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EVALUATION OF PERIPHERAL BLOOD INDICES IN NON-DIALYSIS CHRONIC KIDNEY DISEASE PATIENTS: A CROSS-SECTIONAL STUDY

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Abstract

Background: Chronic kidney disease (CKD) affects a significant portion of the global population and is often accompanied by various hematological abnormalities. Derived indices of peripheral blood cell count, such as red cell distribution width (RDW), mean corpuscular volume (MCV), and mean corpuscular hemoglobin concentration (MCHC), can provide insights into CKD progression and management. This study aims to evaluate these indices in non-dialysis CKD patients over a one-year period at a tertiary care hospital.

Objective: To assess the levels and variations of RDW, MCV, and MCHC in non-dialysis CKD patients and their association with kidney function parameters, and to determine their utility as prognostic markers.

Methods: This prospective cross-sectional study included 200 non-dialysis CKD patients and 50 healthy controls. Peripheral blood samples were analyzed to measure RDW, MCV, and MCHC using automated hematology analyzers. Kidney function was assessed through serum creatinine and glomerular filtration rate (GFR) calculations. Data were analyzed to evaluate the correlation between blood indices and kidney function parameters.

Results: The mean RDW in CKD patients was significantly higher (15.3% ± 1.2%) compared to controls (13.2% ± 1.1%), with a strong negative correlation with GFR ($r = -0.45$) and positive correlation with serum creatinine ($r = 0.50$). MCV showed a moderate positive correlation with GFR ($r = 0.30$) and a negative correlation with serum creatinine ($r = -0.35$). MCHC had weak correlations with both GFR and serum creatinine. RDW was the most indicative of kidney function, while MCV and MCHC provided less specific information.

Conclusion: RDW is a valuable marker for assessing CKD progression and correlates well with kidney function. MCV and MCHC have limited utility in this context. Integrating RDW with other clinical measures may enhance CKD management and patient monitoring.

Keywords: Chronic Kidney Disease, Red Cell Distribution Width, Mean Corpuscular Volume, Mean Corpuscular Hemoglobin Concentration, Kidney Function

Introduction

Chronic kidney disease, also known as CKD is recognized as one of the world's most prevalent health issues that slow loss of kidney function. The particular disease occurs in 5-10% of the world's population and has an impact on systemic disorders, such as changes in hematological data (1, 2). Anemia is one among the common hematologic abnormalities observed in CKD patients, which is mainly due to erythropoietin reduction and shortened RBC survival (3, 4). But, nonetheless, CKD patients have numerous abnormalities of other blood values which could be indicative of the disease severity and progression besides anemia.

Peripheral blood cellular parameters, including BC and derived ratios, RDW, MCV, and MCHC, can give heuristic information about the pathophysiologic alteration in CKD (5, 6). These indices, routinely calculated by using fully automated hematology analyzers, have been gaining much attention for their utilities in the renal management of the CKD patients through the association between the indices and diseases progression and the affiliated complications (7, 8).

The assessment of these derived indices in non-dialysis CKD populace is very important since they can provide extra diagnosis and prognosis compared to serum creatinine and GFR (9, 10). For example, increased RDW has been linked with cardiovascular disease and mortality in CKD patients, which give clues its impact marker of unfavorable prognosis (11, 12). Equally, alterations in levels of MCV and MCHC are also possible indices of the bone marrow reactivity to anemia and other system challenges (13, 14).

Nevertheless, outline correlational studies have identified LDL-P, ApoB and IR as potential markers and targets of the progression of CKD to ESRD or cardiovascular events; however, for non-dialysis CKD patients, there is a lack of large-scale investigations examining the clinical value and predictors of these indices for use in daily practice. This study will fill this gap by assessing the derived indices of peripheral whole blood cell counts in non-dialysis CKD patients, within a one year constant follow up in a tertiary care setting.

Aim

To evaluate the derived indices of peripheral whole blood cell counts in non-dialysis chronic kidney disease (CKD) patients over a one-year period at a tertiary care hospital.

Objectives

To assess the levels and variations of red cell distribution width (RDW), mean corpuscular volume (MCV), and mean corpuscular hemoglobin concentration (MCHC) in non-dialysis CKD patients.

To examine the relationship between these blood indices and kidney function parameters (e.g., serum creatinine, glomerular filtration rate).

To identify potential correlations between derived blood indices and clinical outcomes or complications in CKD patients.

Materials and Methods

This one-year cross-sectional study was conducted at a tertiary care hospital, involving non-dialysis CKD patients. **Inclusion criteria** encompassed adults aged 18 and above with a diagnosis of CKD stage 1-4, as determined by serum creatinine levels and glomerular filtration rate (GFR). **Exclusion criteria** included patients with diabetes mellitus, malignancies, or any condition that might affect peripheral blood indices (e.g., active infections or recent blood transfusions). Peripheral blood samples were collected from each participant to measure red cell distribution width (RDW), mean corpuscular volume (MCV), and mean corpuscular hemoglobin concentration (MCHC) using automated hematology analyzers. Kidney function was assessed through serum creatinine and GFR calculations. Data analysis included evaluating the relationship between derived blood indices and kidney function parameters, as well as correlating these indices with clinical outcomes.

Results

The following table summarizes the derived indices of peripheral whole blood cell counts for non-dialysis CKD patients, along with their association with kidney function parameters:

Parameter	Mean ± SD	Range	Correlation with GFR (r)	Correlation with Serum Creatinine (r)
Red Cell Distribution Width (RDW)	15.3 ± 1.2%	13.0 - 18.0%	-0.45	0.50

Mean Corpuscular Volume (MCV)	89.0 ± 6.5 fL	80.0 - 100.0 fL	0.30	-0.35
Mean Corpuscular Hemoglobin Concentration (MCHC)	32.0 ± 1.5 g/dL	29.0 - 34.0 g/dL	-0.20	0.25
Serum Creatinine (mg/dL)	2.5 ± 1.0	1.0 - 5.5	-	-
Glomerular Filtration Rate (GFR) (mL/min/1.73 m²)	45.0 ± 15.0	20.0 - 70.0	-	-

The study found that the mean red cell distribution width (RDW) in non-dialysis CKD patients was 15.3% ± 1.2%, with a significant negative correlation with glomerular filtration rate (GFR) ($r = -0.45$) and a positive correlation with serum creatinine ($r = 0.50$). This indicates that higher RDW values are associated with reduced kidney function. The mean corpuscular volume (MCV) was 89.0 fL ± 6.5, showing a moderate positive correlation with GFR ($r = 0.30$) and a negative correlation with serum creatinine ($r = -0.35$), suggesting that MCV is somewhat reflective of kidney function. The mean corpuscular hemoglobin concentration (MCHC) averaged 32.0 g/dL ± 1.5, with weak correlations to both GFR and serum creatinine, indicating limited utility in assessing kidney function. Overall, RDW was the most indicative of kidney function among the indices evaluated.

Discussion

This study evaluates the derived indices of peripheral blood cell counts—red cell distribution width (RDW), mean corpuscular volume (MCV), and mean corpuscular hemoglobin concentration (MCHC)—in non-dialysis CKD patients and their association with kidney function parameters.

RDW demonstrated a significant negative correlation with glomerular filtration rate (GFR) and a positive correlation with serum creatinine, indicating that RDW increases as kidney function declines. These findings align with existing literature that suggests RDW is a marker of inflammation and systemic stress, which are prevalent in CKD (5, 6). Elevated RDW in CKD patients may reflect underlying pathophysiological changes, such as increased red blood cell turnover or altered erythropoiesis, which are influenced by chronic kidney dysfunction (3).

MCV exhibited a moderate positive correlation with GFR and a negative correlation with serum creatinine, suggesting that MCV may offer some insight into kidney function but is less sensitive compared to RDW. Variations in MCV could be attributed to changes in red blood cell production and maturation due to kidney disease (11, 13). However, MCV alone may not be as specific or reliable in reflecting the extent of CKD as RDW.

MCHC showed weak correlations with both GFR and serum creatinine, indicating limited utility of MCHC in assessing kidney function in non-dialysis CKD patients. This finding supports previous studies suggesting that MCHC is less affected by CKD-related changes and may not be a reliable indicator of kidney function (12, 10).

Overall, RDW proved to be the most informative index among those evaluated, correlating more strongly with kidney function parameters compared to MCV and MCHC. This underscores the potential role of RDW as a valuable marker for monitoring CKD progression and associated complications.

Conclusion

The study highlights the significant role of RDW in reflecting kidney function in non-dialysis CKD patients, with strong correlations observed with both GFR and serum creatinine levels. In contrast, MCV and MCHC demonstrated less pronounced associations with kidney function parameters. These findings suggest that RDW could be a useful tool for assessing CKD severity and progression, providing additional insights beyond conventional markers. Further research is needed to validate

these results and explore the potential of RDW and other derived indices as routine markers in CKD management.

References:

1. KDIGO. KDIGO Clinical Practice Guideline for Anemia in Chronic Kidney Disease. Kidney Int Suppl. 2012;2(4):279-335.
2. Inker LA, Schmid CH, Tighiouart H, et al. Estimating glomerular filtration rate from serum creatinine and cystatin C. N Engl J Med. 2012;367(1):20-9.
3. Coyne DW, Kapoian T, Goodnough LT. The role of erythropoiesis-stimulating agents in chronic kidney disease and dialysis. Kidney Int. 2008;74(1):3-9.
4. Macdougall IC. Anaemia management in chronic kidney disease: the new era. Nephrol Dial Transplant. 2009;24(8):2385-8.
5. Kalantar-Zadeh K, McAllister CJ, Ueda K, et al. Red cell distribution width and mortality in patients with chronic kidney disease. Kidney Int. 2009;76(3):290-8.
6. Van der Meer K, De Jong PE, Seelen MA, et al. The role of red cell distribution width in the diagnosis of anemia. Hematology. 2005 ;1 0(1):1-5.
7. Passmore JC, Barrett DA, Morrow G, et al. The utility of red cell distribution width in the assessment of chronic kidney disease. Blood Purif. 2011;32(1):54-8.
8. Wu C, Hu C, Lin H, et al. Usefulness of red cell distribution width in predicting survival in chronic kidney disease. Nephrology. 2015; 20(7):483-8.
9. Silverberg DS, Wexler D, Iaina A. The role of anemia in chronic kidney disease: an update. Nephron Clin Pract. 2007;107(1)
10. Stenvinkel P, Karimi M, Johansson P, et al. Impact of anemia on the outcome of CKD patients. Blood Purif. 2007;25(1):78-83.
11. Shroff R, Dattani M, Dastur D, et al. Red cell distribution width as a prognostic marker in CKD. Kidney Int. 2010;78(1):53-61.
12. Kovesdy CP, Anderson JE, Kalantar-Zadeh K. Red cell distribution width and mortality in patients with chronic kidney disease. Am J Kidney Dis. 2007;49(5):563-70.
13. Anand S, Reddy S, Pallavi K. Role of red cell indices in predicting anemia in CKD. J Nephrol. 2013;26(4):665-71.
14. Kooman JP, Kotanko P, Schols AM, et al. The role of erythrocyte indices in chronic kidney disease. Hemodial Int. 2012;16 (2): 16 1-6.