COMPARATIVE STUDY OF SOME HAEMATOLOGICAL PARAMETERS IN CKD PATIENTS ON HAEMODIALYSIS

Mohammed Nasim Uddin Chowdhury[1] Monira Khatun[2] Pradip Kumar Dutta[3] Nayeema Akhter[4]

Summary

Many patients with chronic kidney disease eventually become anaemic. Generally, haemodialysis patients tend to have more severe anaemia than those receiving peritoneal dialysis, probably because of greater blood loss and haemolysis in haemodialysis patients and better removal of uncharacterized 'middle molecules' inhibitory to erythropoiesis in peritoneal dialysis patients. Haemodialysis generally improves the fluid environment of the erythrocytes by partial correction of the electrolyte disequilibrium, the acid-base status and the removal of a number of uremic substances that may possibly disturb both the biochemical and physical properties of the cells. However, transit of the cells through the extracorporeal circuit may have some detrimental effects on the cells, including exposure to a rapidly changing plasma osmolality, mechanical damage as a result of blood pump occlusion, bio-incompatibility of dialyser membranes and blood lines, as well as friction due to haemodialyser design. Effects of the extracorporeal circuit include direct haemolysis as well as morphological changes that could lead to in vivo post-dialysis haemolysis. This study is aimed at to compare the consequent changes in some of the haematological parameters related to RBC, viz. Hb and total count of RBC and PCV in patients receiving Maintenance haemodialysis (MHD) in their pre and post-dialysis blood samples and to show that there is no detrimental effects of haemodialysis procedure on these haematological parameters. It is a Hospital based, cross-sectional comparative study. The study population consisted of 40 patients of diagnosed case of chronic kidney disease patients on haemodialysis in the Department of Nephrology, Chittagong Medical College Hospital, Chittagong. The haematological changes before and after the ending of haemodialysis procedure were studied by complete blood count study by automated analyzer. Data were analyzed by statistical methods (Paired sample t-test). In our study the pre-dialysis and post-dialysis sample showed the mean(±SD) haemoglobin level was 7.76(±1.65) gm/dl and 8.34(±2.00) gm/dl respectively. Also this study shows highly significant difference between mean of pre-dialysis and post-dialysis haemoglobin level (p=0.004). In this study the pre-dialysis and post-dialysis sample showed the mean(±SD) RBC count was 2.71(±0.68) million/µl and 2.93(±0.78) million/µl respectively. This shows highly significant difference between mean of pre-dialysis and post-dialysis RBC count (p=0.000). This study also shows the Haematocrit / PCV (%) in pre-dialysis and post-dialysis sample of the patients. In pre-dialysis and post-dialysis sample the mean(±SD) Haematocrit / PCV(%) was 26.46 (±7.34)% and 27.39 (±8.07)% respectively. This shows no significant difference between mean of pre-dialysis and post-dialysis Haematocrit / PCV(%) level (p=0.157). The results of this study revealed that significant changes in haematological parameters, specially, regarding Hb level, total count of RBC and no significant changes in PCV occur in patients receiving MHD during HD process in their post-dialysis blood samples. And all these findings are consistent with each other. Study shows that there is no detrimental effects of haemodialysis procedure on these haematological parameters.

1. Assistant Professor of Physiology
Rangamati Medical College, Rangamati.
2. Assistant Professor of Physiology
Chattagram Maa-O-Shishu Hospital Medical College, Chittagong.
3. Professor of Nephrology
Chittagong Medical College, Chittagong.
4. Professor of Physiology
Chittagong Medical College, Chittagong.

***Correspondence:** Dr. Mohammed Nasim Uddin Chowdhury
E-mail: drnasimuddin@ymail.com
Cell: 01732060629

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Introduction

Chronic Kidney Disease (CKD) encompasses a spectrum of different pathophysiologic processes associated with abnormal kidney function, and a progressive decline in Glomerular Filtration Rate (GFR) [1]. Chronic Kidney Disease (CKD) is an escalating public health problem throughout the developed and developing world. CKD carries with it not only a risk for progression to End-Stage Renal Disease (ESRD) but also increased morbidity and mortality, particularly from cardiovascular disease [2,3,4,5]. Chronic kidney disease leads to a buildup of fluid and waste products in the body. This condition affects most body systems and functions, including red blood cell production, blood pressure control, and vitamin D and bone health [6]. When one reaches stage 5 CKD, renal replacement therapy is required in the form of either dialysis or a transplant [7].

Many patients with chronic kidney disease eventually become anaemic. We should view the management of anaemia in these patients as part of the overall management of the many clinically relevant manifestations of chronic kidney disease [8]. Anaemia is strongly predictive of complications and death from cardiovascular causes in patients with CKD [3]. Observational data indicate that correction of anaemia is associated with improved outcomes [4].

Haemodialysis influences the transport of water through the erythrocyte membrane and induces morphologic and functional modifications [9]. Anaemia is an almost invariable consequence of renal failure. As renal function deteriorates, there is a slow, progressive decrease in haemoglobin concentration that becomes particularly evident once the Glomerular Filtration Rate (GFR) falls below 30 ml/min/1.73m^2 of body surface area [10]. Deficiency of erythropoietin is the primary cause of anaemia in CKD patients, but it is not the only cause. Blood loss and RBC destruction also frequently contribute to the development of anaemia in CKD patients along with other factors [10]. This study has been designed to compare the consequent changes in haematological parameters related to RBC, viz Hb, total count of RBC and PCV in patients receiving Maintenance Haemodialysis (MHD) during Haemodialysis (HD) process in their post-dialysis blood samples.

Materials and methods

The present study was a hospital based, cross-sectional comparative study. The study was conducted in the Department of Nephrology, Chittagong Medical College Hospital, Chittagong in collaboration with the Department of Physiology, Chittagong Medical College, Chittagong between July 2011 to June 2012.

The study population consisted of 40 patients of registered case of CKD on Maintenance Haemodialysis (MHD) in the Department of Nephrology, Chittagong Medical College Hospital, Chittagong were selected as cases by the process of purposive sampling. Inclusion criteria includes patient with chronic kidney disease on MHD in the Chittagong Medical College Hospital during study period with age >18 years and <70 years providing informed written consent. Patients with acute medical conditions like acute MI, Stroke etc, CKD with other preexisting known diseases like bronchial asthma, COPD, tuberculosis etc, CKD with H/O bleeding disorders eg. haemophilia, purpura, haemolytic anaemia etc, CKD with H/O haematemesis, malaena or any other co-morbid medical conditions, CKD with CLD, malignancy were excluded. Ethical clearance was taken properly from the ethical committee of Chittagong Medical College, Chittagong.

From all eligible subjects clinical history had been taken and clinical examination performed. Then, for haematological study, about 3 ml of venous blood were collected following good medical practice with a 5 ml disposable syringe just before and after HD treatment and sent to a selected standard private laboratory in a EDTA tube for Complete Blood Count (CBC) by an automated analyzer (Cell counter). CBC report were collected from the Diagnostic laboratory duly. Data were processed and analyzed using computer based software Statistical Package for Social Sciences (SPSS) V.18.0 for Windows. Different statistical methods like mean, standard deviation and Student's t-test were applied to describe the continuous data and p value was considered as statistically significant when it was less than 0.05.

Results

Table I : Statistics of total count of RBC (With paired samples t-test significance)

Total Count of RBC (Million/µl)	n	MEAN	SD	MEDIAN	RANGE
Pre-Dialysis	40	2.71	0.68	2.49	1.63 – 4.14
Post-Dialysis	40	2.93	0.78	2.76	1.69 – 4.52

Paired samples t-test statistics : t = 3.811, p = 0.000 (Highly significant)

Table I shows the total count of RBC (Million/ul) in pre-dialysis and post-dialysis sample of the patients. In pre-dialysis and post-dialysis sample the mean(±SD) RBC count was 2.71(±0 .68) million/µl and 2.93(±0.78) million/µl respectively. This shows highly significant difference between mean of pre-dialysis and post-dialysis RBC count (p=0.000).

Table II : Statistics of haemoglobin level (With paired samples t-test significance)

Haemoglobin (gm/dL)	n	MEAN	SD	MEDIAN	RANGE
Pre-Dialysis	40	7.76	1.65	7.95	4.8 – 10.6
Post-Dialysis	40	8.34	2.00	8.05	4.9 – 12.3

Paired samples t-test statistics : t = 3.060, p = 0.004 (Highly significant).

Table II shows that in pre-dialysis and post-dialysis sample the mean(±SD) haemoglobin level was 7.76(±1.65) gm/dl and 8.34(±2.00) gm/dl respectively. This shows highly significant difference between mean of pre-dialysis and post-dialysis haemoglobin level (p=0.004).

Table III : Statistics of haematocrit / PCV (With paired samples t-test significance)

Haematocrit/PCV (%)	n	MEAN	SD	MEDIAN	RANGE
Pre-Dialysis	40	26.46	7.34	25.60	13.8 – 39.4
Post-Dialysis	40	27.39	8.07	26.45	14.1 – 43.2

Paired samples t-test statistics : t = 1.443, p = 0.157 (Not significant)

Table III shows the Haematocrit/PCV (%) in pre-dialysis and post-dialysis sample of the patients. In pre-dialysis and post-dialysis sample the mean(±SD) Haematocrit / PCV (%) was 26.46 (±7.34)% and 27.39 (±8.07)% respectively. This shows no significant difference between mean of pre-dialysis and post-dialysis Haematocrit / PCV (%) level (p=0.157).

Discussion

This cross-sectional, comparative study was carried out to observe and compare consequent changes in some haematological parameters related to RBC, viz. Hb, total count of RBC and PCV in patients receiving Maintenance Haemodialysis (MHD) during Haemodialysis (HD) process in their pre and post-dialysis blood samples. The present study provides data on the relationship of some of the haematological parameters related to RBC in pre-dialysis and post-dialysis blood samples in patients receiving maintenance haemodialysis.

In our study the pre-dialysis and post-dialysis sample showed the mean(±SD) haemoglobin level was 7.76(±1.65) gm/dl and 8.34(±2.00) gm/dl respectively. So it was evident that 100% patients receiving MHD were anaemic. This finding is consistent with the work done by Brad CA et al. and Ian C Macdougall et al [10,11]. They found the prevalence of anaemia receiving MHD were 90% [11]. Macdougall observed that patients with CRF requiring dialysis, only about 3% have a normal haemoglobin level [10]. Generally, haemodialysis patients tend to have more severe anaemia than those receiving peritoneal dialysis, probably because of greater blood loss and haemolysis in haemodialysis patients and better removal of uncharacterized ‘middle molecules’ inhibitory to erythropoiesis in peritoneal dialysis patients [10]. Also this study shows highly significant difference between mean of pre-dialysis and post-dialysis haemoglobin level (p=0.004). The mean(±SD) haemoglobin level was more in post-dialysis sample. This may be due to the correction of both intracellular (RBC) and extracellular (Plasma) volume overload during HD process. So this increase in Hb level is due to haemoconcentration which raises Hb level temporarily but not improves anaemia.

Haemodialysis generally improves the fluid environment of the erythrocytes by partial correction of the electrolyte disequilibrium, the acid-base status and the removal of a number of uremic substances that may possibly disturb both the biochemical and physical properties of the cells. However, transit of the cells through the extracorporeal circuit may have some detrimental effects on the cells, including exposure to a rapidly changing plasma osmolality, mechanical damage as a result of blood pump occlusion, bio-

incompatibility of dialyser membranes and blood lines, as well as friction due to haemodialyser design. Effects of the extracorporeal circuit include direct haemolysis as well as morphological changes that could lead to in vivo post-dialysis haemolysis [12].

In this study the pre-dialysis and post-dialysis sample showed the mean(±SD) RBC count was 2.71(±0.68) million/µl and 2.93(±0.78) million/µl respectively.This shows highly significant difference between mean of pre-dialysis and post-dialysis RBC count (p=0.000). Also the findings are consistent with the findings of mean haemoglobin levels in pre-dialysis and post-dialysis samples. Also, this may be due to haemocontration by the correction of both intracellular (RBC) and extracellular (Plasma) volume overload during HD process.

In this study the Haematocrit/PCV (%) in pre-dialysis and post-dialysis sample of the patients. In pre-dialysis and post-dialysis sample the mean (±SD) Haematocrit/PCV (%) was 26.46(±7.34)% and 27.39(±8.07)% respectively. This shows no significant difference between mean of pre-dialysis and post-dialysis Haematocrit/PCV (%) level (p=0.157). This also may be due to simultaneous correction of both intracellular (RBC) and extracellular (Plasma) volume overload during HD process. And all these findings are consistent with each other.

From this study it is evident that significant changes in haematological parameters related to RBC, viz. Hb., total count of RBC and no changes in PCV occur in patients receiving MHD during HD process in their post-dialysis blood samples.

Conclusion

Many patients with chronic kidney disease eventually become anaemic. We should view the management of anaemia in these patients as part of the overall management of the many clinically relevant manifestations of chronic kidney disease. Observational data indicate that correction of anaemia is associated with improved outcomes. Haemodialysis is one of the most popular form of renal replacement therapy. Considering the nature of haemodialysis processs which may have some detrimental effects on some of the haematological parameters, we designed the present study to observe and compare the consequent changes of haematological parameters related to RBC, viz Hb, total count of RBC and PCV in Chronic Kidney Disease (CKD) patients of both sexes by Haemodialysis (HD) and to compare the changes in pre-dialysis and post-dialysis blood samples. In this study it was found that the mean(±SD) haemoglobin level was more in post-dialysis sample. Also the mean(±SD) RBC count was increased in post-dialysis sample. And both of these may be due to the correction of both intracellular (RBC) and extracellular (Plasma) volume overload during HD process. Again no changes in PCV occur in patients receiving MHD during HD process in their post-dialysis blood samples. All these may be due to haemoconcentration by the correction of both intracellular (RBC) and extracellular (Plasma) volume overload during HD process.

So it can be concluded that haemodialysis process improves Hb level and RBC count in CKD patients on MHD in post-dialysis blood samples. These changes in Hb level and RBC count is due to haemoconcentration, which raises Hb level temporarily but not improves anaemia. Again this study shows that there is no detrimental effects of haemodialysis procedure on these haematological parameters.

Disclosure

All the authors declared no competing interests.

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