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STUDY OF THYROID FUNCTION IN PATIENTS WITH CHRONIC KIDNEY DISEASE

Biochemistry

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ABSTRACT

Chronic Kidney Disease (CKD) is a long-standing illness with increasing global prevalence, and among its systemic manifestations, thyroid dysfunction, particularly hypothyroidism is a significant yet often overlooked endocrine abnormality. This cross-sectional study, conducted from 1st January to 31st December 2019 at MES Medical College, Perinthalmanna, aimed to assess the thyroid function profile and prevalence of hypothyroidism in CKD patients, and to analyze the relationship between thyroid hormone levels and CKD stages.91 adult CKD patients were evaluated for serum levels of Free Triiodothyronine (FT3), Free Thyroxine (FT4), and Thyroid Stimulating Hormone (TSH) using chemiluminescence immunoassay, along with kidney function parameters including serum creatinine, urea, and estimated glomerular filtration rate (eGFR). The mean age was 53.08 ± 13.6 years, with females comprising 54.4% of participants, and the majority (57.1%) were in Stage 5 CKD. The mean eGFR was 17.09 ± 13.89 ml/min/1.73 m². Hypothyroidism was observed in 30.8% of patients (20.9% overt and 9.9% subclinical), with elevated TSH in 30.8%, while FT3 and FT4 remained within reference ranges in most cases. A significant association was found between CKD stage and hypothyroidism ($p < 0.05$). The findings underscore the high prevalence of thyroid dysfunction in CKD, particularly as the disease progresses, highlighting the importance of routine thyroid screening for early detection and management.

KEYWORDS

Chronic Kidney Disease, Hypothyroidism, Thyroid Hormones, eGFR, TSH, FT3, FT4

INTRODUCTION

Chronic Kidney Disease (CKD) is a major global health concern affecting an estimated 10–15% of the adult population worldwide[1]. It is characterized by a gradual loss of kidney function over months or years and leads to various metabolic and systemic complications[2]. CKD not only affects the renal excretory functions but also disrupts endocrine and metabolic pathways, particularly involving the thyroid gland[1,3]. The thyroid and kidneys are closely interconnected. Thyroid hormones play a key role in maintaining renal development and physiological function, including glomerular filtration rate (GFR), sodium reabsorption, and renal hemodynamics[2,12]. Conversely, the kidneys are vital for the metabolism, degradation, and excretion of thyroid hormones[1,10].

In CKD, multiple changes in thyroid physiology occur. These include altered peripheral conversion of thyroxine (T4) to triiodothyronine (T3), reduced protein binding of thyroid hormones due to uremia, and impaired hypothalamic-pituitary-thyroid (HPT) axis feedback[2,8]. Uremic toxins, iodine retention, and chronic inflammation further disrupt thyroid homeostasis[4,9]. Consequently, patients with CKD frequently present with low T3 syndrome, subclinical hypothyroidism or overt hypothyroidism[5,6,7]. Recognizing and managing thyroid dysfunction in CKD patients is crucial, as untreated hypothyroidism may exacerbate cardiovascular risk, anemia and overall morbidity[3,4,11].This study aims to evaluate thyroid function in CKD patients, identify the prevalence and types of hypothyroidism, and assess the correlation between thyroid hormone alterations and CKD stages.

MATERIALS AND METHODS

Study Design and Setting: This hospital-based cross-sectional study was conducted at MES Medical College, Perinthalmanna, Kerala.

Duration: 1st January 2019 to 31st December 2019.

Participants: 91 CKD patients aged over 18 years attending nephrology and general medicine outpatient departments. Patients with prior thyroid disorders or taking thyroid-altering medications were excluded.

Data Collection: Demographic, anthropometric, and clinical data were collected using a structured questionnaire. Blood samples were analyzed for serum urea, creatinine, FT3, FT4, and TSH using chemiluminescence immunoassay (VITROS 5600).

Working Definition: The clinical diagnosis of chronic kidney disease was based on the guidelines of National Kidney Foundation[16], in which stages of chronic kidney disease are defined according to the glomerular filtration rate .CKD stages were categorized based on eGFR calculated using the MDRD formula: $186 \times (\text{Creatinine}/88.4)^{-1.154} \times (\text{Age})^{-0.203} \times (0.742 \text{ if female}) \times (1.210 \text{ if black})$

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using SPSS trial version 17. Descriptive statistics were presented as mean ± SD or percentages. ANOVA was used to assess differences between CKD stages.

RESULTS

The study population included 91 patients with CKD, comprising 49 females (54.4%) and 42 males (45.6%), with a mean age of 53.08 ± 13.6 years. The largest age group was 51–60 years, and most participants belonged to a joint family setup. Educationally, a majority had completed primary school, and a significant proportion (77.7%) were unemployed. Socioeconomically, most were in class III or IV based on BG Prasad's classification. Comorbid hypertension was present in 70.3% and diabetes mellitus in 11% of patients.

Biochemical parameters showed elevated mean serum urea (81.35 ± 41.5 mg/dL) and creatinine levels (5.88 ± 3.9 mg/dL), indicating advanced renal dysfunction. The CKD stages showed that stage 5 was seen on more than half of the patients (57.1%) , followed by stage 4 in 23.1% and stage 3 in 19.8%. The mean eGFR was 17.09 ± 13.89 ml/min/1.73 m², and over half the patients (57.1%) were classified as stage 5 CKD.

Table 1 : CKD Stages

CKD stages	Frequency	Percentage (%)
Stage 3: 30-59 ml/min per 1.73 m2	18	19.8
Stage 4: 15-29 ml/min per 1.73 m2	21	23.1
Stage 5: <15 ml/min per 1.73 m2	52	57.1

Thyroid function results revealed that 30.8% had elevated TSH levels (>5.5 mIU/L), indicating hypothyroidism. Mean TSH was 4.914 ± 3.9 mIU/L. FT3 and FT4 levels remained within normal range in most cases, with means of 2.13 ± 0.92 pg/ml and 1.18 ± 0.59 ng/dL, respectively. Overt hypothyroidism was diagnosed in 20.9% and subclinical hypothyroidism in 9.9% of patients. Notably, the prevalence of hypothyroidism was highest in CKD stage 5 patients (61.5% of all hypothyroid cases).

Table 2 : CKD Stage vs Hypothyroidism

CKD stages	Subclinical (n)	Overt (n)
Stage 3: 30-59 ml/min per 1.73 m2	01	03
Stage 4: 15-29 ml/min per 1.73 m2	03	05
Stage 5: <15 ml/min per 1.73 m2	05	11

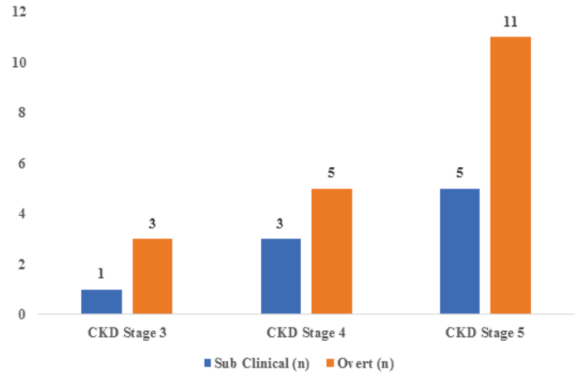

Figure 1 : CKD Stage vs Hypothyroidism

DISCUSSION

The findings of this study underscore a strong association between CKD progression and the incidence of thyroid dysfunction, particularly hypothyroidism. The prevalence of hypothyroidism (30.8%) among CKD patients is consistent with earlier studies, such as those by Pakhle et al.[6] and Rhee et al.[4], which demonstrated that decreased GFR is linked to increased TSH and reduced T3 levels.The results of our study was similar and comparable to a study done by Dr.J.Punekar et al to find the relationship between thyroid function in chronic kidney disease patients[17].

Table 3 : Proportion of Hypothyroidism in Chronic Kidney Disease

CKD STAGE	OUR STUDY	Dr.J.Punekar et.al
Stage 5	57.1 %	68 %
Stage 4	23.1 %	24 %
Stage 3	19.8 %	8 %

The elevation of TSH with normal FT3 and FT4 levels in some patients highlights the presence of subclinical hypothyroidism[5,7]. This condition, while often asymptomatic, may progress to overt hypothyroidism and exacerbate CKD complications, including anemia, dyslipidemia, and cardiovascular disease[4,11,14]. Reduced peripheral conversion of T4 to T3 and impaired renal clearance of TSH due to uremia likely contribute to these alterations[2,8,10].

The strong female predominance and higher prevalence of hypothyroidism in stage 5 CKD further emphasize the need for routine thyroid screening in advanced CKD[7,9,13]. Additionally, the presence of common comorbidities such as hypertension and diabetes supports the multifactorial burden these patients face[6,14]. Comparison with other regional and international studies confirms the reliability of our findings and the need for clinicians to adopt integrated endocrine-nephrology management strategies[1,4,11]. Early diagnosis and treatment of thyroid dysfunction may improve clinical outcomes and quality of life for CKD patients[3,5,15].

CONCLUSION

This study has demonstrated that subclinical and overt hypothyroidism is present among chronic kidney disease patients. 30.8% of total patients were found to have hypothyroidism. Prevalence of hypothyroidism increased with reduced estimated GFR[4,5,6].In our study most of the patients belong to stage 5 CKD and the number of hypothyroid patients were more in this stage[7]. Among the hypothyroid patients, most of them were overt. No cases of hyperthyroidism were found. Thus timely identification and treatment of these thyroid abnormalities could alter the course of the disease and help in reducing morbidity of CKD patients[1,3,4,11].

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