



Estimation of Renin enzyme activity and some biochemical parameters among chronic renal failure patients in Tikrit city

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ABSTRACT

Chronic renal failure is a deficiency and failure in the excretory function of the kidneys, which causes a general imbalance in the body by retaining and accumulating nitrogenous waste and harmful substances as a result of metabolic reactions. Other functions of the kidneys, such as the regulation of fluids and electrolytes, may also be affected. This study's primary purpose is to estimate some parameters in the serum of chronic renal failure patients. Data and blood samples were obtained from 90 patients with chronic renal failure and 50 healthy volunteers for this cross-sectional study, conducted between 11 April and 26 July 2022. The results of this study show a considerable rise in the level of renin enzyme in patients (4.824 ± 0.045) compared to the control (2.86 ± 0.39), a high level of ALT in patients (19.56 ± 8.13) compared to the control (11.24 ± 0.98), high level of ALP in patients (95.34 ± 67.71) compared to the control (38.81 ± 5.14), high level of AST in patients (25.33 ± 8.63) compared to the control (11.58 ± 0.94), low level of albumin in patients with chronic renal failure (3.12 ± 0.44) compared to the control (3.90 ± 0.49), high level of globulin in patients with chronic renal failure (8.34 ± 0.68) compared to the control (3.01 ± 0.41), low level of calcium in patients with chronic renal failure (1.731 ± 0.053) compared to the control (2.510 ± 0.063), high level of potassium in the serum of patients with chronic renal failure (6.256 ± 0.068) compared to the control (4.513 ± 0.22), low level of sodium in patients with chronic renal failure (119.82 ± 2.15) compared to the control group (143.76 ± 2.11). According to this study, all physiological

systems are significantly impacted by chronic renal failure. According to the results, chronic renal failure affects several electrolytes and liver function tests and causes a considerable increase in renin levels.

Keywords: *Chronic renal failure, Renin, Aspartate Amino Transferase Alanine Amino Transferase, Albumin, Globulin, Calcium, Sodium, Potassium*

INTRODUCTION

Chronic renal failure (CRF) or chronic kidney disease (CKD) is characterized by a persistent impairment of kidney function, or a measured glomerular filtration rate (GFR) less than 60 ml per minute / 1.73 m² or an abnormally increased blood creatinine for more than 3 months. A progressive decrease of kidney function is frequently involved, necessitating renal replacement treatment (dialysis or transplantation).¹ The pathophysiology of CRF is mainly associated with specific starting mechanisms. Over time, adaptive physiology contributes, causing compensatory hyperfiltration and hypertrophy of the remaining functional nephrons. As the injury progresses, histopathologic abnormalities subsequently appear, including glomerular architectural distortion, aberrant podocyte activity, and disruption of filtration leading to sclerosis.² The two primary serum proteins are globulin and albumin. Albumin is unquestionably used as a nutritional marker in clinical assessments. Immunoglobulin and acute phase proteins comprise the majority of globulin, and a higher amount of globulin indicates a more serious inflammatory state. They can each predict patient outcomes on their own.³ In addition to helping the body's osmotic and acid-base balance, sodium also plays a function in the organization of the body's water balance, which helps regulate the amount of water pumped into cells. Although sodium a number several vital functions in roles the body, its abundance and quality in renal patients are troublesome because the kidneys cannot filter sodium ions and other surplus fluids. As a result, any disturbance in renal function results in an imbalance in salt levels.⁴ The kidneys eliminate any excess potassium from the bloodstream after

the body uses the needed potassium. However, when the kidneys don't function correctly, they cannot filter this extra potassium, which results in elevated blood levels of K⁺.⁵ The kidneys control intestinal calcium absorption using the enzyme 1 hydroxylase to change 25-hydroxyvitamin D₃ [25(OH)D₃], the storage form of vitamin D, into 1,25 dihydroxy vitamin D₃ [1,25(OH)₂ D₃, calcitriol], the active form of vitamin D. Before changes in calcium, phosphorus, or PTH levels can be noticed, calcitriol production is suppressed early in the progression of chronic kidney disease (CKD).⁶ End-stage renal disease (ESRD) patients frequently have aberrant blood enzyme levels. This is partly caused by the lack of renal excretion and the frequent occurrence of numerous comorbid disorders. Alkaline phosphatase (ALP), aspartate aminotransferase (AST), and alanine aminotransferase (ALT) are the serum enzymes most frequently utilized to determine the diagnosis of hepatobiliary diseases (ALT). Patients with and without renal failure commonly have ALT and AST measurements to evaluate their liver functioning.⁷ Measuring the activity of the enzyme renin, which aids in the diagnosis of primary hyperaldosteronism, which accounts for (5%-13%) of this pressure, and hence aids in the control of other forms of stress, is crucial for the medical evaluation of patients with high blood pressure.⁸

MATERIAL AND METHODS

Study Design

The study is cross sectional study achieved in Tikrit city from 11th April to 26th July 2022, data and blood samples collected from 90 patients with chronic renal failure and 50 healthy.

Tools and Apparatus

Several devices and equipment were used in this study. The study shows the apparatus in table 1 and the equipment in table 2.

Methods

Estimation of Renin

The diagnostic kit (kit) provided by the Canadian Business Diagnostics Biochem Canada was used to determine renin enzyme amounts (DBC). The charge of renin secretion in the blood plasma was assessed at pH = 6 in response to Ang-II and by skipping the proper inhibitor.

Estimation of albumin

Principle: Bromine interacts with the albumin. A color change is caused by a weakly acidic medium in BCG (Broom Cresol Green). The indication ranges from yellow-green to bluish-green.

Estimation of globulin

Principle: By deducting the albumin value from the serum's quantitative protein value, the globulin concentration is derived from the blood serum. According to the following equation:

globulin concentration (L/g) = proteolytic concentration Quantitative – albumin concentration

Estimation of Alanine Amino Transferase (ALT), and Aspartate Amino Transferase (AST)

Principle: A method that depends on the quantitative estimation of pyruvate and oxaloacetate liberated by interactions with dinitrophenylhydrazine.

Estimation of Alkaline Phosphatase (ALP)

Principle: This method estimate the amount of released phenol by its interaction with 4-Amino Antipyrin.

Estimation of calcium

Principle: The protein contained in the formula O-cresolphthalein is a complex one O-dissolved

TABLE 1. Tools and material used in our study.

N	Tools and material	Company
1	Disposable syringes	Mirab-Syria
2	Disposable tips	Germany
3	Micropipette	Germany
4	Test tubes	Germany
5	Plane tubes	AFma – Dispo, Jordan
6	Bottle washing water	India

TABLE 2. Used apparatus in our study.

N	Apparatus	Company
1	Incubator	Turkey Elektromag
2	Centrifuge	Germany-Dupont
3	Ultra Violet & Visible Spectrophotometer	Cecil Instrument Limited, America

with 8-hydroxyquinoline, which reacts with calcium ions in an alkaline medium to form a colored complex whose intensity can be read by a spectrometer, is not required to precipitate as part of the approved colorimetric method. This process can be completed rapidly. when using ideal chemical conditions, it produces good results.

Estimation of potassium

Principle: The reaction of potassium ion with sodium tetraphenylboron (TPB-Na) in an alkaline medium to form a fuzzy suspension of potassium tetraphenylboron (TPB-K).

Estimation of sodium

Principle: Sodium precipitates with Mg-uranyle acetate, the uranyl ions remain attached to the filtrate and work to form a yellow complex with thioglycolic acid.

RESULTS AND DISSCUSIONS

The results showed an increase in the amount of renin enzyme, where the level in patients was higher (4.824±0.045) than that in the control (2.86±0.39).

TABLE 3. Concentration of Renin, ALT, ALP, AST, Globulin and Albumin.

GROUPS	PARAMETERS					
	Renin ng/ml/h	ALT U/L	ALP U/L	AST U/L	Globulin g/dL	Albumin g/dL
PATIENTS	4.824±0.045	19.56±8.13	95.34±67.71	25.33±8.63	8.34±0.68	3.12±0.44
CONTROL	2.86±0.39	11.24±0.98	38.81±5.14	11.58±0.94	3.01±0.41	3.90±0.49

TABLE 4. Concentration of Calcium, Sodium and Potassium.

GROUPS	PARAMETERS		
	Calcium	Sodium	Potassium
PATIENTS	1.731±0.053	119.82±2.15	6.256±0.068
CONTROL	2.510±0.063	143.76±2.11	4.513±0.22

The references confirm that a high amount of the enzyme renin indicates a health issue, such as malignant hypertension, Addison's disease, liver cirrhosis, or blockage of an artery in or near the kidney.⁹ The adrenal gland's hormone aldosterone, which is released and may be the cause of the elevated level of renin, is active. According to studies, a problem with this hormone's release results in an imbalance in the activity of the renin enzyme, which then affects the osmotic pressure of the blood in the blood vessels (renal tubules) inside the kidney and, ultimately, the kidneys' ability to filter waste products.¹⁰ Or, the high level of diabetes in patients with diabetic nephropathy, one of the causes of chronic renal insufficiency, may be to blame for the rise in renin enzyme levels. To assess the cardiovascular risks of patients with diabetes, the amount of glomerular filtration must be determined, and lipid-lowering medications are used to lower the LDL level. Additionally, Ang-II inhibitors are used because they improve the function of the heart and blood vessels.⁹ This study's results are confirmed by another study 2010 which shows a significant increase in the level of renin enzyme in the blood plasma of renal insufficiency patients treated with hemodialysis before hemodialysis.¹¹ The level of liver function enzymes is higher in patients with chronic renal failure than in controls, with the level of ALT in patients being higher

(19.56±8.13) than that in controls (11.24±0.98). This finding is supported by a 2017 study that found that participants with chronic kidney disease had significantly higher levels of ALT than participants without chronic kidney disease,¹² the difference between the levels of ALP in patients (95.34±67.71) and controls (38.81±5.14) This finding is supported by another study conducted in Erbil in 2017 that found that pre-hemodialysis patients had greater levels of ALP than control subjects.⁷ The level of AST in patients (25.338.63) compared to controls (11.580.94) is different from the findings of another study from 2012, which found that patients with kidney disease had much lower levels of AST. They linked the cause to the AST enzyme's diminished efficacy as a result of the buildup of hazardous chemicals in patients' serum with renal failure.¹³ Results of this study indicate that patients with chronic renal failure have lower levels of albumin (3.12±0.44) than controls (3.90±0.49), and other studies (2007) show low levels of albumin in patients with chronic renal failure and explain that this is a sign of kidney disease progression caused by changes in the structure of the basement membrane of the renal glomeruli or due to protein malnutrition or dietary restrictions, as proteinuria is the excretion of protein in the urine.¹⁴ This study showed a higher level of globulin in patients with chronic renal failure (8.34±0.68)

compared to the control (3.01 ± 0.41); the results of this study, which are supported by previous studies, demonstrate that individuals with chronic renal failure had greater levels of globulin than controls.¹⁵ This study showed a low level of calcium in patients with chronic renal failure (1.731 ± 0.053) compared to the control (2.510 ± 0.063), and another study reveal when compared to the control groups Still more significant than in the pre-hemodialysis stage, the calcium concentration in CRF patients remained low post-hemodialysis.¹⁶ Renal failure seems to reduce intestinal calcium absorption. The plasma content of blood urea nitrogen is inversely correlated with the fractional absorption of calcium.¹⁷ The result of this study shows higher level of potassium in the serum of patients with chronic renal failure (6.256 ± 0.068) compared to the control (4.513 ± 0.22); this finding is supported by another study from 2011, which found that individuals with chronic renal failure had significantly higher levels of potassium than the control group.¹⁸ This study showed low levels of sodium in patients with chronic renal failure (119.82 ± 2.15) compared to the control group (143.76 ± 2.11); another study from 2016 supports these findings, showing that chronic renal failure patients' pre-dialysis sodium levels were lower than those in the control group.¹⁹

CONCLUSIONS

According to this study, all physiological systems are significantly impacted by chronic renal failure. According to the results, chronic renal failure affects several electrolytes and liver function tests and causes a considerable increase in renin levels.

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