International Journal of Clinical and Diagnostic Pathology

ISSN (P): 2617-7226
ISSN (E): 2617-7234
www.patholjournal.com
2021; 4(2): 20-23
Received: 16-02-2021
Accepted: 18-03-2021

Dr. Shreesh Kadur J M
Orthopedic Surgeon,
Sky Superspeciality Hospital,
Iritty, Kannur, Kerala, India

Dr. Sharvani S
Senior Resident,
Kodagu Institute of
Medical Sciences, Madikeri,
Karnataka, India

Corresponding Author:
Dr. Sharvani S
Senior Resident,
Kodagu Institute of
Medical Sciences, Madikeri,
Karnataka, India

A study of hematological profile in CKD patients who are undergoing hemodialysis in a tertiary health care institute

Dr. Shreesh Kadur JM and Dr. Sharvani S

DOI: https://doi.org/10.33545/pathol.2021.v4.i2a.352

Abstract
Chronic kidney disease is a major cause of morbidity and mortality in developing countries. These patients tend to have various hematological abnormalities especially anemia which needs prompt treatment. A cross sectional observational study was conducted to study various hematological abnormalities commonly found in chronic kidney disease patients who were undergoing hemodialysis for a minimum period of three months. The principal finding in this study was prevalence of anemia in all the patients studied. There was presence of significant number of abnormal cells in the peripheral smear like Burr cells, Macroovalocytes and fragmented RBCs. However white blood cell count, Platelet count, Bleeding time and Clotting time were within normal limits. With this study we could conclude that anemia is a major comorbidity in hemodialysis patients, which require detailed evaluation and management.

Keywords: chronic kidney disease, hematological abnormality, anemia, hemodialysis

1. Introduction
Chronic kidney disease (CKD) and End stage renal failure(ESRD) are major health problem in the world, including India. The disease affects almost 10% of the general population and affects 50% of the high risk population who suffer from non communicable diseases like hypertension and diabetes mellitus [1]. It is estimated that the number of patients undergoing hemodialysis increases by 10-20% each year [2].
KDIGO (Kidney disease improving global outcome) 2012 guidelines define CKD as abnormalities of kidney structure or function, present for 3 months, with implications for health. CKD is classified on the basis of cause, GFR category, and albuminuria category (CGA). On the basis of GFR, CKD have been categorized into total of 5 stages [3].
KDIGO guidelines define anemia in CKD as Hb concentration is o13.0 g/dl (or 130 g/l) in males and o12.0 g/dl (or 120 g/l) in females [3]. The major cause of anemia is decreased production of erythropoietin by the damaged peritubular cells of kidney [4].
CKD patients are also prone to bleeding because of dysfunctional platelets and also defects in platelet aggregation [5]. Uremic patients may also have decrease in white blood cell count.
Albumin globulin ratio is said to have significant association in prediction of development of CKD and also has prognostic significance [6]. This study was conducted to know various haematological abnormalities observed in CKD patients undergoing hemodialysis.

2. Materials and Methods
The study was conducted in the hemodialysis unit in district hospital, in a rural district of Karnataka. Study was designed on cross-sectional basis. A total of 70 cases of age >18 years were studied. All of the patients were undergoing hemodialysis at least 3 months prior to the commencement of study. Any acute illness and chronic hematological health condition were excluded in the study patients.
The CBC of each patient was done on a 5-part Neon Kohden Hematology analyzer. Peripheral blood smears were made and stained with Leishman stain, and examined for RBC, WBC and platelet morphology.
The bleeding time of each patient was recorded by giving a 5mm deep puncture on the fingertip and pressure applied on a blotting paper.

The time taken for bleeding to stop was taken as bleeding time. At the same time blood is aspirated into a thin capillary tube followed by intermittent tilting of tube. Clotting time was estimated as the time taken for the blood to stop flowing.

3. Results

3.1 Age and sex

The total number of patients included in study was 70. Patients included in the age group between 22-85 years. Mean age of study population was 52.68+/- 15.08 years. 2.85% of the study patients were male and 27.15% were female.

3.2 Dialysis details and comorbidities

The average duration of patients undergoing hemodialysis is 17.5 months. Blood urea levels of patients were in the range of 37-219mg/dl with mean value of 113.35+/- 35.26 mg/dl. Serum creatinine ranged from 20.8-4.2 mg/dl with mean of 9.32+/- 3.12 mg/dl. 82.85% of study population had Hypertension and 60% patients had Diabetes mellitus. 52.85% patients had diabetic nephropathy, 25.7% patients had chronic glomerulonephritis, 15.7% had interstitial nephritis and about 5% patients had other causes like obstructive uropathy or nonpiable kidney (Figure 1).

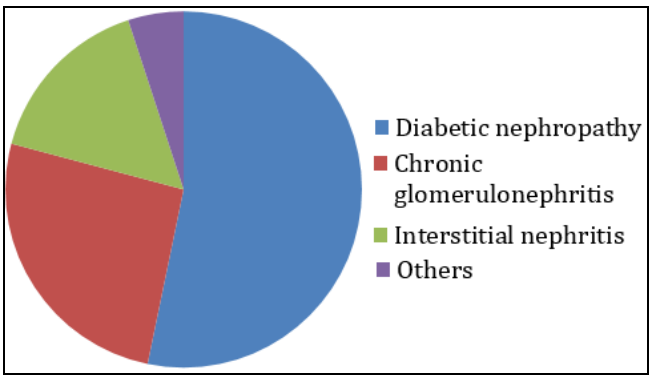

Fig 1: Pie chart showing frequency of CKD causes

3.3 Anemia

Anemia as defined by WHO criteria [7] was present in 100% of study population. Mean hemoglobin percentage in study population was 8.46+/-1.70 gm%. For tabulation hemoglobin of less than 7gm % was considered severe, 7-11 gm % was considered moderate and more than 11gm % as mild anemia. 30% patients had mild anemia, 34.29% had moderate anemia and 35.71% patients had severe anemia. With the increase in duration of dialysis there was an increase in severity of anemia (Table 1).

Table 1: Duration of dialysis X Severity of anemia

Duration of hemodialysis X Hb	3-12 months		13-24 months		≥25 months		Total	
	No	%	No	%	No	%	No	%
< 7 gm%	2	12.4	18	37.5	5	83.3	25	35.71
7.1- 11 gm%	3	18.8	20	41.7	1	16.7	24	34.29
>11 gm%	11	68.8	10	20.8	0	0	21	30.0
Total	16	100	48	100	6	100	70	100

3.4 Peripheral smear

Peripheral smear examination done in all patients showed Normocytic normochromic RBCs in 68.57% of patients, 18.57% had dimorphic cells. Microcytic hypochromic cells were found in 11.43% patients while 1.43% patients had macrocytes (Table 2). Smear examination also showed presence of few abnormal cells like Burr cells in 14.28%, Macroovalocytes in 11.44% patients and Fragmented RBCs in 5.71% patients (Table 3).

Table 2: Prevalence of various types of Anemia

Anemia based on morphology	Females(19)		Males(51)		Total	
	No	%	No	%	No	%
Normocytic normochromic	12	63.16	36	70.59	48	68.57
Microcytic hypochromic	3	15.79	5	9.81	8	11.43
Macrocytic	0	0	1	1.96	1	1.43
Dimorphic	4	21.05	9	17.64	13	18.57
Total	19	100	51	100	70	100

Table 3: Prevalence of various types of abnormal cells as seen in peripheral smear

Abnormal RBC	Females(19)		Males(51)		Total	
	No	%	No	%	No	%
Normocytic normochromic	12	17.14	36	51.43	48	68.57
Fragmented RBC	2	10.53	2	3.92	4	5.71
Burr cells	2	10.53	8	15.69	10	14.28
Macroovalocytes	3	15.78	5	9.8	8	11.44
Total	19	100	51	100	70	100

3.5 WBC

The mean WBC count was 6132+/- 2126.5 cells/Cumm. 14.3% patients had leukopenia and 4.28% patients had leucocytosis. Neutrophils were predominant in patients who had leucocytosis.

3.6 Platelets with bleeding and clotting time

The mean platelet count in study population was 2.47+/-0.94 lakh/cumm. Mean bleeding time was 4.27+/- 1.32 minutes and mean clotting time was 8.85+/-1.17 minutes. Only 1.42% of study population had prolonged bleeding time.

4. Discussion

Mean age of patients included in this study is 52.68+/- 15.08 years. This was similar to those studies like Chinwuba *et al*. [8] and MN Islam *et al*. [9]. Our study had majority of male patients that is 72.85%, as also in studies like Chinwuba *et al*. [8], MN Islam *et al*. [9] Arun S *et al*. [10] and Bhattacharjee K *et al*. [11]. In the study group included 82.85% patients were hypertensive. Similarly a study by Chakravarthi *et al*. [12] had 95.6% hypertensive patients and similar results in studies by Bhatta S *et al*. [13], and George SV *et al*. [14]. Diabetic nephropathy constituted major etiology of CKD (52.85%) in our study which is similar to the study by Chakravarthi *et al*. [12]. However study by Chinwuba *et al*. [8] showed prevalence of diabetes in only 15.1% of study population. Study by Chinwuba *et al*. [8] also had 37% of study patients with chronic glomerulonephritis which is similar to our study which had 25.7% of chronic glomerulonephritis cases.

Anemia in CKD is predominantly because of reduced production of erythropoietin by damaged peritubular cell which is mainly normocytic normochromic type. With progression of disease because of reduced dietary intake and repeated dialysis patients might develop other nutritional deficiencies. This leads to microcytic hypochromic, macrocytic and dimorphic anemia. The mean hemoglobin level in our study was 8.46+/-1.70 gm %. In a study by Chakravarthi *et al*. [12] mean hemoglobin level was 7.39 gm% as in studies by Bhattacharjee K *et al*. [11]. Bhatta S *et al*. [13], Barde R *et al*. [15] and Hakim *et al*. [16]. Our study had 68.57% patients having normochromic normochromic anemia which is similar to ones in studies by Mudiyammanavara NR, *et al*. [17] and George SV *et al*. [14]. But a study by Talwar *et al*. [18] showed more prevalence of microcytic hypochromic cells of about 60% compared to our study which had 11.43% prevalence of microcytic hypochromic anemia. CKD patients will have some abnormal cells on peripheral smear examination. Patients with severe uraemia will have Burr cells [19]. Fragmented RBCs are common with hemolysis, which could be because of decreased enzyme activity in RBC membrane, reduced RBC survival and also toxins used in the dialysate like copper, nitrates and formaldehyde [19, 20]. Our study showed around 10% of Burr cells and 10% fragmented RBCs similar to study by A Chakravarthi *et al*. [12].

Mean WBC count was 6160+/- 2152.42/cumm which was within normal range. Results of this were similar to studies conducted by Chakravarthi *et al*. [12]. CKD patients tend to have higher incidence of infection compared to general population. Our study showed presence of neutrophilic leucocytosis in 11.42% patients. A similar observation was also seen in studies conducted by George SV *et al*. [14] and Rathod SG [21]. CKD patients are prone to bleeding because of paltelet abnormalities and functional defect. Mean platelet count was within normal limits in our study. However study done by Gafter U *et al*. [22] and Dorgalaleh *et al*. [23] had significantly reduced platelet count and few other studies have also shown platelet dysfunction in ESRD patients [24, 25]. The mean bleeding and clotting time in our study population were normal, similar to study by Chakravarthi *et al*. [12]. However study by Butt M *et al* () found increased bleeding time in 33% of patients on hemodialysis.

5. Conclusion

In this study 100% of CKD patients undergoing hemodialysis had anemia. Anemia seen in study population was predominantly normocytic normochromic type. Peripheral smear examination showing abnormal cells like fragmented RBCs suggest hemolysis as contributory factor for anemia other than EPO deficiency. The higher incidence of secondary infections is suggested by neutrophilic leucocytosis. Platelet count was within normal limits also bleeding time and clotting time. However these parameters were abnormal in other studies conducted. It can be concluded that it is necessary to monitor the haematological parameters in dialysis patients to initiate early treatment and to improve the outcome.

6. Statement of consent: Informed written consent was obtained from all subjects in the study to publish data for educational purpose.

7. Conflict of Intrest: None

8. Acknowledgements: Dr Lokesh A J, HOD Department of General medicine, Kodagu institute of medical sciences, Madikeri.

9. Reference

1. Nitta K, Okada K, Yanai M, Takahashi S. Aging and chronic kidney disease. Kidney and Blood Pressure Research 2013;38(1):109-20.
2. Jha V. Current status of end-stage renal disease care in India and Pakistan. Kidney International Supplements 2013;3(2):157-60.
3. Kidney international supplements, KDIGO 2012 Clinical Practise guidelines for evaluation and management of Chronic Kidney Disease. Official Journal of the international Society of Nephrology 2013, 3(1).
4. McGonigle RJ, Wallin JD, Shadduck RK, Fisher JW. Erythropoietin deficiency and inhibition of erythropoiesis in renal insufficiency. Kidney international 1984;25(2):437-44.
5. Hassanein AA, McNicol GP, Douglas AS. Relationships between platelet function tests in normal and uraemic subjects. Journal of clinical pathology 1970;23(5):402-6.
6. Park J, Kim HJ, Kim J, Choi YB, Shin YS, Lee MJ. Predictive value of serum albumin-to-globulin ratio for incident chronic kidney disease: A 12-year community-based prospective study. PloS one 2020;15(9):e0238421.
7. World Health Organization. Iron deficiency anemia: Assessment, prevention and control. A guide for programmer manager; Geneva: WHO 2001. Available from: http://apps.who.int/iris/bitstream/10665/66914/1/WHO_NHD_01.3.pdf?ua=1
8. Ijoma C, Ulasi I, Ijoma U, Ifebunandu N. High prevalence of anemia in predialysis patients in Enugu, Nigeria. Nephrology Research & Reviews 2010;2(1):61-5.
9. Islam MN, Ferdous A, Zahid AZ, Alam M, Islam MN. Haematological profile of patients with chronic kidney disease in Northern Bangladesh. Dinajpur Med Col J 2015;8(1):21-7.
10. Arun S, Prabhu MV, Chowta KN, Bengre ML. The hematological pattern of the patients with chronic kidney disease in a tertiary care setup in South India.

Journal of Clinical and Diagnostic Research. 2012;6(6):1003-6.
11. Bhattacharjee K, Das D, Rabha P, Kalwar AK, Kar G, Bhattacharjee P. A study on hematological profile in patients of chronic renal failure with special reference to serum iron profile. Journal of Evidence based Medicine and Healthcare 2015;2(46):8212-9. https://doi.org/10.18410/jebmh/2015/1107
12. Chakravarti A, Ukey A, Bajaj P, Saragade P. A study of hematological profile in patients of chronic renal failure undergoing hemodialysis at a tertiary health care institute. MVP Journal of Medical Science 2017;4(2):107-12.
13. Bhatta S, Aryal G, Kafle RK. Anemia in chronic kidney disease patients in predialysis and postdialysis stages. Journal of Pathology of Nepal 2011;1:26-9. https://doi.org/10.3126/ jpn.v1i1.4446
14. George SV, Pullockara JK, Sailesh KS, Mukkadan JK. A study to assess changes in the hematological profile inchronic kidney disease. The Pharma Innovation Journal 2015;4(6):1-3.
15. Barde R, Patel HV, Shah PR. A study of anemia prevalence in CKD patients on maintenance hemodialysis: A single centre study. Journal of Evidence Based Medicine and Healthcare 2015;2(39):6344-48. https://doi.org/10.18410/ jebmh/2015/871
16. Hakim YAH, *et al*. The effect of hemodialyis on hemoglobinconcentration Platelet count and white blood cell count in end-stage renal failure. Int. Journal of Medical Research and Health Sciences 2016;5(5):22-35.
17. Mudiyammanavara NR, Dhananjaya PE, Agarwal R. Cross sectional study of anaemia in chronic kidney disease. Indian Journal of Basic and Applied Medical Research 2015;4(2):414-9.
18. Talwar VK, Gupta HL, Shashinarayan. Clinico-haematological profile in chronic renal failure. The Journal of Association of Physicians of India 2002;50:228–33. PMid:12038654
19. Chandra M. Pathogenesis of the anemia of chronic renal failure: The role of erythropoietin. Nefrologia, 1990, 10.
20. Vos FE, *et al*. . Red blood cell survival in long-term dialysis patients. Am J Kidney Dis 2011;58(4):591-8. https://doi. org/10.1053/j.ajkd.2011.03.031 PMid:21715072
21. Rathod SG, Ade AK, Shekokar PP. A study of haematological changes in chronic renal failure. Sch J App Med Sci 2014;2(4A):1232-4.
22. Gafter U, Bessler H, Malachi T, Zevin D, Djaldetti M, Levi J. Platelet count and thrombopoietic activity in patients with chronic renal failure. Nephron 1987;45(3):207-10. https://doi.org/10.1159/000184118 PMid:3574570
23. Dorgalaleh A, *et al.* . Anemia and thrombocytopenia in acute and chronic renal failure. Int. J Hematol Oncol Stem Cell Res 2013;7(4):34-9. PMid:24505541 PMCid:PMC3915422
24. Kaw D, Malhotra D. Hematology: Issues in the dialysis patient: Platelet dysfunction and end-stage renal disease. Sem112 inars in Dialysis 2006;19:317-22. https://doi.org/10.1111/j.1525-139X.2006.00179.x PMid:16893410
25. Van Bladel ER, *et al*. . Platelets of patients with chronic kidney disease demonstrate deficient platelet reactivity *in vitro*. BMC Nephrology 2012;13:127. https://doi. org/10.1186/1471-2369-13-127 PMid:23020133 PMCid:PMC3473261
26. Butt ML, Shafi T, Farooqui I. Effect of dialysis on bleeding time in chronic renal failure. Journal-Pakistan Medical Association 1998;48:242-4.