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The effects of chronic renal failure and hemodialysis in blood characteristics Sudan

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Abstract
This study was conducted to determine the hematological changes before and after hemodialysis, among patients suffering chronic renal failure. Hundred blood samples were collected from fifty patients (12-70 years old) and fifty healthy persons with age ranging between (18-30 years).The samples were analyzed for Complete blood counts, peripheral blood picture and deferential blood counts.The obtained results were statically treated using (SPSS)program. The patients with chronic renal failure before hemodialysis showed abnormal hematological parameters means as low counts for Hb, PCV, RBCs, MCV and MCH. The parameters MCHC, WBCs and platelets showed normal range counts. Reticulocyte count was found to be significantly high compared with the control and the normal standard ranges.

Keywords: hemodialysis, chronic renal failure, reticulocyte, platelets, differential count

1. Introduction

Renal failure is now one of the major public health problems worldwide. It is known as kidney failure, renal failure or renal insufficiency. It is a medical condition in which the kidneys fail to filter waste products effectively from the blood. Chronic kidney disease, also known as chronic renal disease, is a progressive loss in renal function over a period of months or years (National Kidney foundation; 2002). In Sudan according to the Ministry of Health records the rate of renal failure was increased through the few past years, where approximately 70 to 140 new patients undergo dialysis each year. This high frequency is thought to be due to epidemic malarial infection, which is well known to cause glomeruli nephritis (liao, *et al*; 2012) [15]. The two main forms are acute kidney injury, which is often reversible with adequate treatment, and chronic kidney disease, which is not reversible. In both cases, there is usually an underlying cause (Liao, *et al*; 2012) [15]. Renal failure is mainly determined by a decrease in glomerular filtration rate, which may be detected by a decrease in urine production or by determination of waste products, creatinine and urea in the blood (A.D.A.M, 2012) [16]. In renal failure, there may be some problems such as, increased fluid in the body , increased acid levels, raised levels of potassium, decreased levels of calcium, increased levels of phosphate, and in later stages. Bone marrow may be affected, leading to anemia disease. Long-term kidney problems are associated with an increased risk of cardiovascular disease (Per Grinsted; 2005) [17]. Dialysis removes urea and other toxic components from plasma (Mayne PD, Mayne ZP; 1994) [14]. These effects vary with several physiological and non-physiological factors. It has been reported that dialysis lowers hemoglobin level and red blood cells count. This is more pronounced in females than males and in patients in advanced age because of the reduced erythropoietin concentration (Fishbach F.A; 2003). Dialysis remains as the most common form of renal replacement therapy worldwide ,due to, the high cost associated with transplantation and difficulties of finding a compatible organ donors(Dacie Jv, Lewis SM; 2001) [6]. It was reported that, approximately, 100 white individuals per million populations require renal replacement therapy in the United Kingdom each year (Eaward C.R, 1999). Anemia in patients with chronic renal failure is a common manifestation and it has been described as normocytic normochromic anemia. Deficiency of erythropoietin (EPO) with hypo proliferative bone marrow (B.M) appears to be the principal cause of anemia (SaulNurko, MD; 2006) [8]. Anemia increase in prevalence and severity as renal function decreases, is becoming much more common when the glomerular filtration rate reaches 60 milliliter per minute or less (Mario B., *et al*; 2003). Anemia is defined as hemoglobin levels less than (11.0 g/dl) and hematocrit less than 33% in premenopausal women, and less than 12.0 g/dl, (Hct< 37%) in adult men and post-menopausal women (C. van Y, *et al*; 1999). The main cause responsible for anemia of chronic renal failure is erythropoietin deficiency. However other factors may play a role in the development of anemia in patients suffering chronic renal failure, these include deficiencies of (iron and folic acid), inflammation, and hyperparathyroidism with meyelofibrosis, external blood loss as well as hemolysis and bone marrow suppression. These factors may probably be induced by retained toxic metabolites and all can contribute or lead to anemia and blunt the response to recombinant human erythropoietin (Anatole Besarab; 2000) [11]. Intensive dialysis is most effective treatment for metabolic effects results from inadequate renal function. Anemia is managed by increase of Erythropoietin, if adequate iron sources are available. Hematocrit of 35% can be maintained by subcutaneous or intravascular (EPO) injection. 95% of patients treated with erythropoietin hormone showed no significant side effects (Marcum J.A; 1986) [12]. Heparin is generally used for patients with chronic renal failure to prevent clot of blood during hemodialysis, as highly sulfate glucosamine, widely used as an injected anticoagulant (Hung YJ, *et al*; 2001) [3]. The high negative charge density of heparin contributes to its very strong electrostatic interaction

with thrombin. The formation of ternary complex between AT, thrombin, and heparin lead to inactivation of thrombin *(Andrikos E, et al; 2005*) [14].

2. Methodology

Blood samples were collected from fifty out patients at the dialysis unit in kosti Teaching Hospital (Sudan). 5 ml blood samples were taken before and after hemodialysis. Each sample was transferred to EDTA anticoagulant tube. The samples were carefully labeled with identification name and number. The patients under investigation were, a 23 males and 27 females with ages ranging from (12to 70 years). Fifty control samples were collected from healthy volunteers, who do not known to have any history of hematological abnormalities. The control samples were taken from 25 males and 25 females, with ages ranging from (18-30 years). For complete blood counts automated analyzer system (sysmex) was used. Thin blood film technique was used for differential counts.

3. Results and Discussion

The results of blood counts (table 1) showed that, all the measured parameters were within the normal standard ranges for the control group, except in the case of (PCV).The patients with chronic renal failure before hemodialysis showed abnormal hematological parameters means as low counts for Hb, PCV, RBCs, MCV and MCH. The parameters MCHC, WBCs and platelets showed normal range counts. Reticulocyte count was found to be severely high compared with the control and the normal standard ranges. Samples analysis after hemodialysis showed clearly high counts in, HB, PCV, RBCs, MCV and MCH, compared with the pre hemodialysis counts. This means that hemodialysis have high positive effects on some blood characteristics. The platelets count showed very small changes. The reticulocyte and MCHC values were almost similar to the values before hemodialysis treatment. According to the, RBCs the patients under study may be classified as highly anemic before hemodialysis ($2.9\times10^{6)}$ compared with (4.9×10^{6}) after hemodialysis. Wintrobes *et al*; (2013) reported that, the primary cause of decreased RBCs count is chronic renal failure. Besara MD, *et al*. (2000) [11] reported that the life span of RBCs in chronic renal failure patients is shorter than the normal (120 day to average of 70-80 days). In a study carried by Fihscbach F. (2000) dialysis was found to lower the hemoglobin level and red blood cells count in chronic renal disease, because of impaired erythropoietin secretion and increased destruction of red blood cells. In this study hemoglobin level and red blood cells count were low before hemodialysis and their values were significantly raised after dialysis (table 1). According to Esther R. Van Bladel (2012) patients with chronic kidney disease show reduced platelets. This study showed clearly low platelets count before hemodialysis compared with, post- HD, control group and the normal standard ranges.

Table1: Hematological parameters before and after HD (Mean values)

Measured parameters	Pre-HD Mean	Post-HD Mean	Control mean	Normal range mean
Hb	7.7 g/dl	10.5 g/dl	12.5 g/dl	15 (±20) g/dl
PCV	25.02%	30%	35%	45 (±5)%
RBCs	2.9×10^{6}	4.9×10^{6}	5×10^{6}	$5.0\ (\pm0.5)\times10^{6}$
MCV	76.7fl	86.9 fl	85fl	92 (±9) fl
MCH	22pg	2***8***.9pg	30pg	29.5 (± 2.5) pg
MCHC	29.5g/dl	29.6g/dl	31g/dl	33 (±1.5) g/dl
Reticulocyte	3.5	3.8	1.5	0.5-2.5%
WBCs	5,000	3,100	4,200	4,000-11,000
Platelets	195,000	200,000	250,000	150,000 – 400,000

Table 2: Blood differential count among the study group.

Cell type	Pre-HD mean	Post-HD Mean	Control Mean	Normal range
neutrophils	54.8%	57.3%	65%	50-65%
lymphocyte	36.5%	35.6%	40%	30-40%
Monocytes	8.3%	6.5%	6%	0-10%
Eosinophil	1.6%	1.6%	4%	0-4%
Basophils	0.04%	0.06%	0%	0-1%

Table (2) showed that, the renal failure patients have lower percentage of neutrophils and basophils and higher percentage of lymphocyte, and monocyte before HD, compared with those after HD. Eosinophil counts were similar pre and post HD. Generally all the analyzed samples showed differential counts within the normal ranges. The control group samples showed blood differential counts equal to the highest standard ranges, neutrophils (65%),lymphocyte (40%), monocyte (6%) and eosinophil (4%).The results obtained in this study were found to agree with that reported by Mohamed Siddig *et al*; (2008) [18]. The blood films of the studied group showed microcytic hypo chromic anemia. This did not agree with Saul Nurko, MD, (2006) [8], who reported that, anemia in patients with chronic renal failure is a common manifestation and described as normocytic normochromic anemia.

Conclusion

From the present study it may be concluded that, Patients with chronic renal failure before hemodialysis showed high abnormal changes in hematological parameters. It has been proposed that in chronic renal failure, impaired production of erythropoietin is the main reason for the decrease in red blood cell counts (Hung YJ, *et al*; 2001) [13]. Hemoglobin concentration, hematocrit, platelet count and total leukocyte count, were significantly increased in the studied group after HD, and became almost near to the normal ranges. Other associated factors like increased hemolysis, suppression of bone marrow, erythropoietin, hematuria and gastrointestinal blood loss may play a role in the decrease of red blood cells count, hemoglobin concentration and hematocrit and Uremic hemodialysis. The chronic renal failure patients in this study were found to be microcytic hypochromic before HD and normocytic normochromic after hemodialysis.

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