



The relationship of Red Cell Distribution Width (RDW) with Stroke Severity and Prognosis in Acute Ischemic Stroke

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Abstract

Introduction: The red cell distribution width (RDW) is a numeric estimation of the erythrocyte dimension in the circulation. Increased RDW has been shown to have a predisposing role in the development of vascular thrombosis and therefore it is an instigator of cerebrovascular diseases. In this study, we aimed to investigate the relationship between RDW values with stroke severity and prognosis in patients in comparison with a healthy control group.

Methods: The first 24 hours complete blood count examinations of the hospitalized patients with acute ischemic stroke were requested. Neurological examination was evaluated with NIHSS on Day 1 and Day 10 and early prognosis was evaluated with mRS.

Results: 271 patients with acute ischemic stroke and 142 control patients were included in the study. The mean age of the patients and in the control group were 69.54 ± 12.8 and 68.35 ± 19.38 , respectively. Male to female (M/F) ratio of patients and the control group were 52.2/47.8 and 44.6/55.4, respectively. The mean RDW values were 15.39 ± 1.4 in the stroke group and 14.59 ± 2.02 in the control group. Mean RDW values were significantly different between the two groups ($p: 0.04$). There was no correlation between stroke severity and early prognosis and RDW ($p > 0.05$).

Discussion and Conclusion: RDW values were found to be high in acute ischemic stroke patients, but there was no correlation between RDW values, stroke severity and early prognosis.

Keywords: Inflammation; ischemic stroke; RDW.

Stroke affects over 20 million people every year globally and it is the second most important cause of mortality^[1,2]. Besides, it may also cause significant disability for the survivors, resulting in a need for physiotherapy^[3]. The neurological impairment associated with stroke is usually assessed by NIH stroke scale (NIHSS)^[4,5] and the outcome is predicted by using Barthel index, Rankin Scale or Glasgow Outcome Scale^[6]. Recently, several studies have claimed that red cell distribution width (RDW) may be a good predictor of outcome in strokes^[7-10]. Also some studies have

claimed that RDW values have a statistically significant correlation with the NIHSS scores^[11]. However, this claim has been disputed by some researchers, who failed to find similar association^[12]. If these claims are true, then RDW will be a simple and inexpensive biomarker for the assessment of the severity of stroke. In the present study, we aimed to investigate the relationship between RDW values with stroke severity and prognosis in patients in comparison with a healthy control group.

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Submitted Date (Başvuru Tarihi): 14.01.2019 **Accepted Date (Kabul Tarihi):** 11.04.2019

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Materials and Methods

After obtaining the approval of the local ethics committee, CBC tests of patients with acute ischemic stroke who were hospitalized were requested within the first 24 hours. Patients with acute ischemic stroke who were not planned to receive t-pa were included in the study. Also, individuals without hematological diseases were included in the group. A control group consisting of 142 individuals with no additional diseases was examined and their files were analyzed retrospectively. Neurological examination was evaluated with NIHSS on Day 1 and Day 10, and early prognosis was evaluated with mRS. Venous blood samples were collected from the medial cubital vein. RDW values were determined using the CBC measurement panel within the hospital. Also, the RDW calculation [standard deviation (SD)/MCVx100%] was checked using the equation.

Kolmogorov-Smirnov test was used to investigate whether the variables were normally distributed. Mean and standard deviation values were given for variables with normal distribution. Student's T-test was used for parametric variables with normal distribution. Chi-square test was used for non-parametric non-numeric data. Pearson's test was used as the correlation test. P values less than 0.05 were considered statistically significant. Statistical analysis was performed using the 17th version of the Statistical Package for Social Sciences (SPSS).

Results

271 patients with acute ischemic stroke and 142 control patients were included in the study. The mean age in the patient and control groups were 69.54±12.8 and 68.35±19.38, respectively. Male to female (M/F) ratios of patients and the control group were 0.93 in AIS group and 1.21 in the control group, and there was no statistically significant difference in terms of gender and age ($p>0.05$). Female/male ratio were 0.91 in AIS group and 1.1 in the control group, and there was no statistically significant difference in terms of gender and age ($p>0.05$). The mean Hgb concentrations were 13.43±1.59 in AIS and 13.29±1.49 in the control group. The mean RDW values were 15.39±1.4 in the stroke group and 14.59±2.02 in the control group. Mean RDW values were significantly different between the two groups ($p=0.04$) (Table 1). There were no statistically significant difference in terms of gender and age with RDW ($p>0.05$). There was no correlation between stroke severity and RDW. ($p=0.99$, $r=-0.001$). There was no correlation between early prognosis and RDW ($p=0.14$, $r=-0.153$) (Table 2).

Table 1. Demographic data

Variables	AIS patients (n: 271)	Control group (n: 142)	p
Gender ratio (F/M) (n)	0.93(131/140)	1.21(78/64)	0.16
Age (years)	69.54±12.8	68.35±19.38	0.08
Hemoglobin (g/L)	13.43±1.59	13.29±1.49	0.54
RDW (%)	15.39±1.4	14.59±2.02	0.04

Table 2. Correlation matrix

	RDW	p
Age		
Pearson's r	0.014	0.881
Sex		
Pearson's r	0.017	0.848
NIHSS 1 st day		
Pearson's r	-0.001	0.99
mRS		
Pearson's r	0.153	0.14

Discussion

The relation between high RDW values and chronic systemic diseases has been known for many years^[13,14]. A myriad of studies report increased mortality in acute ischemic stroke with increased RDW^[15]. Eventhough the reason behind the increment in RDW of acute ischemic stroke patients is not completely understood, inflammation is thought to be playing the major role^[16-18]. Inflammation has effects on the red cell production process by disturbing iron metabolism, suppressing erythropoietin in molecular level and inhibiting the proliferation of erythroid progenitor cells^[17,19,20]. The severity of stroke is generally assessed by NIHSS, which has been shown to be a reliable predictor of outcome^[5,6]. Recently, several studies have tried to find a simpler alternative to NIHSS. Some of these studies have focused on RDW, as it has already been established as a prognostic biomarker in a variety of medical conditions, cardiovascular disease^[21-25], pulmonary disease^[26,27] and diabetes^[28]. In a case control study involving 224 stroke patients and an equal number of matched controls it was found that RDW was a powerful predictor of stroke. In addition, the researchers observed that higher values of RDW was associated with increased risk of stroke^[9]. Ani et al.(2009)^[7] also found that those subjects who had RDW values higher than 13.9% had two fold increased risk of death compared to the reference group. Our study showed that increased RDW values were associated with acute ischaemic stroke, hence the strong

correlation between high RDW values and ischaemic stroke. Our study failed to show a correlation between RDW values and stroke severity and prognosis.

Conclusion

RDW values measured at first admission may be considered as a prognostic marker in acute ischemic stroke. Our results suggest that, statistically significant, RDW levels are higher than the healthy subjects in CVO patients, but there is not any association between the severity or the prognosis of the disease and the RDW levels. Future studies with a greater scope and population are needed to clarify the assumption of the present study.

Ethics Committee Approval: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: M.Ü.; Design: F.D.; Data Collection or Processing: M.D.; Analysis or Interpretation: M.Ü.; Literature Search: R.K.; Writing: F.D.

Conflict of Interest: None declared.

Financial Disclosure: The authors declared that this study received no financial support.

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