

## Research Article

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# Effect of haemodialysis on haematological parameters in chronic kidney failure patients Peshawar-Pakistan

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### Abstract

Chronic kidney disease (CKD) is a worldwide issue. The causes of kidney failure are diabetes, hypertension, pyelonephritis, glomerulonephritis and nephrolithiasis. Kidney transplantation and dialysis are possible solutions of kidney failure. The proportion of kidney failure is increasing worldwide. Less data available in our community about hemodialysis (HD) having impact on blood parameters especially on hematological parameters. The objective of present study was to determine the effect of haemodialysis on different haematological parameters. This analytical study was conducted at the Institute of Kidney Diseases (IKD), Peshawar on kidney failure patients. A total of 240 blood samples were collected before and after dialysis from 120 haemodialysis patients. Data was analyzed through statistical package for social sciences (SPSS) version 22. In current study, 55.8% were male and 44.1% were female patients with mean age of  $40.47 \pm 15.27$  years. Majority haemodialysis patients with 25.8% were observed in age group range from 26 to 39 years. In present study, Red Blood Cell (RBC), Hemoglobin (Hb), Hemotocrit (HCT), Mean Cell Hemoglobin Concentration (MCHC), Red cell Differential Wedge (RDW), Total Leucocyte Cells (TLC) and Platelets (Plt) were observed significantly decreased in hemodialysis patients than control group whereas only Mean Cell Hemoglobin (MCH) and MCHC were increased in CKD patients than control group. RBC, HB, HCT and MCHC significantly increased in post dialysis as compared to pre-dialysis while TLC and platelets decreased in post dialysis session. It is concluded with present study that hemodialysis has significant effect on haematological parameters. Low level of hemoglobin is a risk factor for hemodialysis patients. This study recommends the screening of hematological parameters before performing hemodialysis.

**Keywords:** Chronic; Disease; Haematological; Haemodialysis; Kidney; Peshawar

## Introduction

Chronic kidney failure is a major worldwide public health crisis with greater burden and high expenses on welfare, generally observed in developing countries [1]. Most of kidney failure cases are found in middle and old age people [2]. Chronic kidney failure is characterized by the appearance of low level glomerular filtration rate (GFR) of kidney(s) for 3 months or more. Kidney function can be measured through creatinine level [3]. The exact causes of kidney failure are unknown but the plausible are diabetes mellitus (18%) arterial hypertension (38%), pyelonephritis (15%), glomerulonephritis (8%), miscellaneous (5%), nephrolithiasis (8%) and unknown (8%) [4]. In end stage kidney failure patients, kidney transplantation and dialysis are possible treatment [5]. Mortality rate of chronic kidney failure patients is increased annually from 1990-2013 is 409000 to 956000 [3]. The mortality rate in the United State is 35 thousand per annum. The death rate is increased by 52% in last sixteen years and greater among blacks than whites [6]. Chronic kidney disease prevalence in US is 16.8% [7]. The figure of estimated ends stage kidney disease is virtually 0.1 million in the Middle East [8]. No authentic data is existed both in India and Pakistan regarding the chronic kidney disease [9]. Report shows that 0.2 million people in India go to terminal kidney failure annually [6]. Exact prevalence is unknown in Bangladesh but approximately 20 million people are suffering from chronic kidney disease which is about 18% of the total population [1]. However the estimated combined prevalence of stage 3 and stage 4 is 14% in Pakistan; in which highest percentage is found in Punjab (19%), followed by Baluchistan and Khyber Pakhtunkhwa (12% each), while 7% in Sindh. According to the population based economic survey 2005-2006 closely 21 million people of Pakistan have either in stage 3 or stage 4 [10].

The number of kidney failure patients is gradually increasing in Pakistan and rest of the world. As mentioned earlier that the results of different studies are contradictory regarding the number of Platelets, MCV and MCHC after dialysis. Therefore, this study was conducted to identify the significant changes that occur during hemodialysis. The aim of the present study was to determine effect of haemodialysis on different haematological parameters, anemia and its severity in chronic kidney failure patients in Peshawar, Khyber Pakhtunkhwa province of Pakistan.

## Materials and methods

### Study Setting, Duration and Design

This analytical cross sectional study was carried out in seven months from January to July 2017 at Nephrology department of Institute of Kidney Disease in Hayatabad Medical Complex (HMC), Peshawar, Pakistan.

### Population criteria

#### Inclusion Criteria

Patients suffering from kidney failure having done 20 times or greater hemodialysis were included in the present study irrespective of their age and gender.

#### Exclusion criteria

Pregnant female, other than kidney transplant, hematological malignancy and blood transfused patients and having dialysis done less than 20 times were excluded from the study.

### Sample size

A total of 120 haemodialysis were included which were compared with the 120 controls group.

### Blood collection and analysis procedure

A total of 240 blood samples were collected from 120 haemodialysis patients immediately before and after haemodialysis and 120 from control group. Two milliliter (ml) of venous blood samples were collected in ethylene diamine tetra acetic acid (EDTA) (Becton Dickinson, Franklin Lakes, NJ) blood tube from every participant for complete blood count. Samples were analyzed through

automatic haematology analyzer (Sysmex XE-21 analyzers) used to determine the haematological parameters such as haemoglobin, red blood cells, mean cell volume, packed cell volume, mean cell haemoglobin, mean cell haemoglobin concentration, white blood cell and platelets counts [11, 12].

#### Ethical Consideration

Consent form was taken from all the participants after brief description of the study.

#### Data analysis

All data was entered into the SPSS program version 22. Data was summarized in descriptive form to compute the mean and standard deviation (mean $\pm$ SD) for pre and post haemodialysis. Pair t-test was used for different between pre and post dialysis parameters whereas independent t-test was used to calculate difference between mean of RBCs and its indices, leucocytes and platelets between hemodialysis patients and control group.  $P < 0.05$  was considered as statistically significant.

#### Results and discussion

Out of total 120 patients, 55.8% (n=67) were male and 44.2% (n=53) were female while in control group 59.2% (n=71) were male and 40.8% (n=49) were female participants. Mean age of patients was 40.5 $\pm$ 15.3 years (12-85 years) whereas mean age of control group was 38.2 $\pm$ 13.2 years (15-68 years). The mean age of male patients was 39.7 $\pm$ 16.2 years (Age range 12-85 years) and female patients was 41.4 $\pm$ 14.2 years (Age range 13-67 years). Hemodialysis patients as per their age and stages of anemia are shown in (Table 1). Out of total patients, 91.7% (n=110) were anemic and only 08.34% (n=10) patients were normal. Severe anemia was observed in 02.3% (n=03), moderate anemia was 45.0% (n=54) and mild anemia was in 44.2% (n=53) patients. Severity of anemia was found highest in age group of 45-60 years of patients, followed by 30-45 years, 15-30 years, 60-above and 01-15 years as shown in (Table 2). Similar results like

present report were also revealed from the study of Asif et al., (2015) that haemoglobin is one the frequently effected haematological parameter in chronic kidney failure patients because of decline in erythropoitin production [13]. Mohamed and Ali [5] reported from Sudan that all chronic kidney failure patients were anemic; the anemia was mild, moderate and severe with 28.2%, 56.1% and 15.5% patients respectively. Jelkmann [14] reported that anemia is commonly recorded in chronic kidney failure. Anemia is initial and common complicated problem in these patients due to suppression of erythropoiesis and loss of RBC in dialysis process to some extent [10, 15, 16].

RBC, HB, HCT, MCHC and RDW significantly increased in post dialysis as compared to pre dialysis while MCV, and TLC decreased significantly whereas MCH and Platelets decreased non-significantly in post dialysis as shown in (Table 3). In present study, RBC, Hb, HCT, MCHC, RDW, TLC and platelets were observed significantly decreased in both pre and post dialysis session in CKD patients as compared to control group whereas only MCH non-significant and MCHC significant were observed increased in CKD patients as compared to control group. RBCs, Hb, Hct, MCHC and RDW showed significant increase in post dialysis which may be due to removal of extra waste fluid after ultra-filtration technique from the hypervolumic patients. On the other hand, few parameters showed decrease level in post dialysis such as MCV and MCH. Statistical significant decrease in MCV may be due to loss of erythrocyte membrane (protein) during haemodialysis similar findings were reported by other authors [17], whereas significant decrease in MCH could be due to supine position and consequent hemodilution caused by redistribution of water from extra to intravascular space [17]. Like present results, Ali et al. [18] Pakistan revealed that RBC, Hb, HCT,

MCH and MCHC were decreased in 23%, 28.9%, 30.6%, 4.2% and 10% respectively in chronic kidney failure patients, while non-significant change was recorded in MCV. Pereira *et al.* [19] reported similar results except MCH while Malyszko *et al.* [19] reported similar results from their studies like present report. Similarly, Alghythan *et al.* [8] from Saudi Arabia reported significant decreased in RBC, Hb, Hct and MCH in chronic kidney failure patients as compared to control group and non-significant decline in MCV, MCHC and RDW. Present study is also in line with the report of Yassein *et al.* and Suresh *et al.* [6, 21] who recorded the mean of Hb, RBC and Hct significantly decreased in chronic kidney failure patients as compared to control group. Instant study also supports the findings of a Iyawe *et al.* [1] from Bangladesh who report significant decrease in count of RBC in chronic kidney failure patients. Studies shows similar reports like present that significantly increased in RBCs count, HCT, and Hb concentration pre and post dialysis session [8, 22]. RBC and its indices decreased may be due impaired production of erythropoietin and non-response of bone marrow to erythropoietin and other factors such as increasing hemolysis, hematuria, gastrointestinal bleeding and nutritional substances [23, 24], whereas only MCH non-significant and MCHC significant were observed increased in CKD patients as compared to control group.

TLC significantly decreased in post dialysis which supports the finding of Amin *et al.*, 2014 [22]. The decrease in TLC may be due to supine position and continuously haemodilution caused by redistribution of water from the extra- to intra-vascular space and direct contact of dialysis membrane with the blood cells, which alter these cells [25]. TLC count significantly decreased in dialysis patients

in present study, Iyawe *et al.* [1] and Alghythan *et al.* [8] also reported similar results to that current study that leukocytes count significantly decrease in chronic kidney failure patients than control group, its cause is not found but the possible mechanism was explained that due to exposure of blood to artificial membrane may result in activation of complement system typically C3a and C5a, which lead to leukocytes aggregation resulting decrease in their count [26].

Some studies reported non-significant increase in platelets count like present study [17]. The platelets count decrease is reported as significant by Alghythan *et al.* [8]. Low platelets were explained with fact that complement system was activated due to membrane and blood direct contact [27]. Heparin also reduced the count of platelets and composition of dialysis membrane is key influencing factor for platelet loss [28]. Whereas platelets count also decreased in pre and post dialysis as compared to control group. Yassein *et al.* [6] and other reported similar results like present study [1, 23], which is explained with a fact that Erythropoietin potentiates the effect of megakaryocyte colony stimulating factors, acetylhydroase and paraoxonase (PON1). In chronic kidney disease, impaired erythropoietin secretion leads to a decrease in platelet count. The detection of receptors for erythropoietin in megakaryocytes is understandable. Erythropoietin can affect platelet level and because of extensive homology between erythropoietin and thrombopoietin, erythropoietin act as the major humoral regulator of platelet mass [26, 29].

Variation in result of current study to those of other author reports may be due to duration of the dialysis process, number of sample size, type and efficiency of the equipment used, which may affect the results.

**Table 1. Anemia according to age and stages of anemia in dialysis patients**

Age	Normal Patients	Mild anemia	Moderate anemia	Severe anemia	Percentage
01-15	00	02	00	00	02 (01.67%)
15-30	01	10	13	00	24 (20.00%)
30-45	04	13	14	01	32 (26.67%)
45-60	05	20	16	02	43 (35.83%)
60 & above	00	08	11	00	19 (15.83%)
Total	10 (08.3%)	53 (44.2%)	54 (45.0%)	03 (02.3%)	120 (100%)

**Table 2. Changes in Erythrocytes and its indices, leucocytes and platelets pre and post**

Parameters	Pre-dialysis n=120	Control n=120	T-test	Post-dialysis n=120	Control n=120	T-test
RBC	03.35±0.71	04.78±0.60	0.000	03.45±0.78	04.78±0.60	0.000
HB	09.23±1.66	13.18±1.37	0.000	09.45±1.85	13.18±1.37	0.000
HCT	29.10±5.48	39.09±5.04	0.000	29.56±6.13	39.09±5.04	0.000
MCV	87.32±6.74	83.33±8.12	0.000	86.90±6.58	83.33±8.12	0.000
MCH	28.12±4.16	28.03±2.55	0.837	28.04±4.15	28.03±2.55	0.969
MCHC	31.72±1.25	33.67±1.33	0.000	31.84±1.20	33.67±1.33	0.000
RDW	48.94±6.47	49.04±1.47	0.000	48.32±6.24	49.04±1.47	0.000
WBC	08.33±2.66	09.40±2.82	0.003	07.58±2.95	09.40±2.82	0.000
Platelets	223.21±92.3	250.37±62.8	0.008	222.03±94.7	250.37±62.8	0.007

dialysis with control group

**Table 3. Comparison of Erythrocytes and its indices, Leucocytes and Platelets in pre and post dialysis**

Variables	Pre-dialysis Mean+ SD	Post-dialysis Mean+SD	Paired t-test
RBC x10 <sup>6</sup> /ul	03.35±0.71	03.45±0.78	0.001
HB g/dl	09.22±1.65	09.44±1.85	0.001
HCT %	29.09±5.48	29.55±6.13	0.041
MCV Fl	87.32±6.76	86.9±6.60	0.000
MCH Pg	28.11±4.17	28.04±4.16	0.415
MCHC g/dl	31.72±1.24	31.83±1.20	0.050
RDW %	48.93±6.47	48.32±6.23	0.001
TLC x10 <sup>3</sup> /ul	08.33±2.66	07.58±2.95	0.000
Platelets x10 <sup>6</sup> /ul	223.21±92.37	222.02±94.67	0.743

### Conclusion

It is concluded from the result of current study that the many parameters showed a significant increase in post dialysis session. Whereas all parameters shows significant decreased as compared to control. It is also concluded with the result that moderate anemia is mostly common in chronic kidney disease patients. The DLC, control group, clinical implication and

coagulation profile were not studied in current study. Further prospective study with greater sample size is required to evaluate the anemia conduction and its management.

### Authors' contributions

Conceived and designed the experiments: A Muhammad & MA Zeb, Performed the experiments: A Muhammad, MA Zeb & A Ullah, Analyzed the data: A Muhammad,

A Ullah & N Ali, Contributed materials/ analysis/ tools: A Ullah, IQ Afridi & N Ali, Wrote the paper: A Muhammad, MA Zeb, A Ullah, IQ Afridi & N Ali.

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