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Association between Red Blood Cell Distribution Width and Retinopathy in Patients with Type 2 Diabetes: A Cross-Sectional Study

It has been proposed that inflammation and oxidative stress play a crucial role in the pathogenesis of retinopathy and vascular complications in patients with diabetes [1]. High oxidative stress and inflammation may be a potential underlying mechanism for increasing the red blood cell distribution width (RDW) level and increased RDW can be considered a predictor of diabetes complications [2]. Considering the importance of diabetic retinopathy (DR) as a debilitating disease, the present study aimed to investigate the level of RDW as an inflammatory factor among patients with type 2 diabetes without retinopathy and with non-proliferative (NPDR) and proliferative retinopathy (PDR).

A total of 103 patients with type 2 diabetes were enrolled in this cross-sectional study. All patients underwent a comprehensive ophthalmological examination and were assigned into one of the three groups of: non-retinopathy (n = 37), non-proliferative retinopathy (n = 36), and proliferative retinopathy (n = 30). The demographic and clinical characteristics of the patients (n = 103), stratified by DR phenotype, including 37 non-retinopathy, 30 PDR and 36 NPDR, are listed in Table 1.

The overall mean age and duration of diabetes among non-retinopathy patient with diabetes were significantly lower compared to both NPDR and PDR patients. On the other hand, patients without retinopathy were almost 8–9 years younger compared to those with diabetic retinopathy (Tab. 1). Moreover, patients without retinopathy had a shorter history of diabetes compared to those with retinopathy, while those with PDR had the longest duration of diabetes (Tab. 1).

Visual acuity showed a significant loss in NPDR ($p = 0.017$). It also dropped significantly to a lower degree in PDR ($p < 0.0001$) (Tab. 1). Patients with PDR had significantly higher glycated hemoglobin (HbA1c) compared to NPDR ($p = 0.009$) and non-retinopathy ($p = 0.037$) (Tab. 1, Fig. 1). Patients without retinopathy

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Table 1. Demographic and Clinical Characteristics of the Study Population

Retinopathy status	Diabetes without retinopathy	Proliferative retinopathy	Non-proliferative retinopathy	P
Gender				
Male n (%)	12 (32.4)	12 (40)	18 (50)	0.31
Female n (%)	25 (67.6)	18 (60)	18 (50)	
Age [years]	54.00 ± 9.27[a]	63.76 ± 5.97	62.25 ± 8.57	0.73
Duration of diabetes [years]	8.08 ± 5.78	20.47 ± 9.96	15.17 ± 8.69	< 0.01
Glycated hemoglobin [%]	8.64 ± 2. 21	9.55 ± 2.02	8.60 ± 2.52	0.02
Visual acuity	Right eye: 10.0 (8.1–10.0)[b]	Right eye: 6.0 (4.1–7.1)	Right eye: 8.1 (6.3–10.0)	< 0.01 (right eye)
	Left eye: 10.0 (8.1–10.0)	Left eye: 6.1 (3.8–7.3)	Left eye: 8.1 (7.1–10.0)	< 0.01 (left eye)

[a]Mean ± standard deviation (SD); [b]Median (interquartile range)

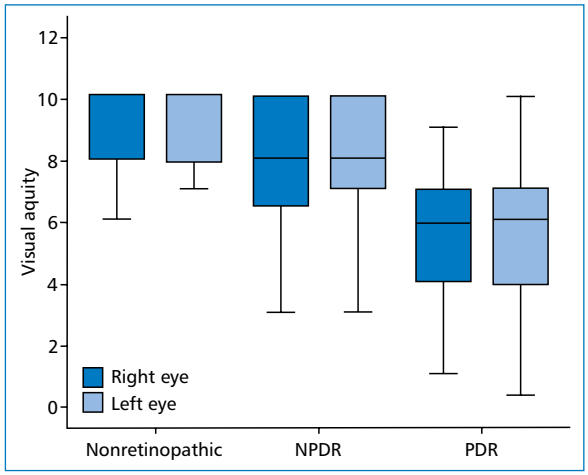

Figure 1. Visual Acuity of Non-Retinopathy, Proliferative Diabetic Retinopathy (PDR), and Non-Proliferative Diabetic Retinopathy (NPDR) Patients
The difference in visual acuity between the three groups was significant for both eyes except between the left eyes of non-retinopathy and NPDR patients

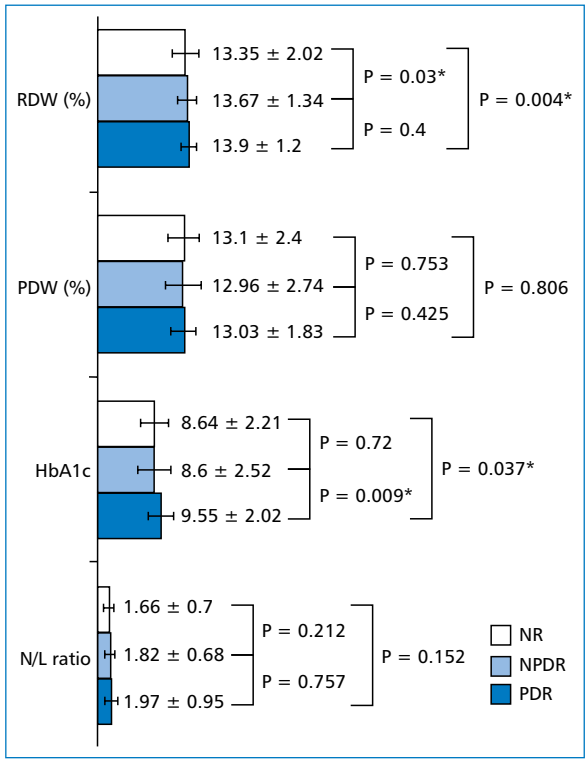

Figure 2. Comparison of Red Blood Cell Distribution Width (RDW), Platelet Distribution Width (PDW), Glycated Hemoglobin (HbA1c), and Neutrophil-to-Lymphocyte Ratio (N/L) among Patient with Diabetes without Retinopathy (NR), and with Non-Proliferative Diabetic Retinopathy (NPDR) and Proliferative Diabetic Retinopathy (PDR)
*Significant differences

had a significantly lower RDW compared to those with both NPDR (p = 0.03) and PDR (p = 0.004). However, the difference in RDW between patients with NPDR and PDR was non-significant (p = 0.4) (Fig. 2). The total platelet count in NPDR and PDR (240.11 ± 62.26 and 237.33 ± 64.97, respectively) was non-significantly lower than those without retinopathy (265.89 ± 71.93) (Fig. 1). Moreover, no significant difference was found in platelet distribution width (PDW) between the three groups (non-retinopathy: 165.89 ± 71.93; NPDR: 240.11 ± 62.26; and PDR: 237.33 ± 64.97) (Fig. 1). The neutrophil to lymphocyte ratio (NLR) also showed no significant difference among the three groups (Fig. 1).

A large body of evidence supports the association between RDW level and diabetic complications. Kurtul et al. demonstrated that RDW was significantly higher in patients with DR compared to those without [3]. However, unlike this study, no comparison was performed between patients with PDR and NPDR. In two studies conducted by Hanan et al. and Sherif et al. patients with DR had significantly higher RDW levels, compared to those in the control group and without macrovascular complications [4, 5].

In conclusion, RDW levels were higher in patients with DR compared to those without retinopathy, suggesting a possible association between RDW and DR. This study provides a valuable direction for further longitudinal studies with larger sample sizes in different populations to elucidate the possible causality relationship between RDW and DR.

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Ethics approval and consent to participate

Informed consents were obtained from the patients and the study was approved by Ethical Committee of Birjand University of Medical Sciences, Iran (ir.bums.rec.1397.302).

Conflict of interest

None declared.

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