WORLD JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH
www.wjpmr.com

ASSESSMENT OF THE IMPACT OF HAEMODIALYSIS ON SOME HAEMATOLOGICAL AND BIOCHEMICAL PARAMETERS OF PATIENTS WITH CHRONIC KIDNEY DISEASE

*[1]Amadi Lilian Ogechi, [2]Ijeoma Okoriwu and [2]Hope M. Okorie

[1]Department of Haematology and BGS, Federal School of Medical Laboratory Technology, Jos.
[2]Department of Haematology and BGS, Imo State University Owerri.

*Corresponding Author: Amadi Lilian Ogechi

Department of Haematology and BGS, Federal School of Medical Laboratory Technology, Jos.

ABSTRACT

The study was carried out to assess impact of haemodialysis on some haematological and biochemical parameters of patients with chronic kidney disease in Jos university teaching hospital (JUTH). One hundred (100) patients undergoing haemodialysis in Jos University teaching hospital formed the subjects for this study, while 50 healthy individuals served as the control population. The subjects were between the ages of 35-68 years and consisted of 52 (52%) males and 48 (48%) females. Whole blood and serum samples were collected from these subjects which was used to determine their haematological parameters as well as serum Creatinine, Urea and Electrolyte levels using standard methods. Data collected were analyzed using the Chi square ($\chi^{2)}$, analysis of variance (ANOVA) test, standard deviation, coefficient of variation and t-test. P values <0.05 and coefficient of variations ≥1 were considered statistically significant. Results from the study showed that the prevalence of CKD is higher in males (52%) than in females (48%). It was also found out that CKD significantly affects the urea, creatinine, Red blood cell population, platelets and Mean Corpuscular Volume (P<0.05). Furthermore, serum urea and platelets appeared to be the most affected by haemodialysis (P<0.05) in this study. In relation to age of the patients, there was no significant relationship (P>0.05) between patients of different age groups and the outcome of haemodialysis. Also, sex of the patients did not appear to determine the outcome of haemodialysis although post-dialysis platelet levels showed slight variation between both sexes. This study shows that Chronic renal failure among CKD patients in jos is associated with different degrees of abnormality in hematological and chemical parameters that needs careful continuous evaluation and management.

KEYWORDS: Haemodialysis, serum Creatinine.

INTRODUCTION

Chronic kidney disease (CKD) is becoming a major and alarming public health burden worldwide. It is rapidly increasing in Nigeria as an epidemic and there is significant burden of CKD, though exact figures vary worldwide (Anupama, and Uma., 2014).

Several occupational exposures have long been accused of impairing renal function and causing CKD (Broe *et al.*, 1996).For example, Exposure to organic solvents have predominantly been linked to the appearance and exacerbation of glomerulonephritis (Ravnskov, 2000). Previous studies conducted in jos plateau state by Bot *et* al, (2019) has equally established the presence of an adverse renal effect from several heavy metals such as cadmium, chromium and lead among occupationally exposed artisans and petrol hawkers. Since this is posing a serious public health menace, it becomes imperative to look at the progression of people undergoing hemodialysis in terms of their hematological and biochemical parameters as a way of assessing their responsiveness to treatment or otherwise.

MATERIALS AND METHODS

Study Area

The study was carried out in Jos North Local Government area of Plateau state, North-Central Nigeria. Jos, Plateau State is roughly located in the center of Nigeria between latitude 80^024'N and longtitude 9^056'north and 8^053'east. The altitude ranges from around 1,200 metres to a peak of about 1,829 metres above sea level. With an area of 391square kilometers, the population was estimated to be 900,000 in 2006. Because of the central location as well as unique weather conditions, the city usually witness immigration of people from other parts of Nigeria. Jos University Teaching Hospital (JUTH) is the largest tertiary health care center in the state and offers haemodialysis services which is accessed by a large number of patients

including referals from other health care institutions hence its suitability for the study (Okoro *et al., 2002).*

Study Population
A total of 150 subjects were recruited for the study among which 100 patients have chronic kidney disease (CKD) while the remaining 50 Subjects (Control Population) are healthy individuals without CKD.

Criteria for Selection
Inclusion Criteria
Patients with CKD who were eighteen years and were currently undergoing haemodialysis in Jos University Teaching Hospital were enrolled into the study. Apparently healthy individuals were used as control.

Exclusion Criteria
Patients with chronic kidney disease who were HIV positive, and/or had septicaemia or ulcers or other proven causes of anaemia other than primarily CKD, and/or those with a history of kidney transplant were exempted from the study.

Sample Size
Sample size was determined using the formula derived by Daniel (1999): $N = Z^2 PQ/d^2$
Sample Size Calculation was done using the 95% confidence International rate, 0.05 Precision and prevalence rate. The prevalence rate of chronic kidney disease at 10.7% (Afolabi., 2009).

Where
N= minimum Sample Size,
Z= Confidence interest of 95% which is equivalent to coefficient of 1.96
P = Proportion of the target population estimated at 10.7% which is (10.7/100 = 0.107).

Q = Alternate proportion (1-p) which is 1-0.107 = 0.893

D = Degree of precision (taken as 0.05)
$N = (1-96)^2 \times (0.107) \times (0.893) = 146.827 (0.05)^2$
Total minimum sample size   = 146.827

Ethical Consideration
Ethical approval was obtained from the JUTH Ethics Committee before commencement of the study. Informed written consent was also obtained from each subject before recruitment into the study.

Sample Collection
Five millilitres (ml) each of venous blood was collected from each study subject by standard venepuncture procedure using vacutainer blood collection set into EDTA Vacutainer bottles as well as plain vacutainer bottles. The samples were analysed in the laboratory within four hours of collection.

Laboratory Analysis
Samples collected in EDTA vacutainer tubes were analyzed for full blood count(haemoglobin, haematocrit, and red cell indices which included mean cell volume, mean cell haemoglobin and mean cell haemoglobin concentration), platelet count, total white cell count and differentials using Mindray BC5000 Haematology Autoanalyzer while samples collected in plain vacutainer tubes were analysed for serum urea, creatinine using Cobas C 111 Chemistry auto analyser while electrolytes where using Labjeniks automated electrolytes analyser respectively.

Data Analysis
Data was summarized by appropriate statistical tools such as mean, median, standard deviation; frequencies and proportion. The t-test was used to compare differences between two groups.

All tests were carried out at a 95% confidence interval; p-value of ≤0.05 was considered significant.

RESULTS

Table 1: Comparison between Pre dialysis results of test subjects and that of control subjects.

Parameter	Mean values of parameters		χ^2	P-value
	Pre-dialysis	Control		
Urea (mmol/L)	21.02	4.71	56.48	**<0.00001**
Creatinine (mg/dL)	9.14	0.92	73.44	**0.00030**
Serum Pottasium (mmol/L)	6.48	3.71	2.07	0.35523
Serum sodium (mmol/L)	148.23	138.22	0.73	0.69419
Serum Chloride (mmol/L)	110.41	100.06	1.07	0.58567
Serum calcium (mmol/L)	2.23	2.38	0.01	0.99501
Serum bicarbonate (mmol/L)	19.71	25.62	1.36	0.50662
Haemoglobin (g/dL)	8.35	12.71	1.50	0.47237
WBC total (X10^9 cells/L)	5.14	6.54	0.30	0.86071
RBC (X10^{12} cells/L)	2.10	4.50	0.50	**0.04880**
Platelets (X10^9 cells/L)	211.79	171.30	9.57	**0.00835**
MCV (fL)	75.7	92.35	77.83	**<0.00001**
MCH (pg)	28.77	31.81	0.29	0.86502
MCHC (g/dL)	38.27	34.49	0.41	0.81465

Neutrophils (%)	62.84	58.06	0.39	0.82284
Lymphocytes (%)	25.08	26.81	0.11	0.94648
Monocytes (%)	4.86	5.50	0.08	0.96079
Eosinophils (%)	3.77	1.81	2.12	0.34646
Basophils = (%)	0.84	0.41	0.45	0.79852

$\sum \chi 2$ **228.71**   **P <0.00001**

Table 2: Pre dialysis and post dialysis result of serum electrolytes according to age groups.

Age Group (Years)	Mean value of Pottasium (mmol/L)		Mean value of Sodium (mmol/L)		Mean value of Chloride (mmol/L)		Mean value of Calcium (mmol/L)		Mean value of Bicarbonate (mmol/L)	
	Pre-dialysis	Post-dialysis	Pre-dialysis	Post-dialysis	Pre-dialysis	Post-dialysis	Pre-dialysis	Post-dialysis	Pre-dialysis	Post-dialysis
35-39	6.66	4.50	132.70	155.17	99.80	112.77	1.86	2.95	18.62	31.64
40-44	6.47	16.03	149.63	130.07	113.43	104.43	1.82	1.70	12.28	12.23
45-49	6.53	9.20	147.80	135.58	110.30	101.60	2.43	2.26	19.24	23.09
50-54	6.10	3.84	144.25	141.70	110.78	107.42	2.50	2.14	18.00	20.33
55-59	7.06	4.43	158.20	131.35	112.95	96.65	2.09	1.92	29.63	13.59
60-64	8.55	4.04	184.30	125.30	130.40	94.30	2.20	1.83	38.9	40.10
≥65	9.17	6.81	167.10	141.20	113.50	110.10	2.39	1.67	21.37	8.98
Mean	7.22	6.98	154.85	137.20	113.02	103.90	2.18	2.07	22.58	21.42
Std Deviation	1.083	4.106	15.623	9.169	8.364	6.322	0.253	0.413	8.206	10.405
Coefficient of Variation	0.15	0.59	0.10	0.07	0.07	0.06	0.12	0.20	0.36	0.49
P Value	0.242		0.315		0.321		0.091		0.063	

Pre-dialysis vs post-dialysis
Pottasium;   **P>0.05**
Sodium;   **P>0.05**
Chloride;   **P>0.05**
Calcium;   **P>0.05**
Bicarbonate;   **P>0.05**

Table 3: Pre dialysis and post dialysis result of Haematology parameters according to age groups.

Age Group (Years)	Mean value of Haemoglobin (g/dL)		Mean value of WBC ($\times 10^9$ cells/L)		Mean value of RBC ($\times 10^{12}$ cells/L)		Mean value of Platelets ($\times 10^9$ cells/L)	
	Pre-dialysis	Post-dialysis	Pre-dialysis	Post-dialysis	Pre-dialysis	Post-dialysis	Pre-dialysis	Post-dialysis
35-39	8.23	9.43	5.32	5.62	3.04	3.67	230.67	247.00
40-44	7.23	8.40	3.91	4.40	3.77	2.82	175.30	163.60
45-49	8.60	9.70	5.30	6.55	3.04	3.24	138.00	150.00
50-54	9.16	9.07	5.09	4.95	3.21	3.18	194.83	176.17
55-59	6.75	6.55	4.78	4.36	2.36	2.28	332.50	258.50
60-64	7.10	7.30	6.40	5.42	2.55	2.66	267.00	260.00
≥65	10.90	8.10	7.60	4.13	4.60	2.71	373.00	103.00
Mean	8.28	8.36	5.49	5.06	3.22	2.94	244.47	194.04
Std Deviation	1.3406	1.0632	1.1023	0.7897	0.7031	0.4246	78.8776	57.0517
Coefficient of Variation	0.16	0.13	0.20	0.16	0.22	0.15	0.32	0.29
P Value	0.940		0.132		0.640		0.031	

Pre-dialysis vs post-dialysis
Haemoglobin;   **P>0.05**
WBC;   **P>0.05**
RBC;   **P>0.05**
Platelets;   **P<0.05**

Table 4: Pre dialysis and post dialysis result of Red blood cell indices according to age groups.

Age Group (Years)	Mean value of MCV (fL)		Mean value of MCH (pg)		Mean value of MCHC (g/dL)	
	Pre-dialysis	Post-dialysis	Pre-dialysis	Post-dialysis	Pre-dialysis	Post-dialysis
35-39	76.73	76.87	29.80	29.07	39.83	38.90
40-44	75.37	75.57	29.70	29.80	39.43	39.47
45-49	80.18	80.98	30.20	30.45	38.55	37.83
50-54	73.80	73.82	27.67	28.18	38.12	38.95
55-59	71.25	69.90	26.90	27.10	32.55	38.80
60-64	71.10	70.70	27.80	27.40	39.20	38.80
≥65	81.20	84.30	28.60	27.30	40.10	41.00
Mean	75.66	76.02	28.67	28.44	38.25	39.11
Std Deviation	3.7043	4.8504	1.1695	1.2551	2.4146	0.8946
Coefficient of Variation	0.05	0.06	0.04	0.04	0.06	0.02
P Value	0.815		0.911		0.641	

Pre-dialysis vs post-dialysis
MCV;   P>0.05
MCH;   P>0.05
MCHC; P>0.05

Table 5: Pre dialysis and post dialysis result of White blood cell differentials according to age groups.

Age Group (Years)	Mean value of Neutrophils (%)		Mean value of Lymphocytes (%)		Mean value of Monocytes (%)		Mean value of Eosinophils (%)		Mean value of Basophils (%)	
	Pre-dialysis	Post-dialysis	Pre-dialysis	Post-dialysis	Pre-dialysis	Post-dialysis	Pre-dialysis	Post-dialysis	Pre-dialysis	Post-dialysis
35-39	50.17	61.67	43.83	31.97	2.57	3.33	3.20	2.60	0.23	0.23
40-44	67.00	61.73	20.93	31.33	6.37	4.70	5.00	1.73	0.70	0.50
45-49	66.63	78.63	16.58	15.35	3.93	1.83	4.25	3.05	1.08	0.38
50-54	64.05	67.72	23.32	26.18	4.67	5.43	3.35	2.28	1.17	0.80
55-59	60.40	61.85	31.40	27.05	5.95	7.90	1.95	1.80	0.65	0.60
60-64	67.90	59.90	41.20	28.70	7.90	10.90	3.10	2.20	0.50	0.40
≥65	61.00	72.70	28.50	22.60	6.00	2.00	4.10	2.00	0.40	0.70
Mean	62.45	66.31	29.39	26.17	5.34	5.16	3.56	2.24	0.68	0.52
Std Deviation	5.7014	6.5256	9.4516	5.3085	1.6271	3.0511	0.9117	0.4310	0.3195	0.1835
Coefficient of Variation	0.09	0.10	0.32	0.20	0.30	0.59	0.26	0.19	0.47	0.35
P Value	0.104		0.081		0.263		0.117		0.315	

Pre-dialysis vs post-dialysis
Neutrophils;   P>0.05
Lymphocytes;   P>0.05
Monocytes;   P>0.05
Eosinophils;   P>0.05
Basophils;   P>0.05

Table 6: Comparison between Pre dialysis and post dialysis results of test parameters according to sex of subjects.

Parameter	Males				Females			
	Pre	Post	χ2	P-value	Pre	Post	χ2	P-value
Urea (mmol/L)	22.36	19.68	30.241	**<0.001**	7.40	10.88	7.118	**0.008***
Creatinine (mg/dL)	9.26	9.02	2.114	0.146	5.77	5.84	1.732	0.188
Serum Pottasium (mmol/L)	6.35	6.60	0.232	0.630	7.67	6.52	<0.001	>1.000
Serum sodium (mmol/L)	144.79	151.67	3.610	0.057	137.28	140.19	0.940	0.332
Serum Chloride (mmol/L)	106.80	114.02	0.131	0.427	103.07	106.60	0.517	0.472
Serum calcium (mmol/L)	2.23	2.22	0.001	0.964	2.16	2.15	0.002	0.964
Serum bicarbonate (mmol/L)	18.13	21.28	0.461	0.497	21.26	24.27	0.368	0.544

Haemoglobin (g/dL)	8.16	8.54	0.465	0.956	8.80	8.71	0.003	0.956
WBC total (X10^9 cells/L)	4.97	5.30	0.001	0.964	5.05	5.35	<0.001	>1.000
RBC (X10^{12} cells/L)	3.05	2.94	0.001	0.964	3.09	3.06	0.005	0.944
Platelets (X10^9 cells/L)	215.91	207.67	9.367	0.064	190.36	168.00	3.430	**0.002***
MCV (fL)	75.36	76.04	0.02	0.933	74.97	76.75	0.007	0.933
MCH (pg)	28.69	28.85	<0.001	>1.000	28.78	28.86	<0.001	>1.000
MCHC (g/dL)	38.38	38.16	<0.001	>1.000	38.48	39.2	0.028	0.867
Neutrophils (%)	63.48	62.20	0.597	0.440	69.94	66.45	0.272	0.602
Lymphocytes (%)	19.70	30.46	0.642	0.423	23.59	27.22	0.386	0.535
Monocytes (%)	5.29	4.43	0.021	0.885	4.97	4.36	0.001	0.975
Eosinophils (%)	5.03	2.50	1.821	0.705	2.78	1.97	0.143	0.705
Basophils (%)	1.13	0.55	0.468	0.494	0.60	0.49	0.007	0.933

p<0.05 is significant   * implies significant

DISCUSSION

The present study showed that males have greater tendency to be involved in chronic kidney disease that require renal dialysis compared with females. This finding agreed with other studies that reported similar findings. (Nadia and Jaafar 2015), Iseki *et al.,* (1996), Isaac *et al.,* (2018) and Habib *et al.,* (2017) reported similar trend among renal patients in Jordan, Japan, Nigeria and India respectively. The high prevalence of renal disease patients of 32% recorded among subjects between 50 years and 54 years in this study is corroborated by the study of Isaac *et al.,* (2018) who observed similar high prevalence among renal disease patients between 51years and 55 years of age in Yola, Nigeria.

Kidney dysfunctions leading to the need for haemodialysis could have an impact on haematology and chemistry parameters of the affected individual. This is evident from the result obtained in this study which showed a statistically significant difference between the pre-dialysis results of renal patients and that of healthy control subjects this is in agreement with the result obtained by Suresh *et al.,* (2012).

Among the heamatological parameters measured in this study, RBCs, platelets and MCV values showed remarkable variation in renal patients as compared to the control population. This is supported by the findings of Anwar *et al.,* (2017) who obtained similar results. The essential cause of decrease RBC counts and consequent decrease in the Hb concentration and packed cell volume in chronic renal failure is impaired erythropoietin production and other factors which suppress marrow erythropoiesis and shortened red cell survival. RBC survival is decreased in uremic patients in proportion to the blood urea nitrogen concentration, and it improves significantly after intensive hemodialysis. Uremic plasma increases the expression of phosphatidyl serine on the outer cell surface in red blood cells. This enhances the recognition of damaged red blood cells by macrophage, leading to their subsequent destruction and decreased survival (Means and Glader, 2009). Anemia is the most common, consistent and severe form of the various hematological abnormalities. Although anemia

may be found at different CKD stages, a strong correlation exists between the incidence of anemia and the degree of CKD severity (Mc Clellan *et al.*, 2004). In addition to anemia, patients with chronic renal failure are prone to develop infections and hemorrhagic diathesis (Castaldi *et al.*, 1966).

Among the chemistry parameters in the present study, a higher value of urea and creatinine were recorded in the study subjects as compared to the control subjects. This is also supported by the findings of El-Zawhry *et al.*, (2013). One of the progressive diseases causing irreversible fall in the glomerular filtration rate further resulting in elevation in values of serum creatinine and blood urea nitrogen values is the chronic renal failure (Tomas *et al.*, 2008). These biochemical changes of the blood reflect the sign and symptoms of the disease. By measuring the serum level so the compounds excreted by the kidneys, assessment of the renal excretory functions can be done and therefore serum levels of electrolytes in the body fluids such as that of sodium, potassium etc. can also be used as a diagnostic tool in assessment of renal diseases (Ben and Gutman, 1977; Fishbane *et al.*, 2004).

In the present study, it was observed that haemodialysis had a strong effect on platelet counts and blood urea levels as they both dropped lower showing a statistical significant difference (P<0.05) after haemodialysis. Sodium and chloride levels only showed slight differences without statistical significance (P>0.05) while other parameters showed no remarkable change resulting from dialysis. Improvement in the form of increased hematological indices at post-dialysis has also been reported by previous studies of Latiweshob *et al.*, (2017); Yasir *et al.*, (2016). This is however, in contrast with the report by Dara, (2009) where there was no significant change in the hematological indices at the post-dialysis stage.

The gender of study subjects seemed to have little effect on the outcome of dialysis as a significant reduction in urea levels was observed generally across board. However, platelet value was observed to have a significant reduction after dialysis only in female subjects. The reason for this is not clearly understood.

CONCLUSSION

We therefore conclude that Chronic renal failure among those undergoing dialysis in Jos University Teaching Hospital is associated with different degrees of abnormality in hematological and chemical parameters that needs continues careful evaluation and management.

RFERENCES

1. Anupama Y.J., Uma G. Prevalence of chronic kidney disease among adults in a rural community in south india. *India Journal of nephrology*, 2014; 24(4): 214-222.

2. Anwar Habib, Razi Ahmad, Sana Rehman Hematological changes in patients of chronic renal failure and the effect of hemodialysis on these parameters. in*ternational Journal of Medical Science,* 2017; *5(11): 4998-, 5003.*

3. Bot,Yakubu S., Nwanjo, Harrison U., Nwosu Dennis C., and Lugos, Moses D Heavy Metal Bioaccumulation ,Urinary Microalbumin and Some Hematological Variables among artisans in jos Metropolis.Archieves of Hematology and Blood Disease, 2019; 2(1): 30-37.

4. Ben Areyeh, D Gutman Saliva in diagnosis of oral and systemic diseases. *Israel Journal of dental medicine,* 1977; 26: 5–9.

5. Castaldi PA, Rozenberg MC, Stewart JH; The bleeding disorder of uraemia. Lancet, 1966 Jul 9; 2(7454): 66-9.

6. Dara KM (2009). Effect of Hemodialysis and peritoneal dialysis on some hematological and biochemical parameters in renal failure. Zanco *Journal of Medical Science,* 2009; 13: 1-7.

7. El–Zawhry, E. I., Salem, M. M., Abdel-Rached, G. H., Wafeek, M., Galal, M. S. and Mohamed, E. E. T., 2015. Effect of renal dialysis on some haematological, electrolytes and biochemical parameters in hepatitis patients. *Egyptian. Academic. Journal. of Biological. Science, 2013; 5(2): 29-34.*

8. Habib Anwar, Razi Ahmad, Sana Rehman Hematological changes in patients of chronic renal failure and the effect of hemodialysis on these parameters. *International Journal of Research in Medical Sciences,* 2017; *5(11): 4998-5003*

9. Hellstrom L., Elinder C.G., Dahlberg B., Lundberg M., Jarup L., Persson B. and Axelson O. Cadmium exposure and end-stage renal disease. *American Journal of Kidney Disease,* 2001; 38: 1001-1008.

10. Isaac Medugu Ferdinand, Jessy Thomas Medugu, M. A. Madusolomuo, Shehu Sarkiyayi, Idris Abdullahi Nasir, Badung Henry, Amos Dangana Pre-and post-dialysis hematological indices of patients with chronic kidney diseases attending dialysis center of a tertiary hospital in Yola, Nigeria. *Asian Pacific Journal of Health Sciences*, 2018; 5(2): 313-325.

11. Iseki K, Iseki C, Ikemiya Y, Fukiyama K. Risk of developing endstage renal disease in a cohort of mass screening. *Kidney International,* 1996; 49: 800–805.

12. McClellan W, Aronoff SL, Bolton WK, Hood S, Lorber DL, Tang KL, *et al* The prevalence of anemia in patients with chronic kidney disease. *Current medical research and Opinionion*, 2004; 20(9): 1501-10.

13. Suresh M, Mallikarjuna RN, Sharan B, Singh M, Hari Krishna B, Shravya KG Hematological changes in chronic renal failure. *International American Clinical Association,* 2012; 2(9): 1-4.

14. Yasir A.H. Hakim, A. A. Abbas, Adil Khalil, Hameeda Ibrahim and Ahmed Mustafa The Effect of Hemodialysis on Hemoglobin Concentration, Platelets count and White Blood Cells Count in End Stage Renal Failure. int*ernational Journal of Medical Research & Health Sciences*, 2016; 5(5): 22-35.