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Research Article

COMPARISON OF HEMATOLOGICAL PARAMETERS OF CKD PATIENTS' PRE AND POST HAEMODIALYSIS- A CROSS-SECTIONAL STUDY

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A B S T R A C T

Background: Chronic kidney disease is one of the emerging life threatening disease in India.

Aims& objectives: To compare the haematologicalparameters in chronic kidney disease patients, pre and post haemodialysis and to correlate their values with duration of haemodialysis.

Materials & methods: Cross-sectional study was done on 29 patients registered for haemodialysis at Karwar Institute of Medical Sciences Hospital, Karwar, Karnataka.5ml of whole blood was drawn from these patients by venepuncture. Two such venous samples of each patient were drawn, one 15 min prior to haemodialysis and another within 10 min post haemodialysis. The venous sample was immediately analysed for complete blood cell count by hematology autoanalyser. The collected data was statistically analysed using Microsoft excel 2010.

Results: Statistically significant increase in RBC count, Haematocrit, Hb, Granulocytes and Granulocyte%, while significant decrease in Lymphocyte% was noted posthaemodialysis. Prehemodialysis mean values of RBC count, Hb, Haematocrit, MCV are less than their normal range, while mean value of MCHC was higher than the normal range. There is insignificant change in mean value of MCV. On correlating the values of pre-dialysishaematological profile with duration of haemodialysis, there was significant negative correlation between duration of haemodialysis and Haemoglobin content (r=-0.27), MCH(r=-0.33), MCHC(r=-0.42).

Conclusion: Early screening of CKD patients for haematologicalparameters is necessary to avoid pre and post haemodialysis complications.

INTRODUCTION

ESRD is anestablishedcondition of renal failure wherein chronic kidney disease has progressed to such a state that patient's kidney is no longer functioning sufficiently. So inevitably he has to rely upon dialysis or transplantation as a treatment modality for his survival. The mortality in patients with ESRD on haemodialysis is due to CVDrather than accumulation of toxins in the blood (Yassin *et al*., 2014). Varioushaemopoietic changes occur in CKD, most commonly in the form of anaemias, mainly because 85% of erythropoietin production occurs in juxta –glomerular apparatus while 15% in the liver (Barret *et al*., 2009). The other causes of anaemia being deficiency of Iron, Vitamin B12, Folic acid (Locatelli *et al*., 2007), shortened redcell survival (EschbachJr *et al*., 1967), gastrointestinal bleeding, severe hyperparathyroidism (Potasman and Better, 1983), and aluminumtoxicity (Kaiser and Schwartz, 1985).

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The severity of anaemia depends on stage of renal failure, wherein it starts appearing at GFR below 60ml/min(Radtke *et al*., 1979; McGonigle *et al*., 1984; Afshar *et al*., 2007) and its prevalence increases when GFR falls below 30ml/min(stage 4 or stage 5 of CKD)(Roger, 2009). This untreated prolonged anaemia could lead to various cardiovascular disorders. Apart from anaemias, renalinsufficiency patients are also prone to bleeding tendencies due to defective platelet adhesion and aggregation (Hassanein *et al*., 1970; Collart *et al*., 1990). Studies also suggest that in patients undergoing dialysis,exposure of blood to artificial membranes in the dialyser could activate the complement system mainly C3a, C5a which induces neutrophil aggregation and adherence of WBCs to the endothelial surface and resulting in low total leucocyte count post haemodialysis(Raymond and Walts, 2004).So, early screening and identifications of these patients is requiredto reduce the mortality and morbidity due to cardiovascular disorders among these patients. So we intended to assess and comparethe haematological parameters of CKD patients' pre and post haemodialysis, and to correlate prehaemodialysis values with duration of dialysis.

MATERIALS AND METHODS

This was a cross sectional study done over a period of 6 months between July 2016 and Dec 2016. All the patients, irrespective of their age and gender, registered for maintenance haemodialysis in Karwar Institute of Medical Sciences Hospital, Karwar, Karnataka were included in the study. Institutional ethical clearance was taken before starting the study. The participants were explained about the intention of the study.

Inclusion criteria

a.The patients who gave informed written consent
b.Patients undergoing maintenance haemodialysis for a minimumduration of 3 months

Exclusion criteria

a.Patients with malignancy or known haematological disorder
b.Patients with recent history ofhaemorrhagic episode
c. Patients on drugs affecting haematological parameters like NSAIDS,Antihistaminics, and Aspirin

Patients fulfilling the inclusion criteria were undergoing haemodialysis at a frequency of 2-3 times per week. Each sitting of haemodialysis lasted for 3-4hr with flow rate of 250-300ml/min. The dialysate used had concentration of K 2 mEq/Land Ca 3mEq/L mixed with bicarbonate solution. The dialyser used was Haemodialysis system DBB-27 containing Hemoflow F6HPS Fresenius polysulfone membrane. 5ml of whole blood was drawn from the patients by venepuncture into EDTA containing vacutainer tubes. Two such venous samples of each patient were drawn, one 15 min prior to haemodialysis and another within 10 min post haemodialysis.The venous sample was immediately analysed for complete blood cell count by using Biotech HL 3125 PLUSfully automatedhaematologyanalyser**.** The data of haematological parameters was compiled in Microsoft excel. It was represented in terms of Mean and Standard deviation. Student's paired t test was used to analyze pre and post heamodialysisvalues of haematological parameters. Pearson's correlation coefficient was notedto correlatebetween duration of haemodialysis and values of haematological parameters pre-dialysis.

OBSERVATION AND RESULTS

During the period of 6 months between July 2016 and Dec 2016 29 patients were registered for maintenance haemodialysis and all gave consent for participation in the study. Mean age of the patients was 55.48±10.22yr. Mean duration of dialysis was 1.74±1.47yr.

Table 1 Mean age, duration of dialysis, height, weightundergoing maintenancehaemodialysis

Patient details	Mean	SD
Mean Age (yr)	55.48	10.22
Mean duration of dialysis (yr)	1.74	1.47
Mean Height (cm)	159.89	6.72
Mean weight (kg) pre dialysis	56.49	9.61
Mean weight (kg) post dialysis	53.83	9.51

N=29

Table 2 List of co-morbid conditions among the participants

Co-morbid condition	Number of participants with %
Diabetes mellitus	13(44.8%)
Hypertension	23(79.3%)
Diabetes and Hypertension	03(10.3%)

N=29

Table 3 Comparison of haematologicalparameters pre and post haemodialysis

Haematological profile	Pre haemodialysis		Post haemodialysis		p value
	Mean	SD	Mean	SD	
WBCx10^3/µL	8.28	2.58	8.91	3	0.162
Lymphocyte%	32.01	13.32	27.86	13.39	0.017*
Lymphocytesx10^3/µL	2.41	1.13	2.36	1.05	0.366
Granulocytes%	60.65	15.03	64.5	16.32	0.032*
Granulocytex10^3/µL	5.03*	2.34	5.99	2.84	0.023*
RBC×10^6/ µL	2.86	0.53	3.12	0.91	0.022*
Hb (gm%)	86.93	16.14	93.45	30.86	0.086*
Haematocrit%	20.56	4.37	22.77	6.93	0.012*
MCV(fL)	72.12	6.86	72.27	6.93	0.247
MCH(pg)	30.2	2.32	30.6	2.42	0.079
MCHC(g/dL)	422.28	44.48	422.34	47.06	0.495
RDWCV(%)	12.65	4.19	12.02	1.08	0.213
PLT×10^3/ µL	259.58	133.25	272.86	97.51	0.254
MPV	7.11	0.7	7.14	0.59	0.357
PDW	8.26	0.42	8.07	0.73	0.079

N=29Students' paired *t* test * p value <0.05

There is statistically significant increase in RBC, Haematocrit, Haemoglobin concentration, Granulocytes and Granulocyte% post haemodialysis,while significant decrease in Lymphocyte%. Prehemodialysis mean values of RBCs, Haemoglobin, Haematocrit, MCV are less than their normal range, while mean value of MCHC was higher than the normal range. There is insignificant change in mean value of MCV.

Table 4 Correlation between duration of Haemodialysis and values of Haematological parameters Pre-Dialysis

Haematological Parameters	Correlation with duration of Haemodialysis (r value)
WBCx10^3/µL	0.011
Lymphocyte%	-0.0126
Lymphocytesx10^3/µL	-0.054
Granulocytes%	-0.0152
Granulocytex10^3/µL	0.0133
RBC×10^6/ µL	-0.115
Hb (gm%)	-0.273*
Haematocrit(%)	0.001
MCV (fL)	0.24
MCH (pg)	-0.334*
MCHC (g/dL)	-0.422*
RDWCV	-0.133
PLT×10^5/ µL	0.087
MPV	0.076
PDW	0.155

N=29, r value - Pearson's correlation co-efficient

There is significant negative correlation between duration of haemodialysis and haemoglobin content (r=0.27), MCH(r=0.33), MCHC(r=0.42).

DISCUSSION

The life of CKD patients progresses until they undergo maintenance haemodialysis at regular intervals as renal replacement therapy. Due to damage to the renal parenchyma, endocrine function of kidney is compromised and patients would suffer from anaemia. The cause for

anaemia in these patients is not only decrease in renal erythropoietic factor but other factors like nutritional deficiencyof macro nutrients and micro nutrients (Iron deficiency ,Vit B12 deficiency) (Locatelli *et al*., 2007). These patients are given erythropoietin supplementation for stimulation of erythropoiesis. The present study noted lower RBC countpre-hemodialysis. There was significant rise in RBC count post-hemodialysis. There is weak negative correlation with duration of haemodialysis which indicates the use of extraneous erythropoietin. Hematocrit raised significantly post-hemodialysis. This correlates with the loss of ECF during haemodialysis. There was not much change in MCV, MCH, and MCHCpost-haemodialysis.

Haemoglobin content is reduced in these patients. Mean value of MCV is lower and mean value of MCH is in normal range. These values suggest higher prevalence of microcytic anaemiaamong these patients, which is similar to other studies done in pre-dialysed and post –dialysis patients(Suega *et al*., 2005). Duration of haemodialysis has significant positive correlation with MCV and negative correlation with MCHC.
The cause for anaemia is not only renal tissue damage but also othermeansas explained in other studies (Locatelli *et al*., 2007; EschbachJr *et al*., 1967; Potasman and Better, 1983; Kaiser and Schwartz, 1985).The WBC count is higher among these patients pre- hemodialysis. The granulocyte count significantly rises post-hemodialysis. The WBC count did not significantly rise post haemodialysis, this change in WBC count post haemodialysis is in contradiction to the findings of earlier study (Latiwesh *et al*., 2017).The fall in WBC count post haemodialysis have been explained to be due to activation of complement system on exposure of blood to dialysermembrane (Raymond and Walts, 2004). The rise in WBC count post haemodialysisin this study could be relatively due to haemoconcentration. There is no correlation between WBC count and duration of dialysis.However, a study done by Shittu *et al* have noted significant increase in WBC count with progression of disease(Shittu *et al*., 2013).

Platelets have been known to interact with dialyzing membrane causing platelet adhesion, aggregation and activation(Lindsay *et al*, 1973)but the mean platelet count is relatively good though the range between minimum and maximum count is wide. This is explained by the supplement of erythropoietin which is similar to thrombopoietin in structure and hence it even stimulates thrombopoiesis. There is no significant change in platelet count post-haemodialysis, which is in contrast with other study (Sharpe *et al*., 1994). This can be explained by the use of anticoagulant heparin pre-hemodialysis which prevents coagulation though the platelets are getting exposed to the dialyser membrane during haemodialysis. The coagulability of blood among these patients is poor though the platelet count may be normal. Close monitoring is required to prevent complications of GI bleeding and internal blood loss among these patients.

CONCLUSION

CKD patients on haemodialysis suffer from anaemiadue to renal erythropoietic factor deficiency and nutritional deficiency. Coagulation profile is also affected due to use of heparin during haemodialysis. Closing monitoring of haematological parameters is highly required to manage the complications.

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