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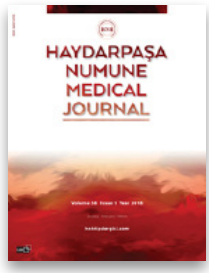

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ORIGINAL ARTICLE

Evaluation of Relationship between Alzheimer's Disease and Red Cell Distribution Volume (RDW)

Mustafa Ülker, Buse Çağla Arı

Department of Neurology, University of Health Sciences Turkey, Erenkoy Mental and Nervous Disease Health Aplication and Research Center, Istanbul, Turkey

Abstract

Introduction: Alzheimer's disease (AD) is a chronic degenerative disease of the central nervous system (CNS) that occurs with neuronal and synapse loss, progressive progression and may lead to impaired cognitive functioning, self-care deficits, and behavioral disorders. Red blood cell distribution width (RDW) is a numerical measure of the variation of the sizes of circulating erythrocytes in the circulation. It has been shown in some studies that increased RDW may affect the cerebrovascular pathology and may have a predisposing role in the development of AD. In this study, we aimed to compare the RDW values of patients with AD and healthy controls. Patients and healthy volunteers followed up in our outpatient clinics of our hospital between 2014-2018 were included in our hospital.

Methods: A total of 98 individuals, including 49 AD diagnosed as AD in Erenkoy Mental Neurologic Disease Hospital outpatient clinic and 49 healthy controls, applied between 2014-2018, were enrolled in this study. Patients who had coronary heart disease, congestive heart failure, diabetes, hypo or hyperthyroidism, malignancy, chronic renal failure, chronic liver disease and hematologic disease were excluded from this study. Venous blood samples were taken from the median cubital vein. RDW values were estimated by the hospital hemogram measurement devices. SD/MCVx100% equation was also used for checking the RDW measurements.

Results: The mean age of AD patients was 77.3± 8.5 and 73.6±12.0 in the control group with a statistically significant intergroup difference (p=0.020). There was no significant intergroup difference concerning gender (Male/Female, 21/28 in an AD group and 22/27 in the control group (p=0.839). There was no statistical difference between groups concerning RDW values. RDW distribution rates were 14.5±1.5 in AD and 14.7±1.9 in the control groups (p=0.206). The average MMSE score was 16 (8-23) in the AD group.

Discussion and Conclusion: Although we could not find any significant relationship between AD and RDW, because of its potential effects on AD, and the presence of studies with contrasting results, these results should be confirmed by studies performed with a higher number of patients.

Keywords: Alzheimer's disease; RDW; inflammation.

Alzheimer's disease (AD) is a chronic degenerative disease of the central nervous system (CNS). AD emerges with neuron and synapse losses in MSS, progresses and causes impaired cognitive functions, self-care deficiencies and behavioral disorders [1, 2]. The pathogenesis of AD is still unclear. Many factors play a role in the formation of AD, such as hereditary, immune, environmental factors and neurotransmitters [1, 2]. Cerebral infarcts that cause decreased cerebral blood flow have been shown to cause dementia, impaired cognitive abilities [3, 4] and increase the

Correspondence (İletişim): Mustafa Ülker, M.D. Erenkoy Ruh ve Sinir Hastaliklari Saglik Uygulama ve Arastirma Merkezi, Noroloji Klinigi, Istanbul, Turkey
Phone (Telefon): +90 542 541 90 64 **E-mail (E-posta):** m23ulker@yahoo.com
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risk of AD, especially in the geriatric population [5, 6].

Red blood cell distribution width (RDW) is a numerical measure of the variety of sizes of circulating erythrocytes. Generally, red blood cells (RBCs) are of standard size. Diseases that induce infective erythropoiesis or destroy RBCs severely cause heterogeneity in the dimensions of RBCs leading to higher RDW values [7, 8]. In addition to the differential diagnosis of anemia, elevated RDW values may be associated with heart failure, cardiovascular events, celiac disease, and inflammatory bowel disease activity [9].

In studies evaluating RDW values and cardiovascular risk factors, it has been shown that RDW may affect cerebrovascular pathology and may have a predisposing role in the development of AD [10, 11]. However, there are few studies in the literature investigating the direct relationship between AD and RDW. Therefore, we aimed to investigate the possible relationship between RDW parameter in people with AD in our study.

Materials and Methods

A total of 98 patients, including 49 AD cases diagnosed, in Erenköy Mental Health and Neurological Diseases Training and Research Hospital between 2014-2018 and 49 healthy individuals were enrolled in this study. This study was planned retrospectively among patients and healthy individuals who had previously applied to an outpatient clinic, previously. MMSE test was performed to evaluate the cognitive functions of all patients. The diagnosis of AD was made after evaluation of cognitive functions based on Magnetic Resonance and other MSS diseases according to the Diagnostic and Statistical Manual of Mental Disorders-IV (DSM-IV) and National Institute of Neurological and Communicative Disorders and Stroke and Alzheimer's Disease and Related Disorders Association (NINCDS–ADRDA) criteria, and exclusion of other CNS diseases.

Patients with coronary artery disease, heart failure, diabetes mellitus, hypo or hyperthyroidism, malignancy, chronic renal failure, chronic collagen disease, chronic liver disease or hematological disease were not included in this study.

Venous blood samples were taken from the median cubital vein. RDW values were determined using the Hemogram measurement panel in the hospital. In addition, RDW calculation was checked using the following equation: standard deviation (SD) / MCV X 100%.

Kolmogorov-Smirnov test was used to investigate whether the variables were normally distributed or not. Average and standard deviation values were given for variables with normal distribution. Student T-test was used for parametric variables with a normal distribution. The Chi-square test was used for non-parametric non-numerical data. Values less than 0.05 for the P-value were considered statistically significant. Statistical analyzes were performed using Statistical Package for the Social Sciences (SPSS) 17 version.

Results

Data of 49 AD patients and 49 healthy controls were evaluated in our study. The mean ages of the patients with AD, and healthy individuals were 77.3±8.5, and 73.6±12.0 years, respectively, with a statistically significant intergroup difference, p=0.020. There was no significant gender difference between patients with AD and in the patients in the control group. While 42.9% (21/49) of the AD and 44.9% (22/49) of the control groups consisted of male study participants, p=0.839. No statistically significant difference was found between the groups concerning RDW. The RDW percentages were 14.5±1.5 in the AD, and 14.7±1.9 in the control groups p=0.206. The MMSE score was 16 (8-23) in the group diagnosed with AD (Table 1).

Discussion

In our study, there was no statistically significant difference concerning RDW between healthy controls and AD patients. In the literature, there are three publications examining the direct relationship between AD and RDW [12–14]. While any relationship between AD and RDW could not be found in one of these studies [12], it was stated that increased RDW increased the risk of AD in the other two studies [13, 14]. It is stated that this effect is higher, especially in non-anemic people [14].

The relationship between high RDW values and chronic systemic diseases has been known for many years [9]. In fact, patients with increased RDW have a higher mortality rate [15]. It is not known exactly how RDW increased before all these mechanisms took effects, but inflammation is

Table 1. Comparison of the sociodemographic features, and RDW values positive Alzheimer patients, and healthy control group

	Patient Group (n=49)	Control group (n=49)	p
Age (mean±SD) years	77.3±8.5	73.6±12.0	0.020
RDW (%) (mean±SD)	14.5±1.5	14.7±1.9	0.206
Gender (male), n (%)	21 (42.9)	22 (44.9)	0.839
MMSE	16 (8-23)		

MMSE: Mini-Mental State Test; Values are expressed as n±standard deviation, n (%) or n (minimum-maximum); p<0.05 was accepted as the level of statistical significance.

thought to play a big role in its development [16]. Inflammation works not only by disrupting iron metabolism, but also by suppressing erythropoietin at the molecular level and inhibiting the proliferation of erythroid progenitor cells [17].

Chemokines, cytokines and reactive oxygen particles released by activated astrocytes and microglia cause neuroinflammation in AD [18, 19]. Acute phase reactants and beta-amyloids in neurofibrillary tangles that cause neuronal damage in brain biopsies of patients with AD have been identified [18]. This finding suggests that inflammation plays an important role in the development of AD. In addition, in the geriatric population with anemia, AD is more likely [12].

Regardless of anemia, isolated elevation in RDW has also been shown to be a risk factor for AD [14]. Increased anisocytosis may increase the risk of AD by affecting blood oxygen transport potential, similar to dementia developing after infarction. However, it is not known exactly what the first trigger mechanism in the development of AD is.

Conclusion

Although we did not find a significant relationship between AD and RDW in our study, these findings should be confirmed by studies involving higher number of patients because RDW may have theoretical effects on AD and availability of studies with the results contradicting results of our study.

Ethics Committee Approval: Retrospective study.

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: M.Ü.; Design: M.Ü.; Data Collection or Processing: B.Ç.A.; Analysis or Interpretation: M.Ü.; Literature Search: B.Ç.A.; Writing: M.Ü.

Conflict of Interest: None declared.

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