

# Significance of red blood cell distribution width and C-reactive protein/albumin levels in predicting prognosis of acute pancreatitis

✉ Eyüp Murat Yılmaz, M.D.,<sup>1</sup> ✉ Altay Kandemir, M.D.<sup>2</sup>

<sup>1</sup>Department of General Surgery, Adnan Menderes University Faculty of Medicine, Aydın-Turkey

<sup>2</sup>Department of Gastroenterology, Adnan Menderes University Faculty of Medicine, Aydın-Turkey

## ABSTRACT

**BACKGROUND:** Acute pancreatitis (AP) is one of the major pathologies among gastrointestinal system diseases. The aim of this study was to determine the relationship between the red cell distribution width (RDW) value and the C-reactive protein (CRP)/albumin ratio in patients with AP.

**METHODS:** In this retrospective study, AP cases were enrolled and divided into 2 groups according to the Ranson criteria as moderate or severe pancreatitis. The RDW and CRP/albumin values, length of hospitalization and stay in the intensive care unit (ICU), and the complications experienced were compared between these 2 groups.

**RESULTS:** A total of 264 patients were included in the study. Moderate pancreatitis was detected in 204 patients (77.2%) while severe pancreatitis was seen in 60 patients (22.8%) ( $p=0.081$ ). There was no statistically significant difference in the RDW value between the groups ( $p=0.193$ ). The CRP/albumin values were significantly higher in the severe pancreatitis group compared with the moderate group ( $p<0.001$ ). The severe AP group also had a longer period of hospital care, both overall and in the ICU ( $p=0.001$ ,  $p=0.047$ ).

**CONCLUSION:** RDW was not a specific marker for predicting prognosis in AP, but the CRP/albumin ratio is an easy-to-apply, inexpensive, and reliable marker.

**Keywords:** Acute pancreatitis; C-reactive protein/albumin; erythrocyte distribution width; prognosis.

## INTRODUCTION

Acute pancreatitis (AP) is one of the most common causes of hospitalization due to pathologies originating from the gastrointestinal tract, with an annual incidence of approximately 13 to 45/100,000.<sup>[1]</sup> The clinical picture may range from moderate to severe, or even mortal, in some cases. Although the mortality rate is around 1%, it increases with age. The rate of complications is in the range of 7% to 42%.<sup>[2]</sup> AP is quite an important clinical picture, and various biochemical tests and imaging methods, such as computerized tomography (CT), as well as some scoring systems, are routinely used in order to determine the intensive care need and prognosis of the patient.<sup>[3]</sup> There is no consensus on markers established for di-

agnosis, prognosis, and response to treatment, although markers such as C-reactive protein (CRP), amylase, lipase, trypsin, phospholipase 2, interleukin (IL)-8, and procalcitonin are currently used to diagnose and predict the severity of the disease.

Early diagnosis is highly important in terms of mortality and complications, and there are some scoring systems available that can be helpful in making an early diagnosis and predicting prognosis. The Ranson criteria, the Acute Physiologic Assessment and Chronic Health Evaluation (APACHE) II, and the Balthazar score are some of those that are most widely used.<sup>[4,5]</sup> Ranson scoring is widely used in general surgery and gastroenterology clinics to predict prognosis.<sup>[4,6]</sup> It is an easy-to-use scoring system with a sensitivity of 40% to 80% in

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Address for correspondence: Eyüp Murat Yılmaz, M.D.

Adnan Menderes Üniversitesi Tıp Fakültesi, Genel Cerrahi Anabilim Dalı, 09100 Aydın, Turkey

Tel: +90 256 - 212 18 50 E-mail: drmyilmaz80@gmail.com



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predicting the severity of the disease.<sup>[7,8]</sup> In addition, many clinical studies have reported that easily accessible markers, such as the neutrophil/lymphocyte ratio, the platelet/lymphocyte ratio, the red cell distribution width (RDW), and the level of procalcitonin can be helpful in predicting severity and prognosis of pancreatitis to different degrees. There are also a few studies in the literature reporting that the CRP/albumin ratio can be used in this respect.<sup>[9,10]</sup>

The objective of this study was to evaluate the efficacy of RDW and CRP/albumin values, both of which are inexpensive, easy-to-access, and reproducible markers available from routine blood tests, in predicting the prognosis of the patients hospitalized due to AP.

## MATERIALS AND METHODS

### Patients and Study Design

Patients admitted to the Aydın Adnan Menderes University gastroenterology department with a diagnosis of AP between January 2014 and November 2017 were included in this study. Approval was obtained from the Non-Interventional Clinical Research Ethics Board of Aydın Adnan Menderes University. The Ranson scores were calculated for all patients at the time of admission, and 2 groups were created: moderate (Ranson score between 0-2) and severe (Ranson score  $\geq 3$ ).<sup>[11]</sup>

The RDW and CRP/albumin values at admission were recorded. For routine imaging, CT was performed for all of the patients at the time of diagnosis, and was repeated for patients suspected of having a complication. Details of the complications observed were also recorded.

Statistical analysis was performed using the demographic data, the length of hospital stay, length of stay in ICU, and any complications experienced.

### Statistical Analysis

The statistical package IBM SPSS Statistics for Windows, Version 20.0. (IBM Corp., Armonk, NY, USA) was used to evaluate the data. Mean $\pm$ SD, median (maximum-minimum), percentage, and frequency values were used as variables. Levene's test was used to assess the homogeneity of variances, a prerequisite for parametric tests. The Shapiro-Wilk test was used to test the assumption of normality. If the parametric test prerequisites were met, Student's t-test was used to compare differences between 2 groups, and if not, the Mann-Whitney U test was applied. The relationship between 2 continuous variables was assessed using the Pearson correlation coefficient, or the Spearman correlation coefficient, in cases where the parametric test prerequisites were not met. P values of  $<0.05$  and  $<0.01$  were considered statistically significant. Test performance can be described by a test's ability to correctly diagnose or to accurately differentiate cases into subgroups (healthy/patient, etc.). The final Ranson scores (0-2;  $>3$ ) were evaluated using receiver operating character-

istic (ROC) curve analysis. The area under the curve (AUC), sensitivity, and selectivity values were calculated.

## RESULTS

A total of 264 patients were included in the study, of whom 159 (60.2%) were female and 105 (39.8%) were male. Among these, 131 (49.6%) patients were identified as nonbiliary and 133 (50.4%) as biliary AP patients. The mean age was 59.97 years (range: 21-95 years). Complications occurred in 22 patients (8.3%), and there was no instance of mortality observed in the group. The mean length of stay in the hospital was 6.43 days (range: 0-34 days), and the mean length of stay in the ICU was 1.04 days (range: 0-34 days). The mean RDW value was determined to be 15.21% (range: 11.3-18%), and the mean CRP/albumin value was 19.16 mg/L (range: 0.05-114.94 mg/L) (Table 1).

When we divided the patients into 2 groups according to the Ranson score, moderate pancreatitis was determined in 204 (77.2%) patients and severe pancreatitis in 60 (22.8%) patients ( $p=0.081$ ). There was no statistically significant difference between the groups in the RDW value ( $p=0.193$ ). However, the CRP/albumin value was significantly higher in the severe AP group than in the moderate AP group ( $p<0.001$ ). The mean length of stay in the hospital and in the ICU was longer in the severe AP group than in the moderate group ( $p=0.001$ ,  $p=0.047$ ) (Table 2).

**Table 1.** Descriptive statistics

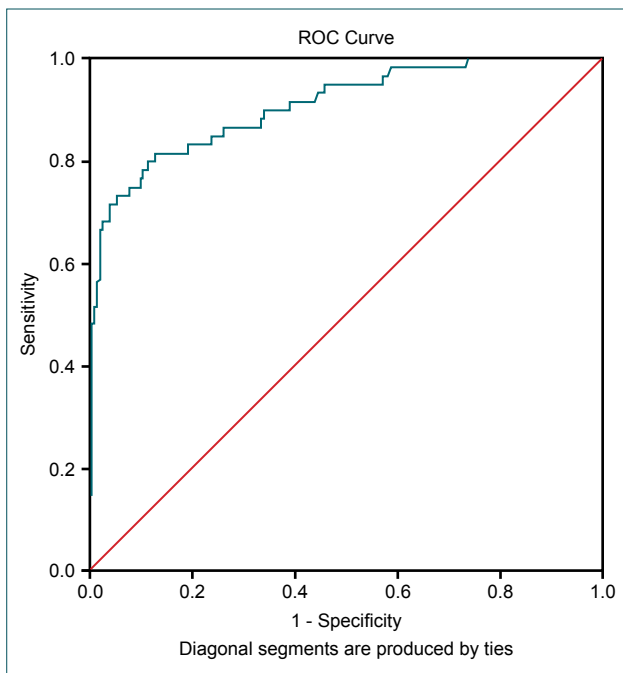
	n	Min.	Max.	Mean $\pm$ SD
Age	264	21.0	95.0	59.97 $\pm$ 17.47
Ranson	264	0.0	6.0	2.06 $\pm$ 1.04
RDW	264	11.3	187.0	15.21 $\pm$ 10.86
ICU (day)	264	0.0	34.0	1.04 $\pm$ 3.43
Total hospital (day)	264	0.0	34.0	6.43 $\pm$ 4.47
CRP/albumin	263	.05	144.94	19.16 $\pm$ 26.09

CRP: C-reactive protein; ICU: Intensive care unit; RDW: Red cell distribution width; Min.: Minimum; Max.: Maximum; SD: Standard deviation.

**Table 2.** Data of moderate and severe acute pancreatitis

Ranson	0-2 (n=204)	>3 (n=60)	p
Age	58.95 $\pm$ 17.54	63.43 $\pm$ 16.88	0.081
RDW	14.34 $\pm$ 1.94	18.15 $\pm$ 22.39	0.193
ICU (day)	0.77 $\pm$ 3.1	1.97 $\pm$ 4.28	0.047*
Total hospital (day)	5.66 $\pm$ 3.01	9.03 $\pm$ 7.01	0.001*
CRP/albumin	9.29 $\pm$ 12.04	52.58 $\pm$ 32.49	0.001*

CRP: C-reactive protein; ICU: Intensive care unit; RDW: Red cell distribution width. \*:  $p<0.05$ .



**Figure 1.** C-reactive protein/albumin ratio cutoff curve according to Ranson value. ROC: Receiver operating characteristic.

ROC curve analysis with a Ranson score cut-off point revealed that it was statistically significant to determine limit values for a CRP/albumin parameter ( $p < 0.01$ ). According to the Rankin scale cut-off point, the CRP/albumin limit value parameter of 8.5102 had a specificity of 66% and sensitivity of 90% (Fig. 1).

## DISCUSSION

Despite improvements in diagnostic algorithms and intensive care conditions, as well as new approaches in treatment modalities, the mortality rate is reported to be 10% to 20% in severe AP cases that develop multiple organ failure.<sup>[12]</sup> Multiple organ failure and infectious necrosis are recognized as the most common factors increasing mortality, and thus they have been used as markers for predicting prognosis in such cases.<sup>[13–15]</sup> Biochemical markers, such as IL-6, IL-8, CRP, and IL-10, in addition to scoring systems, such as the Ranson criteria, the Baltazar score, and the APACHE II score have been used to estimate prognosis.<sup>[16]</sup>

The present study was designed to use biochemical tests that are easily accessible and inexpensive to physicians regardless of location in order to predict the severity and prognosis of AP. RDW is a low-cost and reliable whole blood analyzer parameter showing the distribution of erythrocyte volume and can be measured easily and simply. It is a valuable measurement in many pathological diseases, ranging from sepsis to cancer, and from kidney dysfunction to cardiovascular disease, and it has also been shown in the literature to be an important inflammatory marker.<sup>[10]</sup> It has been identified as an important marker in determining the mortality rate and length of hospital stay in patients in many clinical trials.<sup>[17]</sup> In a study

conducted with 322 AP patients, Gülen et al.<sup>[18]</sup> considered RDW values to be significant for early prediction of prognosis in nontraumatic AP cases. Cetinkaya et al.<sup>[19]</sup> studied 102 patients diagnosed with AP and noted a significant correlation between RDW and mortality values, and indicated that RDW was an important and easy-to-use marker in prognosis. In our study, however, no statistically significant difference was determined, although RDW values were higher in the severe AP group than in the moderate AP group. Though RDW is an easy-to-use test that is inexpensive and readily accessible, the contrast between our results and those in the literature raises questions and would suggest that further studies with larger study groups are needed, especially when our rather large sample size is considered.

The CRP/albumin ratio, currently a popular marker, was the second marker to be examined as part of this study's objective. CRP/albumin is becoming a commonly used marker for various diseases, ranging from inflammatory processes, such as sepsis and ulcerative colitis, to prognosis in cases of malignancies, such as hepatocellular carcinoma and pancreatic cancer.<sup>[20–22]</sup> Although it is recognized as an inflammatory marker, studies investigating CRP/albumin in AP patients are currently very limited in the literature. In their study of 192 patients with AP, Kaplan et al.<sup>[9]</sup> analyzed the Ranson and Atlanta scores, as well as the effects of CRP/albumin values, on prognosis and severity. They observed an increase in severity and poor prognosis with increased CRP/albumin values. They reported better prognosis in the patients with a CRP/albumin ratio  $< 16.28$  and poor prognosis when it was  $> 16.28$ . In our study too, the prognosis became worse and the disease severity increased as the CRP/albumin ratio increased. The length of stay in the hospital and in the ICU, an important predictor of prognosis, increased as the CRP/albumin ratio increased. We found the sensitivity of CRP/albumin to AP to be 90% with a cut-off value of 8.51. While the available research on CRP/albumin in AP is still very limited, it is a very promising, easily measurable, reproducible, noninvasive, and inexpensive test for AP.

In conclusion, AP is a clinical entity with high mortality in severe cases, and therefore a marker for prognosis must be simple, easily accessible, inexpensive, and reliable for physicians. Although many studies have reported that RDW may be such a simple, reliable, inexpensive, and easily accessible test to predict mortality,<sup>[23]</sup> our results did not indicate that RDW was very significant in predicting prognosis. We would like to highlight the CRP/albumin ratio, already a popular marker for inflammation, as a promising potential marker for use in determining a prognosis in AP cases, though we recommend further studies on this topic.

The authors declare that there is no conflict of interest regarding publication of this article. No financial support was obtained.

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## ORIJİNAL ÇALIŞMA - ÖZET

## Akut pankreatitin prognozunu ön görmeye eritrosit dağılım hacmi ve CRP/albumin değerlerinin önemi

Dr. Eyüp Murat Yılmaz,<sup>1</sup> Dr. Altay Kandemir<sup>2</sup><sup>1</sup>Adnan Menderes Üniversitesi Tıp Fakültesi, Genel Cerrahi Anabilim Dalı, Aydın<sup>2</sup>Adnan Menderes Üniversitesi Tıp Fakültesi, Gastroenteroloji Bilim Dalı, Aydın

**AMAÇ:** Akut pankreatit (AP) gastrointestinal patolojiler arasında önemli patolojilerden birisi olup çalışmadaki amacımız eritrosit dağılım hacmi (RDW) ve C-reaktif protein (CRP)/albumin ile prognoz ilişkisini belirleyebilmektir.

**GEREÇ VE YÖNTEM:** Çalışma geriye dönük olup akut pankreatit olguları alınmış ve Ranson skoruna göre ılımlı ve şiddetli grup olarak iki gruba bölünmüştür. Bu iki grup arasında RDW, CRP/albumin ve hastanede yatış ile yoğun bakımda yatış süreleri, komplikasyonları karşılaştırılmıştır.

**BULGULAR:** Toplam 264 hasta çalışmaya alındı. Hastaların 204'ünde (%77.2) ılımlı pankreatit saptanırken, 60 hastada (%22.8) şiddetli pankreatit saptandı (p=0.081). Bu iki grup arasındaki RDW değerlerine bakıldığında istatistiksel olarak anlamlı bir farklılık olmadığı gözlemlendi (p=0.193). C-reaktif protein/albumin değerlerine bakıldığında şiddetli AP grubunda diğer gruba göre değerlerin oldukça yüksek olduğu saptandı (p<0.001). Hastanede toplam yatış süreleri ve yoğun bakımda toplam yatış sürelerine bakıldığında ise şiddetli AP grubundaki hastaların diğer gruba göre daha fazla hastanede kaldıkları gözlemlendi (p=0.001, p=0.047).

**TARTIŞMA:** Akut pankreatit tablosunda RDW net olarak prognozu ön görmeye spesifik bir markır değilken, CRP/albumin kolay uygulanabilen, ucuz ve güvenilir bir markırdır.

**Anahtar sözcükler:** Akut pankreatit; CRP/albumin; eritrosit dağılım hacmi; prognoz.

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