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Original Research Article

Hematological and biochemical studies on hemodylitic patients at the Government General Hospital, Wadi Al-Dawaser

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ABSTRACT

Background: Renal failure is a slowly progressive disease of kidney, characterized by low glomerular filtration. One of the most important replacement therapy of renal failure is hemodialysis which helping in the removal of toxic fluids and metabolic end products from the body.
Methods: This study was carried out on 43 patients with renal failure in the dialysis unit of Wadi Al-Dawaser General Hospital. Patients were 25 males and 18 females, randomly selected for the study between September and November 2018. Blood samples were obtained from all patients pre and post dialysis for serum biochemical analysis including kidney function test, liver function, lipid profile, glucose, electrolytes, while blood sample with anticoagulants collected pre dialysis for complete blood picture.
Results: The hemogram parameters recorded significant decrease while leuckogram insignificantly increase specially eosinophils, in pre-dialysis patients. Serum biochemical parameters were significantly high pre-dialysis recorded 83.7%, 97.7%, 21% for urea, creatinine and uric acid respectively, while significantly decrease post dialysis. In contrast serum glucose and magnesium levels were significantly high pre and post dialysis. As result of decrease of the erythropoietin production in chronic renal failure patients lower hematological indices, increase the risk of anemia are main results.
Conclusions: Dialysis improve the biochemical parameters of serum especially creatinine and urea while glucose and magnesium not improved.

Keywords: Renal failure, Hemodialysis, Hemogram, Urea, Creatinine

INTRODUCTION

Suppression of renal function can be life threatening because it is very important for homeostasis, in chronic renal failure (CRF) great numbers of nephrons have been, which leading to death.[1,2]

End-stage renal disease (ESRD) is the final stage of CRF in which the body fails to maintain fluid and electrolyte balance resulting in uremia. In ESRD is characterized by less than 10% nephron function remaining result in decrease in glomerular filtration rate (GFR).[3]

Suppression of bone marrow, failure of renal erythropoietin production, chronic blood loss and hemolysis are the causes of progressive anemia in patients with CRF.[4]

Renal failure is one of the leading terminal health problems in most of the patients with hypertension and

uncontrolled diabetes. Therefore, abnormalities in serum calcium, phosphorus, magnesium and HbA1c concentrations are common in patients with chronic kidney disease.[5]

In India, The National Kidney Foundation states that, kidney diseases represent the third cause of life-threatening disease. Every year about 10,00,000 persons suffering from lesser forms of kidney diseases while 2,00,000 persons suffering terminal kidney failure.[6] In the United States mortality rate has increased by 52% due to kidney disease in the past 16 years.[7]

In the Arab world both acute and chronic renal failure is high. The available data of exact prevalence of various renal diseases are very limited. In the Kingdom of Saudi Arabia, the reported prevalence of chronic renal failure is 80 to 120 per million populations and there are more than 7200 patients on regular dialysis.[8]

Hemodialysis is one of the renal replacement therapy.[9] The process of removing extra fluid and wastes and from the blood that kidneys cannot remove themselves is known as dialysis.[10] Hemodialysis is usually performed with uremic patients for two to three times a week and the required times for dialysis vary from two to four hours.[11] Various factors, including kidney function, amount of waste in body, level of salts and body weight are affecting dialysis time. Dialysis improves many symptoms of kidney failure, but some problems including hypertension and anemia often require additional drug treatments as well.[12]

The artificial purification system during hemodialysis, can correct essential kidney functions such as electrolytes and acid/base state, the elimination of water and metabolic wastes.[13]

The aim of the study was to evaluate and correlate the value of various hematological and biochemical analysis in blood samples and serum from pre and post dialysis of renal failure patients attending the Artificial Kidney Unit, Government General Hospital at Wadi Al- Dwaser.

METHODS

This study was carried out in the Wadi Al-Dawaser General Hospital. The study included 43 renal dialysis patients (25 males and 18 females) were randomly selected. The study was carried out between September and December 2018. The age group of the patients involved ranged from 14 to 78 years, all patients are Saudi citizen. The patients were admitted to hospital dialysis unit.

Sample blood collection

Two types of blood samples were collected. The first samples were anti-coagulated (di-potassium salt of ethylene diamine tetra-acetic acid (EDTA)) before dialysis for estimation of hematological parameters including hemogram and leukogram, both samples were estimated by using Beckman coulter automatic analyzer. The second samples were collected before and after dialysis for serum separation in clean dried tub without anticoagulant then centrifuged at 2000 rpm for 15 minutes. The clear non-hemolysed supernatant serum was used for serum biochemistry analysis (kidney function test, liver function, lipid profile, glucose and electrolytes) using an automatic Hitachi chemistry analyzer.

Ethical approval

The ethical approval was taken from College of Applies Medical Science and Wadi Al-Dawaser General Hospital for collecting and processing of data from the medical laboratory unit of the hospital.

Data management and analysis

Statistical package for Social Science (SPSS 16) software was used for data entry and analysis.

RESULTS

Among the 43 hemodialytic patients were included in this study. The results showed that the prevalence according to the gender were 58.2% males and 41.8% females. The most susceptible age in males was from 46 to 80 years old and in females was from 15 to 45 years old (Table 1).

Table 1: Prevalence of chronic renal failure according to age and gender among studied hemodialytic patients.

Age groups (years)	Males	%	Females	%	Total (n=43)
15-30	5	11.6	5	11.6	10
31-45	1	2.3	7	16.3	8
46-60	9	20.9	4	9.3	13
61-80	10	23.3	2	4.7	12
Total	25	58.2	18	41.8	43

Table 2: Result of hemogram parameters (anemic patients), before dialysis.

Parameter	Patient no.	%
RBC (million/mm^3)	39	90
Hb (gm/%)	31	72
Hydrochlorothiazide (%)	28	65
Mean corpuscular volume (fl)	5	11.10
Mean corpuscular hemoglobin (pg)	9	20
Mean corpuscular hemoglobin concentration (g/dl)	0	0
Polarized-light therapy (10^3/ul)	3	6.9

No.: Patient number with significant decrease hemogram parameters (anemic).

Before dialysis, hemogram showed significant decrease in red blood cells (RBCs) count, hemoglobin (Hb) concentration and hematocrit% packed-cell volume, while total leucocytic count and platelets showed slight insignificant increases (Table 2). Differential leucocyte count showed insignificant increase in neutrophils, lymphocytes and eosinophiles (Table 3).

Most of serum biochemical parameters (Table 4), of patients were high before dialysis and significantly decreased after dialysis except serum magnesium, calcium and glucose. Regarding to the results of the kidney functions parameters it showed that: urea was high in 83.7%, serum creatinine 97.7% and uric acid 21% of the patients before dialysis. These parameters were reduced to 48.8%, 79% and 2.3% respectively post-dialysis. Results of serum liver enzymes levels, post-dialysis, showed reduction in 18.6% of the patients for alkaline phosphatase level (ALP) level and 11.6% for alanine aminotransferase (ALT) level. Total proteins, albumin and total bilirubin are normal in all patients pre- and post- dialysis. Blood glucose level was found to be high in 37.2% and increased in 18.6% of the patients after dialysis. Pre-dialysis the level of cholesterol is within the normal range in most of the patients just 7% of the patients have high level of cholesterol and increased in 4.6% of patient's post-dialysis. Serum triglycerides were high in 37% of the patient's pre-dialysis and reduced by 23% post-dialysis. Serum calcium level was high in 6.97% of the patient's pre-dialysis, magnesium level was significantly elevated in all patients (100%), and chloride was increased in 39.5% of the patients. potassium phosphorus and sodium were within the normal range. Post-dialysis the level of serum calcium increased in 18.6% of the patients. While magnesium reduced in 4.6% of the patients.

Table 3: Results of leukogram and differential leukocytic count (leukocytosis).

Parameter	Patients no.	Percentage (%)
WBC (10^3/mm^3)	6	13.95
Neutrophils (10^3/mm^3)	4	9.30
Lymphocytes (10^3/mm^3)	7	16.3
Monocytes (10^3/mm^3)	0	0.00
Eosinophils (10^3/mm^3)	11	25.00
Basophils (10^3/mm^3)	0	0.00

No.: Patient number with significant increase in leukocytes.

Table 4: Comparison of some serum biochemical parameters concentrations in pre- and post-dialysis patients.

Parameter	Pre-dialysis patients		Post-dialysis patients		Reduction percent
	N	%	N	%	%
Urea	36	83.7	21	48.8	-34.9
Serum creatinine	42	97.7	34	79	-18.7
Uric acid	9	21	1	2.3	-18.7
ALP	23	53.5	15	34.9	-18.6
ALT	5	11.6	0.0	0.0	-11.6
Total protein	0.0	0.0	0.0	0.0	0.0
Albumin	0.0	0.0	0.0	0.0	0.0
Total bilirubin	0.0	0.0	0.0	0.0	0.0
Glucose	16	37.2	24	55.8	+18.6
Cholesterol	3	7	5	11.6	+4.6
Triglycerides	16	37	6	14	-23
Ca^{++}	3	6.97	11	25.6	+18.6
Ph^{---}	0	0.0	0	0.0	0.0
Na^{+}	0	0.0	0	0.0	0.0
K^{+}	0.0	0.0	0	0.0	0.0
Cl^{-}	17	39.5	17	39.5	0.0
MG^{++}	43	100	42	95.4	-4.6

N: Patient number with high levels of serum biochemical parameters.

DISCUSSION

Impaired renal functions can be life threatening causing death in many countries because kidney is very important for homeostasis.[14]

In this study a total of 43 renal dialysis patients were included, the age group of the patients ranged from 14 to 78 years, males were 25 whereas females are 18. The occurrence of diabetes mellitus is high in Saudi population and 90% of diabetics suffer from type II diabetes mellitus which is higher in urban areas than rural areas.[15]

In this study, it has been observed that the RBC count, Hb concentration and hematocrit are significantly decreased (Table 2) in most of patients before hemodialysis. The main cause of low RBC count in cases of chronic renal failure is the suppression of erythropoietin hormone production which is the humeral regulator for marrow erythropoiesis, and maintaining viability of red blood cells.

In uremic patients the increase blood urea nitrogen concentration decreased RBC survival time. enhances the recognition of damaged RBCs by macrophage and their destruction and decreased survival time. In case of uremic plasma is due to increase in the expression of phosphatidylserine on the outer cell surface of RBCs.[16]

The toxic substance normally excreted by the kidneys is one of hemolytic factor causing decreased red blood cells survival, such as guanidine and its derivatives which appear to be has adversely affect erythrocyte survival and a subset of the many retained metabolites.[17]

Impairing in erythropoietin secretion and increased destruction of red blood cells in case of chronic renal disease leading to a fall in RBCs count and reduction in the hemoglobin concentration and reduction in hematocrit.[18]

There is a slight increase in platelet count in case of treating chronic renal disease patient with erythropoietin.[19]

It has been recorded that the total leukocyte count and platelets were within normal ranges in CKD subjects.[20] Other findings reported include eosinophilia.[21]

The mechanism by which chronic renal disease leads to insignificant change in total leukocyte count, it is not known clearly. Complement activation pathway in vivo due to exposure of blood to artificial membranes may induce neutrophiles to aggregate and adhere to endothelial surface.[22]

The most diagnostic tool in estimation of the effect of dialysis is the evaluation of serum biochemical parameters in renal diseases patients undergoing dialysis.[23]

Kidney functions parameters are highly significant (urea 83.7%, serum creatinine 97.7% and uric acid 21% of the patients. The increased level of urea and creatinine, pre-dialysis, is due to the fall in the GFR while both urea and creatinine showed a significant fall in post-dialysis patients.[24]

Cheng et al stated that salivary and serum levels of urea, Cr, and uric acid in patients with renal disease after dialysis has similar clearing effect.[25]

It is well known that calcium, magnesium, and phosphate are multivalent cations that are essential for various biologic and cellular functions.[26] Kidneys play a significant role in the homeostasis of these ions. Hence, the concentration of calcium, magnesium, and phosphate are going to disturb in patients suffering from renal failure.[27]

Serum levels of electrolytes such as calcium, potassium and chloride, were increased (11.6%), (46.5%) and (39.5%) respectively. Magnesium level was very high in all patients (100%) while phosphorus and sodium are found within the normal range.[26]

In renal failure abnormalities of phosphorus, magnesium, and calcium levels are very common clinical findings. Maintenance of normal phosphorus, magnesium, and calcium homeostasis largely depends on a complex interplay between absorption and renal regulation.[26] Magnesium is involved in many cell functions specially energy metabolism where it is acting as preferential cofactor for many kinases. The kidney and digestive tract-maintained serum magnesium concentration within a narrow range. Patients subjected to hemodialysis and peritoneal dialysis the serum magnesium concentration is parallels the dialysate magnesium level.[28]

CONCLUSION

From our study it can be concluded that the abnormal hematological indices need careful evaluation and management in patients with chronic renal failure, due to decreased production of erythropoietin hormone. Hemodialysis improves serum levels of most biochemical parameters especially creatinine, urea, uric acid and some electrolytes. While serum glucose and magnesium levels do not affect. Magnesium is essential for glucose metabolism which is needed to improve energy level in the diabetic renal failure patients.

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