

# The Value of Red Cell Distribution Width and Inflammatory Markers in Patients with Spontaneous Bacterial Peritonitis

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## Abstract

**Objective:** High red cell distribution width in patients with cardiovascular disease, cerebrovascular disease, acute pancreatitis, sepsis, or hepatitis B is related to higher mortality than with normal or low red cell distribution width. The aim of our study is to investigate the relationship of red cell distribution width and other inflammatory markers with survival in patients with spontaneous bacterial peritonitis.

**Methods:** This retrospective study included patients with spontaneous bacterial peritonitis. Beyond red cell distribution width, Child-Turcotte-Pugh and Model for End-Stage Liver Disease scores were also calculated. In addition to this, C-reactive protein levels and erythrocyte sedimentation rates were also recorded. Spearman's correlation test was used to analyze the relationship between red cell distribution width, survival, and other inflammatory markers.

**Results:** Thirty-four patients with spontaneous bacterial peritonitis were included, and the mean red cell distribution width of patients was  $15.1 \pm 2.69\%$ , the mean C-reactive protein value was  $64.8 \pm 54.4$  mg/L, the mean erythrocyte sedimentation rate was  $29.7 \pm 34.1$  mm/h, and the mean albumin value was  $2.6 \pm 0.42$  g/dL. We found the mean survival of patients as  $8.1 \pm 10.5$  months. The mean Model for End-Stage Liver Disease score was  $19.7 \pm 7.7$  and the Child-Pugh score was  $10.6 \pm 2.1$ . Red cell distribution width was negatively correlated with survival in patients with spontaneous bacterial peritonitis ( $r = -0.393$ ,  $P = .02$ ). However, erythrocyte sedimentation rate ( $r = 0.489$ ,  $P = .005$ ) and albumin level ( $r = 0.412$ ,  $P = .02$ ) were found to be positively correlated with survival.

**Conclusion:** This study shows that red cell distribution width correlated negatively with survival in patients with spontaneous bacterial peritonitis.

**Keywords:** inflammatory markers, Red cell distribution, spontaneous bacterial peritonitis, survival

## INTRODUCTION

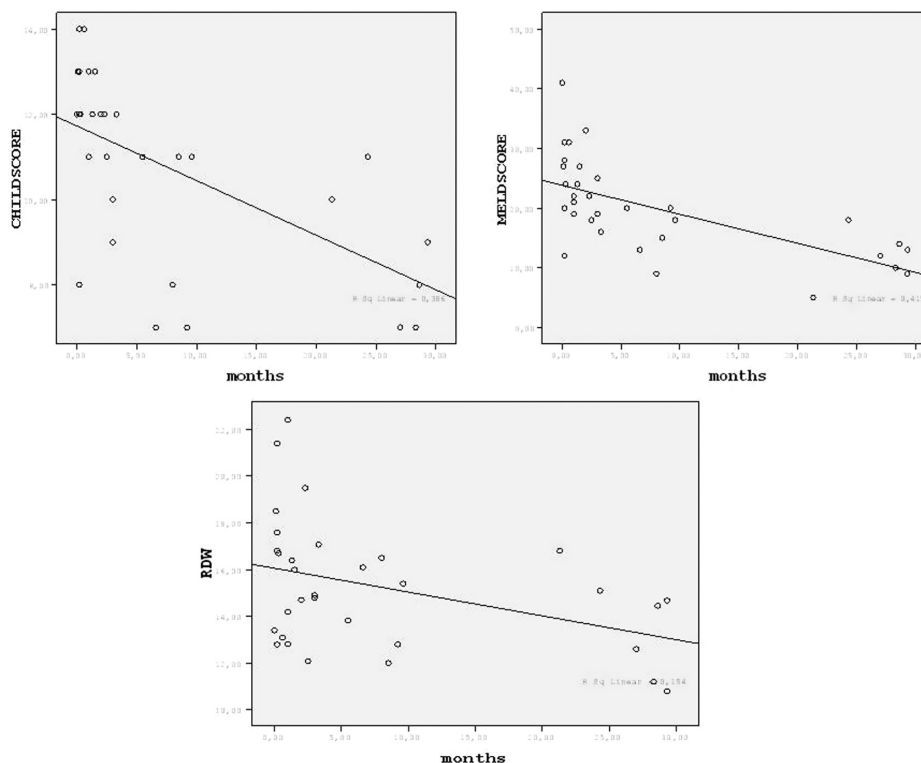
Red cell distribution width (RDW) is assessed by routine complete blood count and is a parameter that reflects the difference in the sizes of erythrocytes. Red cell distribution width is usually used in the differential diagnosis of microcytic anemia due to iron deficiency and hemoglobinopathies such as thalassemia. In recent years, studies showed that high RDW in patients with cardiovascular disease,<sup>1</sup> cerebrovascular disease,<sup>2</sup> acute pancreatitis,<sup>3</sup> sepsis,<sup>4</sup> or hepatitis B<sup>5</sup> is related to higher mortality than with normal or low RDW. The mechanism of the relationship between RDW and mortality with these diseases is not yet known. However, high RDW is associated with chronic inflammation and poor nutrition.<sup>6</sup> Spontaneous bacterial peritonitis (SBP) is one of the most common complications of liver cirrhosis. The frequency of SBP is 1.5%-3.5% in outpatients and 10% in hospitalized cirrhotic patients.<sup>7</sup> Mortality associated with SBP has decreased dramatically over the years. In the 1960s, mortality of SBP was 100%. It declined and, in a recent study, the overall mortality in patients with SBP was determined to be 37.8%.<sup>8,9</sup>

The aim of our study is to investigate the relationship of RDW and other inflammatory markers with survival in patients with SBP.

## METHOD

This retrospective study included 422 patients with cirrhosis who were admitted to the Internal Medicine Department from 2010 through 2013. We evaluated the patients' medical records, each of whom had received a "K74" diagnostic code in accordance with the International Classification of Disease-10. Spontaneous bacterial peritonitis (SBP) was defined as  $>250$  cells/mm<sup>3</sup> polymorphonuclear cells in the ascites of patients with cirrhosis without intra-abdominal infection/malignancies.

A total of 388 patients with cirrhosis were excluded from the study because they had no ascites, had missing medical records, active infection, and/or were suspected of having an infection other than SBP, gastrointestinal bleeding, malignancy, corticosteroid therapy, or immunosuppressive



**Figure 1.** Negative correlation graphics of RDW, MELD score, and Child-Pugh score with survival in patients with SBP. RDW, red cell distribution width; MELD, Model for End-Stage Liver Disease; SBP, spontaneous bacterial peritonitis.

therapy. Beyond RDW, Child-Turcotte-Pugh (CTP) and Model for End-Stage Liver Disease (MELD) scores were also calculated. In addition to this, C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) were also recorded. Life status data and dates of death for the patients in the study were obtained from the Death Notification System of the Ministry of Health. An Automated Beckman Coulter LH 708 Analyzer was used for complete blood count analysis. The study was performed in accordance with the Declaration of Helsinki and was approved by the ethical committee (Ethical Committee of İstanbul, 2006/503).

Statistical Package for the Social Sciences version 24.0. (IBM SPSS Corp.; Armonk, NY, USA) was used for statistical analysis. Descriptive values were given as mean and standard deviation. Categorical variables were given as number of cases and percentage. Spearman correlation test was used to evaluate the relationship between RDW, survival, and other inflammatory markers. Statistical significance was set as  $P < .05$ .

#### MAIN POINTS

- High red cell distribution width (RDW) in patients is related to higher mortality in some diseases.
- The RDW correlated negatively with survival in patients with spontaneous bacterial peritonitis (SBP).
- The erythrocyte sedimentation rate in patients with SBP was found to be positively correlated with survival.

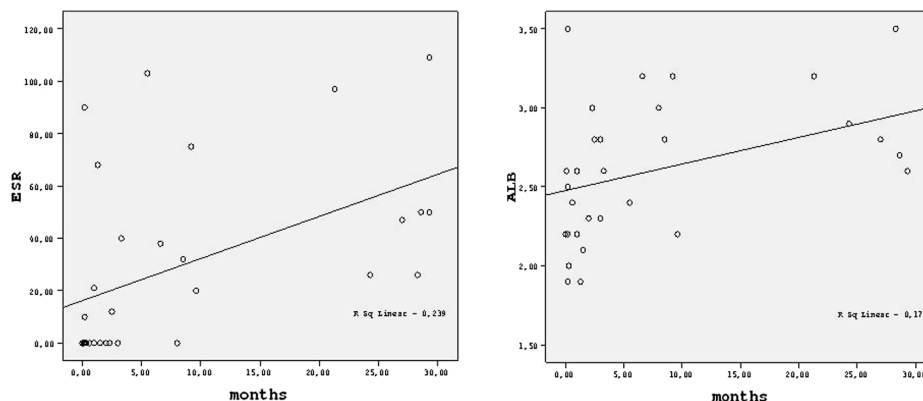
#### RESULTS

A total of 34 patients with SBP were included in the study. Twenty-one (61.8%) of the patients were male and 13 (38.2%) were female. The mean age of the patients in the study was  $59.4 \pm 10.2$  years. In this study, the mean RDW was  $15.1 \pm 2.69\%$ , the mean CRP value was  $64.8 \pm 54.4$  mg/L, the mean ESR was  $29.7 \pm 34.1$  mm/h, and the mean albumin value was  $2.6 \pm 0.42$  g/dL. We found the mean survival of patients with SBP as  $8.1 \pm 10.5$  months. The mean MELD score was  $19.7 \pm 7.7$ , and the Child-Pugh score was  $10.6 \pm 2.1$ .

In the correlation analysis of patients with SBP, RDW negatively correlated with survival and high levels of RDW were found to be associated with shorter survival ( $r = -0.393$ ,  $P = .02$ ). However, ESR ( $r = 0.489$ ,  $P = .005$ ) and albumin ( $r = 0.412$ ,  $P = .02$ ) were found to be positively correlated with survival. C-reactive protein, an inflammatory marker often used in daily practice, did not correlate with survival ( $r = -0.340$ ,  $P = .06$ ). However, MELD score ( $r = -0.644$ ,  $P < .001$ ) and Child-Pugh score ( $r = -0.621$ ,  $P < .001$ ), which are routinely used during the follow-up of patients with liver cirrhosis, showed a negative correlation in patients with SBP (Figures 1 and 2).

#### DISCUSSION

Spontaneous bacterial peritonitis is one of the most common complications of cirrhosis. Although the mortality rate has reduced over the years, overall mortality is still high. In recent years, RDW has been found to be associated with mortality in patients with cardiovascular diseases,<sup>1</sup> malignant tumors,<sup>10,11</sup> and acute pancreatitis.<sup>3</sup> Also, RDW has been associated with clinical activity and mortality of inflammatory bowel diseases.<sup>12</sup>



**Figure 2.** Positive correlation graphics of ESR and albumin with survival in patients with SBP. ALB, albumin; ESR, erythrocyte sedimentation rate; SBP, spontaneous bacterial peritonitis.

The clinical presentation of SBP is heterogeneous. Patients can be asymptomatic,<sup>13</sup> and some patients with SBP present with confusion and shock.<sup>14</sup> Therefore, it is important to determine which patients should be followed more closely in the follow-up of patients with SBP.

Many studies have shown the relationship of RDW with age and gender. Red cell distribution width also increases with increasing age.<sup>15</sup> In our study, it was shown that RDW height was negatively correlated with survival. However, it should be noted that the mean age of our patients was approximately 59 years, and its effect on mortality and RDW should be considered. As a negative aspect of our study, unfortunately, no cut-off was found to predict mortality for RDW.

In our study, RDW correlated negatively with survival in patients with SBP. Thus, the survival of patients with high RDW was found to be shorter. It may be beneficial to review the patients with high RDW more frequently. Albumin, as an important protein showing liver synthesis function, was positively correlated with survival in patients with SBP. In addition, the ESR in SBP was found to be positively correlated with survival. Erythrocyte sedimentation rate can increase if the liver reserve is good enough. Thus, high ESR levels may not be seen in patients with poor liver reserve. The positive correlation of ESR and survival in SBP may be related to good liver reserve in patients with high ESR. C-reactive protein, which is frequently used in daily practice, did not correlate with survival in patients with SBP in our study. We concluded that CRP levels did not predict survival in these patients.

Child-Pugh and MELD scoring systems are used in the routine evaluation of liver cirrhosis and they reflect hepatocellular function. We found a negative correlation between survival and these scoring systems in patients with SBP. In patients with poor liver function (with high MELD and Child-Pugh scores), the addition of SBP into the clinical situation causes significant clinical deterioration. This may lead to a decline in survival rates for these patients.

## CONCLUSION

In conclusion, RDW correlated negatively with survival in patients with SBP. Also, MELD and Child-Pugh scores correlated negatively with survival. On the contrary, ESR and albumin showed a positive correlation with survival.

**Ethics Committee Approval:** Ethical committee approval was received from the Ethics Committee of Istanbul University (Date: 2006, Decision No: 2006/503).

**Informed Consent:** Written informed consent was obtained from all participants who participated in this study.

**Peer-review:** Externally peer-reviewed.

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