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Association of blood elements with acute and chronic renal failure in patients of different ages

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ABSTRACT

The kidneys filter the blood and excrete waste products and extra fluid in the urine. When kidney function is damaged, waste products and extra fluid buildup in the body, which can be dangerous. Deterioration of renal function is slow, with exacerbation of symptoms with exacerbation of chronic renal failure. Sometimes the symptoms of the disease are not distinguished in the early stages, and therefore they are detected only at later stages. Blood factors and elements have important role in kidney function and regulation of them directly is related to kidney health and function. Therefore, this study aimed to study the association of some blood elements (calcium, potassium, and phosphorous) and blood factors like (creatinine) with kidney failure in acute and chronic stages. We also evaluated blood factors content in kidney failure patient in different age and sex groups to find out which age group is most affected by the disease and dysfunction and the impact of the analyzes of the previously mentioned elements. This study evaluated the parameters reported in more than 200 patients with renal failure in the hospitals affiliated to Babylon University of Medical college and compare them with 106 controls without renal failure and the effect and function of each of the variable factors in patients with acute and chronic renal failure and evaluation of the results through examination with dividing patients into specific age groups. The collected data were statistically analyzed by using ANOVA (one way) software in GraphPad Prism program and Excel software. Analyze of blood factors confirmed creatinine and potassium in female patients is higher than in male patients, perhaps because of different physiological structure and hormonal fluctuation which female patients exposed to. This positive correlation is possibly due to active symport events in kidney. We also note that the percentage of phosphorous for young people (15-38) is lower than for other ages. Calcium is more in patients with renal failure in male than in female and in Middle Ages (39-62) possibly due to deteriorated osteogenesis.

1. INTRODUCTION

At the turn of the twenty-first century, the most prominent event facing societies has been the increasing prevalence of chronic and acute renal failure. Where the prevalence of chronic renal failure in the world is about 8% annually. According to the statistics of the Ministry of Health and Medical Education. Acute renal failure occurs due to kidney damage and is characterized by rapidly impaired renal function. This disease causes electrolyte abnormalities due to acid and retention of nitrogenous wastes such as urea and creatinine. The main causes of kidney disease are nephrotic syndromes or nephrolithiasis. The kidneys are two reddish-brown bean-shaped organs found in vertebrates. It is located to the left and right of the posterior peritoneal space. The kidneys are involved in controlling various body fluids, molarity, acid-base balance, various electrolyte concentrations, and absorption of toxins. Purification occurs in the glomeruli: a fifth of the volume of blood entering the kidneys is purified. Examples of reabsorbed substances include insoluble water, sodium bicarbonate, glucose, and amino acids. Examples of excreted substances are hydrogen, ammonium, potassium, and uric acid. The kidneys also have functions that are independent of nephrons. For example, they convert the precursor of vitamin D into the active form, calcitriol; and the synthesis of the hormone's erythropoietin and renin. Operations used in the treatment of kidney disease include chemical and microscopic examination of the urine (urine test), management of kidney function by calculating the estimated glomerular filtration rate (eGFR) using serum creatinine; Renal histology and use of CT scans to evaluate anatomical abnormalities are used for dialysis and kidney transplantation to treat renal failure; One (or both) of these strategies are almost always used when kidney function is less than 15%. Nephrectomy is also often used to treat kidney cell carcinoma.

1.1 History

Before the advancement of modern medicine, acute kidney injury was referred to as uremic poisoning while uremia was contamination of the blood with urine. Starting around 1847, uremia came to be used for reduced urine output, a condition now called oliguria, which was thought to be caused by the urine's mixing with the blood instead of being voided through the urethra [1]. Acute kidney injury due to acute tubular necrosis (ATN) was recognized in the 1940's in the United Kingdom, where crush injury victims during the London Blitz developed patchy necrosis of kidney tubules, leading to a sudden decrease in kidney function. During the Korean and Vietnam wars, the incidence of AKI decreased due to better acute management and administration of intravenous fluids [2].

1.2 Kidney failure

Kidney failure, also known as end-stage kidney disease, is a medical condition in which the kidneys function at less than 15% of normal levels. Kidney failure is classified as either acute renal failure, which develops rapidly and may go away; and chronic kidney failure, which develops slowly and can often be irreversible. Symptoms may include leg swelling, feeling tired, vomiting, loss of appetite, and confusion. Complications of chronic failure also include heart disease, high blood pressure, and anemia. The prognosis of acute failure often depends on a combination of factors such as decreased urine production or increased serum creatinine. The prognosis for chronic failure is based on a glomerular filtration rate (GFR) of less than 15 or the need for renal replacement therapy. It is also equivalent to stage 5 chronic kidney disease [3], [4].

2. Results

The results of all the mentioned cases are presented separately and comprehensively below: The collected data were analyzed by using GraphPad Prism statistical program and ANOVA (One way) was used as

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statistical analysis method. Data were compared with control in each group and p-value threshold for statistical significance considered 0.05.

2.1 Results based on analyzes performed on patient and control people

All the results of the analyzes performed on patients with renal failure were entered and compared with controls and according to the divided ages in the Excel software and in the ANOVA software (one-way ANOVA) were done that now we are going to explain all of them.

2.2 The results of our findings based on the statistical analysis are as follows

(Comparison of elements and factors in different groups):

The graph data is based on the average number of patients from the test results. The results of all the mentioned cases are presented separately and comprehensively below have become: The collected data were analyzed using GraphPad Prism program (one-way ANOVA) software descriptive statistics and Excel software.

2.2.1 Comparison of Creatinine in different groups

According to this figure (3-2) we obtained from ANOVA that shows comparison between patients male and female with control male and female in different ages:

Point: In patients with renal insufficiency, the kidneys are unable to purify waste products and increase creatinine levels in the blood due to the fact that creatine is decomposed into creatinine and the kidneys excrete creatine from the blood. It increases in the blood.

Creatinine Male: the serum creatinine test results were compared for all ages of male patients and controls, and the standard deviation F (DFn, DFd) was {F(5,168) = 35.27} and P values {P<0.0001} And the measurement of blood Creatinine was measured (mmol/L) and the normal percentage of blood Creatinine for this unit is (62 -124).

Creatinine Female: the serum creatinine test results were compared for all ages of female, patients and controls, and the standard deviation F (DFn, DFd) was {F(5,122) = 44.96} and P-values {P < 0.0001}.

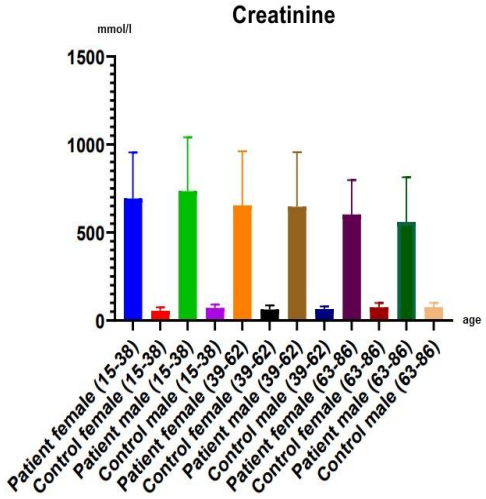

Figure (3-2) Explains the comparison of creatinine between control and patients according to age.

Creatinine (15-38) age group: the serum creatinine test results were compared for female and male patients and controls for ages (15-38), and the standard deviation F (DFn, DFd) was {F(3,43) = 48.94} and P-values {P<0.0001}. According to the diagrams obtained from the ANOVA software, the age comparison between patients and control for female in the age group 15 to 38 is the difference of 637.9 ± 1.8 value higher than that of controls. And the age comparison between patients and control for male in the age group 15 to 38 is the difference of 663.9 ± 1.8 value higher than that of controls.

Creatinine (39-62) age group: the serum creatinine test results were compared for female and male patients and controls for ages (39-62), and the standard deviation F (DFn, DFd) was {F(3,171) = 49.85} and P-values {P<0.0001}. According to the diagrams obtained from the ANOVA software, the age comparison between patients and control for female in the age group 39 to 62 is the difference of 597.9 ± 1.8 value higher than that of controls. And the age comparison between patients and control for male in the age group 39 to 62 is the difference of 581.3 ± 1.8 value higher than that of controls.

Creatinine (63-86) age group: the serum creatinine test results were compared for female and male patients and controls for ages (63-86), and the standard deviation F (DFn, DFd) was {F (3, 76) = 46.48} and P-values {P<0.0001}.

According to the diagrams obtained from the ANOVA software, the age comparison between patients and control for female in the age group 63 to 86 is the difference of 527 ± 1.8 value higher than that of controls. And the age comparison between patients and control for male in the age group 63 to 86 is the difference of 484.4 ± 1.8 value higher than that of controls.

2.2.2 Comparison of Calcium in different groups

The graph data is based on the average number of patients from the test results. According to this figure (3-3) we obtained from ANOVA analysis that shows comparison between male and female patients with control male and female in different ages:

Point 1: Hypercalcemia (increased blood calcium):
By reducing kidney function, patients retain calcium and increase calcium in the blood. In patients with renal insufficiency, the parathyroid gland secretes parathyroid hormone, which causes calcium to leak out of the bone, which increases blood calcium.

Point 2: Hypocalcemia (decrease in blood calcium):
In patients with renal insufficiency, the parathyroid gland, which secretes parathyroid hormone, causes the accumulation of phosphate to calcium and lowers blood

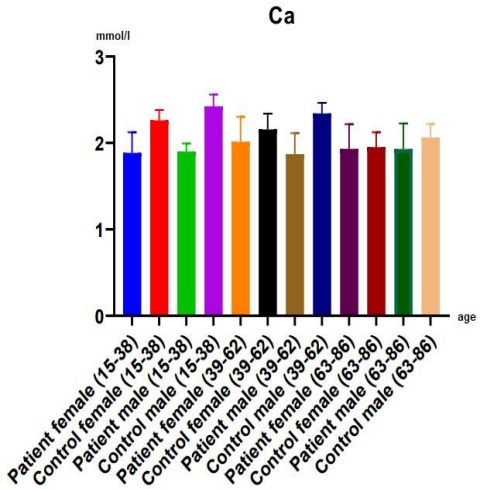

Figure (3-3) Explains the comparison of calcium between control and patients according to age.

Calcium Male: Here serum calcium test results were compared for all ages of male patients and controls, and the standard deviation F (DFn, DFd) was {F(5,168) = 20.12} and P values {P>0.0001} And the measurement

of blood Calcium was measured (mmol/L) and the normal percentage of blood Calcium for this unit is (2.1 - 2.6).

Calcium Female: - The serum calcium test results were compared for all ages of female, patients and controls, and the standard deviation F (DFn, DFd) was {F(5,126) = 6.328} and P-values {P<0.0001}.

Calcium (15-38) age group: The serum calcium test results were compared for female and male patients and controls for ages (15-38), and the standard deviation F (DFn, DFd) was {F(3,43) = 29.20} and P values {P <0.0001}. According to the diagrams obtained from the ANOVA software, the age comparison between patients and control for female in the age group 15 to 38 is the difference of 0.4 ± 1.8 value less than that of controls. And the age comparison between patients and control for male in the age group 15 to 38 is the difference of 0.5 ± 1.8 value less than that of controls.

Calcium (39-62) age group: The serum calcium test results were compared for female and male patients and controls for ages (39-62), and the standard deviation F (DFn, DFd) was {F(3,171) = 22.63} and P values {P<0.0001}. According to the diagrams obtained from the ANOVA software, the age comparison between patients and control for female in the age group 39 to 62 is the difference of 0.14 ± 1.8 value less than that of controls. And the age comparison between patients and control for male in the age group 39 to 62 is the difference of 0.5 ± 1.8 value less than that of controls.

Calcium (63-86) age group: Here serum calcium test results were compared for female and male patients and controls for ages (63-86), and the standard deviation F (DFn, DFd) was {F(3,80) = 1.499} and P values {P =0.2211}. According to the diagrams obtained from the ANOVA software, the age comparison between patients and control for female in the age group 63 to 86 is the difference of 0.02 ± 1.8 value less than that of controls. And the age comparison between patients and control for male in the age group 63 to 86 is the difference of 0.14 ± 1.8 value less than that of controls.

2.2.3 Comparison of Potassium in different groups

The graph data is based on the average number of patients from the test results. According to this figure (3-5) we obtained from ANOVA that shows comparison between patients male and female with control male and female in different ages:

Point: Hyperkalemia (increase potassium): The inability of the kidneys to destroy potassium - because instead of passing urine out, the kidneys return potassium to the bloodstream and increase its amount in the blood.

Potassium Male: Here serum Potassium test results were compared for all ages of male patients and controls, standard deviation F (DFn, DFd) was {F(5,168) = 0.8969} and P values {P=0.4846} And the measurement of blood Potassium was measured (mmol/L) and the normal percentage of blood Potassium for this unit is (3.5 – 5.3).

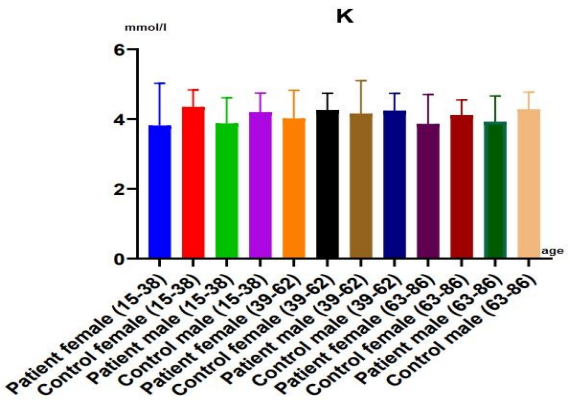

Figure (3-5) Explains the comparison of potassium between control and patients according to age.

Potassium Female: Here serum Potassium test results were compared for all ages of female, patients and controls, the standard deviation F (DFn, DFd) was {F(5,126) = 1.397} and P-values {P =0.2299}.

Potassium (15-38) age group: Here the serum Potassium test results were compared for all ages female and male patients and control for ages (15-38), and the standard deviation F (DFn, DFd) was {F(3,43) = 1.414} and P values {P =0.2517}. According to the diagrams obtained from the ANOVA software, the age comparison between patients and control for female in the age group 15 to 38 is the difference of 0.55 ± 1.8 value less than that of controls. And the age comparison between patients and control for male in the age group 15 to 38 is the difference of 0.4 ± 1.8 value less than that of controls.

Potassium (39-62) age group: Here the serum Potassium test results were compared for female and male patients and controls for ages (39-62), the standard deviation F (DFn, DFd) was {F(3,171) = 0.6557} and P values {P=0.5804}. According to the diagrams obtained from the ANOVA software, the age comparison between patients and control for female in the age group 39 to 62 is the difference of 0.24 ± 1.8 value less than that of controls. And the age comparison between patients and control for male in the age group 39 to 62 is the difference of 0.09 ± 1.8 value less than that of controls.

Potassium (63-86) age group: Here the serum Potassium test results were compared for all ages of female and male patients and controls for ages (63-86), the standard deviation F (DFn, DFd) was {F(3,80) = 1.797} and P values {P =0.1544}. According to the diagrams obtained from the ANOVA software, the age comparison between patients and control for female in the age group 63 to 86 is the difference of 0.25 ± 1.8 value less than that of controls. And the age comparison between patients and control for male in the age group 63 to 86 is the difference of 0.36 ± 1.8 value less than that of controls.

2.2.4 Comparison of Phosphorus in different groups

The graph data is based on the average number of patients from the test results. According to this figure (3-7) we obtained from ANOVA that shows comparison between patients male and female with control male and female in different ages:

Point: In patients with renal insufficiency, parathyroid hormone increases kidney function, increases phosphorus excretion, and increases the amount of phosphorus in the blood. And sometimes when the kidney is damaged, it cannot remove phosphorus from the body and therefore cannot be removed from the blood quickly, and as a result, the amount of phosphorus in the blood increases

Phosphorous Male: Here the serum Phosphorous test results were compared for all ages of male patients and

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controls, standard deviation F (DFn, DFd) was {F(5,168) = 189.0} and P values {P>0.0001} And the measurement of blood Phosphorous was measured (mg/dl) and the normal percentage of blood Phosphorous for this unit is (2.8-4.5).

Phosphorous Female: the serum Phosphorous test results were compared for all ages of female, patients and controls, and the standard deviation F (DFn, DFd) was {F(5,126) = 178.0} and P-values {P < 0.0001}.

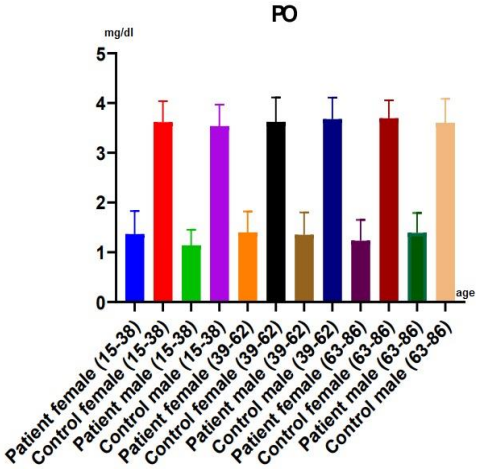

Figure (3-7) Explains the comparison of phosphorous between control and patients according to age.

Phosphorous (15-38) age group: the serum phosphorus test results were compared for male and female patients and controls for ages (15-38), and the standard deviation F (DFn, DFd) was {F(3,43) = 117.0} and P values {P<0.0001}. According to the diagrams obtained from the ANOVA software, the age comparison between patients and control for female in the age group 15 to 38 is the difference of 2.25 ± 1.8 value less than that of controls. And the age comparison between patients and control for male in the age group 15 to 38 is the difference of 2.4 ± 1.8 value less than that of controls.

Phosphorous (39-62) age group: Here the serum phosphorus test results were compared for male and female patients and controls for ages (39-62), and the standard deviation F (DFn, DFd) was {F(3,171) = 275.7} and P values {P < 0.0001}. According to the diagrams obtained from the ANOVA software, the age comparison between patients and control for female in the age group 39 to 62 is the difference of 2.2 ± 1.8 value less than that of controls. And the age comparison between patients and control for male in the age group 39 to 62 is the difference of 2.3 ± 1.8 value less than that of controls.

Phosphorous (63-86) age group: Here the serum phosphorus test results were compared for male and female patients and controls for ages (63-86), and the standard deviation F (DFn, DFd) was {F(3,80) = 203.5} and P values {P< 0.0001}. According to the diagrams obtained from the ANOVA software, the age comparison between patients and control for female in the age group 63 to 86 is the difference of 2.5 ± 1.8 value less than that of controls. And the age comparison between patients and control for male in the age group 63 to 86 is the difference of 2.3 ± 1.8 value less than that of controls.

3. Conclusion

Through our study on patients with acute and chronic renal failure we conclude that the disease of kidney failure is more prevalent in females than males where we notice a higher percentage of creatine, potassium in females than in males for several reasons that the most important is the difference physiological features due to monthly hormonal changes. Of course, infection rate in female is more than male may be due to an

imbalance of ions because women consume less potassium compared to males and muscular structure of males is greater than females. As our results kidney failure in male is characterized by higher proportion of calcium in males possibly due to difference in the physiology of the man's body and the monthly hormonal changes in women. These changes before they occur lead to fluid retention in the body and after they occur to the elimination of toxins in the female body. Also, because women need calcium supplements after they age and reach the age of fifty and above to compensate for the lack of calcium in the woman's body due to the stages of pregnancy childbirth and lactation which absorb calcium from the woman's body. While the man does not go through these stages, he does not suffer from a calcium deficiency. We see that the proportion of phosphorous is equal in females and males alike and this indicates that there is no specific sex affected more or less than the opposite sex for the same ages in patients with renal failure or more precisely proper nutrition or dialysis. Our results also confirmed accompaniment of Ca, K in kidney failure disease in all of the sex and age groups possibly due to symport channel in glomerular section that need to further investigation.

4. References

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