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Evaluation of Clinical Features and Biochemical Markers in Patients with Chronic Kidney Disease

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ABSTRACT

Background: A serious health concern, the prevalence of chronic kidney disease (CKD) is rising, especially in wealthy countries where renal function is impaired. However, new research indicates that concurrent conditions, including type 2 diabetes, hypertension, and cardiovascular illnesses (CVDs), are suddenly becoming more prevalent in developing Asian countries. (3) The number of CKD patients and the growth in healthcare expenses associated with controlling CKD, especially in the fifth stage, are connected. (4) The incidence of stage 1, 2, and 3 CKD in India is 6.62%, 5.40%, and 3.02%, respectively.

Methods: The M.K.C.G. Medical College & Hospital at Berhampur's Department of Medicine enrolled patients who met the inclusion and exclusion criteria for chronic renal disease and received conservative treatment. Approximately seventy-four patients with established chronic renal disease, who were admitted to the M.K.C.G. Medical College & Hospital's Department of Medicine between March 2021 and November 2022 and were receiving conservative therapy were included in the research. Every patient gave his or her informed permission.

Results: After analysis, the results were shown as frequency, percentage, mean, and standard deviation. The chi-square test was employed to see if the variables were related. A P value of less than 0.05 was considered statistically significant. Microsoft Excel was used for data entry, and the Statistical Package for Social Sciences (SPSS Ver. 24) was used for analysis.

Conclusion: The kidney is an essential organ that controls many body processes, such as hormone metabolism, secretion, electrolyte balance, fluid and acid-base balance maintenance, and the excretion of nitrogenous waste.

Key-words: Kidney, Chronic kidney disease (CKD), Type 2 diabetes, Hypertension, Cardiovascular illnesses (CVDs)

INTRODUCTION

As a crucial endocrine organ, the kidney controls many bodily processes via secreting prostaglandins, erythropoietin, renin, and an active form of vitamin D3 [1].

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A decline in GFR to less than 60 mL/min/1.73 m^2 body surface area for more than three months indicates CKD, which is characterized by structural or functional damage to the kidneys.

The prevalence of CKD, which is a major health issue, is steadily increasing, particularly in developed nations where renal function is compromised [2]. However, recent findings point to an abrupt growth of concomitant disorders such as type 2 diabetes, hypertension, and CVDs in developing Asian nations [3]. An increase in the number of CKD cases is correlated with a significant growth in healthcare costs related to managing CKD, particularly in the fifth stage [4]. The incidence of CKD in

India is 13.01–15.04%, with 6.62%, 5.40%, and 3.02% for stages 1, 2, and 3. The most frequent cause of CKD is diabetic nephropathy, and India is the world's diabetes capital. In India, there are around 7.85 million people with CKD [5]. Chronic kidney disease is becoming more commonplace globally, resulting in the permanent loss of metabolic, endocrine, secretory, and excretory processes as well as nephrons [4,5].

The last stage of chronic kidney disease that would cause death in the absence of replacement treatment is known as end-stage renal disease. Irreversible nephron loss, regardless of the cause, is the ultimate common pathway leading to an altered milieu interior, which impacts all bodily systems, including CKD. Common side effects include hyperphosphatemia, dyslipidemia, thyroid dysfunction, and excessive amounts of metabolic waste products, including urea and creatinine. Hypercalcaemia is one type of mineral bone problem [6].

The kidney significantly influences thyroid hormone metabolism, breakdown, and excretion. The synthesis, secretion, metabolism, and degradation of thyroid hormones can, therefore, be altered by the long-term, cumulative deterioration of renal structure and function, such as that seen in CKD, which subsequently manifests itself in a variety of clinical syndromes related to thyroid dysfunction [7,8].

These disorders can be caused by various causes, including decreased concentrations of circulating thyroid hormone, changes in peripheral hormone metabolism, disrupted binding to carrier proteins, increased iodine reserves in thyroid glands, and potential reductions in tissue thyroid content. Eighth, even when a patient has normal thyroid function tests, they may nevertheless have decreased levels of tri-iodothyronine (T3), the most metabolically active thyroid hormone. "Low T3 Syndrome" is the label used for this. Following are some patterns in which thyroid dysfunction may manifest: thyroid hormone excess or deficiency (hypothyroidism or hyperthyroidism); thyroid hypertrophy (diffuse or nodular); and thyroid symptomology (asymptomatic or symptomatic, subclinical, and overt) [7-9].

Dry skin, cold sensitivity, asthenia, hyporeflexia, and reduced BMR are among the clinical characteristics of patients with CKD that are like those of hypothyroidism [6]. It is so challenging to rule out thyroid dysfunction in CKD patients based alone on their clinical history. Thyroid function anomalies in individuals with chronic kidney disease have been the subject of several research. Hyperthyroidism, hypothyroidism, and euthyroidism have all been documented, although the findings have been erratic from the start.

Comparing the general population to those with chronic renal illness, epidemiological studies have demonstrated a much greater frequency of thyroid function abnormalities, particularly hypothyroidism [10]. In Nepal, South Korea, 38.6% of patients had thyroid dysfunction; the most prevalent kinds were subclinical hyperthyroidism (3.3%), overt hypothyroidism (8.1%), and subclinical hypothyroidism (27.2%) [1,7]. It was revealed that thyroid dysfunction affected 66% of CKD patients in South India (Chennai). Only 8% of cases were due to hypothyroidism, whereas 58% were caused by low T3 syndrome.

MATERIALS AND METHODS

Source of data- Patients who were on conservative management fulfilling criteria for chronic kidney disease as per inclusion and exclusion criteria were admitted to the Department of Medicine, M.K.C.G. Medical College & Hospital, Berhampur, India.

Study subjects- Around 74 patients who had documented chronic kidney disease, were on conservative management and were admitted to the Department of Medicine, M.K.C.G. Medical College & Hospital from March 2021 to November 2022 were enrolled in the study. Informed consent was obtained from all patients.

Inclusion criteria

1. Age 18 years and above.
2. People who have chronic renal disease and meet the diagnostic criteria.
3. For at least three months, there must be kidney problems, either structural or functional, as shown by pathologic abnormalities, decreased glomerular filtration rate (GFR), or both.
4. Indicators of renal injury
   - ✓ variations in the urinary system (proteinuria)
   - ▪ Disorders in the blood (renal tubular syndromes)
   - ✓ Disorders in imaging
   - ● Transplantation of the kidneys
5. Glomerulonephrectomy (GFR) ≤ 60 ml/min/1.73 m^2, whether there is renal injury.

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Exclusion criteria

- ✓ Patients on peritoneal dialysis or hemodialysis
- ✓ Kidney transplant patients
- ✓ Patients with a history of thyroid function abnormalities are already on thyroid supplementation or anti-thyroid drugs.
- ✓ Diabetes
- ✓ Nephrotic range of proteinuria
- ✓ Acute stress
- ✓ Recent surgery, trauma, burns, CVA, AMI
- ✓ Cases of drugs altering thyroid profile like

Method of collection of data- Data collected in a Pre-designed Case Investigating Proforma after obtaining consent. Then, the participants were subjected to necessary investigations, and the results were recorded.

Elimination of bias- The study's most common bias, Selection Bias, was eliminated by adding all patients who met the Inclusion and Exclusion criteria. Accurately measuring and cross-checking all essential study variables at least three times before classifying and reviewing previous records eliminated information bias.

Statistical Analysis- Methods such as frequency, percentage, mean, and standard deviation were used to present the results. We looked for correlations between the variables using the chi-square test. Statistics were considered significant when the P value was less than 0.05. The statistical package for the social sciences (SPSS Ver. 24) was used for analysis, whereas Microsoft Excel was used for data entry.

Ethical Approval- The study has been approved by the Ethical Committee of the MKCG Medical College & Hospital, Berhampur, Odisha.

RESULTS

Male predilection was noticed in our study with 47 males and 27 females suffering from disease. Male to female ratio was 1.74:1. In age groups <30, 30-60, and >60 years, 14, 27, and 6 male patients were seen. Similarly, 4, 19, and 4 female patients were seen in age groups <30, 30-60, and >60 years old. A total of 38.11±10.8 years old were the patients. Participants' ages ranged from 22 for the youngest to 66 for the oldest. The average age of male patients was 36.62±10.6 years, and female patients were 40.7±10.8 years. There was no statistically significant difference (p=0.11) between the sexes about age.

Table 1: Distribution of age based on gender

Age (Years)	Male	Female	Total (%)
<30	14	4	18 (24.3)
30-60	27	19	46 (62.2)
>60	6	4	10 (13.5)
Total	47	27	74 (100)
Mean ±SD	36.62±10.6	40.7±10.8	$p=0.11^{NS}$

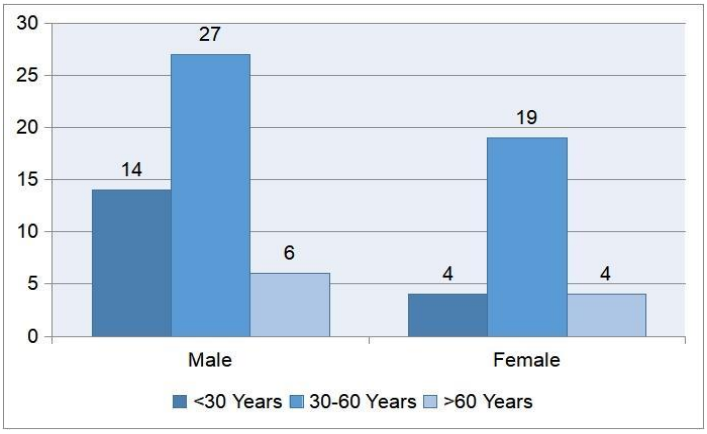

Fig. 1: Distribution of age based on gender

Decreased appetite, nausea/vomiting, oliguria, hiccups, weight loss, dyspnea, and uremic flap was seen in 38 (51.4%), 37 (50%), 21 (28.4%), 24 (32.4%), 33 (44.6%), 25 (33.8%) and 21 (28.4%) patients. The most prevalent symptom was decreased appetite, followed by nausea/vomiting and weight loss.

Table 2: Distribution of presenting complaints

Symptoms	No. of patients (N)	Percentage (%)
Decreased appetite	38	51.4
Nausea/Vomiting	37	50
Oliguria	21	28.4
Hiccups	24	32.4
Weight loss	33	44.6
Dyspnea	25	33.8
Uremic flap	21	28.4

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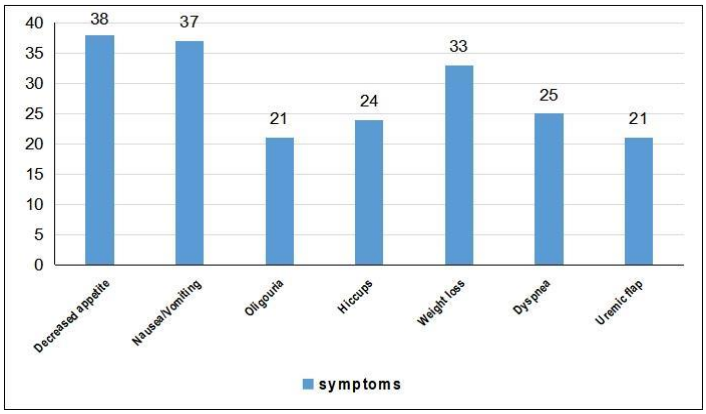

Fig. 2: Distribution of Presenting Symptoms

Out of 74 patients studied, most patients (31 cases, 41.9%) had symptoms of CKD for 7 to 12 months, followed by 22 patients (29.7%) and 14 patients (18.9%) with symptoms extending from 0 to 6 months and 13 to 18 months. Four patients (5.4%) reported experiencing symptoms from 19 to 24 months while 3 patients (4.1%) had symptoms from 25 to 30 months. The mean duration of symptoms was 10.93 ± 7 months with a range of 3.5 months to 36 months.

Table 3: Distribution based on the duration of symptoms in months

Duration (Months)	No. of patients (N)	Percentage (%)
0-6	22	29.7
7-12	31	41.9
13-18	14	18.9
19-24	4	5.4
25-30	3	4.1
Total	74	100

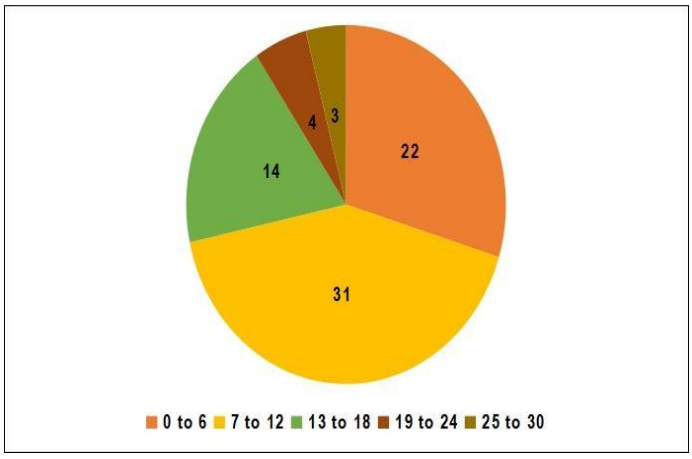

Fig. 3: Distribution based on duration of symptoms in months

Detailed distribution of blood urea levels was studied and enlisted in the above table. The mean blood urea level of patients was 102.85±34.4 mg/dL.

Table 4: Distribution based on blood Urea Levels (mg/dL)

Blood urea (mg/dL)	No. of patients (N)	Percentage (%)
40-80	21	28.4
81-120	37	50
121-160	9	12.2
161-200	7	9.5
Total	74	100

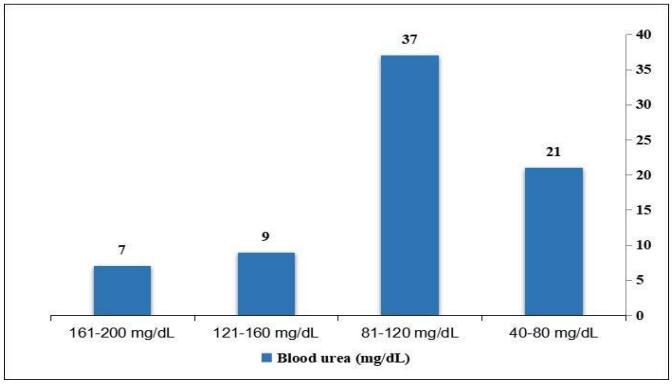

Fig. 4: Distribution-based blood Urea Levels (Mg/Dl)

Serum creatinine was below 4 mg/dL in 22 patients (29.7%), 4 to 8 mg/dL in 39 patients (52.7%), 8 to 12 mg/dl in 11 patients (14.9%) and 12 to 16 mg/dL in 2 patients (2.7%). The mean serum creatinine was 5.8±2.6 mg/dL.

Table 5: Distribution of serum creatinine levels (mg/dL)

Serum creatinine (mg/dL)	No. of patients (N)	Percentage (%)
1.1-4.0	22	29.7
5.0-8.0	39	52.7
9.0-12.0	11	14.9
13.0-16.0	2	2.7
Total	74	100

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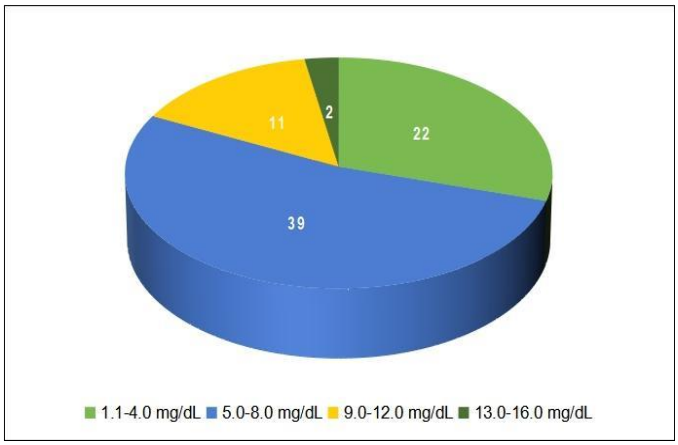

Fig. 5: Distribution of serum creatinine levels (Mg/Dl)

Creatinine clearance was <15 ml/min in 30 patients (40.5%), 15 to 29 ml/min in 37 patients (50%), and 30 to 59 ml/min in 7 patients (9.5%).

Table 6: Distribution based on creatinine clearance (ml/min)

CCL ml/min	No. of patients (N)	Percentage (%)
<15	30	40.5
15-29	37	50
30-59	7	9.5
Total	74	100

DISCUSSION

A range of unique pathophysiological mechanisms are included in chronic kidney disease, which is linked to impaired kidney function and a steady decline in glomerular filtration rate. CKD is a clinical syndrome that results from irreversible loss of renal function [11]. This loss of function affects metabolism, the endocrine, excretory, and synthetic systems. It also causes an accumulation of nitrogenous substances that are not proteins, which causes metabolic disturbances and unique clinical symptoms. End-stage renal disease is defined as the final stage of chronic kidney disease, in which patients would not be able to live without replacement treatment and would ultimately pass away.

Despite having a variety of causes, CKD is the ultimate common pathway of permanent nephron loss, which alters the interior milieu and affects many bodily systems, including the thyroid hormone system [12]. There is a connection between the kidney and thyroid functioning. Thyroid hormones are necessary for kidney growth and development and preserving water and electrolyte balance. Consequently, iodine excretion is decreased in severe renal failure. Poor renal clearance of iodine results in increased amounts of inorganic iodide in the blood, which may inhibit the generation of thyroid hormone and cause the Wolff-Chaikoff effect.

Abnormal thyroid function is linked to low blood total and free T3 concentrations and normal levels of reverse T3 and free T4 in patients with chronic renal disease [13-15]. Most people have TSH levels that are almost normal and are determined to be in a euthyroid condition. Numerous investigations have been carried out to examine aberrant thyroid function in individuals with chronic renal disease. All anomalies, including euthyroidism, hyperthyroidism, and hypothyroidism, have been documented in earlier research. It is unclear how severe renal failure and thyroid dysfunction are related to one another.

The current investigation sought to ascertain the frequency of thyroid dysfunction in individuals with CKD and the relationship between thyroid dysfunction and the severity of renal illness [16-20]. Numerous research with varying degrees of CKD severity and thyroid dysfunction have been done. In our investigation, we only looked at CKD patients receiving conservative treatment. This is because dialysis affects the thyroid profile differently than chronic renal disease. Patients with renal failure who get dialysis often have alterations in their prior serum thyroid hormone levels [21-24]. Studies by Ramirez et al. and Kayima et al. have compared individuals with HD and CKD receiving conservative treatment. We looked at 74 CKD patients. We discovered male preponderance in the current study, with a male-to-female ratio of 1.74:1. The patients' ages ranged from 22 to 66 years old, with a mean age of 38.11±10.8 years. The bulk of patients were in the 30- to 60-year-old age range. Patients who were 30 years of age or under were 18, those who were 31 to 60 years old were 46, and those who were 60 years of age or beyond were 10. Our findings aligned with the research by Kumar A. et al. They discovered that out of the 50 patients in the sample, 17 were female, and 33 were male. The age range covered was 21-70 years. Most of the patients in the sample belonged to the 51-60 age range. 48.8 years was the mean age.

Foundation [25] previous investigation supported our study's findings. Patients with aberrant thyroid profiles ranged in age from 18 to 75 years old, with an average

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age of 54.4 years. In contrast to our findings, the greatest number of patients (32 individuals) were in the 50–70 age range. The ratio of men to women is 24:16. In the CKD with T. days group, the mean age and weight were 54.4±11.0 and 55.12±6.63, respectively.

CONCLUSIONS

This study concluded that "Chronic kidney disease (CKD)" symptoms, duration, and biochemical markers in 74 patients show significant patterns. The most common symptoms were weight loss, nausea/vomiting, and decreased appetite. The study reveals significant delays in CKD diagnosis, with patients experiencing symptoms for 7 to 12 months before identification. Elevated blood urea and serum creatinine levels indicate renal impairment, stressing the importance of prompt CKD diagnosis and management intervention. While addressing CKD prevalence and management in a specific context, the study overlooks risk factors and challenges in developing Asian countries, notably among those with type 2 diabetes and hypertension. Future research could explore how these factors influence CKD progression and develop targeted interventions.

Additionally, investigating socioeconomic and cultural influences on CKD prevalence and management, along with longitudinal studies tracking patient outcomes, could inform tailored CKD management strategies in resource-limited settings, including the exploration of new diagnostic tools and treatment approaches.

CONTRIBUTION OF AUTHORS

Research concept- Susanta Kumar Nahak, Luzoo Prachishree
Research design- Luzoo Prachishree
Supervision- Susanta Kumar Nahak
Materials- Chandan Kumar Gantayat
Data collection- Chandan Kumar Gantayat
Data analysis and Interpretation- Luzoo Prachishree, Susanta Kumar Nahak
Literature search- Suryasnata Sahoo
Writing article- Luzoo Prachishree
Critical review- Susanta Kumar Nahak
Article editing- Luzoo Prachishree
Final approval- Susanta Kumar Nahak

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