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Comparative Study of Haematological Parameters, Before and After Haemodialysis. In Patients of Stag V of C.K.D. Undergoing Regular Haemodialysis

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ABSTRACT

Haemodialysis (HD) is most common form of renal replacement therapy for CKD stage-V worldwide and despite use of recombinant human erythropoietin (rhEPO), anaemia is frequent finding in HD patients. Present study was aimed to compare haematological parameters, before and after haemodialysis.in patients of stage V of CKD, undergoing regular haemodialysis. Present study was single-center, cross sectional comparative study, conducted in patients of CKD-V who are undergoing regular haemodialysis irrespective of etiology of CKD. In present study, 66 adult patients, 51 males (77.27 %) and 15 females (22.73 %) were included. Majority of patients were from 41-50 years of age group (33.33 %) and from 31-40 years of age group (22.72 %). Overall mean age was 41.03±12.6 years. Maximum number of patients (77.27 %) were on HD for period of less than 5 years. There was significant change of increase in haemoglobin concentration, RBC count, HCT and decrease in platelet count in post HD values as compared to pre-HD values. There was no significant change in total leukocyte count, differential leukocyte count and RBC indices. Most common peripheral blood smear finding was normocytic normochromic anaemia (84.84%) followed by microcytic hypochromic anaemia (9.09%) and macrocytic anaemia (6.06%). There were no changes in peripheral blood smear finding post HD as compared to pre-HD. There was statistically significant increase in haemoglobin concentration, haematocrit, RBC count and decrease in platelet count post-HD as compared to pre-HD values.

INTRODUCTION

Chronic kidney disease (CKD) is a global public health problem and chronic renal failure (CRF) is a debilitating condition responsible for high morbidity and mortality with greater burden of cost of care especially in developing countries like India[1,2]. CKD adversely affects the haematopoietic system most common clinical manifestation being anaemia and is often contributing substantially to the morbidity and mortality of the condition[3].

Anaemia is a common complication of chronic kidney disease which develops in the course of disease. It is common sequelae of the chronic kidney disease, associated with significant morbidity. Amongst haematological parameters affected in CKD haemoglobin concentration and RBC indices are commonly and severely affected. There is mild to moderate leukocytosis and thrombocytopenia at severe stage of CKD[4].

Haemodialysis (HD) is most common form of renal replacement therapy for CKD stage-V worldwide and despite use of recombinant human erythropoietin (rhEPO) anaemia is frequent finding in HD patients. Anaemia may be predictive of an increased risk of mortality in HD patients[5]. Altogether changes in haematological parameters have major influence on quality of life of HD patients. Present study was aimed to compare haematological parameters, before and after haemodialysis.in patients of stage V of CKD, undergoing regular haemodialysis.

MATERIAL AND METHODS

Present study was single-center, cross sectional comparative study, conducted in department of pathology at Belgavi Institute of Medical Sciences Hospital, Belgavi, India. Study duration was of 19 months (1^{st}-30^{th} 2014-2016 December-June). Study approval was obtained from institutional ethical committee.

Inclusion criteria: Patients of CKD-V who are undergoing regular haemodialysis irrespective of etiology of CKD, willing to participate in present study

Exclusion criteria: Patients with haematological malignancy. Haemorrhagic episode in past three months. Study was explained to patients in local language and written consent was taken for participation and study. CKD stage V was diagnosed by clinical features, creatinine clearance <15 mL min calculated by Cockcroft-Gault equation[12] bilateral small kidney visualized on ultrasound or reports of nephrologist when available with the patients.

The relevant clinical details were collected from the patient and general physical examination was done. Informed written consent was obtained from the patient for blood investigation and with proper aseptic precautions 5 mL venous blood collected in EDTA (Ethylene Diamine Tetra Acetic acid) just before starting haemodialysis and after completion of haemodialysis from venous port and arterial port of in vitro circulation of haemodialysis respectively. Blood sample was collected only for one setting of HD for each patient. Haematological investigations such as haemoglobin concentration, RBC count, PCV, Red cell indices i.e. MCV, MCH, MCHC, Reticulocyte count by using new methylene blue, Red cell distribution width (RDW) Total leukocyte count (WBC count) Differential leukocyte count, platelet count and peripheral smear by using Leishman's stain were done at central diagnostic laboratory, Department of pathology by using automated cell counter (Sysmex KX 21). Demographic data was represented by tables and charts. The values were expressed in Mean±Standard deviation (SD). Data is not following normal distribution curve so the median and interquartile range is calculated by using SPSS software and Wilcoxon signed ranks test is applied as test of significance to calculate p-value.

RESULTS

In present study, 66 adult patients, 51 males (77.27 %) and 15 females (22.73 %) in CKD stage V requiring maintenance HD were included. Majority of patients were from 41-50 years of age group (33.33 %) and from 31-40 years of age group (22.72 %). Overall mean age was 41.03±12.6 years. Most common cause for CKD stage V was diabetes along with hypertension (46.96%) followed by diabetes alone (22.7%) and hypertension alone (22.7%). Other causes were polycystic kidney disease (PCKD) (4.5%) systemic lupus erythematosis (SLE) involving kidney (3%) obstructive uropathy (3%) and interstitial nephritis (1.5%) were other causes for the CKD Table 1 and 2.Time period of these patients on haemodialysis varied from 2 years to 11 years. Maximum number of patients (77.27 %) were on HD for period of less than 5 years Table 3 and Fig 1 and 3.

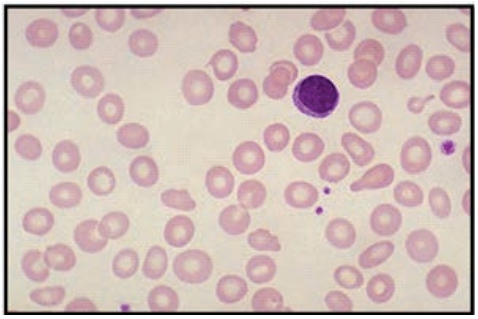

Fig 1: Peripheral blood smear showing normocytic normochromic anaemia (Leishman stain, 1000X)

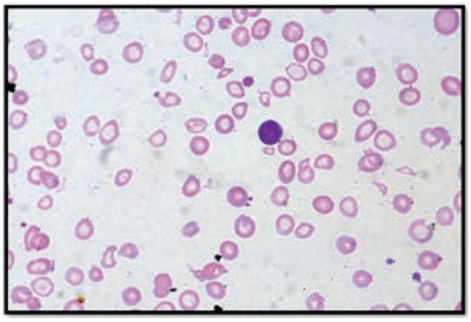

Fig 2: Peripheral blood smear showing microcytic hypochromic anaemia (Leishman stain, 1000X)

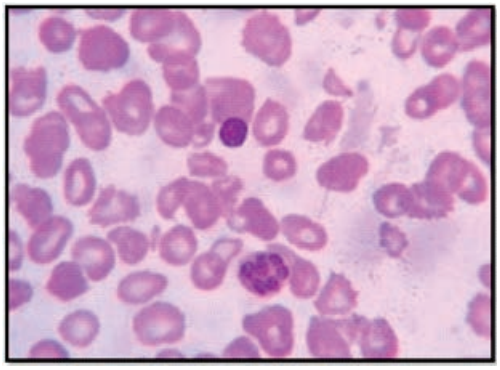

Fig 3: Peripheral blood smear showing macrocytic anaemia (Leishman stain, 1000X)

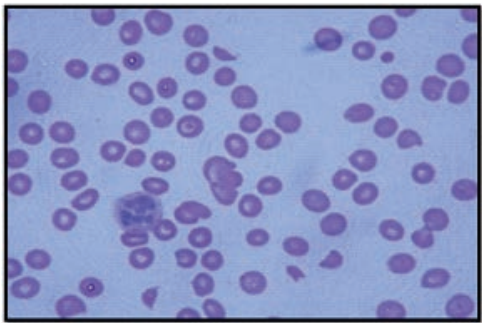

Fig. 4: Peripheral blood smear showing normocytic normochromic anaemia with thrombocytopenia (Leishman stain, 400X)

Mean pre-HD haemoglobin concentration was 8.60±2.02 and of post HD was 9.93±2.45 with pre-HD and post HD change p value of 0.001 which was statistically significant. Mean pre-HD RBC count was 3.11±0.65 and of post HD was 3.51±0.82 with pre-HD and post HD change p-value of 0.001 which was statistically significant. Mean pre-HD hematocrit was 26.89±6.13 and of post HD was 86.89±8.36 with pre-HD and post HD change p-value of 0.006 which was statistically significant. Mean pre-HD platelet count was 1.94±0.75 and of post HD was 1.55±0.60 with pre-HD and post HD change p-value of 0.001 which was

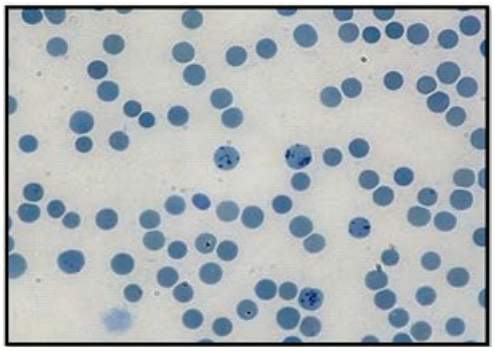

Fig 5: Peripheral blood smear showing reticulocyte (New methylene blue stain, 1000x)

statistically significant. Mean pre-HD and post HD of MCV, MCH, MCHC, total leukocyte count and differential leukocyte count were shown in with p>0.05 which was statistically insignificant. There was significant change of increase in haemoglobin concentration, RBC count, HCT and decrease in platelet count in post HD values as compared to pre-HD values. There was no significant change in total leukocyte count, differential leukocyte count and RBC indices. Most common peripheral blood smear finding was normocytic normochromic anaemia (84.84%) followed by microcytic hypochromic anaemia (9.09%) and macrocytic anaemia (6.06%). There were no changes in peripheral blood smear finding post HD as compared to pre-HD Table 4 and 5.

DISCUSSION

Chronic renal failure is a major health problem and it greatly affects the economic and social status of affected patients. Dialysis treatment (HD) remains the

Table 1: General characteristics

	No. of patients	Percentage
Age groups (in years)		
20-30	12	18.18
31-40	15	22.72
41-50	22	33.33
51-60	13	19.69
61-70	04	6.06
Mean age (Mean±SD)	41.03 ±12.6	
Gender		
Male	51	
Female	15	

Table 2: Causes of CKD in CKD stage V patients on haemodialysis

Causes of CKD	Male	Female	Total	Percentage
DM+HTN	24	7	31	46.96
Diabetes	12	3	15	22.7
Hypertension	11	1	12	18.18
PCKD	2	1	3	4.5
SLE	-	2	2	3.0
Obstructive uropathy	1	1	1	3.0
Interstitial nephritis	1	-	2	1.5

Table 3: Distribution of duration of haemodialysis in CKD stage V patients

Duration of HD	Male	Female	Total	Percentage
≤5 yrs	40	11	51	77.27
6-10 yrs	10	04	14	21.21
11-15 yrs	01	00	01	1.51

Table 4: Pre HD and Post HD haematological parameters in CKD stage V patients

Variables	Pre HD	Post HD	p-value
Hb (g dL)	8.60±2.02	9.93±2.45	0.001
RBC count (x106 µL)	3.11±0.65	3.51±0.82	0.001
HCT (%)	26.89±6.13	30.83±7.45	0.001
MCV (FL)	86.05±8.52	86.89±8.36	0.006
MCH (PG)	27.66±3.22	27.51±3.17	0.023
MCHC (g dL)	31.94±1.30	31.88±1.21	0.557
RDW (SD FL)	46.82±4.62	46.75±4.61	0.886
WBC count (x103 µL)	5.60±2.03	5.52±1.71	0.622
DLC- Neutrophils (%)	64.93±6.23	64.60±6.20	0.806
DLC- Lymphocytes (%)	56.98±10.62	57.50±9.97	0.920
DLC- Eosinophils (%)	4.84±2.74	4.62±2.67	0.594
DLC- Monocytes (%)	0.93±0.89	0.86±0.85	0.437
Platelet counts (x103 µL)	1.94±0.75	1.55±0.60	0.001

Table 5: Peripheral smear findings in CKD stage V patients

Peripheral blood smear finding	Male	Female	Total	Percentage
Normocytic Normochromic anaemia	41	13	54	81.81
Microcytic hypochromic anaemia	5	1	6	9.09
Macrocytic anaemia	3	1	4	6.06
Normocytic Normochromic anaemia with thrombocytopenia	2	-	2	3.03

principal method of treatment for correcting the renal dysfunction. HD increases longevity of patients with CKD stage V patients by removing the metabolic end products and excess of water. The results of this present study show that the patients with CKD stage V on regular HD display degrees of changes of various haematological parameters.

Monitoring haemoglobin concentration response over time is a critical step in anaemia management in CKD stage V patients. An estimation of true haemoglobin concentration from insufficient data without accounting for short-term variability may lead to inappropriate or unnecessary dose adjustments, leading to haemoglobin concentration cycling and exposing patients to harmful side effects[6-8].

Khan and Krishnan[9] retrospectively analyzed the relationship between haemoglobin concentration monitoring frequency and haemoglobin concentration variability, they reported that more frequent haemoglobin concentration monitoring was associated with less haemoglobin concentration variability and hence clinical impact. The present study showed that the mean of each RBCs count, haemoglobin Table 1: concentration, hematocrit levels statistically significant increase in renal failure patient's post-HD when compared to pre-HD levels. Our results are in accordance with the findings of Costa *et al.*[10] and Pereira *et al.*[11] Studies done by Jaroszynski *et al.*[12] Rangel *et al.*[13] Geller *et al.*[14] have also shown a statistically significant increase in mean of haemoglobin concentration and Hct value in CKD stage V patients post-HD when compared to pre-HD results. However the findings of present study are not in accordance with those reported by Małyszko *et al.*[15] who found that the haemoglobin concentration and RBC counts did not differ significantly post-HD. Vickers *et al.*[16] also reported no significant difference between the pre and post-HD with respect to RBCs count. Also Mohamed *et al.*[17] reported an insignificant increase of RBCs count but a decrease of MCH and MCHC values in renal failure patients post-HD. Moreover Inagaki *et al.*[18] found a significant decrease in the Hct levels in patients undergoing HD. The increase of each RBCs count, haemoglobin concentration, Hct levels post-HD can be explained by the fact that before HD, patients are usually hypervolemic and the values of RBCs count, haemoglobin concentration , Hct levels are also lower. As ultrafiltration takes place, RBCs count, haemoglobin concentration and Hct values proportionally increase. There were no change in reticulocyte count post HD as compared to pre-HD. Present study findings are in accordance with study done by Costa *et al.*[10] and Pereira *et al.*[11] Present study showed that there is no significant change in Mean±SD of RDW post HD as compared with pre-HD. Similar findings were shown by study done by Costa *et al.*[10] and Pereira *et al.*[11]. The present study showed that the mean of leukocyte count and the mean counts of each, neutrophils, lymphocytes, monocytes and eosinophils statistically insignificant difference in renal failure patients post-HD when compared to pre-HD counts. Present study findings are in accordance to those reported by Mohamed *et al.*[17] and Pereira *et al.*[11]. Present study findings are not in accordance to those reported by Rangel *et al.*[13] They found significant increase in WBS count and differential count Post HD as compared with pre-HD. The increase in leukocytes and differential counts post-HD were explained by the fact that at the beginning of HD, patients are usually hypervolemic and the values of the leucocytes and differential counts are lower. As ultrafiltration takes place, leucocytes and differential counts proportionally increase. The mean platelet count in the present study showed a significance decrease in patients post-HD when compared to pre-HD counts. This finding agrees with findings of study done by Yeniçerioglu *et al.*[19] Pereira *et al.*[11] Jaroszynski *et al.*[12] Rangel *et al.*[13] and Geller *et al.*[14] who reported a significant decrease in circulating platelets post-HD when compared to the pre-HD counts.

Present study results are not in accordance with study done by Mohamed et al.[17] found that there were no statistically significant differences between the mean platelets count post-HD when compared to pre-HD counts. The decrease in platelet count post-HD may be due to either the HD procedure itself, through the interaction of blood with membranes that may activate complement or to the heparin used during dialysis was one of the factors accounting for the

increased platelet aggregation after dialysis. In a study done by Docci *et al.*[20] stated that the dialysis membrane composition is a major factor influencing hemodialysis-associated platelet loss. Present study showed most common peripheral blood smear finding is normocytic normochromic anemia (81.81%) followed by microcytic hypochromic anemia (9.09%) macrocytic anemia (6.06%) and normocytic normochromic anaemia with thrombocytopenia. Study done by Pereira *et al.*[11] Rangel *et al.*[13] and Geller *et al.*[14] also showed that most common peripheral blood smear finding were normocytic normochromic anaemia. There were no changes in peripheral blood smear finding post HD as compared to pre-HD. Globally the dialysis-monitoring strategy is principally based on measurement of biochemical parameters before and after each session of dialysis. Statistically significant change in most haematological parameters post HD as compared to pre-HD could be due to haemodilution, HD procedure itself or heparin used during HD. However, further randomized and controlled studies are necessary to support this hypothesis. Further research studies are necessary to follow up patients through at least three HD sessions while continuously measuring their haematological and haemostatic parameters. Data from such studies corroborated with clinical data, will be more representative of the effect of HD on haematological parameters.

CONCLUSION

The results of present study showed changes in the haematological parameters post HD as compared to pre-HD in CKD stage V patients on HD. There was statistically significant increase in haemoglobin concentration, haematocrit, RBC count and decrease in platelet count post-HD as compared to pre-HD values. Altered platelets count is usually suggestive of bleeding and thrombosis tendency.

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