Correlation of red cell distribution width with the parameters of severity of kidney disease in patients undergoing hemodialysis

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ABSTRACT

Introduction and Aim: The Red cell Distribution Width (RDW) is elucidated as a marker in measuring the variation of volume in erythrocytes. Many studies have revealed that RDW elevation is associated with the increased mortality risk in general population. We aimed to study the correlation of RDW with the parameters of severity of kidney disease in patients undergoing hemodialysis.

Materials and Methods: This is a retrospective observational study. By using G power statistical software with the power of 0.85, the sample size was calculated as 90. Inclusion criteria: This study was conducted from the medical records of patients of both sexes having kidney disease undergoing hemodialysis in Melmaruvathur Adhiparasakthi Institute of Medical Sciences and Research, Melmaruvathur. The records were grouped into 3 groups based on the values of Red cell distribution width. Group I with RDW values 10-13%, Group II with RDW values 13.1-15%, Group III with RDW values more than 15%. Exclusion criteria: The records of patients undergoing haemodialysis having coronary artery diseases and iron deficiency anaemia were excluded. The clinical data that were collected are red cell distribution width, hemoglobin, serum creatinine and blood urea (pre & post dialysis).

Results: Our study proves that there was no correlation between RDW values and the parameters of severity of kidney disease.

Conclusion: This study suggests that RDW levels have no correlation with the urea, creatinine and hemoglobin of patients with kidney disease under chronic hemodialysis, but it is clinically significant.

Keywords: Red cell distribution width; hemodialysis; kidney disease.

INTRODUCTION

ed cell distribution width (RDW) is used as a marker in iron-deficiency anemia. RDW routinely performed as part of complete blood count (CBC) analysis. Red cell distribution width is the coefficient of variation of red cell volume (1). It is indicated as one of the red blood cell indices in recent days (2). The normal range of RDW is 11.5-14.5 (2). Elevated red cell distribution width reveals the variability in red blood cell volume (3, 4). Moreover, red cell distribution width often used along with Mean corpuscular volume (MCV) which accurately reflects the red blood cell status of the individual. In the growing trend of diagnostic procedures, red cell distribution width have carved a niche by emerging as one of the independent prognostic factors in differential diagnosis of various types of anemia, acute and chronic cardiovascular diseases (5) including heart failure, myocardial infarction. The association of RDW levels are not only with cardiovascular diseases but also indicated to rise in community-acquired pneumonia (6). It also serves as a potential biomarker of cerebral infarction in patients on hemodialysis (7).

There are also evidences to evaluate that RDW is independently related to endothelial dysfunction in chronic kidney disease (CKD) patients (8), uremic patients (9) and kidney transplant recipients (10). In addition to these, recent studies valued it as a predictive factor for mortality in older adults in the population (11). However, the mechanisms remain unknown how elevated red cell distribution width had been associated with these diseases. Besides, there is little available data to suggest that the elevated RDW levels are associated with the severity of kidney disease in CKD patients. There are new data available to indicate that the mortality risk is high in end stage renal disease patients on hemodialysis (12, 13, 14). Therefore, we aimed to study the correlation between RDW values and the parameters of severity of kidney disease in patients undergoing hemodialysis and its association with other clinical parameters like hemoglobin values too.

MATERIALS AND METHODS

Type of study: Retrospective observational study.

Sample size: By using G power statistical software with the power of 0.85, the sample size was calculated as 90.

Inclusion criteria: After obtaining Institutional Ethical Committee Clearance, We, retrospectively analyzed the medical records of 90 patients who were on hemodialysis for kidney disease in the multi-specialty hospital, Melmaruvathur Adhiparaskthi Institute of Medical Sciences and Research for about two years from 1st January 2017 to 31st December 2018. The patients involved in this study received hemodialysis for four-five hours three times a week. The numbers of medical records of male and female patients included in this study were 66 and 24 respectively. They belong to the age group between (21 - 77 yrs). We included the following data of the above-mentioned patients from the medical records of the hospital concerned. The recorded data include Age, Gender, Date and year of undergoing hemodialysis and laboratory parameters

RDW- CV Groups	Frequency	RDW- CV Groups
10-13	23	25.6
13.1-15	46	51.1
ABOVE 15	21	23.3
Total	90	100.0

 Table 1: Frequency distribution of RDW – CV Groups

such as hemoglobin level, red cell distribution width, blood urea nitrogen and serum creatinine.

Exclusion criteria: We excluded the records of patients who were diagnosed with coronary artery diseases and iron deficiency anemia.

Data Collection

The records of the patients were grouped according to the RDW values obtained. Group I include the patients with RDW levels of 10-13%, Group II include the patients with RDW levels of 13.1-15%, Group III include the patients with RDW levels above 15%. The frequency distribution of the above mentioned RDW groups are tabulated in the Table 1. Then correlation of RDW values with parameters of severity of kidney disease like blood urea (pre & post hemodialysis), serum creatinine (pre & post hemodialysis) and hemoglobin was done by appropriate statistical method.

Statistical analysis

Mean and standard deviation for blood urea pre hemodialysis & post hemodialysis were measured respectively. Mean and standard deviation for serum creatinine pre hemodialysis & post hemodialysis were measured respectively. Mean and standard deviation for Red cell Distribution Width – Coefficient Variation (RDW – CV) Group I, II & III pre hemodialysis & post hemodialysis were also measured respectively. Then correlation of RDW values with parameters of severity of kidney disease like blood urea (pre & post hemodialysis), serum creatinine (pre & post hemodialysis) and hemoglobin was done by Pearson correlation method.

RESULTS

The records of 90 kidney disease patients on hemodialysis of age between 21-77 years with mean and standard deviation of 49.72 and 13.03 and of both

sexes, 66 males comprising 73.3% and 24 females comprising 26.7% were analyzed. Mean and standard deviation for blood urea pre hemodialysis were 85.34 and 27.17 and post hemodialysis were 23.19 and 6.99 respectively. Mean and standard deviation for serum creatinine pre hemodialysis were 8.26 and 3.12 & post hemodialysis were 2.76 and 2.19 respectively. Mean and standard deviation for RDW - CV Group I pre hemodialysis were 84.48 and 23.38 and post hemodialysis were 24.09 and 5.53, Mean and standard deviation for RDW-CV Group II pre hemodialysis were 90.22 and 31.68 & post hemodialysis were 23.61 and 7.46, Mean and standard deviation for RDW-CV Group III pre hemodialysis were 75.62 and 16.46 and post hemodialysis were 21.29 and 7.34 respectively. Then by Pearson correlation method, we correlated RDW values with blood urea (pre and post hemodialysis), serum creatinine (pre and post hemodialysis) and hemoglobin which shows no correlation (Table 2).

 Table 2: No Correlation between RDW – CV, Urea, Creatinine and Hemoglobin

		UREA PRE	UREA POST	CREATININE PRE	CREATININE POST
RDW-CV	Pearson Correlation	162	148	102	005
	P value	.127	.165	.337	.965
	Ν	90	90	90	90
HGB	Pearson Correlation	.024	126	.028	024
	P value	.824	.237	.792	.823
	N	90	90	90	90

DISCUSSION

Our study proves that there is no correlation between the RDW values and the parameters of severity in kidney disease and hemoglobin in patients undergoing hemodialysis. But there are number of studies in the literature described RDW changes in patients with impaired renal functions. Tekce et al., evaluated red cell distribution width in chronic hemodialysis patients (12). They confirmed that RDW levels are increased above the normal reference ranges in end stage renal disease patients especially in the subgroups of inflammation and malnutrition. Docci et al., was the first to confirm that there is an association between elevated RDW level in chronic kidney disease patients and healthy individuals (9). Vashista et al., incrementally correlated that increased RDW values is associated with the mortality of hemodialysis patients (15). Not only chronic kidney disease patients in hemodialysis have RDW levels in the peak as mentioned in the studies above but also acute kidney injury patients in continuous renal replacement therapy also proved to have raised RDW levels as an independent predictor of mortality (16). The study of Solak et al., was indicating the association between increased RDW and endothelial dysfunction (8).

RDW is now associated as the all-cause mortality in patients in chronic dialysis unit (14). Similarly, the authors of other studies have highlighted the fact that RDW is correlated with cardiovascular mortality too (5).

Limitations

The lesser number of subject's records in a single centre and the shorter duration of two years of observational nature of this study could be the limitations for this study.

CONCLUSION

Our study shows that there is no proven association between RDW values and blood urea, serum creatinine (parameters of severity of kidney disease) and hemoglobin in patients undergoing hemodialysis. But this is clinically significant. However, longitudinal studies are needed to observe the correlation between RDW values and the parameters of severity of kidney disease in patients undergoing hemodialysis.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this paper.

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