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Original Article

Clinical and Biochemical Profile of Patients with Chronic Kidney Disease in a Tertiary Care Hospital

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ABSTRACT

Background: Chronic kidney disease (CKD) is characterized by the gradual worsening of renal failure and various clinical, biochemical, cardiovascular and radiological malfunctions. The description of these results is significant to fully evaluate patients who are affected with CKD. **Objective:** To consider the clinical and biochemical characteristics of patients with chronic kidney disease who visited a tertiary care hospital. **Methods & Materials:** The current cross-sectional study was carried out at the Department of Medicine, Shaheed Tajuddin Ahmad Medical College, Gazipur, Bangladesh between June 2022 and December 2022 in a sample of 100 patients with CKD. Demographic features, clinical observation, vital signs, photos of biochemical parameters, serum electrolytes, electrocardiographic observations and radiological observations were evaluated. Descriptive statistics were used to analyze data. **Results:** The mean age of the participants was 46.6±8.3 years, and 74.0% were male. The mean duration of CKD was 20.7±18.1 months. The mean serum creatinine, blood urea nitrogen and estimated glomerular filtration rate were 2.9+1.3 mg/dl, 23.0+5.8 mg/dl and 25.0+14.7 mL/min/1.73 m 2 respectively. The mean serum albumin was 2.9100.4g/dl and the mean total protein was 6.4100.2g/dl. The mean serum sodium, potassium, chloride and bicarbonate levels were 137.8±5.5, 4.4±0.8, 98.2±2.9 and 25.0±2.2 mmol/L, respectively. In 61.0% ECG was normal, and sinus tachycardia was present in 27.0%. The ultrasonography revealed that bilateral renal parenchymal disease was identified in 89.0% of patients. **Conclusion:** CKD patients showed significant renal abnormalities along with biochemical, nutritional, electrolytes, cardiovascular and radiologic abnormalities. Extensive clinical and laboratory assessment can contribute to a better description of the overall disease profile for the tertiary-care CKD populations.

Keywords: *Chronic kidney disease, Renal functioning, Biochemical profile, Electrolytes. EGFR.*

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INTRODUCTION

Chronic kidney disease (CKD) is a chronic clinical condition that is marked by chronic impairments of kidney structure or activity with significant implications on overall body health. The development of renal failure leads to progressive impairment of the kidney in the regulation of body fluid volume and electrolyte, acid-base, and the excretion of metabolic waste products. When CKD advances, therefore, patients can exhibit a large array of both clinical and biochemical abnormalities [1].

Regulation of water and electrolyte balance has a significant part in internal homeostasis of the kidneys. This may lead to disruptions in serum sodium, potassium, chloride and bicarbonate levels; impaired renal activity may decrease the capacity of the kidneys to maintain adequate water and electrolyte retention or excretion. These malfunctions can gain more significance as the renal dysfunction progresses and can be one of the reasons of clinical decline in patients with CKD admitted to the hospital [2]. Thus, the measurement of the biochemical and electrolyte parameters can be considered a significant part of clinical examination of the patients with renal failure.

One of the significant abnormalities of the electrolytes that patients with systemic and renal disorders may experience is hyponatraemia, which should be considered as a serum sodium level lower than 135 mmol/L. It could be secondary to disruptions in water homeostasis, renal water excretion, overload of water, or drug interactions, or a number of underlying systemic diseases. The clinical significance of hyponatraemia is not solely based on the absolute sodium level but rather it is based on the severity and the rate of acquisition of the abnormality [3].

The symptoms of hyponatraemia may be mild or even unspecific findings or severe neurological effects. The patients can present weakness, nausea, vomiting, confusion, altered consciousness, seizures, or coma, especially in case the decrease in serum sodium is extreme or occurs fast. This abnormality is, thus, clinically significant when it comes to hospitalized patients, as various underlying conditions and treatment-related factors can be the cause of disruptions in sodium homeostasis [4].

Electrolyte imbalances in chronic disease patients could be the result of diverse factors. Impaired renal functioning, abnormal water regulation, comorbid diseases, and medication exposure are all factors that could affect serum sodium levels. Hyponatraemia is further reported to be related to various systemic disorders and identification of underlying clinical setting is critical to proper evaluation and treatment [5]. Besides, the abnormalities in sodium concentration can be present with the modifications in other biochemical parameters of chronic renal impairment.

Biochemical picture of CKD patients is the source of valuable data about the degree of renal dysfunction and its systemic implications. There is also the possibility of reduced glomerular filtration that can cause the accumulation of nitrogenous waste products, as well as the abnormalities in the protein metabolism, serum albumin, lipids profile, and urinary protein excretion are also the possibilities of the disease process. Serum creatinine, blood urea nitrogen,

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estimated glomerular filtration rate, serum albumin, total protein, and urinary protein are parameters that are thus used in the overall evaluation of renal and nutritional status [1].

The aspects related to medication may also be applicable in determining the electrolyte abnormalities. Some of the most popular prescribed drugs have been related to hyponatraemia, especially in the case of susceptible patients having multiple comorbidities. Thus, identification of clinical signs of a patient with CKD and electrolyte disturbance must take into account the underlying pathology of the kidney disease, as well as other potential contributory factors, such as medication exposure [6].

Besides biochemical problems, CKD patients can have different symptoms and physical manifestations of the consequences of renal failure on the system. Weakness, anorexia, nausea, vomiting, dyspnoea, edema, pallor, and abnormalities in cardiovascular or respiratory examination may be encountered in patients with advanced renal disease. The evaluation of these clinical features along with laboratory, electric cardiography, and visualization results can give a complete image of the patient.

Although CKD has clinical significance and biochemical abnormalities, the overall clinical and biochemical profile of CKD patients is still of interest within the framework of tertiary-care hospitals in Bangladesh. An improved knowledge of demographic features, current complaints, comorbidities, physical examination, renal status, biochemical indices, electrolyte status, and pertinent study results can be useful in reporting the continuum of the disease in this context. Hence, the current study was carried out to determine the clinical and biochemical characteristics of chronic kidney disease patients presenting to a tertiary care hospital in Bangladesh.

METHODS & MATERIALS

It was a cross-sectional study, which was undertaken in a hospital, specifically the Department of Medicine, Shaheed Tajuddin Ahmad Medical College, Gazipur, Bangladesh. The study was carried out from June 2022 to December 2022. There were 100 patients with chronic kidney disease (CKD) that met the inclusion criteria of the study. The purpose of the study was to present the clinical and biochemical profile of the patients with chronic kidney disease (CKD) visiting the Medicine Unit of the hospital.

Inclusion Criteria

- The patients who were willing to participate in the research were of both sexes.
- Patients who gave written informed consent to participate.
- There were patients who participated in the appropriate clinical and laboratory studies needed to conduct the study.

Exclusion Criteria

- Patients who were not willing to give written informed consent.
- Pregnant patients.
- Patients with CKD who were receiving regular dialysis.
- Congestive cardiac failure (CCF) in patients.
- Chronic liver disease (CLD) patients.
- Patients with cor pulmonale.
- Patients with a clinical condition or information inadequate to carry out the necessary study assessment.

Data Collection

Patient interviews, physical examination, and laboratory investigation were used to collect data based on a structured questionnaire with the variables of interest. The patient or attendant giving details of a patient was then given a detailed clinical history and in detail examined. Relevant investigation reports were gathered and documented as per a pre-set study protocol. The gathered data consisted of demographic factors, clinical presentation, comorbidity, duration of CKD, vital signs, general examination, biochemical, serum electrolytes, electrocardiography (ECG) and radiology results.

Statistical Analysis

The data collected were first coded and organized followed by statistical analysis. The data was put into a computerized database and analyzed using Statistical Package for the Social Sciences (SPSS) and Microsoft Excel. Continuous variables were in the form of mean ± standard deviation (SD), and categorical variables in the form of frequency and percentage. The association between categorical variables was determined by the chi-square test. Where necessary, correlation analysis was conducted to determine the relationships between continuous variables. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Participation in the study was voluntary. Written informed consent was obtained from participants after providing an explanation of the study in Bangla. The participants were told that they had the choice of either participating or not participating. All the information collected was confidential and interviews were held at a convenient time and location that would be convenient to the respondents.

RESULT

The authors provide the demographic and the selected clinical features of the participants of the research. The average age of the patients was 46.6±8.3 years, the highest percentage was the group of 41-50 years (46.0%). Male patients (74.0%), females (26.0%), and male to female ratio (2.8:1) were considered as the majority in the study population. The mean duration of CKD was 20.7±18.1 months. Such results suggest that the middle-aged males took the greater percentage as the study population (*Table I*).

Table I
Clinical characteristics of the study participants (*n*=100).

Clinical characteristics	Value
Age (years), mean ± SD	46.6 ± 8.3
BMI (kg/m²), mean ± SD	22.5 ± 4.1
Duration of CKD (months), mean ± SD	20.7 ± 18.1
Duration of CKD (months), range	5–144
Male, n (%)	74 (74.0)
Female, n (%)	26 (26.0)

The average serum creatinine level was 2.9±1.3mg/dL and the average blood urea nitrogen level was 23.0±5.8mg/dL. Mean estimated glomerular filtration rate (eGFR) was 25.0 +14.7 mL/min/1.73 m 2 and this indicates that there was a considerable deterioration in the renal functioning among the study participants. The mean 24-hour total protein in urine was 2.31 + 1.3 and 74.0% and 26.0% of the patients with 1+ and 2+, respectively had positive urinary albumin (*Table II*).

Table II
Renal biochemical profile of the study participants (*n*=100).

Renal biochemical parameters	Mean ± SD	Range
Serum creatinine (mg/dL)	2.9 ± 1.3	1.5–8.6
Blood urea nitrogen (mg/dL)	23.0 ± 5.8	10.0–33.0
eGFR (mL/min/1.73 m²)	25.0 ± 14.7	7–58
24-hour urinary total protein	2.3 ± 1.3	0.9–4.9
Urinary albumin 1+, n (%)	74 (74.0)	—
Urinary albumin 2+, n (%)	26 (26.0)	—

The nutritional and metabolic biochemical characteristics. The mean of the fasting level of glucose in the blood was 6.0mmol/L. The average total cholesterol level and triglyceride level were 173.9 ±21.6 and 151.2±31.4 mg/dL respectively. The average serum albumin was 2.9±0.4 g/dl and the average total protein was 6.4±1.2 g/dl. The TSH average of the participants was 3.2 ±1.5, which provided the overall picture of the metabolic, nutritional and endocrine state of the respondents (*Table III*).

Table III
Metabolic and nutritional biochemical profile of the study participants (*n*=100).

Biochemical parameters	Mean ± SD	Range
Fasting glucose	6.0 ± 1.0	4.3–10.0
Total cholesterol (mg/dL)	173.9 ± 21.6	122–222
Triglyceride (mg/dL)	151.2 ± 31.4	100–242
Serum albumin (g/dL)	2.9 ± 0.4	2.2–3.6
Serum total protein (g/dL)	6.4 ± 1.2	4.0–7.9
TSH (µIU/mL)	3.2 ± 1.5	1.2–6.2

Mean serum sodium was 137.85±5.5 mmol/L, mean potassium, chloride and bicarbonate were 4.4±0.8, 98.2±2.9 and 25.0±2.2 mmol/L respectively. Overall, the electrolyte profile indicated the difference in the serum levels of electrolytes among the CKD patients (*Table IV*).

Table IV
Serum electrolyte and acid–base profile of the study participants (*n*=100).

Parameters	Mean ± SD	Range
Serum sodium (mmol/L)	137.8 ± 5.5	117–147
Serum potassium (mmol/L)	4.4 ± 0.8	2.5–8.2
Serum chloride (mmol/L)	98.2 ± 2.9	86–109
Serum bicarbonate (mmol/L)	25.0 ± 2.2	19–31

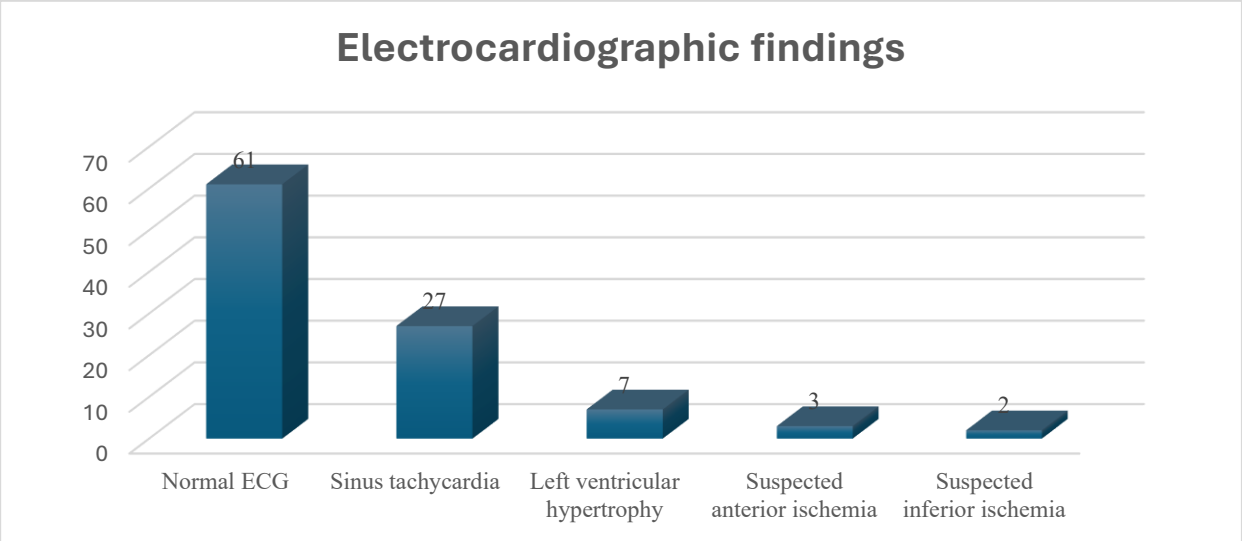


Figure 1 Electrocardiographic findings among the study participants (*n*=100).

Sixty-one percent of patients had a normal ECG. The most common abnormal ECG was sinus tachycardia which was seen in 27.0% of participants. The incidence of left ventricular hypertrophy was 7.0% and the incidence of the suspected anterior and inferior ischemic changes were 3.0% and 2.0% respectively (*Figure 1*).

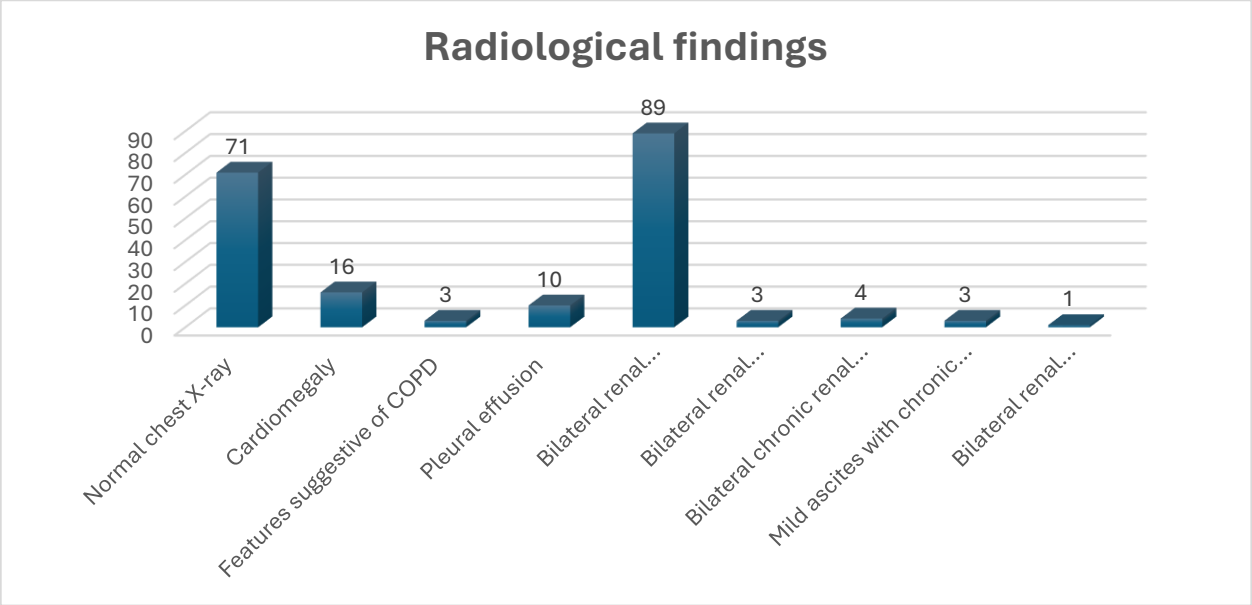


Figure 2 Radiological findings among the study participants (*n*=100).

Chest X-ray was found normal in 71.0% percent of the patients, cardiomegaly, pleural effusion and COPD-related changes were detected in 16.0%, 10.0% and 3.0%, respectively. The most common sonographic observation was bilateral renal parenchymal disease that was found in 89.0% of patients. Other findings reported were chronic renal parenchymal disease with cystitis, fatty liver, mild ascites with cystitis-related alterations and a tiny hepatic cyst (*Figure 2*).

The mean Glasgow Coma Scale was 13.9±1.1, the mean pulse rate was 93.1±7.4 beats/min, the mean systolic blood pressure was 139.6±18.5 mmHg, the mean diastolic blood pressure was 86.6±10.8 mmHg and the mean respiratory rate was 19.7±2.5 breaths/min. The results give a general picture of the clinical condition and physiological values of the recruited CKD patients (*Table V*).

Table V
Clinical examination and vital signs of the study participants (*n*=100).

Clinical parameters	Mean ± SD	Range
Glasgow Coma Scale	13.9 ± 1.1	11–15
Pulse rate (beats/min)	93.1 ± 7.4	80–104
Systolic blood pressure (mmHg)	139.6 ± 18.5	95–220
Diastolic blood pressure (mmHg)	86.6 ± 10.8	60–120
Respiratory rate (breaths/min)	19.7 ± 2.5	16–25

DISCUSSION

This cross-sectional research was an evaluation of the clinical, biochemical, electrolyte, electrocardiographic, radiological and physiological features of 100 chronic kidney disease (CKD) patients admitted to a tertiary care hospital. The population that the study targeted was made up of mostly middle-aged individuals with a mean age of 46.6±8.3 years with 46.0% of the population falling within the 41-50 years age bracket. The mean BMI was 22.5±4.1 kg/m² and the mean duration of CKD was 20.7±18.1 months. Middle-aged patients were underrepresented in the current study as compared to the study conducted by Sood et al., which had a mean age of 62.25±17.77 years, whereas the study by Memon et al. had a mean age of 55.8±15.16 years. Even higher mean age of 73.9±9.8 years was reported by Imai and Shibagaki. Age pattern disparities could be linked to disparities in the population of the study, the location, and patient choice [7,8,9].

The current study population was composed of 74.0% male patients with a male-to-female ratio of 2.8:1. This was in line with the Sood et al. and Uduagbamen et al. studies, which found male proportions of 57.0% and 64.9% respectively, though other studies depicted a more equal or female-dominated distribution [7,10,11]. The average BMI of 22.5±4.1 kg/m2 suggested that the total population of the study was in the normal BMI range that was generally similar to the results of Uduagbamen et al. when close to half of the CKD patients had BMI less than 25kg/m2 [10].

The kidney function was severely impaired as indicated by the renal biochemical profile. The mean serum creatinine was 2.9±1.3 mg/dL, BUN was 23.0±5.8 mg/dL and eGFR was markedly reduced at 25.0±14.7 mL/min/1.73 m². Furthermore, 74.0% of patients had 1+ urinary albumin and the mean 24-hour urinary total protein was 2.3±1.3. Uduagbamen et al. reported a mean creatinine of 165.78±21.15 µmol/L and eGFR of 48.73±3.63 mL/min/1.73 m², while Abdelhamid et al. reported mean serum albumin of 3.62±0.58 g/dL and eGFR of 48.93±2.49 mL/min/1.73 m². Therefore, renal functional impairment of the current population was considerable, but the differences in the disease stage and study setting could be the causes of such variations between the studies [10,12].

The nutrition and metabolic history revealed a mean of 6.0±1.0 fasting glucose, total cholesterol 173.9±21.6 mg/dL, and triglyceride 151.2±31.4 mg/dL. Notably, the level of serum albumin was relatively low: 2.9±0.4 g/dL, whereas total protein was 6.4±1.2 g/dL. The reduced albumin amount might be a measure of the nutritional and protein-loss load that is often experienced by patients with end-stage CKD. Biochemical profile the overall direction of the findings is similar to those provided by Uduagbamen et al. and Abdelhamid et al. in CKD populations [10,12].

Concerning electrolyte variations, mean serum sodium was 137.855.5mmol/L, potassium 4.426mmol/L, chloride

98.22.9mmol/L and bicarbonate 25.02.2mmol/L. These values were also generally similar to that of Uduagbamen et al., which indicated sodium 135.58±11.4 mmol/L, potassium 4.26±1.19 mmol/L, chloride 100.43±3.74 mmol/L and bicarbonate 25.99±10.95 mmol/L. Lower average sodium concentrations were occurring in other studies, especially in hospitalized CKD patients with hyponatraemia [8,10,11].

The ECG reports revealed that 61.0% were normal ECGs, 27.0% reported a sinus tachycardia, LVH 7.0%, suspected anterior ischemic changes 3.0% and suspected inferior ischemic changes 2.0%. These results indicate that even though the majority of the patients did not have a significant ECG finding, a significant percentage of patients had rhythmic or structural/ischemic abnormalities. The current thesis lacked a directly similar ECG distribution of another CKD cohort and, thus, these results could be initially viewed as a description of the cardiovascular profile of the analyzed group [13,14].

In 71.0% of the patients, radiological examination revealed normal chest X-ray, whereas 16.0%, 10.0%, and 3.0% of patients had cardiomegaly, pleural effusion and COPD-related changes, respectively. In 89.0%, ultrasonography showed bilateral renal parenchymal disease, therefore, becoming the most common radiological finding. The fact that bilateral renal parenchymal abnormalities are high is also in line with the well-understood structural involvement that would be present in patients with existing CKD and the thesis did not offer a directly comparable percentage with another imaging-based work [15].

Lastly, the clinical examination revealed that the mean GCS was 13.9±1.1, pulse was 93.1±7.4 beats/min, systolic blood pressure was 139.6±18.5 mmHg, diastolic blood pressure was 86.6±10.8 mmHg and respiratory rate was 19.7±2.5 breaths/min. The results of blood pressure did not differ with those of Uduagbamen et al who found mean systolic and diastolic pressure of 139.84±28.14 and 84.66±11.94 mmHg each. An average pulse rate of 92±13beats/min had also been reported by Abdelhamid et al., similar to the present finding [10,12]. In general, the results reveal that the patients with CKD studied had significant renal dysfunction with biochemical, nutritional, electrolyte, cardiovascular and radiological abnormalities.

CONCLUSION

This experiment showed that chronic kidney disease patients were found to have significant renal dysfunction with a number of clinical and biochemical anomalies. Male population was the dominant in the study, where in a significant number, the advanced CKD was present. Decreased eGFR, high serum creatinine, and decreased serum albumin and abnormal urinary protein excretion were indicators of damaged renal function. Changes in electrolytes were also observed. Some of the patients exhibited cardiovascular and radiological abnormalities such as sinus tachycardia, cardiomegaly, pleural effusion, and bilateral renal parenchymal disease. The results will emphasize the need to thoroughly evaluate CKD patients with clinical and biochemical evaluation to ensure effective management in tertiary care institutions.

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