A Study on Thyroid Profile in Patients with Chronic Kidney Disease admitted in at a Tertiary Care Teaching Hospital of Purbi Medinipur, West Bengal: A Cross-Sectional Study

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ABSTRACT

Background: Chronic Kidney Disease (CKD) is a significant public health burden in India, particularly in rural districts of West Bengal. Thyroid dysfunction is one of the most commonly encountered endocrine abnormalities in CKD patients, yet it is frequently underdiagnosed. This study was undertaken to evaluate the thyroid profile in admitted CKD patients at a tertiary care teaching hospital of Purbi Medinipur. **Objectives**: To assess the pattern of thyroid dysfunction and to correlate thyroid hormone levels with the stage of CKD.**Methodology:** A hospital-based cross-sectional study was conducted over a period of 12 months. A total of 64 patients diagnosed with CKD (Stage 3–5 as per KDIGO guidelines) were enrolled using a systematic random sampling technique. Thyroid function tests including serum TSH, Free T3 (FT3), and Free T4 (FT4) were measured using ELISA-based chemiluminescence immunoassay. **Results**: Out of 64 patients, 53.1% showed abnormal thyroid function. Subclinical hypothyroidism was the most common pattern (31.2%), followed by overt hypothyroidism (15.6%) and sick euthyroid syndrome (6.3%). TSH levels showed a statistically significant rise with advancing CKD stages ($p < 0.001$), while T3 and T4 levels declined progressively. **Conclusion**: Thyroid dysfunction, particularly hypothyroidism, is highly prevalent

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among CKD patients. Routine thyroid screening should be incorporated in the management protocol of all CKD patients in clinical practice.

Keywords: Chronic Kidney Disease (CKD), Thyroid dysfunction, TSH, Hypothyroidism, Sick Euthyroid Syndrome, West Bengal.

1. INTRODUCTION

Chronic Kidney Disease is defined as an abnormality of kidney structure or function persisting for more than three months, with implications for health. It has emerged as a major non-communicable disease globally, with an estimated prevalence of 10–13% in the general population. In India, particularly in rural districts like Purbi Medinipur of West Bengal, CKD is increasingly recognised as a silent epidemic, often presenting late due to limited awareness and delayed healthcare seeking behaviour.

The kidney plays a vital role in the metabolism, conversion, and excretion of thyroid hormones. As glomerular filtration rate (GFR) declines in CKD, several alterations in thyroid hormone physiology occur. These include reduced peripheral conversion of thyroxine (T4) to triiodothyronine (T3), diminished protein binding, altered feedback mechanisms, and impaired iodine clearance. These changes collectively predispose CKD patients to various forms of thyroid dysfunction, most notably hypothyroidism and the sick euthyroid syndrome.

Studies conducted across India and globally have reported the prevalence of thyroid dysfunction in CKD to range between 40% and 70%, depending on the severity of renal impairment. However, very limited data are available from the eastern Indian region, particularly from West Bengal. The clinical significance of thyroid dysfunction in CKD extends beyond biochemical derangements, as it contributes to anaemia, dyslipidaemia, cardiovascular complications, and poor quality of life, all of which are already inherent concerns in CKD management.

Given this background, the present cross-sectional study was designed to evaluate the thyroid profile among CKD patients admitted to a tertiary care teaching hospital of Purbi Medinipur, West Bengal, and to correlate the findings with disease severity.

2. OBJECTIVES

Primary Objective:

To evaluate the pattern of thyroid dysfunction in patients with Chronic Kidney Disease admitted to a tertiary care hospital of Purbi Medinipur, West Bengal.

Secondary Objectives:

(i) To correlate thyroid hormone levels (TSH, FT3, FT4) with the stage of CKD as classified by the KDIGO criteria.

(ii) To study the sociodemographic profile of CKD patients and its association with thyroid abnormalities.

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(iii) To identify the most prevalent pattern of thyroid dysfunction in the study population.

3. METHODOLOGY

Study Design: Hospital-based cross-sectional study.

Study Setting: Department of Medicine, Tertiary Care Teaching Hospital, Purbi Medinipur, West Bengal.

Study Duration: 12 months (January 2023 to December 2023).

Sample Size Calculation:

The sample size was calculated using the following standard formula for a cross-sectional study:

$$\mathbf{n = Z^2 \times p \times q / d^2}$$

Where:

n = required sample size

Z = 1.96 (standard normal value at 95% confidence interval)

p = expected prevalence of thyroid dysfunction in CKD = 0.50 (50%, as per published literature)

q = 1 – p = 0.50

d = allowable error = 0.125 (12.5%)

$$n = (1.96)^2 \times 0.50 \times 0.50 / (0.125)^2 = 3.8416 \times 0.25 / 0.015625 \approx 61.47 \approx 62$$

Adding approximately 3% for non-response or data loss, the final sample size was rounded up to 64 patients.

Method of Sampling:

Systematic Random Sampling was employed. All CKD patients admitted during the study period were assigned a serial number. Every nth patient (sampling interval k = Total admissions / 64) was selected from the admission register. This ensured equal probability of selection and minimised selection bias.

Inclusion Criteria:

(i) Patients aged 18 years and above diagnosed with CKD (Stage 3–5 per KDIGO 2012 classification). (ii) Patients admitted to the Medicine ward of the hospital. (iii) Patients willing to give written informed consent.

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Exclusion Criteria:

(i) Known cases of primary thyroid disease prior to CKD diagnosis. (ii) Patients on thyroid medications, amiodarone, or lithium. (iii) Pregnant women. (iv) Acute kidney injury (AKI) patients. (v) Patients with other significant endocrine disorders (diabetes mellitus was not excluded per se but thyroid medication use was excluded).

Data Collection:

A pre-structured, pre-tested proforma was used for data collection. Sociodemographic details, clinical history, and biochemical parameters were recorded. Blood samples were collected in the morning (fasting state) for thyroid function tests — serum TSH, FT3, and FT4 — using ELISA-based chemiluminescence immunoassay on the Cobas e411 analyser. Renal function tests (serum creatinine, eGFR using CKD-EPI equation) and complete blood count were also performed.

Ethical Considerations:

The study was approved by the Institutional Ethics Committee (IEC). Written informed consent was obtained from all participants. Confidentiality of patient data was strictly maintained throughout the study.

Statistical Analysis:

Data were entered in Microsoft Excel and analysed using SPSS version 25.0. Descriptive statistics (frequency, percentage, mean ± SD) were used for quantitative variables. The Chi-square test was applied for categorical associations, and one-way ANOVA was used to compare means across CKD stages. A p-value of < 0.05 was considered statistically significant.

4. RESULTS

A total of 64 patients with confirmed Chronic Kidney Disease (Stage 3–5) were enrolled in this study. The findings are presented below under various subheadings.

4.1 Sociodemographic Profile

The sociodemographic characteristics of the study participants are summarised in Table 1. The majority of patients were in the 41–60 years age group (50.0%), followed by 18–40 years (28.1%), and above 60 years (21.9%). Male patients constituted 62.5% of the study population, while females accounted for 37.5%. A significant proportion of

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patients (65.6%) were from rural areas, which is consistent with the predominantly rural catchment area of the tertiary hospital in Purbi Medinipur.

In terms of educational status, 31.3% of patients were illiterate, and 46.9% had primary or secondary level education. Regarding occupation, farmers and labourers formed the largest group (43.8%), followed by housewives (21.9%). Based on the Modified BG Prasad Socioeconomic Classification, Class III (middle class) constituted 31.3% of participants, while Classes IV and V together accounted for 43.7%, indicating a predominance of lower socioeconomic background in the study sample.

Table 1: Sociodemographic Profile of Study Participants (n = 64)

Variable	Number (n=64)	Percentage (%)
Age Group (Years)		
18 – 40	18	28.1
41 – 60	32	50.0
> 60	14	21.9
Gender		
Male	40	62.5
Female	24	37.5
Residence		
Rural	42	65.6
Urban	22	34.4
Education		
Illiterate	20	31.3
Primary/Secondary	30	46.9
Graduate and above	14	21.9
Occupation		
Farmer/Labourer	28	43.8
Housewife	14	21.9
Service/Business	12	18.7
Retired/Unemployed	10	15.6
Socioeconomic Status (Modified BG Prasad)		
Class I (Upper)	6	9.4
Class II (Upper Middle)	10	15.6

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Class III (Middle)	20	31.3
Class IV (Lower Middle)	18	28.1
Class V (Lower)	10	15.6

4.2 CKD Stage Distribution

Among the enrolled patients, Stage 4 CKD (GFR 15–29 ml/min/1.73m²) was the most common presentation (40.6%), followed by Stage 3 (31.3%) and Stage 5 (28.1%). The distribution is presented in Table 2.

Table 2: Distribution of CKD Stages Among Study Participants (n = 64)

CKD Stage (KDIGO)	Number (n=64)	Percentage (%)
Stage 3 (GFR 30–59)	20	31.3
Stage 4 (GFR 15–29)	26	40.6
Stage 5 (GFR < 15)	18	28.1

4.3 Pattern of Thyroid Dysfunction

Out of 64 patients, 34 (53.1%) showed some form of thyroid dysfunction. Subclinical hypothyroidism was the most prevalent abnormality, noted in 20 patients (31.2%), defined as elevated TSH (> 4.2 mIU/L) with normal FT3 and FT4 levels. Overt hypothyroidism (elevated TSH with low FT4) was found in 10 patients (15.6%). Sick euthyroid syndrome characterised by low T3 with normal or low T4 and normal to slightly elevated TSH was identified in 4 patients (6.3%). The remaining 30 patients (46.9%) were euthyroid. The findings are summarised in Table 3.

Table 3: Pattern of Thyroid Dysfunction in Study Participants (n = 64)

Thyroid Function	Number (n=64)	Percentage (%)
Euthyroid (normal)	30	46.9
Subclinical Hypothyroidism	20	31.2
Overt Hypothyroidism	10	15.6
Sick Euthyroid Syndrome	4	6.3

4.4 Correlation of Thyroid Hormones with CKD Stage

A progressive deterioration in thyroid hormone levels was observed with advancing CKD stages. Mean TSH levels increased significantly from 4.2 ± 1.1 mIU/L in Stage 3 to 10.4 ± 3.8 mIU/L in Stage 5 ($p < 0.001$). Correspondingly, mean T3 declined from 92 ± 14 ng/dL in Stage 3 to 58 ± 18 ng/dL in Stage 5, and mean T4 decreased from 6.8 ±

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1.2 µg/dL to 4.1 ± 1.6 µg/dL across the same stages. All correlations were statistically significant ($p < 0.05$). These findings are detailed in Table 4.

Table 4: Mean Thyroid Hormone Levels Across CKD Stages (n = 64)

CKD Stage	Mean TSH (mIU/L)	Mean T3 (ng/dL)	Mean T4 (µg/dL)
Stage 3	4.2 ± 1.1	92 ± 14	6.8 ± 1.2
Stage 4	6.8 ± 2.3	74 ± 16	5.4 ± 1.4
Stage 5	10.4 ± 3.8	58 ± 18	4.1 ± 1.6
p-value	< 0.001	< 0.001	0.002

5. DISCUSSION

The present study evaluated the thyroid profile in 64 patients with CKD admitted to a tertiary care teaching hospital of Purbi Medinipur, West Bengal. The findings reveal a high prevalence of thyroid dysfunction (53.1%) in this population, with subclinical hypothyroidism being the most predominant pattern.

The sociodemographic findings of this study reflect the typical demographic burden of CKD in rural eastern India. The predominance of male patients (62.5%) in the 41–60 years age group, belonging to lower socioeconomic classes and engaged in physically demanding occupations, aligns with findings reported by Kher (2002) and Shah et al. (2013), who noted that hypertension and diabetic nephropathy — both more common in middle-aged males in this region — are leading causes of CKD in India. The high proportion of rural patients (65.6%) underscores the need for enhanced primary healthcare and early nephrology referral systems in districts like Purbi Medinipur.

The overall prevalence of thyroid dysfunction in the present study (53.1%) is consistent with previously published literature. Chandra et al. (2010) reported thyroid abnormalities in 48–60% of CKD patients, while Mooraki et al. (2005) noted a similar range in Iranian patients on conservative management. The predominance of subclinical hypothyroidism (31.2%) in our study correlates closely with findings by Lim (2012), who described subclinical hypothyroidism as the most frequently encountered thyroid abnormality in non-dialysis CKD patients. This pattern is attributed to impaired degradation of TSH, altered pituitary-thyroid feedback, and possible iodine accumulation in renal failure.

The progressive increase in TSH with advancing CKD stages and the corresponding decline in T3 and T4 levels observed in this study are in agreement with findings reported by Basu and Mohapatra (2012) and Kaptein et al. (1988). The low T3 state, particularly pronounced in Stage 5 CKD, results primarily from reduced peripheral deiodination of T4 to active T3 due to uraemic toxins inhibiting the enzyme 5'-monodeiodinase. This explains why sick euthyroid syndrome was exclusively observed in advanced CKD patients in our cohort.

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Overt hypothyroidism (15.6%) in the present study was slightly higher than the 10–12% reported in some Western studies, but comparable to Indian studies where iodine deficiency in rural populations may compound renal-related thyroid abnormalities. It is worth noting that hypothyroidism itself can impair renal function by reducing cardiac output and renal blood flow, creating a vicious cycle that accelerates CKD progression. This bidirectional relationship has been emphasised in recent reviews by Lo et al. (2019).

From a clinical standpoint, the significance of identifying thyroid dysfunction in CKD patients cannot be overstated. Untreated hypothyroidism in CKD patients worsens dyslipidaemia, aggravates anaemia by reducing erythropoietin sensitivity, impairs cardiac function, and contributes to overall uraemic symptoms. Furthermore, the interpretation of thyroid function tests in CKD must be done cautiously, as the normal reference ranges may not be directly applicable to this population owing to altered protein binding, altered volume of distribution, and changes in TSH glycosylation.

A notable strength of the present study is its focus on a relatively underrepresented population from rural West Bengal. However, the study is limited by its cross-sectional design, which precludes causal inference. Additionally, the relatively small sample size of 64, while sufficient for the study objectives, may limit the generalisability of findings. Longitudinal studies and dialysis sub-group analyses would provide more comprehensive insights.

6. CONCLUSION

This cross-sectional study demonstrates that thyroid dysfunction is highly prevalent in patients with Chronic Kidney Disease, affecting over half (53.1%) of the study population. Subclinical hypothyroidism is the most common form, followed by overt hypothyroidism and sick euthyroid syndrome. The severity of thyroid dysfunction shows a clear and statistically significant correlation with the stage of CKD, becoming more pronounced as renal function deteriorates. Given the high prevalence and clinical implications of thyroid abnormalities in this population, it is strongly recommended that routine thyroid function testing (TSH, FT3, FT4) be incorporated as part of the standard workup for all CKD patients, irrespective of clinical symptoms. Early identification and appropriate management of thyroid dysfunction may help improve the overall quality of life and clinical outcomes in CKD patients, particularly in resource-constrained settings such as rural Purbi Medinipur of West Bengal.

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7.Declaration

Conflict of Interest: The authors declare no conflict of interest.

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