HEMATOLOGICAL CHANGES IN PRE AND POST HEMODIALYSIS IN PATIENTS WITH CHRONIC RENAL FAILURE

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ABSTRACT

BACKGROUND

CKD is a major problem worldwide, which is growing rapidly. It is the major cause of morbidity and mortality throughout the world. RBC count, Hb, hematocrit, platelet and TLC got decreased in chronic renal failure patients in many studies. Hemodialysis increases red blood cell count (RBC), hemoglobin (Hb) and packed cell volume (PCV) according to a study done to find out the effects of hemodialysis. In present study, the hematological parameters before and after hemodialysis will be observed and analyzed in CKD patients.

MATERIALS AND METHODS

This study was done on patients suffering from chronic renal failure admitted in hemodialysis unit at B.L.D.E. University's Shri BM Patil Medical College, Hospital and Research Centre, Vijayapura from 1st December, 2015 to 30th June, 2017. Under aseptic precautions, two milliliters of venous blood was taken from renal failure patients before and after hemodilaysis in an ethylene diamine tetra acetic acid (EDTA) vacutainer and immediately analyzed for a complete hemogram, including Hb, RBC count, and RDW, using an automated hematology analyzer. A peripheral smear was prepared from the same sample.

RESULTS

A total of 80 patients suffering from chronic renal failure were included in this study. Out of 80 patients of CRF, 58 patients (72.5%) were male and 22 patients (27.5%) were female. Maximum number of patients i.e. 25 were in age group of 51- 60 years (31.3%). In our study, Hb level was found to be increased after hemodialysis as compared to pre- dialysis. Mean Hb value in pre- dialysis patients was 7.69 ± 1.95 whereas in post dialysis patients, it was 8.46 ± 2.87 with a significant p value of 0.004. WBC level was found to be increased after dialysis when compared to pre- dialysis patients. Mean WBC value in pre- dialysis patients was 8 ± 5.31 whereas in post dialysis patients, it was 9.57 ± 6.70 with a significant p value of 0.005. Platelets were found to be decreased after dialysis as compared to pre- dialysis. Mean platelet value before dialysis was 2.10 ± 0.78 where as it was 1.87 ± 0.69 in post dialysis cases with a significant p value of 0.022. HCT level after dialysis was increased when compared to predialysis cases. Mean value of HCT before dialysis was 25.21 ± 6.49 whereas after dialysis it was 26.94 ± 7.10 with a significant p value of 0.038. NCNC anemia was most commonly seen both in pre- and post-dialysis cases.

CONCLUSION

Most of the hematological parameters like Hb, WBC, MCH, MCHC and HCT increased after HD as compared to predialysis cases. Platelet count was found to be decreased after dialysis as compared to predialysis cases. So, to evaluate the effectiveness of hemodialysis, it is necessary to test the complete hemogram before and after HD.

KEYWORDS

Anemia, Chronic renal failure, Hemoglobin.

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BACKGROUND

Chronic Kidney disease (CKD) is a major problem worldwide, which is growing rapidly. It leads to progressive destruction of renal mass with irreversible sclerosis and loss of nephron. The Kidney Disease Outcomes Quality Initiative designates 5 stages of CKD, with stage 5 being ESRD, the point at which patients' loss of kidney function need dialysis or kidney transplant.[1]

In CKD, haematological parameters are commonly affected. Red cell, WBC, HCT and haemoglobin indices are commonly and severely affected. Several authors noted total white cell count, platelet count and bleeding time of normal ranges but striking eosinophilia and prolonged bleeding time. This is because major part of erythropoietin i.e. 90%, produced in the juxta glomerular apparatus of the kidney

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and rest i.e. 10 % are produced in the liver and other organs.[2]

Most common complication in chronic kidney disease is anemia. The severity of anemia is directly proportional to the degree of renal function. (ESA) Erythropoietin–stimulating agents are used to correct anemia and to maintain hemoglobin level.[1]

Rising incidence of chronic kidney disease is a major problem for both healthcare and the economy in future years.[3] Over 1.1 million patients are estimated to have renal failure worldwide with an annual increase at a rate of 7%. In the USA, the incidence and prevalence counts are expected to increase by 44 and 85%, respectively, from 2000 to 2015 the incidence and prevalence rates per million populations by 32 and 70%.[4] The age adjusted incidence rate of end stage kidney disease was found to be 229 per million population in India and more than one lakh new patients get renal replacement therapy (RRT) yearly.[3]

Prevalence of CKD in India, Bangladesh and Pakistan estimates near or >20% in some communities, and in Nepal and Sri Lanka the prevalence appears to be between 10 and 20% in a study conducted in east Asia. In China, estimates range from 10 up to 19% in the Tibetan region which equates to nearly 120 million people living with CKD in China and in Malaysia, the prevalence has been reported to be approximately 10%.[5]

Diabetes and hypertension account for over 2/3rd of the cases of CKD in western countries, and account for 40–60% cases of CKD in India. According to Indian Council of Medical Research data, in Indian adult population, prevalence of diabetes has risen to 7.1%, (varying from 5.8% in Jharkhand to 13.5% in Chandigarh) and in urban population (over the age of 40 years) the prevalence is as high as 28%. Prevalence of hypertension in the adult population is 17% (14.8% from rural and 21.4% from urban belt).[6]

At the end of 2011, the number of patients being treated for ESRD globally was estimated to be 2,786,000 with a 6-7% growth rate, continues to increase at a significantly higher rate than the world population. Approximately 2,164,000 were undergoing dialysis treatment and around 622,000 people were living with kidney transplants of these 2,786,000 ESRD patients.[7]

In India, the first hemodialysis was performed in 1961.50 years later there are more than 800 centers in the country providing hemodialysis. Hemodialysis was introduced in Southern India in 1963, at the Christian Medical College and Hospital, Vellore, South India.[8] However, in India the number of patients / pmp on maintenance hemodialysis is far less than in the developed nations, and even countries in south East Asia.[9]

There are many side effects of dialysis on the variable blood components. It lowers the hemoglobin (Hb) level and red blood cell (RBC) count; more pronounced in females than males, and in patients in advanced age because of the reduced erythropoietin concentration in these patients. HD decreases the percentage of RNA-rich platelets through elimination of the younger and more active platelets while it does not affect apoptosis of neutrophils or monocytes. Due to the high cost associated with transplantation and difficulty in finding a compatible organ donor, dialysis remains the most common form of renal replacement therapy worldwide. Approximately, 100 white individuals per million population (pmp) require renal replacement therapy in the United Kingdom each year.[10]

Aim of the Study

To study hematological changes in patients suffering from renal failure before and after hemodialysis.

Sample Collection

Two milliliters of blood was taken in an ethylene diamine tetra acetic acid (EDTA) vacutainer and immediately analyzed for a complete hemogram, including Hb, RBC count, and RDW, using an automated hematology analyzer. A peripheral smear was prepared from the same sample.

Inclusion Criteria

Patients with renal failure on RRT in the form of hemodialysis admitted at dialysis unit were included in the study.

Exclusion Criteria

1) Patients with other systemic illness without renal failure.
2) Known hematological malignancy causing secondary renal failure.
3) Patients with end stage renal disease treated with renal replacement therapy in the form of renal transplantation.
4) History of blood transfusion during last three months.

Ethical clearance of the study was obtained from Institutional Ethical Committee.

MATERIALS AND METHODS

This study was done on patients suffering from chronic renal failure admitted in hemodialysis unit at B.L.D.E. University's Shri BM Patil Medical College, Hospital and Research Centre, Vijayapura from 1st December, 2015 to 30th June, 2017. Under aseptic precautions, two milliliters of venous blood was taken from renal failure patients before and after hemodialysis in an ethylene diamine tetra acetic acid (EDTA) vacutainer and immediately analyzed for a complete hemogram, including Hb, RBC count, and RDW, using an automated hematology analyzer. A peripheral smear was prepared from the same sample. Patients with chronic renal failure on RRT in the form of hemodialysis at hemodialysis unit were included in the study.

Statistical Analysis

With average standard deviation of WBC count in pre-hemodialysis and post hemodialysis 1.8 (6.32 ± 1.82 & 7.46 ± 1.87)[8] and at 99% confidence level, considering 90% power in the study, the sample size is ≈ 80. Data was analyzed by Mean ± SD, Paired t test/ Wilcoxen paired test, Correlation coefficient and Chi square test when required.

RESULTS

The study Hematological changes in pre and post hemodialysis patients with chronic renal failure. Was undertakenat B.L.D.E. University's Shri BM Patil Medical College, Hospital and Research Centre, Vijayapura during the period from 1st December, 2015 to 30th June, 2017.

A total of 80 patients suffering from chronic renal failure were included in this study. In present study, out of 80 patients of CRF, 58 patients (72.5%) were male and 22 patients (27.5%) were female. Maximum number of patients i.e. 25 were in age group of 51-60 years (31.3%), out of which 15 were male and 10 were female.

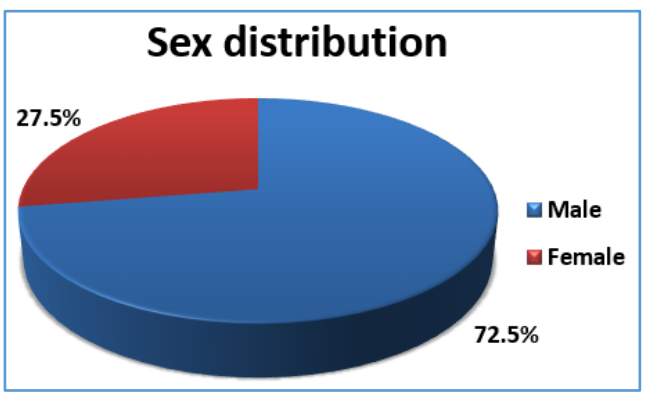

Figure 1. Distribution of Cases by Sex

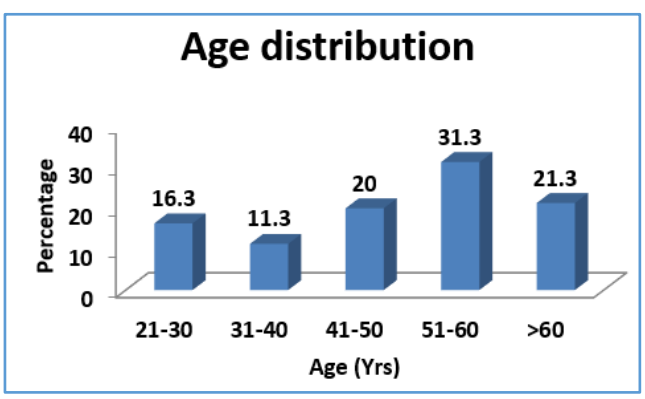

Figure 2. Distribution of Cases by Age

Age (Yrs.)	Minimum	Maximum	Mean	SD
	23	78	50.0	15.1

Table 1. Mean Age of Patients

Age (Yrs.)	Male		Female		t test p value (two tailed)
	N	%	N	%	
21-30	11	19.0	2	9.1	0.218
31-40	8	13.8	1	4.5	
41-50	10	17.2	6	27.3	
51-60	15	25.9	10	45.5	
>60	14	24.1	3	13.6	
Total	58	100.0	22	100.0	

Table 2. Distribution of Cases by Age and Sex

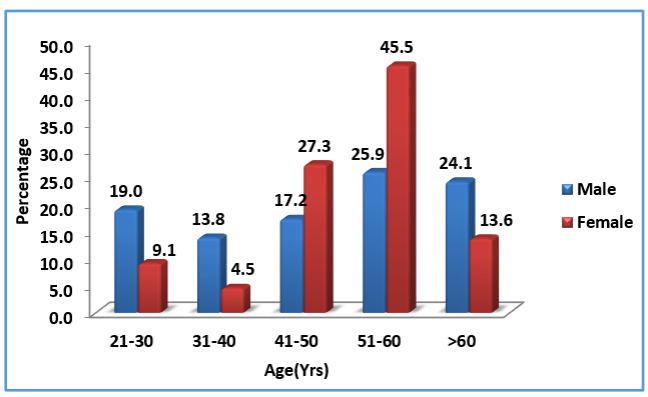

Figure 3. Distribution of cases by Age and Sex

Parameters	Pre		Post		t test p value (two tailed)
	Mean	SD	Mean	SD	
Age	50.0	15.1	50.0	15.1	--
RBC	2.87	0.79	3.00	0.87	0.184
WBC	8.00	5.31	9.57	6.70	0.005*
Hb	7.69	1.95	8.46	2.87	0.004*
Platelet	2.10	0.78	1.87	0.69	0.022*
MCV	88.88	10.67	88.91	10.27	0.972
MCH	27.01	2.82	27.67	2.51	0.038*
MCHC	30.48	2.77	31.09	2.33	0.040*
HCT	25.21	6.49	26.94	7.10	0.038*
RDW	16.13	3.14	15.92	2.45	0.519

Table 3. Comparison of UAS and LAS at Different time Periods After Operation

Note: *significantly distributed at 5% level of significance

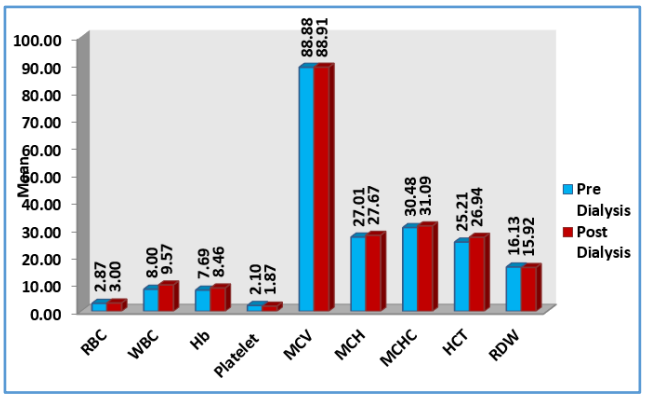

Figure 4. Comparison of UAS and LAS at Different Time Periods After Operation

Anemia	Pre- Dialysis (N=80)		Post Dialysis (N=80)		Chi sq. test p value (two tailed)
	N	%	N	%	
Macrocytic anemia	11	13.8	10	12.5	0.815
Macrocytic smear	1	1.3	0	0.0	0.316
MCHC anemia	13	16.3	14	17.5	0.833
MCHC smear	1	1.3	0	0.0	0.316
NCHC anemia	13	16.3	15	18.8	0.677
NCHC smear	1	1.3	0	0.0	0.316
NCNC anemia	39	48.8	34	42.5	0.427
NCNC smear	1	1.3	6	7.5	0.053
Dimorphic anemia	0	0.0	1	1.3	0.316
Total	**80**	**100.0**	**80**	**100.0**	

Table 4. Morphology of Anemia in Pre- & Post Dialysis Patients

Figure 5. Automated Haematology Analyzer (Sysmex XN-1000)

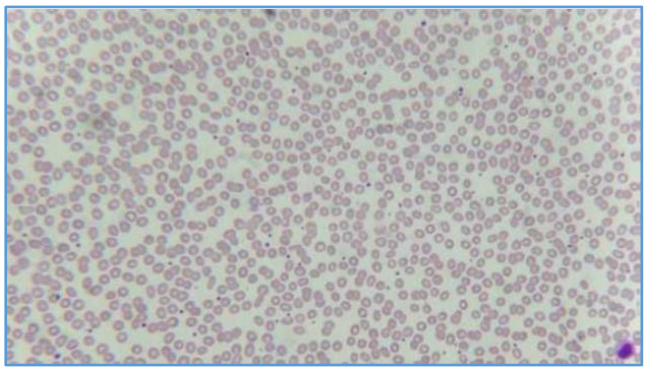

Figure 6. Photomicrograph of Peripheral Smear Showing Normocytic Normochromic Type of Anaemia (40x)

Mean value of WBC before dialysis was 8 ± 5.31 whereas post dialysis, it was 9.57 ± 6.70 with a significant p value of 0.005. Mean value of Hb before dialysis was 7.69 ± 1.95 whereas after dialysis, it was 8.46 ± 2.87 with a significant p value of 0.004. Mean value of platelet before dialysis was 2.10 ± 0.78 which got decreased after dialysis to 1.87 ± 0.69 with a significant p value of 0.002. Mean value of MCH in predialysis was 27.01 ± 2.82 and after dialysis it became 27.67 ± 2.51with a significant p value of 0.038. Mean value of MCHC in predialysis was 30.48 ± 2.77 whereas after dialysis it got increased to 31.09 ± 2.33 with a significant p value of 0.040. Mean value of HCT before dialysis was 25.21 ± 6.49 whereas after dialysis it got increased to 26.94 ± 7.10 with a significant p value of 0.038.

DISCUSSION

In this study, a total number of 80 patients suffering from chronic renal failure were selected. The result of the study shows significant changes in hematological parameters before and after dialysis. The observations were compiled, results statistically analyzed and discussed in comparison with previous studies.

Studies	Hb level after dialysis
Mohd Ali MS et al	Increased
Alghythan AK et al	Increased
Bhatta S et al	Decreased
Hakim Y AH et al	Decreased
Present study	Increased

Table 5. Comparison of Hb Level Between Present Study with Previous Studies After Dialysis

In our study, Hb level was found to be increased after hemodialysis as compared to pre- dialysis. Mean Hb value in pre- dialysis patients was 7.69 ± 1.95 whereas in post dialysis patients, it was 8.46 ± 2.87 with a significant p value of 0.004.

In a study of Mohd Ali MS et al,[10] Hb level was also increased in post dialysis as compared to predialysis patients.

In a study of Alghythan AK et al,[4] Hb level was found to be increased in post dialysis as compared to predialysis patients.

In a study of Bhatta S et al,[11] Hb level got decreased in post dialysis patients as compared to pre- dialysis.

In a study of Hakim Y AH et al,[12] Hb level was found to be decreased in post dialysis patients as compared to predialysis patients.

Studies	WBC Count After Dialysis
Pandian J et al	Decreased
Mohd Ali MS et al	Increased
Hakim Y AH et al	Increased
Present study	Increased

Table 6. Comparison of WBC Count of Present Study with Previous Studies After Dialysis

In our study WBC level was found to be increased after dialysis when compared to pre- dialysis patients. Mean WBC value in pre- dialysis patients was 8± 5.31 whereas in post dialysis patients, it was 9.57 ± 6.70 with a significant p value of 0.005.

In a study of Pandian J et al,[13] WBC count was decreased after dialysis when compared to pre- dialysis cases.

In a study of Mohd Ali MS et al,[10] WBC count was found to be increased in post dialysis patients when compared to pre- dialysis patients.

In a study of Hakim Y AH et al,[12] WBC count was increased in post dialysis cases when compared to pre-dialysis patients.

Studies	Platelets Count After Dialysis
Pandian J et al	Decreased
Hakim Y AH et al	Decreased
Latiwesh OB et al	Decreased
Daugirdas JT et al	Decreased
Present study	Decreased

Table 7. Comparison of Platelets Count of Present Study with Previous Studies After Dialysis

In our study, platelets were found to be decreased after dialysis as compared to pre- dialysis. Mean platelet value before dialysis was 2.10 ± 0.78 where as it was 1.87 ± 0.69 in post dialysis cases with a significant p value of 0.022.

In a study of Pandian J et al,[13] platelet count was decreased in post dialysis cases as compared to predialysis. In a study of Hakim Y AH et al,[12] platelet count was decreased in post dialysis cases as compared to predialysis. In a study of Latiwesh OB et al,[14] platelet count was found to be decreased in post dialysis patients when compared to predialysis.

In a study of Daugirdas JT et al,[15] platelet count was found to be decreased in post dialysis patients when compared to predialysis.

Studies	HCT Level After Dialysis
Bhatta S et al	Decreased
Present study	Increased

Table 8. Comparison of HCT of Present Study with Previous Studies After Dialysis

In our study, HCT level after dialysis was increased when compared to predialysis cases. Mean value of HCT before dialysis was 25.21 ± 6.49 whereas after dialysis it was 26.94 ± 7.10 with a significant p value of 0.038.

In a study of Bhatta S et al,[11] HCT was found to be decreased in post dialysis cases when compared to predialysis cases.

Studies	Most Common Type of Anemia Before and After Dialysis
Suega K	NCNC
Pandian J	NCNC
Kaze FF	MCHC
Bhatta S	MCHC
Present study	NCNC

Table 9. Type of Anemia in Present Study Compared with Previous Studies

In our study NCNC anemia was most commonly seen both in pre- andpost-dialysis cases.

In a study of Bhatta S,[11] MCHC anemia was most commonly seen both in pre- and post dialysis.

In a study of Suega K,[16] NCNC anemia was seen in majority of cases both in pre- andpost-dialysis.

In a study of Pandian J,[13] NCNC anemia was seen most commonly before and after dialysis.

In a study of Kaze FF,[17] MCHC anemia was seen in majority of cases both before and after dialysis.

CONCLUSION

- Most of the hematological parameters like Hb, WBC, MCH, MCHC and HCT increased after HD as compared to predialysis cases. Platelet count was found to be decreased after dialysis as compared to predialysis cases.
- So, to evaluate the effectiveness of hemodialysis, it is necessary to test the complete hemogram before and after HD.

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