

## **Hematological and Biochemical Parameters in Pre-Dialysis Renal Failure Patients**

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### **Abstract**

Renal failure performs the stage of worsening of the kidney work, it lacks the capacity to filter impurities from the blood, which causes a general imbalance in the body. The aim of this study is to evaluation specific hematological and biochemical parameters in renal failure patients before dialysis and compare results with healthy control. Blood samples were taken from 50 patients and 40 controls. This study found a significant decrease in Hb, PCV in all patients while WBCs showing significant increase in male patient before peritoneal dialysis only, in female WBCs showed significant increase in both dialysis. PLT showed significant increase in all patients. Urea and creatinine are found to be significantly increased in patients. Depending on the study results, there are physiological and biochemical changes for all renal failure patients that lead to effect on the function of difference organs.

**Keywords:** Hematological, Biochemical Parameters, and Pre-Dialysis Renal Failure.

### **1. Introduction**

Renal failure is a condition in which kidneys become unable to perform their normal activity. This could be attributed to different factors including infections, autoimmune diseases, toxic chemicals, diabetes, cancer and some endocrine disorders [1]. Renal failure occurs when a few nephrons are damaged and the kidneys

are unable to perform their functions. RF can be sub-divided into two types including acute, and chronic renal failure [2].

Acute renal failure (ARF) is an ordinary condition in hospitalized patients, characterized by a quick fall in glomerular filtration rate (GFR). Carries a high morbidity and mortality, often preventable, then rapid diagnosis and treatment may

prevent irreversible loss of nephron [3]. Chronic renal failure (CRF) is kidney damage for more than three months as evidenced by structural or functional abnormalities with or without decreased GFR and manifested either as pathological abnormalities or kidney damage markers in blood or urine or in the imaging test. Many people are unaware of the problem until more than 70% of kidney function has been lost [4]. Dialysis is the most common replacement organization of renal therapy and the best way to save the life of patients with renal failure [5].

Dialysis is a mechanism by which the waste product, fluid, and other ions are removed from the circulatory system when the two kidneys are lacking its ability to do that, or when they losses its function, or when intoxicated, or toxins need to be removed quickly to avoid any deterioration [6]. The main classifications of dialysis are hemodialysis and peritoneal dialysis. Hemodialysis is a renal replacement treatment where a semi-permeable membrane removes uremic retention output from the blood to purify it [7].

Peritoneal dialysis is an alternative for renal treatment that utilizes the peritoneal membrane as the exchange surface for exclusion water and solutes by pumping a

sterile solution into the peritoneal cavity by the catheter, this method is complementary to hemodialysis [8]. The aim of this study is to evaluate some hematological parameters such as hemoglobin (HB), packed cell volume (PCV), white blood cells (WBCs), and platelets (PLT), and other biochemical parameters such as blood urea and creatinine in renal failure patients before hemodialysis and peritoneal dialysis, compared the results with control people.

## **2. Methodology**

The study includes 50 patients with renal failure in the unit of artificial kidney in AL-Kut Hospital, Wasit, Iraq from October 2024 to February 2025. Fifty patients were included, separated into two teams according to the dialysis type. Thirty patients with hemodialysis, fifteen males, and fifteen females. Also, twenty patients with peritoneal dialysis, eleven males, and nine females.

The control team were forty healthy individuals, twenty males, and twenty females free from any signs, or symptoms of any disease such as renal disease, liver disease, diabetes mellitus, or lipid disorders. Verbal consent was obtained from subjects and all of them agreed to contribute to the study. The data was taken, five mL of venous

blood were collected from all subjects, two mL of blood was put in an anticoagulant EDTA K3 tube for hematological parameters. Hematological test was done using a complete blood cell picture measuring device (CELL-DYN Ruby). The remaining three mL of blood are used to extract serum to analyze kidney functional tests (serum creatinine, blood urea) and used Reflotron Kit specific for each biochemical parameter by (Roche Diagnostic GmbH).

### 2. 1 Statistical Analysis

Results of this study were analyzed statistically by using IBM Statistical Package for the Social Sciences (SPSS 25) by finding mean  $\pm$  significant difference (mean  $\pm$  SD) using independent-Sample T Test analyze and taking ( $P \leq 0.05$ ) as the lowest limit of significance value to evaluate differences between renal failure patients before Hemodialysis and peritoneal dialysis and compared the results with healthy control.

### 3. Results

Hematological parameters, hemoglobin (Hb), packed cell volume (PCV), total number of WBCs, and platelets (PLT) for males and females' patients with renal failure before dialysis (hemodialysis and peritoneal) compared to control subjects are shown in

tables 1, and table 2. This study found a significant decrease ( $P \leq 0.05$ ) in Hb, PCV in renal failure patient before hemodialysis and peritoneal dialysis in both genders compared with the control, while WBCs, showing significant increase in male patient only before peritoneal dialysis, hemodialysis showed non-significant differences, in female WBCs showed significant increase in both dialysis. PLT showed significant increase in male and female patient in both dialysis compared to control.

**Table 1:** Hematological parameters of males with RF before dialysis compared to control.

Parameters	Control (20)	Hemodialysis (15)	Peritoneal dialysis (11)
Hb g/dl	13.020 $\pm 1.687$ A	8.259 $\pm 1.259$ B	9.139 $\pm 1.654$ B
PCV %	40.422 $\pm 4.561$ A	29.572 $\pm 4.248$ B	23.850 $\pm 3.258$ B
WBCs $10^3/ \mu\text{L}$	6.316 $\pm 0.758$ A	6.751 $\pm 0.914$ A	11.473 $\pm 2.179$ B
PLT $10^3/ \mu\text{L}$	220.71 $\pm 43.145$ A	258.27 $\pm 53.487$ B	278.19 $\pm 37.147$ B

**Table 2:** Hematological parameters of females with RF before dialysis compared to control.

Parameters	Control (20)	Hemodialysis (15)	Peritoneal dialysis (9)
Hb g/dl	12.966 ± 1.347A	7.939 ± 1.987B	8.159 ± 1.479 B
PCV %	39.152 ± 4.302 A	27.272 ± 5.200 B	29.210 ± 3.422 B
WBCs 10 <sup>3</sup> /μL	5.704 ± 0.652A	6.523 ± 0.912 A	7.006 ± 1.922 A
PLT 10 <sup>3</sup> /μL	247.14 ± 63.248 A	312.81 ± 49.327 B	298.12 ± 47.715 B

The biochemical parameters blood urea and creatinine for both two gender patients with renal failure before dialysis (hemodialysis and peritoneal) compared to control subjects are shown in tables 3, and 4. Results in table 3 and 4 found a significant increased ( $P \leq 0.05$ ) in urea and creatinine in renal failure patient before hemodialysis dialysis and peritoneal dialysis in both gender compared with the control.

**Table 3:** Biochemical parameters of males with RF before dialysis compared to control.

Parameters	Control (20)	Hemodialysis (15)	Peritoneal dialysis (11)
Blood urea (mg /dl)	29.721 ± 7.318 A	152.41 ± 39.707 B	237.8 ± 48.268 B
Creatinine (mg/dl)	0.590 ± 0.135 A	7.039 ± 1.580 B	8.653 ± 2.147 B

**Table 4:** Biochemical parameters of females with RF before dialysis compared to control.

Parameters	Control (20)	Hemodialysis (15)	Peritoneal dialysis (9)
Blood urea (mg /dl)	31.125 ± 9.712 A	159.01 ± 42.783 B	227.8 ± 45.354 B
Creatinine (mg/dl)	0.691 ± 0.103 A	8.971 ± 2.547 B	9.650 ± 3.122 B

#### 4. Discussion

Hb concentration shows a significant decrease in patients with both types of RF diseases before dialysis hemodialysis and peritoneal. In both genders patients compared with the control groups. These results agreed with other researchers reported that renal insufficiency is commonly associated with erythropoietin (EPO) depending on anemia in renal failure patients [9-10]. Also, dysfunctional kidneys produce insufficient amount of erythropoietin hormone (EPO), and this may be the primary cause of anemia in dialysis patients [11].

The erythropoietin hormone circulates in blood plasma and acts to produce red blood cells, on erythroid progenitor cells in the bone marrow, concurrently. The release of iron from storage sites can be reduced by chronic inflammatory diseases, resulting in low transferrin saturation (Fe<sup>+</sup> sat%). Increases in the risk of gastrointestinal bleeding because of platelet dysfunction may be other factors exacerbate anemia in patients

with renal failure. Hb concentration in hemodialysis patients were lower than in peritoneal dialysis patients because patients with hemodialysis had severe anemia than in peritoneal dialysis. Secondary hyperparathyroidism is listed among the possible reasons for causing anemia in hemodialysis patients. This reduction in Hb level in HD patients may occur for a several reasons.

Under the normal physiological situation, the kidneys produced around 90% of erythropoietin hormone. The conditions that an increase in the production of erythropoietin in the kidney was hypoxia, which subsequently stimulates erythropoiesis, as a result to hypoxia and functional renal tissue declines in patients, the kidney incapable of creating enough erythropoietin [12]. In comparison to the control groups, PCV concentration observes significant decrease in both types of disease. These results agreed with mean values of Hb concentration, where PCV was significantly lower in renal failure patients with anemia compared to control subjects [13].

The mean values of (PLT) show a significant increase in patient in both gender males and females' patients compared to the healthy team. This result is consistent with platelet count increase during dialysis

compared to healthy groups concluded that uremic toxins that collected in the patients' blood renal failure diagnosed may affect platelet activity, induce hemostatic imbalances and regulate by thrombotic disorders [14]. The mean values of (WBC) show no significant difference in the males and females hemodialysis patients and females second type dialysis compared to the healthy team. Result also agreed with the leucocytes count in end-stage renal disease (ESRD) patients were not significantly higher pre-HD when compared to the counts of healthy people [15].

However, our study shows a significant increase in male peritoneal dialysis patients compared to the healthy team. This finding agreed with a total WBC consider as a universal indicator of inflammation and contagion, and it may be correlated with development of kidney disease and renal function change in the public citizens, and the peritoneal dialysis was more susceptible to inflammation than hemodialysis [16]. The presented study also showed that the blood urea and serum creatinine increase in renal failure patients before dialysis in both gender (males and females) compared to the healthy team. Finding consistent with chronic renal failure patients (CRF), serum creatinine levels was elevated, and it is greatly

explained as a measurement only of renal function [17]. Besides, a significant elevated in same parameter in patients with chronic kidney disease [18].

The current study concluded that blood urea and serum creatinine parameters are considered as the most important solute eliminate from the kidney and it were the first organic solutes detected in the renal failure patient's blood. The increased in the levels of these parameters (urea and creatinine) due to the kidney losing their ability to remove nitrogenous waste from the blood in the renal failure state and that lead to accumulation of these wastes or substances in the blood of the patients [19].

## **5. Conclusion**

In conclusion, physiological and biochemical blood changes for all renal failure patients that lead to effect on the function of the difference organs. In renal failure patients' urea and creatinine show significant increase than in the control group and patients were found to be anemic. Renal failure patients at risk of death which are due to infection, anemia, high blood pressure, increase in urea and deficiency in the body's immunity. Finally, individuals perhaps undergo early medical screening for kidney disease, particularly those experiencing

symptoms such as reduced urine output, leg swelling, fatigue, rapid heartbeat, and similar signs, to receive timely treatment.

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