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Comparative Study of Haematological and Biochemical Parameters in Patients with Renal Failure in Thi-Qar City

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Abstract

This study was conducted at Al-Shatra Hospital in Iraq, at the dialysis center. Its aim was to investigate indicators affecting kidney function, namely urea and creatinine levels, the effect of age, glomerular filtration rate (GFR), and a complete blood count (CBC) including hemoglobin, white blood cells, and platelets. These were compared to healthy individuals. One hundred samples were taken from patients, divided into 70 patients with kidney failure and 30 healthy individuals. The results showed a highly significant increase ($p < 0.01$) in both urea (134) compared to healthy individuals (38) and creatinine (4.9) compared to healthy individuals (0.5). No significant difference was found in age. The healthy (51) and the sick (54) years. The GFR rate (27) showed a highly significant decrease ($p<0.01$) when compared to the healthy (123). As for hemoglobin, it showed a highly significant decrease ($p<0.01$) from (11) to (9.0). As for white blood cells and platelets, no significant difference was shown, as WBC in the healthy (7.7) and in the sick (6.9), while platelets (191) in the healthy and in the sick (177).

Key words: Renal failure, Erythropoietin, Urea, Creatinine

الملخص

أجريت هذه الدراسة في مستشفى / الشطرة /العراق في مركز غسل الكلى وكانت الهدف منها دراسة المؤشرات التي تؤثر على كفائه الكلة في مرضى الفشل الكلوي والتي تمثلت بنسب اليوريا والكرياتين وتأثير العمر ومعدل الترشيح الكبيبي وايضاً صوره الدم التي شملت هيموغلوبين وخلايا الدم البيضاء والصفيحات الدموية. ليتم مقارنتهم مع الأصحاء حيث تم اخذ 100 عينه من المرضى تم تقسيهم70 مرضى الفشل الكلوي و30 اصحاء واظهرت النتيجة ارتفاع عالي المعنوية ($p<0.01$)لكل من اليوريا (134)عند مقارنتها بالأصحاء (38) والكرياتين (4.9)عند مقارنته بالأصحاء(0.5)اما العمر لم يظهر فرق معنوي حيث. الاصحاء (51) والمرضى (54) سنه. ومعدل(27)GFR اظهر انخفاض عالي المعنوية ($p<0.01$) عند مقارنته بالأصحاء (123) اما بالنسبة هيموجلوبين اظهر انخفاض عالي المعنوي ($p<0.01$ من(11) إلى (9.0) اما خلايا الد البيضاء والصفيحات الدموية لم تظهر فرق معنوي حيث WBC في الاصحاء (7.7)والمرضى (6.9) اما الصفيحات (191)في الاصحاء وفي المرضى (177).

الكلمات المفتاحية: الفشل الكلوي, الارثروبيتنين, الكرياتنين, اليوريا

Introduction

The kidney is a vital organ in the body of a living organism due to its great importance in maintaining the body's functions by eliminating waste and toxins through blood filtration, which results in urine containing urea, creatinine, and harmful substances(1)(2). Because of their accumulation in the body, they cause urea toxins, which arean increase in urea and urinary toxins in the blood(3)(2). These toxins include many compounds such as urea, creatinine, and uric acid, in addition to medium-sized molecules and proteins, which the damaged kidneys cannot excrete adequately(4). Urinary toxins also lead to the exacerbation of systemic infections, increased oxidative stress, high blood pressure, and heart failure, which accelerates the deterioration of the patient's condition and the remaining kidney functions(5). This is common in patients with chronic kidney failure. Also, the kidney has a very important function, which is the production of the hormone erythropoietin, which is the chemical message that the kidneys send to the bone marrow, ordering it to increase the production of red blood cells, which are responsible for carrying oxygen(6) (7). When the kidneys fail, this vital production ceases, leading to one of the most common and

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debilitating complications for kidney failure patients: renal anaemia and low haemoglobin levels (8).In chronic kidney disease, the kidney cells responsible for producing erythropoietin are damaged, resulting in a severe deficiency of this hormone (9). This deficiency prevents the bone marrow from producing enough red blood cells. This affects their production. Red blood cell lifespan is shortened due to the accumulation of uremic toxins in the blood (uremia), causing the red blood cell membranes to become fragile and break down more quickly than normal(10). Iron deficiency occurs as a result of frequent blood loss during dialysis sessions, poor iron absorption from the intestines, or insufficient iron intake in the diet (11)(12)(13)(14).

Material and Method

1. Study Design and Population

This cross-sectional study was conducted on a group of patients with chronic kidney disease (CKD) at various stages (according to the KDIGO classification) between September and December 2025 at the Al-Shatra Dialysis Center, in addition to a control group of apparently healthy individuals matched for age and sex. Ethical approval was obtained from the Institutional Review Board for Medical Research, and all participants provided written consent. Sample Collection and Clinical Variables.

• Samples: After obtaining written informed consent from all participants (or their legal guardians), a 5 mL venous blood sample was drawn from each participant early in the morning (after an 8–10 hour fast). The sample was divided into two tubes: one containing the anticoagulant EDTA (2 mL) for complete blood count (CBC) analysis, and one plain tube without anticoagulant (3 mL) for serum preparation and separation of biochemical parameters. The samples were centrifuged into an EDTA tube immediately after withdrawal, while the serum tube was left to coagulate at room temperature for 30 minutes before centrifugation. Model: Eppendorf 5810 at 3000 rpm for 10 minutes. The serum was separated and then collected and stored in Eppendorf tubes at -20°C until analysis.

• Measured Variables:

• Creatinine and urea: Measured in serum using enzyme-linked chromatography methods (e.g., modified Jaffe for creatinine, Urease-GLDH for urea) on an automated chemical analyser.

• Estimated glomerular filtration rate (eGFR): Calculated using the CKD-EPI (or MDRD) equation based on serum creatinine levels, age, sex, and ethnicity.

• Haemoglobin, white blood cells (WBCs), and platelets (PLT): Measured using an automated complete blood count (CBC) analyser.

2. Statistical Analysis

The Statistical Analysis System (SAS, 2018) program was used to detect the effect of group differences on study parameters. The Least Significant Difference (LSD) test (ANOVA) was used to significantly compare means.

3. Ethical and Practical Considerations General

This study was approved by the scientific committee at the College of Veterinary Medicine, Al-Shatra University, in the study design (Approval Number: SU-EC-2025-4). Blood samples were collected from patients in the renal failure center in Al -Shatrah. After obtaining patients consent and with facilitation of the mission from the veterinary medicine college Patients with acute inflammatory diseases, malignant tumors, or who were

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receiving iron or erythropoietin therapy during the month prior to the study were excluded (to avoid affecting extra renal hemoglobin and ferritin).

Results and discussion

A study of 100 samples was recorded at the dialysis center in Al-Shatra, divided into 70 kidney failure patients and 30 healthy individuals, to compare the percentages of urea and creatinine and calculate the glomerular filtration rate between the patients and the healthy individuals. Also, a blood count was performed to calculate hemoglobin, white blood cells, and platelets, and also to compare them with those of healthy individuals. It was found that there are highly significant differences between the patients and the healthy individuals, with an increase in urea (134) and creatinine (1.2) when compared to the healthy individuals, and a decrease in the glomerular filtration rate from 123 in the healthy individuals to 27 in the dialysis patients, as indicated in Table 1. This increase in the percentages of urea and creatinine is due to the failure of the kidneys to eliminate these toxins, which causes urea toxins This result is consistent with (15) (16)(17), and this is consistent with. Previous studies have shown an increase in urea and creatinine levels. In healthy kidneys, urea and creatinine, resulting from the breakdown of proteins and muscle tissue This result is consistent with (18) (19) are eliminated. However, in kidney failure, this filtration capacity is reduced, leading to the accumulation of these toxins. Creatinine buildup is a strong indicator of kidney function because it is not reabsorbed after filtration This result is consistent with. (20)(21)(22) A decrease in the rate of glomerular filtration is one of the main reasons for this elevated creatinine level. This result is consistent with (21)(23). The kidneys contain millions of filtering units (glomeruli), and in kidney failure, these units are damaged. This result is consistent with (24)(25), reducing their ability to filter toxins from the blood, thus causing their accumulation. Dehydration is another cause of increased urea levels due to fluid loss. The kidneys try to retain water but cannot eliminate urea as efficiently. This result is consistent with (26)(27). Burns and infections also cause increased protein breakdown in muscles(28) ,which is then metabolized into urea. Age did not show a significant difference when comparing patients with healthy individuals. Perhaps due to the sample size and individual differences, and because the elderly

They are most likely to die from complications of kidney failure. This result is consistent with (29) the low haemoglobin levels, as indicated in Table (2) in kidney failure patients, are due to the kidneys' inability to produce erythropoietin, the hormone responsible for red blood cell production (30)(31). This hormone is produced in the kidneys, and when the kidneys fail, its production decreases, leading to a reduction in red blood cells and hemoglobin levels, causing anemia. This is common in kidney failure patients, or iron deficiency, due to blood loss during dialysis This result is consistent with, (9) or a shortened lifespan of red blood cells resulting from the accumulation of toxins This result is consistent with (32), making them fragile and prone to breakdown, or a deficiency in folic acid and vitamin B12 due to malnutrition or their loss during dialysis. (33) White blood cell counts, however, showed no change. The difference in white blood cell count was significant (7.7) in healthy individuals and (6.9) in patients. This is attributed to immunosuppressive corticosteroid treatments or chronic inflammation This result is consistent with (34). Patients with kidney failure often suffer from chronic inflammation, which suppresses the immune system, preventing it from responding to increased white blood cell counts during severe infections. As for platelets, no significant difference was observed when

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compared to healthy individuals (191) and patients (177). This is likely due to the heparin used in dialysis or because platelets may decrease during the dialysis process This result is consistent with (35). The direct action of heparin may cause reversible platelet aggregation and a mild immune response (HIT type 1), especially with high doses or repeated exposure during dialysis (36). Impaired heparin clearance in renal failure means heparin remains in the bloodstream for a longer period because the kidneys cannot eliminate it efficiently, increasing the likelihood of platelet inhibition(37)(38).

Interactions with the dialysis membrane may activate platelets upon contact with the dialysis membrane, and in the presence of heparin, this could lead to increased platelet consumption(39)(40).

Table (1): Comparison between healthy and diseased statues in Age, Urea, S. creatinine and GFR.

Health status	Sample size	Means ±SE			
		Age (year)	Urea (Mg/dl)	S. creatinine (Mg/dl)	GFR
Healthy	30	51.133 ± 3.656 a	38.666 ± 2.539 b	0.520 ± 0.037 b	123.666± 2.648 a
Diseased	70	54.214 ± 2.069 a	107.541± 6.866 a	4.946 ± 0.414 a	27.942 ± 2.966 b
L.S.D.	100	7.864 ns	21.131**	1.2623**	9.644**
P-value		0.4388	0.0001	0.0001	0.0001
		Means with the different letters in same column differed significantly. ** (P≤0.01).			

Table (2): Comparison between healthy and diseased statues in (Hb, WBC, PIL)

Health status	Sample size	Means ±SE		
		WBC	Hb	PIL
Healthy	30	7.780± 0.371 a	11.346± 0.395 a	191.266 ± 12.995 a
Diseased	70	6.988± 0.247 a	9.0215± 0.363 b	177.591± 6.055 a
L.S.D.	100	0.893 ns	1.2159**	24.9 ns
P-value		0.0817	0.0003	0.2784
		Means with the different letters in same column differed significantly. ** (P≤0.01).		

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Conclusions:

Patients with kidney failure showed higher urea and creatinine levels and lower glomerular filtration rate compared to healthy individuals. Similarly, hemoglobin levels were lower in dialysis patients compared to healthy individuals. White blood cell and platelet counts did not show significant differences, and age did not appear to affect patients compared to healthy individuals.

Conflicts of interest

There are no conflicts of interest.

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