Elevated MPV levels may be seen in cardiac or non-cardiac disorders besides many inflammatory situations (4). It is known that, uremic patients have platelet function disorders due to various reasons. (5). Nasri et al. showed increased MPV levels in uremic patients (6). Asanuma supported these findings by reporting higher MPV values in HD patients than healthy control group (7). However different findings are also available (8).

Studies about MPV in patients with chronic renal disease or HD are limited and give conflicting results. Also there is not any study investigating MPV in peritonitis attacks. Based on this background, we aimed to evaluate MPV levels of PD patients and in acute peritonitis attacks.

## MATERIALS AND METHODS

The present study was performed in Nephrology and Microbiology departments. Forty two peritonitis attacks (between July 2009 and July 2013) of 37 PD patients were included in the study. The control group was composed of 42 age-and-sex-matched healthy subjects. Our study was approved by the local ethics committee and conducted in accordance with the ethical principles described by the Declaration of Helsinki. Informed written consent form was obtained from all participants before the study. Patients' medical history, demographic (age, sex, duration of peritoneal dialysis) and laboratory data (the complete blood count, blood chemistry, plasma CRP levels, cell counts and peritoneal fluid cultures), response to treatment and response times were received from the recorded data of the patients' files. Patients with any infection or any acute peritonitis attack history in the last 3 months, with connective tissue and inflammatory bowel diseases, active infection, malignant diseases, acute myocardial infarction within 3 months, hematologic diseases-disorders, endocrine diseases, and patients who take antiaggregant or anticoagulant medications and those who did not want to participate to the study were

excluded from the study. Peritonitis was diagnosed by abdominal pain, blurring of dialysate fluid and deceleration of dialysate flow (peritoneal effluent) with an increased number of leukocytes more than 50% of which are neutrophilic PMN's (9). Measurement of complete blood cell count and CRP levels of PD patients (1 month before an acute peritonitis and time in which patients had not any infection) were taken as "the stable period of PD".

### *Biochemical and Haematological analyses*

Venous blood samples were collected into tubes containing ethylenediaminetetraacetic acid (EDTA). To avoid platelet swelling, MPV, platelet distribution width (PDW) and platelet count values were measured in the blood samples between 15-30 min after sampling. An automated blood cell counter was used for these measurements (Sysmex XT 2000i, Kobe, Japan). CRP levels were measured by original reactive via Beckman Coulter Inc. Immage 800® (USA) device. All samples were run in duplicate and the mean values were used for statistical analysis.

### *Statistical Methods*

Continuous variables were presented as mean  $\pm$  SD and categorical variables were expressed as percentage. Kolmogorov-Smirnov test was used to evaluate of the distribution of variables. Student's t-test was used for continuous variables those with normal distribution and Mann-Whitney U test was used for continuous variables those without normal distribution. Chi-square test was used for categorical variables. The comparison of MPV levels (before and after peritonitis) from the same patients were performed with paired-t test. Pearson and Spearman correlation analysis were used to assess the relationships.  $p < 0.05$  value was accepted as significant level. For statistical calculations, SPSS statistical software (SPSS for Windows, version 17.0. inc. Chicago, IL, USA) was used.

## RESULTS

The mean age of the patients was  $56.23 \pm 17.18$  years and the control group was  $53.50 \pm 8.45$  years. Male-female ratio of the patients and the control group was 19\23 and 23\19 respectively. Mean age and the male-female ratio of the groups were similar. The characteristics and laboratory data of patients and the control group were presented in Table 1. Mean duration of PD of the patients

**Table 1. Demographic and biochemical data of the groups**

Variables	Patients group (stable period) ( n:42)	Control group( n:42)	p value
Age (year)	56.23±17.18	53.50±8.45	ns
Sex*			
Male	19 (%45.2)	23(%54.8)	ns
Female	23 (%54.8)	19 (%45.2)	
MPV(fl)	10.82±0.84	9.60±0.50	<0.001
PDW (fl)	12.15±2.05	11.08±1.071	0.004
Platelet (x10 <sup>3</sup> /u)	240.452±77.019	281.665±65.38	0.01

All parameters were expressed as mean ± standard deviation unless otherwise stated

\* Data were expressed as number (%)

p <0.05 value was accepted as significant level and the significant differences between the groups were shown in bold

ns: not significant

was 28.93±20.23 months when the peritonitis attack was occurred. Mean hospitalization day due to acute peritonitis attack was 21.92±10.96.

Mean MPV value of PD patients in the stable period was 10.82±0.84 fl and the control group was 9.60±0.50 fl. MPV values were significantly higher in patients, compared with the control group (p <0.001). Mean MPV value of the patients during the peritonitis attack was 9.40±1.16 fl and was significantly lower compared with the stable period of the same PD patients (p<0.001) (Figure 1). Mean CRP values of PD patients were 13.41±16.63 mg/dl and 5.06±10.73 mg/dl in peritonitis attack and the stable period respectively (p=0.002) (Table 2). In 33 patients (78.5%) culture results were positive. According to the results of peritoneal fluid culture, reproductive outcomes were as follows: Staphylococcus aureus 20 (60.6%), Pseudomonas aeruginosa 5 (15.2%), Acinetobacter baumannii 2 (6.1%), Enterococcus faecium 2 (6.1%), Klebsiella pneumoniae 2 (6.1%) and Escherichia coli 2 (6.1%).

In the correlation analysis, in the peritonitis attack period, MPV levels were negatively correlated with CRP levels, hospitalization day, peritoneal fluid and plasma leukocyte count (r= -0.751, p<0.001) ; (r= -0.355, p=0.002) ; (r= -0.851, p<0.001) ; (r= - 0.579, p<0.001) respectively

(Figure 2). Besides, patients with culture positivity had higher MPV and CRP levels (p=0.006, p<0.001) respectively.

## DISCUSSION

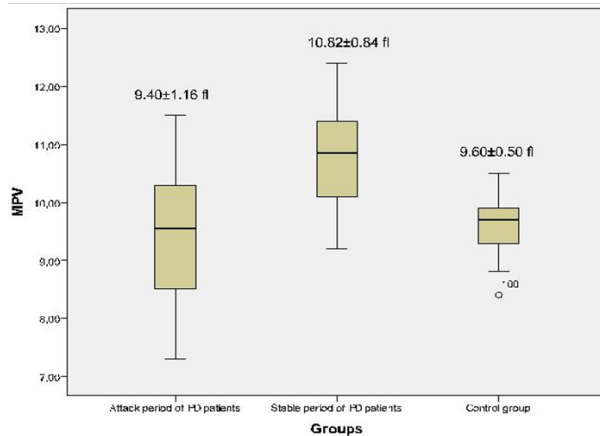
Peritonitis is the most important infectious complication in peritoneal dialysis patients. (1) Increased MPV values indicates larger platelet volume. Larger platelets are more active, more prone to adhesion and aggregation (4). Increased MPV levels in uremic patients and HD patients were demonstrated before (6,7). But it has not been evaluated in PD patients and peritonitis attacks. In our study, MPV values of PD patients and its variation in acute peritonitis attack were evaluated for the first time and MPV values of PD patients in stable period were found higher than the control group. Also, a significant decrease was detected in peritonitis attack period. This result might be due to the systemic inflammation, overproduction of the proinflammatory cytokines and acute phase reactants because they lead to the release of smaller platelets by suppressing the megakaryopoiesis (10). Also Becchi et al. found decreased MPV levels in sepsis (11). Increased CRP levels during acute peritonitis attack, are well known (12). In our study, CRP levels were found higher in acute

**Table 2. Laboratory data of the PD patients with acute peritonitis attacks and their stable period**

Variables	Stable period	Peritonitis attack	p value
MPV(fl)	10.82±0.84	9.40±1.16	<0.001
CRP(mg/dl)	5.06±10.73	13.41±16.63	0.002
PDW (fl)	12.15±2.05	11.48±1.72	<0.001
Platelet (x10 <sup>3</sup> /u)	240.452±77.01	253.881±107.48	<0.001

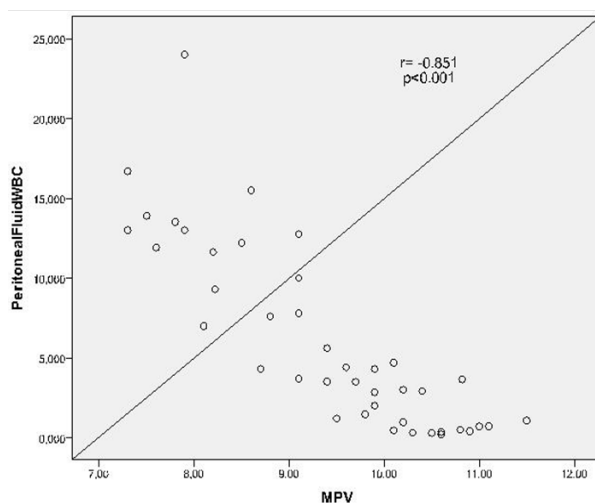
All parameters were expressed as mean ± standard deviation

p <0.05 value was accepted as significant level and the significant differences between the periods were shown in bold



**Figure 1.** Mean platelet volume (mean ± standard deviation) of the study population (Control group, the same PD patients in the stable period and their attack period)

peritonitis attack compared with the stable period of PD patients. Besides, an inverse relationship was found between CRP and MPV levels. In the previous studies it has been reported that, CRP levels were correlated with the severity of illness and peritoneal fluid leukocyte count in peritonitis attacks (13). In our study, leukocyte count of the peritoneal fluid and the plasma were showed a positive correlation with CRP and a negative correlation with MPV values. In addition, there was an inverse relationship between the hospitalization day and MPV levels at the



**Figure 2.** Mean platelet volume (fL) and peritoneal fluid leukocyte count ( $\mu\text{l}$ )

attack period suggesting that it may be helpful to predict the severity of the illness as CRP.

In conclusion, serum MPV measurement may be considered as a quick and reliable tool without any cost in the assessment of acute peritonitis. This is the first study investigating the relationship between MPV levels and acute peritonitis and its severity. Our results suggest that assessment of MPV in acute peritonitis in PD patients may indicate systemic inflammation. MPV may be used as an hepler marker to predict the severity of acute peritonitis.

*Declaration of interest*

The authors declare that they have no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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