Effect of Hemodialysis and Peritoneal Dialysis on some Hematological and Biochemical Parameters in Renal Failure

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ABSTRACT

Background and Objectives: The purpose of the present study was to determine the effects of hemodialysis and peritoneal dialysis on some hematological and biochemical parameters in patients with renal failure on the dialysis.

Methods: Fifty two patients with renal failure were taken in this experiment on dialysis studied in the dialysis and kidney disease center in hawler teaching hospital, twenty six patients were taken for haemodialysis and the remaining patients were taken for the peritoneal dialysis process. Some hematological and biochemical parameters were taken before and after dialysis.

Results: In the Hemodialysis Patients: Hemoglobin concentration (Hb gm/dl), Red blood cells (RBCs x106/µl) and packed cell volume (PCV %) count, blood sugar (mg/dl), serum calcium (mg/dl), serum sodium (meq/L) and serum potassium (meq/L) were high significantly increased in patient with renal failure after hemodialysis in comparison before hemodialysis, while blood urea (mg/dl) were high significantly decreased in patient with renal failure after hemodialysis in comparison before hemodialysis. In the Peritoneal dialysis patients: Hb (gm/dl) and PCV (%) count, blood sugar (mg/dl) and serum calcium (mg/dl) were high significantly increased in patient with renal failure after peritoneal dialysis in comparison before peritoneal dialysis, while blood Urea (mg/dl) and serum Creatinine (mg/dl) were high significantly decreased in patient with renal failure after peritoneal dialysis in comparison before peritoneal dialysis, while there were non significant differences in serum sodium (meq/L) before and after peritoneal dialysis.

Conclusions: Hemodialysis significantly increases some RBC, Hb and PCV. Hemodialysis cause significantly decreases blood sugar and urea. Peritoneal dialysis significantly increases PCV and Hb. Peritoneal dialysis cause decreases the blood urea and blood sugar. Hemodialysis was more useful and gives good results than peritoneal dialysis.

Key words: Renal failure patients, Haemodialysis, Peritonialdialysis, Anemia.

INTRODUCTION:

Dialysis is a treatment that does some of the things done by healthy kidneys. It is needed when kidneys can no longer take care of the body's needs. Dialysis is needs when end stage kidney failure develop usually by the time lose about 85 to 90 percent of the kidneys function[1]. Dialysis uses a membrane as a filter and a solution called dialysate to regulate the balance of fluid, salts and minerals carried in the bloodstream. The membrane may be man as in hemodialysis or natural as in peritoneal dialysis [2]. Healthy kidneys clean blood by removing excess fluid, minerals, and wastes. They also make hormones that keep bones strong and blood healthy. When kidneys fail, harmful wastes build up in the body; blood pressure may rise, and thee body may retain excess fluid and not make enough red blood cells. When this happens, need treatment to replace the work of failed kidneys [3]. Anemia is common in people with kidney disease because the kidneys produce the hormone

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erythropoietin (EPO), which stimulates the bone marrow to produce red blood cells. Diseased kidneys often don't make enough EPO, and so the bone marrow makes fewer red blood cells. EPO is available commercially and is commonly given to patients on dialysis [4]. A dialyzer works on the principle of blood flowing along one side of a semi-permeable membrane made of cellulose or a similar product, with the dialysate flowing along the other side [5]. The main purpose of the present study is to evaluate the effect of hemodialysis and peritoneal dialysis on anemia in patients with renal failure on the dialysis.

MATERIALS AND METHODS:

Fifty two patients with renal failure were taken in this study on dialysis studied in the dialysis and kidney disease center in Hawler teaching hospital, twenty six patients were taken for hemodialysis and the remaining patients were taken for the peritoneal dialysis process. Some hematological and biochemical parameters were taken before and after dialysis.

Equipment and Procedures of dialysis: When first visit a hemodialysis center, it may seem like a complicated mix of machines and people. But once when learn how the procedure works and become familiar with the equipment.

Dialysis Machine: The dialysis machine is about the size of a large television. This machine has three main jobs: Pump blood and monitor flow for safety, Clean wastes from blood and Monitor the blood pressure and the rate of fluid removal from the body.

Dialyzer: The dialyzer is a large canister containing thousands of small fibers through which blood is passed. Dialysis solution, the cleansing fluid, is pumped around these fibers. The fibers allow wastes and extra fluids to pass from blood into the solution, which carries them away. The dialyzer is sometimes called an artificial kidney. Dialysis solution, also known as dialysate, is the fluid in the dialyzer that helps remove wastes and extra fluid from blood. It contains chemicals act like a sponge. The doctor will prescribe a specific dialysate for your treatments. This formula can be adjusted based on how well the patients tolerate the treatments and on the blood tests [6].

Needles: Many people find the needle sticks to be one of the most unpleasant parts of hemodialysis treatments. Most people, however, report getting used to them after a few sessions. If the needle insertion is painful, an anesthetic cream or spray can be applied to the skin. Most dialysis centers use two needles; one to carry blood to the dialyzer and one to return the cleaned blood to the body. Some specialized needles are designed with two openings for two-way flow of blood, but these needles are less efficient and require longer sessions. Needles for high-flux or high-efficiency dialysis need to be a little larger than those used with regular dialyzer.

Hematological analysis:

Complete blood Count:-Complete blood counts (CBC) of all blood samples were carried out. The blood parameters included total white blood cells count (WBCs), red blood cell count (RBCs), hemoglobin (Hb) concentration, packed cell volume (PCV), were measured by Coulter Counter (Sysmex K-1000),TOA medical electronics CO., LTD. KOBE. JAPAN [7].

Determination of serum sodium and potassium ion concentrations:

Serum Na^+ and K^+ were determined by means of flame photometer (Galenkamp Flame Analyzer, Germany). For determination of Na^+ an orange filter with the intensity of (598 nm) was used .For K^+ a deep red filter with the intensity of (766 nm) was used [8].

Serum calcium determination:

Spectrophotometric method was used for serum calcium determination. This kit was purchased from (Biomedx-France) [9].

Blood glucose determination:

Blood samples was collected from patients and analyzed for glucose level employing glucosticks with the glucometer (Accu-Chek, Roch diagnosticGmbH, Mannheim

, germany) [10].

Statistical Analysis:

All data are expressed as means ± standard error means (M ± SEM) and statistical analysis was carried out using statistically available software (SPSS version 11.5). Comparisons between groups were made using paired t-test analysis. P values <0.05 were considered significant.

RESULTS:

Effects of Hemodialysis on Some Hematological and Biochemical Parameters in Patients with Renal

Effects on hematological parameters: Hemoglobin concentration (gm/dl) was high significantly increased (P<0.009) in patient with renal failure after the process of hemodialysis (9.98 ± 1.75) in comparison before hemodialysis (7.47 ± 1.99). Red blood cells ($x10^6/\mu l$) count were high significantly increased (P<0.01) in patient with renal failure after the process of hemodialysis (6.16 ± 0.8) in comparison before hemodialysis (5.04 ± 0.56). Packed Cell Volume (PCV %) count was high significantly increased (P<0.009) in patient with renal failure after the process of hemodialysis (37.36 ± 1.57) when compared before hemodialysis (29.3 ±

Table (1): Effects of Hemodialysis on the Hb concentration, RBCs, PCV, Blood urea, Blood sugar, Serum Ca, Na and K in patients with renal failure before and after Hemodialysis.

Parameters	Before Hemodialysis	After Hemodialysis	Statistical Decision
Hemoglobin	7.47 ± 1.99	9.98 ± 1.75	P<0.009
Red blood cells	5.04 ± 0.56	6.16 ± 0.8	P<0.01
Packed cell volume	29.3 ± 1.33	37 ± 1.57	P<0.009
Blood Urea	196.9 ± 20.59	147.1 ± 8.09	P<0.034
Blood Sugar	95.4 ± 7.46	143.1 ± 13.96	P<0.01
$S.Ca^{++}$	7.87 ± 0.18	9.17 ± 1.28	P<0.01
$S.Na^{+}$	138.8 ± 2.10	146.9 ± 1.96	P<0.001
$S.K^{+}$	5.16 ± 0.49	5.98 ± 051	P<0.034

Effects on blood Urea: Blood urea (gm/dl) was significantly decreased (P<0.034) in patient with renal failure after the process of hemodialysis (196.9 ± 20.59) in comparison before hemodialysis (147.1 ± 8.09).

Effects on blood sugar: Blood sugar (gm/dl) was high significantly increased (P<0.01) in patient with renal failure after the process of hemodialysis (143.1± 13.96) when compared before hemodialysis (95.4 ± 7.46).

increased (P<0.01) in patient with renal failure after the process of hemodialysis (9.17 ± 1.28) when compared before hemodialysis (7.87 ± 0.18).

Effects on serum sodium: Serum sodium (meq/L) was high and significantly increased (P<0.001) in patient with renal failure after the process of hemodialysis (146.9 ± 1.96) when compared before hemodialysis (138.8 ± 2.10).

Effects on serum potassium: Serum potassium (meq/L) was significantly increased (P<0.034) in patient with renal failure after the process of hemodialysis (5.98 ± 0.51) when compared before hemodialysis (5.16 ± 0.49).

Effects of Peritoneal dialysis on Some Hematological and Biochemical Parameters in Patients with Renal Failure:

Effects on hematological parameters:
Hemoglobin concentration (gm/dl) was significantly increased (P<0.04) in patient lysis (9.76 ± 0.88) in comparison before hemodialysis (9.26 ± 0.93). White blood cells ($x10^6/\mu l$) count was slightly Increased (P<0.053) in patient with renal failure after the process of hemodialysis (9.5 ± 0.5) in comparison before hemodialysis (7.8 ± 0.8). Packed cell volume (PCV %) count was significantly increased (P<0.05) in patient with renal failure after the process of hemodialysis (30 ± 2.98) when compared before hemodialysis (29.2 ±

Table (2): Effects of Peritoneal dialysis on the Hb, WBCs, PCV, serum creatinine, Blood urea, Blood sugar, Serum Ca and Na in patients with renal failure before and after peritoneal dialysis.

Parameters	Before Peritoneal dialysis	After Peritoneal dialysis	Statistical Decision
Hemoglobin	9.26 ± 0.93	9.76 ± 0.88	P<0.04
White blood cells	7.8 ± 0.8	9.5± 0.5	P<0.053
Packed cell volume	29.2 ± 2.54	30 ± 2.98	P<0.05
S. Creatinine	6.94 ± 0.88	6.32 ± 0.68	P<0.04
Blood Urea	252.5 ± 26.43	192 ± 23.52	P<0.045
Blood Sugar	126.5 ± 15.08	106.5 ± 12.37	P<0.042
$S.Ca^{++}$	8.52 ± 0.059	8.4 ± 0.057	P<0.06
$S.Na^{+}$	131.2 ± 1.28	133.6 ± 1.56	P<0.29

Effects on serum Creatinine: Serum Creatinine was significantly decreased (P<0.04) in patient with renal failure after the process of hemodialysis (6.32 ± 0.68) when compared before hemodialysis (6.94 ± 0.88).

Effects on blood Urea: Blood urea (gm/dl) was significantly decreased at (P<0.045) in patient with renal failure after the process of hemodialysis (192± 23.52) in comparison before hemodialysis (252.5 ± 26.43).

Effects on blood sugar: Blood sugar (gm/dl) was high and significantly increased (P<0.042) in patient with renal failure after the process of hemodialysis (106.5 ± 12.37) when compared before hemodialysis (126.5 ± 15.08.

Effects on serum calcium: Serum calcium (mg/dl) was high and significantly increased (P<0.06) in patient with renal failure after the process of hemodialysis (8.4 ± 0.057) when compared before hemodialysis (8.52 ± 0.059).

Effects on serum sodium: There was non significant difference in serum sodium (meq/L) before and after the process of hemodialysis.

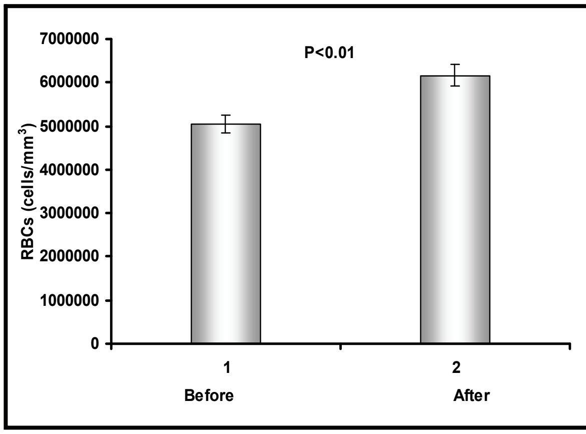


Figure (1): Effects of Hemodialysis on RBCs count in patients with renal failure

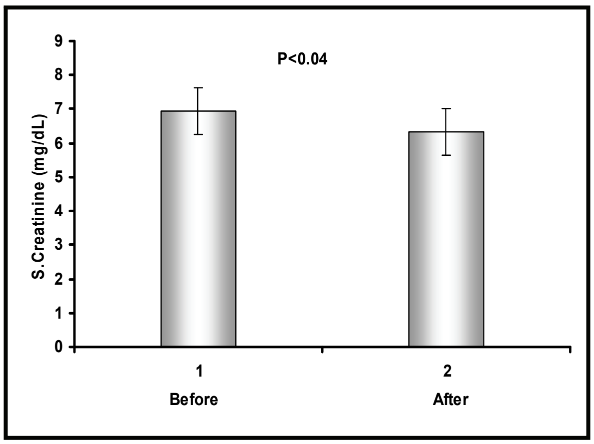
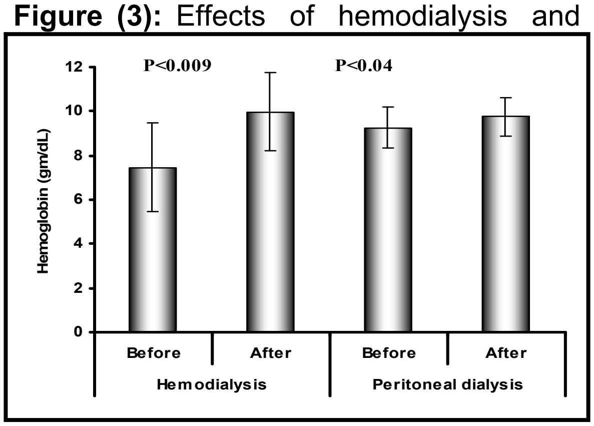


Figure (2): Effects of Peritoneal dialysis on serum creatinine in patients with renal failure

Figure (3): Effects of hemodialysis and



peritoneal dialysis on Hb in patients with renal failure.

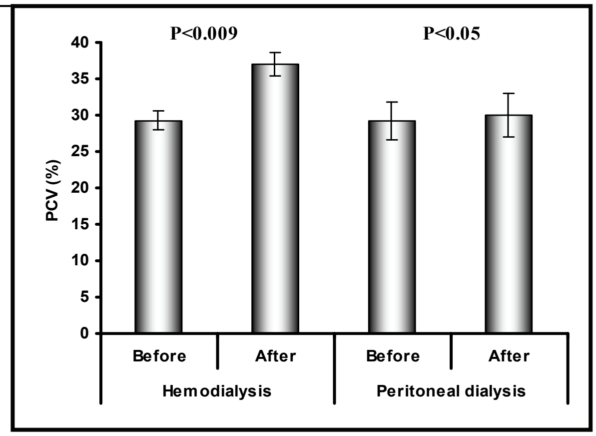


Figure (4): Effects of hemodialysis and peritoneal dialysis on PCV count in patients with renal failure.

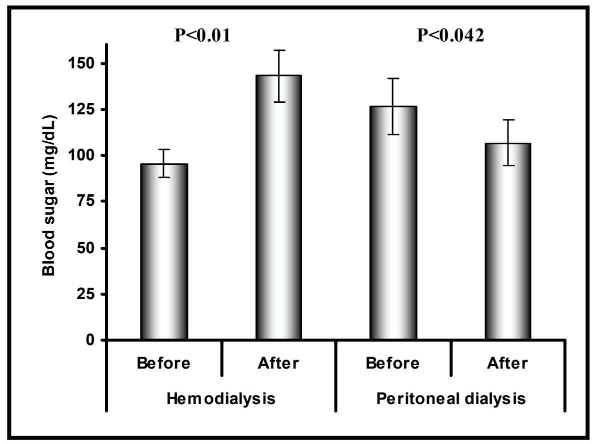
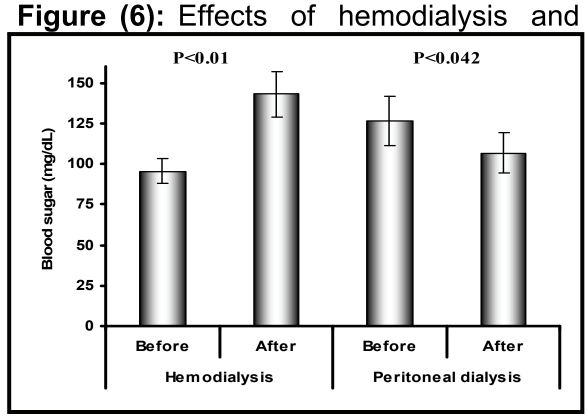


Figure (5): Effects of hemodialysis and peritoneal dialysis on blood urea in patients with renal failur

Figure (6): Effects of hemodialysis and



peritoneal dialysis on blood sugar in patients with renal failure

DISCUSSION:

The Hb concentration, RBCs, WBCs and PCV were significantly increased after the process of dialysis. This observation confirms the fact that the EPO production did not apparently increase substantially, since the renal is hypertrophied. Accordingly, as was anticipated, lack of EPO production contributed significantly to the pathogenesis of the anemia [11]. Furthermore, chronic renal failure (CRF) groups exhibited a significant fall in hemoglobin and hematocrit [12]. It was observed that treatment the patients with dialysis successfully reverses anemia in uremic patients [13]. Furthermore, the elevations in hematocrit and hemoglobin were partly explained by increases in red blood cell counts. Furthermore, angiotensin II could enhance erythropoiesis indirectly via its stimulatory effect on the adrenal cortical cells to secrete androgens [14]. Eschbach and Adamson [15], observed that anemia accompanied by CRF is characterized by relatively blunted EPO secretion from the kidney. This observation confirms the fact that CRF has very high iron stores but very low erythropoietin levels. Because these subjects lacked kidney function, they not only failed to excrete toxins from the body via the kidney, they also failed to produce the erythropoietin needed for erythropoiesis [4]. Adamson [16], speculated that erythropoiesis involves the close interaction of iron and erythropoietin. In essence, erythropoietin is accelerator that drives erythropoiesis. Iron is the main source for the production of new red blood cells. When the two are coupled, red cell production moves briskly and efficiently. Serum calcium was lower before dialysis and this may be due to that the kidneys are in part responsible for the conversion of vitamin D to its active metabolite, which is important in the absorption of calcium from the intestine, so in renal failure patients most kidneys were failed, so this make lowering vitamin D [17]. Serum calcium was significantly increased production of erythropoietin. Marrero *et al.* [18], demonstrated that EPO binding to its receptor, results in the activation of a cytosolic tyrosine kinase that in turn, catalyzes the tyrosine phosphorylation and activation of phospholipase C. The latter cause's hydrolysis of phosphatidylinositol 4, 5-bisphosphate and generation of inositol 1, 4, 5-triphosphate. These events lead to a biphasic rise in Ca^{+2} associated with an initial Ca^{+2} release from intracellular stores, followed by influx of Ca^{+2} through erythropoietin receptor operated, voltage-independent channels. The change in serum sodium is due to lowering of renin secretion from the kidney that is important in sodium control, because of failing large part of kidney [17]. Serum creatinine and urea were significantly decreased after dialysis. Decreased urinary excretion dialysis play a crucial role in retention of metabolites (creatinine, urea, electrolytes and water), the increased formation of metabolites through catabolic processes and alternative metabolic pathways also yields an influence [19], this impedance to excretion, in the presence of a continued constant release of creatinine from muscle, leads to an accumulation of creatinine throughout total body water and thus a rise in its serum concentration [20].

CONCLUSIONS AND RECOMMENATIONS:

Hemodialysis significantly increases some hematological parameter (RBC, Hemoglobin concentration and PCV). Hemodialysis cause significantly decrease blood sugar, blood urea. Peritoneal dialysis significantly increases PCV and Hemoglobin concentration. Peritoneal dialysis cause decreases the blood urea and blood sugar. Hemodialysis was more useful and gives good results than peritoneal dialysis. Further researches are required to be carrying out in order to know the effect on hormonal changes. We can use peritoneal dialysis when the patients are younger. Hemodialysis must be uses in chronic stage of renal disease, while the

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