

**Original Research Article** 

# COMPLETE BLOOD COUNT ANALYSIS IN CKD PATIENTS ON HEMODIALYSIS: A CASE CONTROL STUDY FROM MIMSR MEDICAL COLLEGE, LATUR, MAHARASHTRA

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## ABSTRACT

**Background:** Chronic kidney disease (CKD) defined as either damage or decreased kidney functions for 3 or more months and is a pathophysiologic process associated with abnormal kidney functions and progressive decline in glomerular filtration rate (GFR). Among the renal replacement therapy HD is the most convenient modality after renal transplantation. Frequency of HD cycles differ among individual patients but 3 cycles per week lasting for 3-5 hrs are usual requirement. HD cycle frequencies, duration, adequacy and complications usually monitored and ensured by different laboratory tests.

**Materials and Methods:** This prospective cross-sectional case control study was conducted in hemodialysis unit of MIMSR Medical College, Latur, Maharashtra, between April 2024 and March 2025.

**Results:** The difference in RBC Count, Haemoglobin, MCV, MCH and HCT values was highly significant and lower in CKD patients on HD patients than control groups. MCHC, RDWCV and PDW found no significant difference between CKD patients on HD patients and control groups. Platelet count and MPV significantly dropped in CKD-HD patients.

**Conclusion:** This study concluded anemia is most common finding in CKD patient on hemodialysis along with changes in TLC and differential leukocyte count. This study also showed that drop in platelet count along with MPV. **Keyword:** Blood Count Analysis, CKD, Hemodialysis.

## **INTRODUCTION**

Chronic kidney disease (CKD) defined as either damage or decreased kidney functions for 3 or more months and is a pathophysiologic process associated with abnormal kidney functions and progressive decline in glomerular filtration rate (GFR).<sup>[1]</sup> Increasing prevalence, morbidity and mortality of chronic kidney diseases is an important public health concern globally as well as in India. Significant CKD burden in India attributed to the increasing prevalence of diabetes, hypertension, obesity and ischemic heart disease. True burden of CKD in India is not known as there is no easy availability of dedicated centers for kidney care, lack of easy access to renal replacement therapy and of a registry.  $\overline{[2,3,4]}$ absence multi-systemic involvement in CKD includes hematological manifestations anemia, thrombocytopenia, are leucopenia, bleeding diathesis, splenomegaly, hypersplenism, shortened RBC life span, hemoglobinopathies, and hypocellular bone narrow. Deranged hematological parameters like hemoglobin concentration, red blood cell (RBC) count, red blood cell indices, leukocyte count, and platelet count used as marker in the effective treatment of these hematological manifestations in the management of CKD and hemodialysis patients.<sup>[5,6]</sup> Among the renal replacement therapy HD is the most convenient modality after renal transplantation. 2 Frequency of HD cycles differ among individual patients but 3 cycles per week lasting for 3-5 hrs are usual requirement. HD cycle frequencies, duration, adequacy and complications usually monitored and ensured by different laboratory tests.<sup>[7]</sup>

Present study designed to know the most hematological changes in CKD patients undergoing HD.

## **MATERIALS AND METHODS**

This prospective cross-sectional case control study was conducted in hemodialysis unit of MIMSR Medical College, Latur, Maharashtra, between April 2024 and March 2025. Study was presented and approved by Institutional Ethics Committee. Two hundred participants were enrolled in the study. Hundred patients with CKD on HD (CKD-HD) and hundred healthy controls matching for age and sex were selected. All the demographic details and clinical data collected from patient compiled in excel sheet. Informed consent was obtained from all study patients before enrollment. After obtaining informed consent of the patient, with all necessary aseptic precaution blood sample was collected by puncturing suitable vein. Complete blood picture with peripheral smear examination was done by drawing 3ml of blood via venipuncture into EDTA containing tube and processed. All hematological parameters including red Blood Cell count (RBC), Red blood cell indices - mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC) hemoglobin concentration, total white blood cells (WBC), neutrophils, lymphocytes, packed cell volume (PCV),Red cell Distribution width(RDW), platelet count and platelet indices (PDW-Platelet distribution width, MPV-Mean platelet volume) were estimated by using Nihon Kohden(Celltrack  $\alpha$ +) automatic analyzer.



Figure 1: Automated Cell Counter

#### Statistical analysis

Data was collected by using a structure proforma. Data thus was entered in MS excel sheet and analyzed by using SPSS 24.0 version IBM USA. Qualitative data was expressed in terms of percentages and proportions. Quantitative data was expressed in terms of Mean and Standard deviation. Association between two qualitative variables was seen by using Chi square/ Fischer's exact test. Comparison of mean and SD between two groups will be done by using unpaired t test to assess whether the mean difference between groups is significant or not. Descriptive statistics of each variable was presented in terms of Mean, standard deviation, standard error of mean. A p value of <0.05 was considered as statistically significant whereas a p value <0.001 was considered as highly significant.

## RESULTS

Overall age and gender was compared in study and details described in table 1 and Table 2. Age of the study participants comparable but gender difference was significant with male preponderance.

Table 1: Age distribution of study participants							
		Cases		Controls		Tatal	_
		No	%	No	%	Total	р
Age group in years	<20	5	5.0	1	1.0	6	0.55, Not significant
	21-30	19	19.0	18	18.0	37	
	31-40	17	17.0	24	24.0	41	
	41-50	19	19.0	19	19.0	38	
	51-60	19	19.0	19	19.0	38	
	>60	21	21.0	19	19.0	40	
Total		100	100.0	100	100.0	200	

### Table 2: Gender distribution of study participants

		Cases		Controls		Tatal	
		No	%	No	%	Total	Р
Gender	Male	73	73.0	59	59.0	132	
	Female	27	27.0	41	41.0	68	0.037, Significant
Total		100	100.0	100	100.0	200	_

Table 3 and Table 4 show results of statistical analysis of hematological parameters in CKD-HD group and healthy controls. There was not significant decline in TLC but percentage lymphocyte count declined significantly (in CKD-HD group. Differential granulocyte and monocyte count values were higher in CKD-HD groups than controls but not significantly raised. Almost all patients (99%) were suffering with anemia and 31%, 64% and 4% patients suffering from severe, moderate and mild anemia respectively. The difference in RBC Count, Haemoglobin, MCV, MCH and HCT values was highly significant and lower in CKD patients on HD patients than control groups. MCHC, RDWCV and PDW found no significant difference between CKD patients on HD patients and control groups. Platelet count and MPV significantly dropped in CKD-HD patients.

Table 3: Hematological parameters between CKD patients on HD and healthy controls							
Gro	up	Ν	Mean	Std. Deviation	t	р	Inference
TLC -	Cases	100	7048.80	2360.76	-1.668	0.097	Not significant
	Controls	100	7547.50	1835.92		(>0.05)	
Granulocyte	Cases	99	72.92	11.91	1.562	0.120	Not significant
	Controls	100	70.24	12.22		(>0.05)	
Lymphocyte	Cases	100	21.19	9.87	-2.171	0.031	Cian (Canad
	Controls	100	24.50	11.62		(<0.05)	Significant
Managerta	Cases	100	4.91	3.28	1.70(	0.074	Not significant
Monocyte	Controls	100	4.20	2.17	1.790	(>0.05)	
RBC Count	Cases	100	3.01	0.58	-17.994	0.0001	Highly significant
	Controls	100	4.71	0.75		(<0.01)	
Haemoglobin	Cases	100	8.05	1.59	-23.582	0.0001	Highly significant
	Controls	99	13.40	1.61		(<0.01)	
MCV	Cases	100	81.55	7.13	-2.681	0.008	Highly significant
MCV	Controls	100	85.29	12.00		(<0.01)	
MCII	Cases	100	26.92	2.53	-3.946	0.0001	Highly significant
мсп	Controls	100	28.64	3.55		(<0.01)	
MCHC	Cases	100	32.77	2.00	-0.973	0.332	Not significant
MCIIC	Controls	100	33.08	2.42		(>0.05)	
UCT	Cases	100	24.65	4.79	22.051	0.0001	Highly significant
пст	Controls	100	40.13	5.13	-22.031	(<0.01)	Fighty significant
RDWCV	Cases	99	16.91	16.82	1.254	0.211	Not significant
	Controls	100	14.79	1.59	1.234	(>0.05)	
Platelet	Cases	100	203.30	71.72	-4.597	0.0001	Highly significant
	Controls	100	254.40	84.92		(<0.01)	
MPV	Cases	100	6.50	1.76	7.079	0.0001	Highly significant
	Controls	100	8.12	1.01	-/.9/8	(<0.01)	
PDW	Cases	100	17.90	1.69	0.902	0.373	Not significant
	Controls	100	19.23	14.76	-0.893	(>0.05)	

Table 4: Severity of anemia in CKD patients on HD

Haamaglahin loval (gm9/)	CKD patients on HD				
Haemoglobin level (gill 76)	No	%			
<7 (severe)	31	31.0			
7 to 11(moderate)	64	64.0			
11 to 13(mild)	4	4.0			
>13 No Anemia	1	1.0			
Total	100	100%			

### DISCUSSION

This study tested the hematological parameters in CKD patients on HD. When compared with age matched individuals a highly significant decline in RBCs. hemoglobin, MCV, MCH and hematocrit/PCV values found in CKD group compared to the healthy control. A cross-sectional descriptive, prospective study by Mohammad N. Khan et al. conclude that as per WHO guidelines for anemia almost all of patients with CKD undergoing HD were suffering from anemia with lower Hb and hematocrit value.<sup>[8]</sup> These results are in agreement with results obtained by Modi D et al,<sup>[5]</sup> Lakshmi Latchupatula et al,<sup>[6]</sup> Gautam Panduranga et al,<sup>[9]</sup> Dr. Shreesh Kadur JM, et al,<sup>[10]</sup> Arjun Chakravarti et al,<sup>[11]</sup> Akanksha H et al,<sup>[12]</sup> shows anemia was most common hematological change in CKD patients undergoing HD and is due to less erythropoietin released from peritubular cells of kidney in CKD patients. Though the major cause of anemia in CKD patients remains insufficiency of erythropoietin, factors such as increased hemolysis, of bone marrow suppression, hematuria and gastrointestinal blood loss also contributes in it.<sup>[13]</sup>

Decline in TLC was not significant, within normal range and finding was in line with work by Gautam Panduranga et al,<sup>[9]</sup> Mega Kahdina et al.<sup>[14]</sup> Percentage lymphocyte count was decreased significantly in CKD-HD group than healthy controls and this finding is in agreement with results by Humudat Y et al,<sup>[15]</sup> Akanksha H et al.<sup>[12]</sup> The mean values of percentage granulocyte and monocyte are on higher side in CKD-HD group than healthy controls but not significantly raised and this finding in agreement with Modi D et al5. An increased neutrophil count and reduced lymphocyte count are independent predictors of increased mortality risk in haemodialysis patients.<sup>[13]</sup>

Lastly, we observed significant drop in mean platelet count and MPV in CKD-HD group but within reference range and these findings were in line with Alshabrawy. M. Abdelnabi et al,<sup>[16]</sup> Arjun Chakravarti et al,<sup>[11]</sup> Ertugrul Erken et el. showed stage 3-5 CKD patients with lower MPV associated with lower mean eGFR and inversely correlated with serum CRP levels.<sup>[17]</sup> The low platelet count in hemodialysis patients may be because of decreased production and increased destruction due to anticoagulant drugs used in clinical settings (eg. Heparin).<sup>[18]</sup>

## CONCLUSION

This study concluded anemia is most common finding in CKD patient on hemodialysis along with changes in TLC and differential leukocyte count. This study also showed that drop in platelet count along with MPV. This warrants periodic checkup of hematological parameters like Hemoglobin, RBC indices, TLC, differential leukocyte count, platelet counts and platelet indices to reduce and prevent the risk of cardiovascular morbidity and mortality related with anemia and platelet abnormality.

#### REFERENCES

- Dr. Lipica Sinha, Dr. Ina Shah and Dr. Hansa M Goswami, Dr. Dhruv Parmar and Dr. Aarti Parel. Study of the hematological parameters in chronic kidney disease patients in a tertiary care centre. International Journal of Clinical and Diagnostic Pathology 2024; 7(4): 17-21.
- Santosh Varughese, Georgi Abraham. Chronic Kidney Disease in India. Clin J Am Soc Nephrol 13: 802–804, 2018. doi: https://doi.org/10.2215/CJN.09180817
- Nipun ShresthaID, Sanju Gautam, Shiva Raj Mishra, Salim S. Virani4, Raja Ram Dhungana. Burden of chronic kidney disease in the general population and high-risk groups in South Asia: A systematic review and metaanalysis. PLOS ONE. https://doi.org/10.1371/journal.pone.0258494 October 14, 2021
- Y. J. Anupama, G. Uma. Prevalence of chronic kidney disease among adults in a rural community in South India: Results from the kidney disease screening (KIDS) project. Indian Journal of Nephrology. July 2014;24(4):214-221
- Modi D, Modi J, Chaudhary P, Dinkar S. Evaluation of hematological parameters and hemodialysis outcomes in patients with chronic kidney disease from north Gujarat: A prospective study. Tropical Journal of Pathology and Microbiology. 2021;7(5):266-271
- 6. Lakshmi Latchupatula, Shreni Vipparthi, P.R.D. Ganesh Basina. A study of hematological profile in patients with chronic kidney failure in southern india. International

Journal of Medicine and Public Health. Jan-Mar 2024;14(1):83-88

- Claudia Chidiac, Dania Chelala, Dany Nassar, Chadia Beaini, Hiba Azar, Serge Finianos, et al. Routine laboratory testing in hemodialysis: how frequently is it needed? BMC Nephrology.2022; 23:344
- Mohammad N. Khan, Abozer Elderdery. Journal of Hematology. Jan 2018;7(1):1-6.
- Gautam Panduranga, Ugendhar Perla. Study of hematological profile in patients with chronic kidney disease. International Journal of Advances in Medicine. 2020 Jan;7(1):11-16.
- Dr. Shreesh Kadur JM and Dr. Sharvani S. A study of hematological profile in CKD patients who are undergoing hemodialysis in a tertiary health care institute. International Journal of Clinical and Diagnostic Pathology 2021; 4(2): 20-23.
- Arjun Chakravarti, Archana Ukey, Preeti Bajaj,Pradnya Saragade. A Study of Hematological Profile in Patients of Chronic Renal Failure Undergoing Hemodialysis at a Tertiary Health Care Institute. MVP Journal of Medical Sciences. July-December 2017;4(2):107–112.
- Akanksha H, Usha M, Rashmi K, Clement Wilfred D. Uncovering the Links Between Hematological and Biochemical Parameters in Chronic Kidney Disease: A Case-Control Study. International Journal of Health Sciences and Research. October 2023;13(10):377-383.
- Dr. Pradhiksha Dasaprakash, Dr. Shivashekar Ganapathy and Dr.Veena Raja.Effects of haemodialysis on Hemoglobin and red cell indices in chronic kidney disease patients at a tertiary health care institute. International Journal of Clinical and Diagnostic Pathology. 2019;2(1):96-100.
- Mega Kahdina, Nunuk Mardiana, Dyah Fauziah. Levels of Hemoglobin, Leukocytes, and Platelets of Chronic Kidney Disease Patients Undergoing Hemodialysis in Surabaya. Biomolecular and Health Science Journal.2018;01(01):29-33.
- 15. Humudat, Y. Assessment of the impact of anemia on hematological parameters among hemodialysis patients with chronic kidney disease. Revis Bionatura 2023;8 (1)32. http://dx.doi.org/10.21931/RB/2023.08.01.32
- Alshabrawy M. Abdelnabi, Emam Mohamed Mohamed Ismaeyl, Ahmed Mohamed Mohamed Abdellatif. Hematological Indices in Chronic Kidney Disease Patients and The Effect of Hemodialysis on These Indices. The Egyptian Journal of Hospital Medicine. October 2021;85 (2):4257-4262.
- Ertugrul Erken, Cansu Ulgen, Feyza Nur Sarisik, Neziha Erken, Ozkan Gungor and Orcun Altunoren. Hematological Parameters and Clinical Features in Patients with Advanced Chronic Kidney Disease. Yonago Acta Medica 2020;63(4):353–359 doi: 10.33160/yam.2020.11.008
- Ruchi Khadayate, Piyush Sahu, Shilpi Sahu, Siddhi Karale. Study of Hematological Profile in Chronic Renal Failure Patients on Hemodialysis in a Tertiary Care Hospital. International Journal of Health Sciences and Research. December 2020;10(12):1-7.