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REGULAR LABORATORY MONITORING OF RENAL FUNCTION IN PATIENTS WITH CHRONIC DISEASES MAY DELAY PROGRESSION TO DIALYSIS IN JORDANIAN PATIENTS

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ABSTRACT

Introduction: Regular laboratory assessment of kidney function in patients with chronic diseases plays a crucial role in the early detection of renal impairment and may help delay progression to dialysis. **Methods:** This multi-centre study aimed to analyse routine laboratory data of patients with chronic diseases in Jordan. Data were collected from several centres and included key laboratory parameters measured every six months, such as serum creatinine, urea, uric acid, albumin, glucose, aspartate aminotransferase (AST), and alanine aminotransferase (ALT). The analysis aimed to identify trends in these parameters, explore potential correlations among them, and assess their implications for patient management and outcomes, specifically progression to end-stage renal disease requiring dialysis. **Results:** In a study involving 400 patients with Chronic Diseases aged 10 to 84, the highest average glucose level was observed in the 70-79 age group at 174.8 mg/dL. The peak creatinine levels were noted in the 40-49 age range, while the highest urea levels were recorded in the elderly group of 80-89 years, which exhibited the lowest creatinine level at 6.35 mg/dL. Interestingly, levels of uric acid, AST, and ALT remained within normal ranges across all age groups. However, a concerning finding was that albumin levels in the 80-89 age group were below normal, indicating potential issues with nutritional status or kidney function in this demographic. **Conclusion:** Indeed, Regular Laboratory Monitoring of Renal Function in patients with Chronic Diseases is directly influenced by their clinical status. Factors such as the underlying kidney disease, age, comorbidities, and overall health greatly impact parameters like electrolyte levels, creatinine clearance, and haemoglobin. For example, older patients or those with additional health issues may experience more pronounced shifts in their lab results due to decreased physiological resilience and potential complications. Consequently, healthcare providers must closely monitor these variations and adjust treatment protocols accordingly to ensure optimal patient outcomes. Regular assessment of laboratory data tailored to each patient's condition is essential for effective management in patients with Chronic Diseases.

KEYWORDS: laboratory assessment, progression, early detection, delayed dialysis.

INTRODUCTION

The kidneys play a vital role in maintaining homeostasis by regulating body fluids, osmolality, acid-base balance, and electrolyte concentrations. They achieve this through various mechanisms, including filtration in the glomerulus, where blood is filtered to remove waste products and excess substances, forming urine. This filtration process not only eliminates toxins but also allows for the reabsorption of essential nutrients and electrolytes, such as sodium, potassium, and bicarbonate, into the bloodstream. By adjusting the composition of urine based on the body's needs, the kidneys help maintain stable internal conditions, prevent dehydration, and manage pH levels, thereby playing a crucial part in overall physiological health.[1]

Chronic kidney disease (CKD) is characterized by the gradual loss of kidney function over time, often without noticeable symptoms in its early stages. The primary causes of CKD include diabetes mellitus, hypertension, glomerulonephritis, and polycystic kidney disease. Risk factors such as obesity, smoking, and a family history of kidney disease can also contribute to the development of CKD. As kidney function declines, patients may eventually experience symptoms such as fatigue, swelling, and changes in urination, underscoring the

importance of early detection and management.[10] Chronic kidney disease (CKD) is an increasingly prevalent condition often associated with comorbidities such as diabetes mellitus (DM) and high blood pressure (HBP). CKD is classified into five stages based on estimated glomerular filtration rate (eGFR): stage 1 with eGFR greater than 90 ml/min, stage 2 with eGFR 60-89 ml/min, stage 3a with eGFR 45-59 ml/min, stage 3b with eGFR 30-44 ml/min, stage 4 with eGFR 15-29 ml/min, and stage 5 (kidney failure) with eGFR less than 15 ml/min. Understanding these stages is critical for developing effective management strategies, delaying disease progression, and improving patient outcomes.[3]

Diabetic kidney disease (DKD) is a severe complication of diabetes mellitus, characterized by progressively worsening renal function due to prolonged hyperglycaemia. Elevated glucose levels activate the renin-angiotensin system (RAS), leading to a decrease in glomerular filtration rate (GFR) and triggering glomerular hyperfiltration. This hyperfiltration at the single-nephron level results in hemodynamic alterations that reduce functional nephron mass, consequently increasing glomerular hydraulic pressure. The elevated pressure can cause damage to filtration structures, allowing macromolecules to leak and ultimately resulting in nephron injury and progressive renal failure. Effectively managing blood sugar levels and monitoring kidney function are critical in preventing the progression of DKD in diabetic patients.[7]

High blood pressure is a significant concern for patients undergoing dialysis, with hypertension defined as blood pressure exceeding 140/90 mm Hg being prevalent in this population. The condition is closely linked to increased mortality and cardiovascular events. In dialysis patients, hypertension often arises from volume overload and sodium retention, which are common due to impaired kidney function. Additional factors contributing to hypertension include increased arterial stiffness and the activation of the renin-angiotensin-aldosterone system (RAAS). Effective management of hypertension in these patients is crucial to improve overall health outcomes and reduce the risk of cardiovascular.[5]

In dialysis patients, significant changes in laboratory test results are influenced by the physiological and pathological effects of chronic kidney disease (CKD) and the haemodialysis (HD) process. One of the most notable changes occurs in creatinine levels, which reflect the body's muscle metabolism and renal clearance. Following haemodialysis, creatinine concentrations drop to low levels due to the removal of waste products, but as the body continues to generate creatinine and renal clearance remains minimal, levels begin to rise again. This cyclical pattern often leads to peak creatinine levels just before the next dialysis session, highlighting the importance of continuous monitoring to evaluate kidney function and adjust treatment effectively.

Urea is indeed a nitrogenous waste product resulting from protein metabolism, and its levels in the blood can provide insights into kidney function, often assessed through the glomerular filtration rate (GFR). However, using urea as a sole indicator of renal function has limitations, as its concentration is influenced by factors such as dietary protein intake and hydration status. In chronic kidney disease (CKD), elevated urea can become toxic, reflecting not only the impaired clearance by the kidneys but also the complexities of protein metabolism in these patients. Therefore, while urea levels are helpful, they should be interpreted alongside other markers and clinical assessments for a more comprehensive evaluation of renal function.[4]

Albumin serves as a critical biomarker for assessing nutritional status and inflammation in dialysis patients, with levels often affected by protein-calorie malnutrition and changes in catabolic rates. Hypoalbuminemia, characterized by low serum albumin levels, typically results from decreased albumin synthesis and increased catabolism, reflecting underlying health issues such as inadequate dietary intake or chronic inflammation. In the context of dialysis treatment, monitoring albumin levels is vital, as low albumin may indicate poor nutritional status, which can lead to increased morbidity and negatively impact overall health outcomes. Therefore, timely interventions to address hypoalbuminemia are essential for improving the well-being of dialysis patients.[10]

The research will examine the levels of biomarkers for liver function, specifically Aspartate transaminase (AST) and Alanine transaminase (ALT), as well as other laboratory values such as creatinine, urea, uric acid, albumin, and glucose, in patients across different age groups. The study will also explore how uremic factors and pyridoxine deficiency affect the activity of these liver enzymes in patients with Chronic Kidney Disease (CKD).

METHODS

four hundred patients of different ages range from 10 to 84. This study that done by a multi-center retrospective study that included patients with Chronic Diseases for more than one year. Laboratory data collected included yearly average of creatinine, urea, uric acid, Albumen, glucose, AST, and ALT.

RESULTS

According to Table 1, the highest creatinine and urea average results found in hypertension patients is (8.92) and (126.1) respectively, on another hand, the Uric Acid, AST, and ALT show a normal result in all disorders, but in the Albumin test that is highly important in Patients with Chronic Diseases patients presented close to lower rang (3.4 to 5.4) in all disorders (3.72 to 3.95) especially in Diabetic patients (3.72), while the average results of glucose in diabetic and hypertension was (191,105)

respectively, and Another disease have normal mean of glucose values.

Table 1 Disruption the average of laboratory tests according to some common disorder.

Disorder/Test	Glucose	Creatinine	Urea	Uric acid	AST	ALT	Albumin
Another Disease	103.9	8.88	119.8	5.13	14.1	12.3	3.95
DM	191	7.58	113.3	4.49	16.9	12.8	3.72
HTN	105	8.92	126.1	4.65	15.5	11.74	3.78
DM and HTN	170.6	8.44	119.5	4.25	15.1	12.8	3.73

* Glucose, Creatinine, Urea and Uric Acid units (mg/dl), AST, ALT units (U/L) Albumin units is g/dl.

Table 2 open the light on the ages of patients with Chronic Diseases and most common laboratory tests that ranges from 11 years to 84 years, the highest glucose average found in (70 – 79) that was 174.8, and the creatinine found in (40 – 49), on another hand the highest urea level in (80 –89) and this group have lowest creatinine 6.35, while the Uric acid, AST and ALT normal in all ages, but the Albumin in (80 – 89) is lower than normal rang(3.4 -5.4) and the most age group is (40 – 49) in 39 patient from 150 (26%) and lower age group is (80 – 89) in percent as (1.3%), while group (70 – 79) present the peak level of glucose (174 mg/dl) but in creatinine test the highest group is (40 – 49) (9.3 mg/dl). while the most percent of age group is (40 – 49) (26%) and three and fifth ages groups become equal according to frequency of patients, and the lower frequency age group is (80 –89) (1.3%).

Table 2: Average of laboratory tests results in Patients with Chronic Diseases according to ages.

Age/Test	Glucose	Creatinine	Urea	Uric Acid	AST	ALT	Albumin	Age
10 -- 29	151.3	7.2	111.3	4.33	25.1	17.9	3.77	21.6
30 -- 39	124.7	9.6	121.2	4.7	13.7	13.1	3.85	35.6
40 -- 49	142.5	9.37	128	4.44	15.7	11.8	4.04	44.9
50 -- 59	147.1	8.16	112	4.75	12.9	10.4	3.72	55.2
60 -- 69	158.7	7.35	116.2	4.5	15	12.6	3.49	63.9
70 -- 79	174.8	7.39	120	4.69	12.9	10.31	3.8	72.5
80 -- 89	128.7	6.35	149	5.4	17.1	16.3	3	83

* Glucose, Creatinine, Urea and Uric Acid units (mg/dl), AST, ALT units (U/L) Albumin units is g/dl

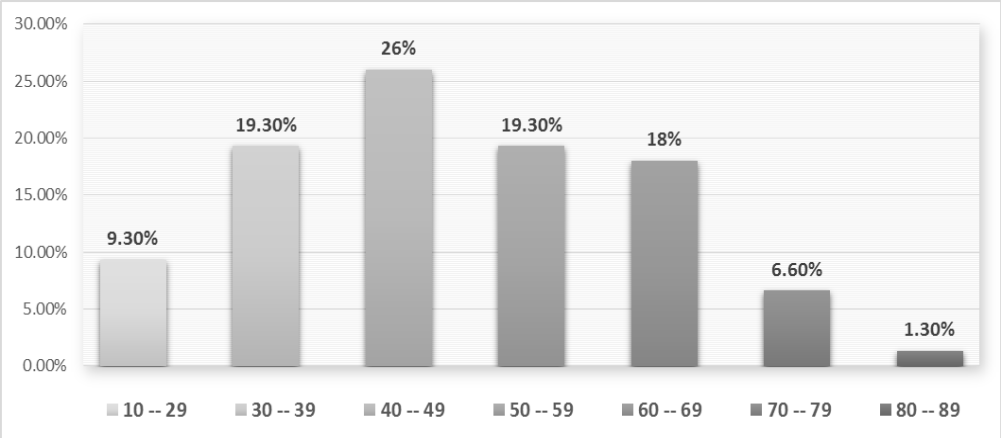

Figure 1: the percent of each age group in patients with Chronic Diseases.

DISSECTION

This research highlights that various disorders, particularly diabetes mellitus (DM) and hypertension (HTN), significantly affect glomerular filtration rate (GFR) and contribute to the progression of end-stage renal disease (ESRD). Patients with chronic diseases often exhibit alterations in multiple laboratory tests, especially kidney function tests (KFT), which are crucial for monitoring renal health. Understanding these effects is essential for optimizing patient management and treatment strategies in those with advanced kidney disease.[9]

The study emphasizes the complex interplay between renal function and other bodily systems. Laboratory findings reveal both kidney-related abnormalities, such as elevated creatinine and urea in certain age groups, and non-renal changes, including low albumin levels in older adults. Liver enzymes AST and ALT were significantly lower in patients undergoing haemodialysis (HD), likely due to the inhibitory effects of uremic toxins and pyridoxine deficiency. Age was also identified as a critical factor in renal failure, with the 40–49 age group being the most prevalent (26%). High glucose levels in the 70–79 age group and elevated creatinine in the 40–49 age group indicate that age-specific renal changes are important considerations in patient management.[3]

Patients with chronic diseases require regular laboratory monitoring of renal function to prevent progression to renal failure and the need for haemodialysis. This process necessitates continuous interaction with healthcare staff, particularly nurses, highlighting the importance of professional support in clinical settings. Despite the lack of home-based equipment, timely interventions in clinical environments significantly improve patient outcomes and overall health.[10]

CONCLUSION

Patients with chronic diseases require regular laboratory monitoring to manage their renal function. Laboratory results can vary depending on the patient's underlying conditions and age, reflecting the complexity of renal assessment in this population. Failure to manage renal function adequately may lead to the need for haemodialysis or, in some cases, kidney transplantation, which is associated with specific eligibility criteria and variable success rates. Many patients, however, remain on conservative management of chronic diseases to mitigate risks associated with dialysis and transplantation. Despite these strategies, chronic disease patients remain at risk of complications such as infections, blood clots, and sepsis, which pose significant threats to patient safety during and after treatment.[7]

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