Journal of Society Medicine
Research & Review Articles on Diseases
Journal of Society Medicine. 2023; 2(5)

Correlation Between Depression Level and Red Blood Cell Distribution Width (RDW) and Erythrocyte Sedimentation Rate (ESR) in Chronic Kidney Disease (CKD) Patients Undergoing Regular Hemodialysis at Haji Adam Malik General Hospital Medan

Dwi Prianto[1*], Wika Hanida Lubis[2], Alwi Thamrin Nasution[3]

[1] *Departement of Internal Medicine, Faculty of Medicine University of North Sumatera*

[2] *Division of Psychosomatic, Departement of Internal Medicine, Faculty of Medicine University of North Sumatera*

[3] *Division of Nephrology and Hypertension, Departement of Internal Medicine, Faculty of Medicine University of North Sumatera*

***Corresponding Author**: Dwi Prianto, E-mail: dr.dwiprianto@gmail.com

ARTICLE INFO

Article history:
Received
2 April 2023

Accepted
31 May 2023

Manuscript ID:
JSOCMED-020423-25-3

Checked for Plagiarism: Yes

Language Editor:
Rebecca

Editor-Chief:
Prof. Aznan Lelo, PhD

ABSTRACT

Introduction: Chronic Kidney Disease are related to inflammation and stress levels therefore depression is a predictor that will increase the morbidity and mortality of patients with chronic kidney disease undergoing hemodialysis.

Method: This research is an analytical study with a cross-sectional design which carried out in Januari until February 2023, at Hemodialysis Installation of RSUP. H. Adam Malik. To analyze the correlation between the Depression Level and Red Blood Cell Distribution Width (RDW) and Erythrocyte Sedimentation Rate (ESR), the Pearson correlation test was used if the data was normally distributed. If the data is not normally distributed, Spearman's correlation test is performed. Statistical analysis using 95% confidence level ($p<0.05$).

Results: In this research, demographic characteristics of 85 patients with mean age of the patients was 49.56 years old with a standard deviation of 13.46. Based on Spearman rho test it was found that there was a significant correlation between RDW and the BDI II score with p value 0.003. The degree of correlation or r value was 0.318. This indicates that there is a weak correlation between the RDW score and the BD II score. Based on Pearson test it was found that there was a significant correlation between ESR and the BDI II score with p value 0.009. The degree of correlation or r value was 0.280. This indicates that there is a weak correlation between the ESR value and the BD II score.

Conclusion: Level of depression were found to be correlated with Red Blood Cell Distribution Width (RDW) and Erythrocyte Sedimentation Rate (ESR) in CKD patients whose undergoing regular hemodialysis.

Keywords

Depression, Red blood cell distribution width, Erythrocyte edimentation rate, Chronic kidney disease.

How to cite: Prianto D, Lubis WH, Nasution AT. Correlation Between Depression Level and Red Blood Cell Distribution Width (RDW) and Erythrocyte Sedimentation Rate (ESR) in Chronic Kidney Disease (CKD) Patients Undergoing Regular Hemodialysis at Haji Adam Malik General Hospital Medan. *Journal of Society Medicine*. 2023; 2(5): 164-169. **DOI: https://doi.org/10.47353/jsocmed.v2i5.49**

INTRODUCTION

Based on data by Centers for Disease Control (CDC) in 2007-2010, the highest prevalence of depression was in the age group 40-59 years, which was 9.45%. Data on the incidence of depression in Indonesia varies greatly and differs in each research area [1].

Disorders of Chronic Kidney Disease are related to inflammation and stress levels thus activating the Hypothalamic-Pituitary-Adrenal Axis (HPA) and autonomic nerves which will increase pro-inflammatory production [2]. Release of cytokines cell pro-inflammation will activate corticotropin releasing hormone (CRH) in the hypothalamus which will result in the secretion of adrenocorticotropic hormone (ACTH) and finally the HPA axis system will release cortisol glucocorticoids into the blood circulation [3].

Various biomarkers have been studied to assess the inflammatory process that occurs in depressed and chronic kidney disease(CKD) patients. Recently, the Red Blood Cell Distribution Width (RDW) and Erythrocyte Sedimentation Rate (ESR) values are said to be good inflammation indicators. Oxidative stress and chronic inflammation in Chronic Kidney Disease will suppress the process of erythropoiesis and shorten the life of erythrocytes, resulting in heterogeneous circulating size of erythrocytes (anisocytosis) and seen as an increase in the Red Blood Cell Distribution Width (RDW) value. Increased Erythrocyte Sedimentation Rate (ESR) was also reported in patients with depressive disorders compared to normal people. This is because it is supported by the theory that chronic inflammation plays an important role in depression pathogenesis [4].

Depression is a predictor that will increase the morbidity and mortality of patients with chronic kidney disease undergoing hemodialysis which affects the level of adherence to treatment or hemodialysis and the patient's immunity. The prevalence of depression varies from 7% to 50%. From this data, countries with mostly CKD patients suffer depression are in Europe [5].

METHOD

This research is an analytical study with a cross-sectional design which carried out in Januari until February 2023, at Hemodialysis Installation of RSUP. H. Adam Malik with the approval from Research Ethics Commission, Faculty of Medicine University of North Sumatera. Sampling by means of consecutive sampling.

Samples were chronic kidney disease patients undergoing regular hemodialysis and meets the inclusion criteria, namely men or women aged > 18 years, CKD patients undergoing regular hemodialysis, received information and gave consent to participate voluntarily and in writing (informed consent) and did not meet exclusion criteria , namely patients with impaired consciousness, previously used antidepressants, BDI-II score = 0-13, active infectious disease, autoimmune, malignancy and patients not willing to give informed consent.

Basic characteristics data of the study population are presented in graphs/tables of frequency distribution and analyzed descriptively. The Kolmogorov-Smirnov test is used to test data normality. To analyze the correlation between the Depression Level and Red Blood Cell Distribution Width (RDW) and Erythrocyte Sedimentation Rate (ESR), the Pearson correlation test was used if the data was normally distributed. If the data is not normally distributed, Spearman's correlation test is performed. Statistical analysis using 95% confidence level ($p<0.05$).

RESULT

In this research, demographic characteristics of 85 patients included in the analysis were described which 47 patients (55.3%) were male while 38 patients (44.7%) were female. The mean age of the patients was 49.56 years old with a standard deviation of 13.46. The median age was 58 years with the youngest patient was 20 years old and the oldest patient was 78 years old. Mean hemodialysis duration in all patients was 19.35 months with a standard deviation of 27.7.

Table 1. Demographic Characteristics of the Research Sample

Parameter	Total (n)
Gender (n,%)	
Male	47 (55,3%)
Female	38 (44,7%)
Age (years old)	
Mean ± Standard Deviation	49,56 ± 13,46
Median (min-max)	58 (20-78)
Hemodialysis duration (months)	
Mean ± Standard Deviation	19,35 ± 27,7
Median (min-max)	7 (1-132)

Patients were examined for RDW and ESR value as 2 haematological parameters which were included in this research. The mean RDW in all patient samples was 15.04 with a standard deviation of 1.83. The median value of the RDW is 14.8 with the minimum value was 11.9 and the maximum value was 18.8.

The depression level of the research sample was measured in this research. Depression assessment using BDI II. Scores range from 0 to 63. Interpretation of scores; 14-19 indicates mild depression, 20-28 indicates moderate depression, 29-63 indicates severe depression. In the descriptive analysis based on the patient's depression category, it was found that there were 37 patients with mild depression (43.5%). 18 patients with moderate depression (21.2%) and 30 patients with major depression (35.3%). This shows that patients with chronic kidney disease undergoing chronic hemodialysis tend to experience mild depression.

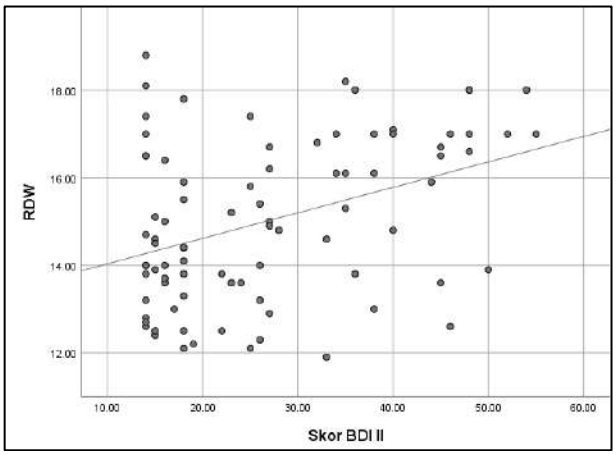

Figure 1. Scatter Plot Graph of RDW to BDI II Score

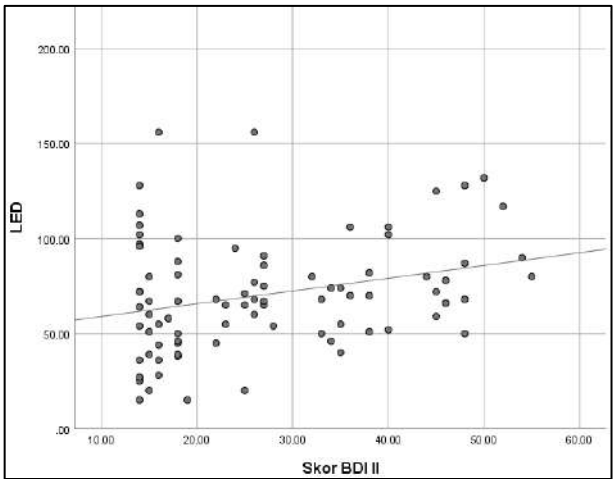

Figure 2. Scatter Plot Graph of ESR to BDI II Score.

DISCUSSION

Patients were examined for RDW and ESR value as 2 haematological parameters which were included in this research. The mean RDW in all patient samples was 15.04 with a standard deviation of 1.83. The median value of the RDW is 14.8 with the minimum value was 11.9 and the maximum value was 18.8. This is consistent with research by Tekce et al in 2014 which found that mean RDW of the entire study population was 13.2% (reference range: 12–16%).[6] The RDW is a quantitative measure of anisocytosis, is a parameter that is easy, inexpensive, and is reported routinely as part of a complete blood count. Other studies have also reported that increased RDW is associated with poor prognosis in patients with cardiovascular disease (ie heart failure, myocardial infarction and other coronary artery disease) regardless of hemoglobin value. The correlation between RDW and inflammatory markers, hs-CRP and erythrocyte sedimentation rate (ESR), suggests that

increased RDW may arise from an underlying inflammatory state that is associated with poor clinical prognosis.[7]

The mean ESR in patients was 70.02 with a standard deviation of 29.84. The median value of ESR was 68 with the minimum value was 15 and the maximum value was 156. This is consistent with Alsomaili's study in 2015 which showed an increase in ESR in patients undergoing hemodialysis with ESR value was 55.6 ± 30.4. The usefulness of measuring ESR in nephrology patients is unclear and the literature suggests that 1-17% of patients with very high ESR (>100 mm/hour) are associated with kidney disease of various etiologies.[8]

Based on Spearman rho test it was found that there was a significant correlation between RDW and the BDI II score with p value 0.003. The degree of correlation or r value was 0.318. This indicates that there is a weak correlation between the RDW score and the BD II score. Diagnostic research conducted by Demircan et al in 2016 showed an AUC value was 0.62 with a significance 0.007. This is consistent because AUC 0.62 indicates that although RDW can be used as a diagnostic parameter, its effectiveness is quite weak.[9]

In CKD patients, high RDW values are associated with increased mortality.[10] Increased RDW values can be found in inflammatory or infectious conditions due to premature release of reticulocytes into the circulation, especially in chronic conditions. Oxidative stress and chronic inflammation in chronic kidney disease will suppress the process of erythropoiesis and shorten the life of erythrocytes, resulting in heterogeneous circulating size of erythrocytes (anisocytosis) and seen as an increase in the red blood cell distribution width (RDW) value.[9]Many studies have reported a positive relationship between depression and inflammation, in which some suggest the possibility that depression is an inflammatory disease. A higher RDW value in individuals with depressive and anxiety symptoms can be used as a predictor of an increased risk of developing cardiovascular disease in patients.[11] In addition, increasing the RDW value in patients with depression is also important for clinical improvement because a high RDW is associated with an increased risk of stroke, anemia and atherosclerosis.[12]

Research by Feng shows that the red cell distribution width (RDW) is related to depressive symptoms, where the group with mild depressive symptoms is found to be higher than the group without depressive symptoms.[13] However, another study that compared individuals with depressive symptoms with those without any mental illness reported that there was no significant difference in the RDW values of the two groups. This could be due to differences in the number of study samples, thereby reducing statistics significance.[14]

Based on Pearson test it was found that there was a significant correlation between ESR and the BDI II score with p value 0.009. The degree of correlation or r value was 0.280. This indicates that there is a weak correlation between the ESR value and the BD II score. The correlation between ESR and depression has also not been studied before, but Setyaningrum et al's study found that high ESR was found in patients with anxiety disorders compared to healthy people. This is supported by the statement that chronic inflammation plays an important role in the pathophysiology of depression. Inflammation is an important body mechanism to protect from foreign bodies. This inflammatory mechanism will release various pro-inflammatory cytotoxins, namely CRP (C-Reactive Protein) and fibrinogen. Then, the increase in fibrinogen levels is then a factor that increases the erythrocyte sedimentation rate (ESR).[15]

Bathon et al concluded that the ESR value was high in these patients and there was no significant difference between pre and post hemodialysis. However, the study by Brouillard et al was not in line with Barthon et al, where Brouillard et al found that the ESR in patients undergoing hemodialysis would increase slightly. Also maili et al's study showed that as many as 79.5% of patients failed end-stage renal disease (ESRD) experienced an increase in ESR values (≥ 25 mm/hour).[8] Research by Vargas showed an increase in ESR values in smokers who experienced depression compared to non-smokers who were not depressed.[16] Chang showed that the group who had suicidal ideation had increased levels of hs-CRP and ESR compared to those who did not have suicidal ideation.[17]

The strength of this research is that it is new in terms of linking ESR and RDW to depression. This research method also uses a correlation test therefore strength of the degree of correlation can be assessed in addition to significance. Hopefully, this research can become the basis for other research in the future.

The limitation of this research is the cross-sectional research design which only allows to determine the correlations between variables and not a causal relationship. Single-center research can also be a limitation of this research. Several other important aspects for the assessment of depression such as family history, social life background, and other comorbidities were not evaluated.

CONCLUSION

Level of depression were found to be correlated with Red Blood Cell Distribution Width (RDW) and Erythrocyte Sedimentation Rate (ESR) in CKD patients whose undergoing regular hemodialysis.

DECLARATIONS

Ethics approval and consent to participate. Permission for this study was obtained from the Ethics Committee of Universitas Sumatera Utara and Haji Adam Malik General Hospital.

CONSENT FOR PUBLICATION

The Authors agree to publication in Journal of Society Medicine.

FUNDING

This research has received no external funding.

COMPETING INTERESTS

None.

AUTHORS' CONTRIBUTIONS

All authors significantly contribute to the work reported, whether in the conception, study design, execution, acquisition of data, analysis, and interpretation, or in all these areas. Contribute to drafting, revising, or critically reviewing the article. Approved the final version to be published, agreed on the journal to be submitted, and agreed to be accountable for all aspects of the work.

ACKNOWLEDGMENTS

Authors admiited contributions of colleagues and institutions therefore authors like to show gratitude to supervisors and all parties who support and contributed in this research.

REFERENCE

1. Kementerian Kesehatan RI. Infodatin (Pusat Data dan Informasi Kementerian Kesehatan RI). 2018.
2. Michopoulos V, Powers A, Gillespie C, Ressler K, Jovanovic T. Inflammation in fear and anxiety based disorders : PTSD, GAD, and beyond. Neuropsychopharmacology. 2017; 42(1): 254-270.
3. Melmed S. and Jameson L. Anterior pituitary : Physiology of pituitary hormones 'In Harrisons Principles of Internal Medicine. New York: McGraw-Hill Education. 2015.
4. Zahed N, Sharifi M, Karimi M, Nikbakht H. Impact of sertraline on serum concentration of CRP in Hemodialysis patient with depression. Journal of Renal Injury Preventation. 2017; 6(1): 65-6.
5. Palmer S, Vecchio M, Craig J, Tonelli M, Johnson D, Nicolucci A. et al. Prevalence of depression in chronic kidney disease : Systematic review and meta-analysis of observational studies. Kidney Int. 2013; 84(1): 79-91.
6. Tekce H, Kin Tekce B, Aktas G, Tanrisev M. and Sit M. The evaluation of red cell distribution width in chronic hemodialysis patients. International journal of nephrology. 2014; 1: 1.

7. McPherson R. and Pincus M. Henry's Clinical Diagnosis and Management by Laboratory Methods. Elsevier Saunders: London. 2011.
8. Alsomaili MI, Yousuf M, Hejaili F, Almotairi W, Al-Sayyari AA. Erythrocyte sedimentation rate in stable patients on chronic hemodiaysis. Saudi Journal of Kidney Diseases and Transplantation. 2015; 26(6): 1149.
9. Demircan F, Gozel N, Kilinc F, Ulu R, Atmaca M. The impact of red blood cell distribution width and neutrophil/lymphocyte ratio on the diagnosis of major depressive disorder. Neurol Ther. 2016; 5: 27-33
10. Batista-García F, Hernández M, Suria S, Esparza N, Checa MD. Diabetic foot and renal failure. Theoretical and practical considerations. Nefrologia. 2012; 32(3): 399. DOI: https://doi.org/10.3265/Nefrologia.pre2012.Feb.11385
11. Shafiee M, Tayefi M, Hassanian SM, Ghaneifar Z, Parizadeh MR, Avan A. et al. Depression and anxiety symptoms are associated with white blood cell count and red cell distribution width: A sex-stratified analysis in a population-based study. Psychoneuroendocrinology. 2017; 84: 101–108. DOI: https://doi.org/10.1016/j.psyneuen.2017.06.021
12. Wysokiński A. and Szczepocka E. Red blood cells parameters in patients with acute schizophrenia, unipolar depression and bipolar disorder. Psychiatria Danubina. 2018; 30(3): 323–330. DOI: https://doi.org/10.24869/psyd.2018.323
13. Feng J, Lu X, Li H, Wang S. High neutrophil-to-lymphocyte ratio is a significant predictor of depressive symptoms in maintenance hemodialysis patients: a cross-sectional study. BMC Psychiatry. 2022; 22(1): 1-8. DOI: https://doi.org/10.1186/s12888-022-03963-7
14. Lin Z, Lawrence WR, Huang Y, Lin Q, Gao Y. Classifying depression using blood biomarkers: A large population study. Journal of Psychiatric Research. 2021; 140: 364–372. DOI: https://doi.org/10.1016/j.jpsychires.2021.05.070
15. Setyaningrum RH, Septiawan D, Batong JP. Relationship between Anxiety Score and Erythrocyte Sedimentation Rate (ESR) in Hemodialysis Patient. Indonesian Journal of Medicine. 2020; 5(02): 109-115.
16. Vargas HO, Nunes SOV, de Castro MRP, Vargas MM, Barbosa DS, Bortolasci CC, Venugopal K, Dodd S, Berk M. Oxidative stress and inflammatory markers are associated with depression and nicotine dependence. Neuroscience Letters. 2013; 544: 136–140. DOI: https://doi.org/10.1016/j.neulet.2013.03.059
17. Chang CC, Tzeng NS, Kao YC, Yeh CB, Chang HA. The relationships of current suicidal ideation with inflammatory markers and heart rate variability in unmedicated patients with major depressive disorder. Psychiatry Research. 2017; 258: 449–456. DOI: https://doi.org/10.1016/j.psychres.2017.08.076