e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15 (6); 1623-1627

Original Research Article

Thyroid Dysfunction in Chronic Kidney Disease and its Correlation with EGFR

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Received: 20-04-2023 / Revised: 17-05-2023 / Accepted: 26-06-2023
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Conflict of interest: Nil

Abstract:

Introduction: Patients with chronic renal failure (CKD) often exhibit signs and symptoms suggestive of thyroid dysfunction. Various studies have reported conflicting results regarding thyroid function in uremic patients, including hyperthyroidism, hypothyroidism, and euthyroid state. Thyroid dysfunction is associated with increased mortality and severity of renal disease. The prevalence of thyroid dysfunction in CKD ranges from 13% in early stages to 70% in end-stage renal disease (ESRD). This study aimed to investigate the prevalence and correlation of thyroid dysfunction with estimated glomerular filtration rate (eGFR) in patients with CKD.

Methodology: This cross-sectional observational study included 150 patients diagnosed with CKD. Participants were recruited from a hospital or clinic using a convenient sampling method. Demographic information, clinical parameters (thyroid function and kidney function), and data on potential confounding factors were collected. Statistical analysis involved calculating the prevalence of thyroid dysfunction, assessing the correlation between thyroid dysfunction markers and eGFR, and performing subgroup analysis.

Results: The study analyzed the sex-wise age distribution of participants, revealing a median age of 55 years among males, females, and the total clinical trials. The prevalence of thyroid dysfunction among CKD patients was examined based on sex, showing that low T3 syndrome was present in 48.6% of males and 69.2% of females, low T4 syndrome in 18.9% of males and 30.8% of females, and high TSH in 2.7% of males and 7.7% of females. An association was found between thyroid hormone levels and renal function. Serum T3 levels were associated with the severity of CKD, even in the presence of normal TSH levels.

Conclusion: This study contributes to understanding the age distribution, prevalence, and correlation of thyroid dysfunction in CKD patients. The findings emphasize the importance of considering thyroid function in the management of CKD. Further research is warranted to explore the clinical implications and potential interventions related to thyroid dysfunction in CKD patients.

Introduction

Patients with chronic renal failure often have signs & symptoms suggestive of thyroid dysfunction. These findings include dry skin, sallow complexion, low temperature, cold intolerance, decreased basal metabolic rate, lethargy, fatigue, edema & hyporeflexia. Various studies of thyroid functions in uremic patients have been carried out which have shown conflicting results. Hyperthyroidism, hypothyroidism & euthyroid state have all been reported by various workers.

The kidney normally contributes to the clearance of iodine, primarily by glomerular filtration. Thus iodide excretion is diminished in advanced renal failure, leading sequentially to an elevated plasma inorganic iodide concentration and an initial increment in thyroidal iodide uptake [1].

Serum triiodothyronine (T3) levels were consistently found to be low without any regard to treatment of CKD. Serum total & free thyroxine (T4) concentrations have been reported as low, normal or high. Serum thyroid stimulating hormone (TSH) levels were found to be normal in most patients of CKD even in those whose CKD is complicated by low T3 concentration.

A reduction in total T3, but not in free T3 concentrations was associated with an increased all-cause and cardiovascular mortality in euthyroid CKD patients [2]. Total and free T3 behave as survival markers in patients with CKD both in HD and in PD.

Prevalence of hypothyroidism in end stage renal disease (ESRD) have been estimated between 0 and 9%. There is also increased prevalence of goitre in patients with ESRD. Though there are multiple factors which predicts the overall mortality and severity of renal disease, one among the important factor is thyroid dysfunction.

It has been shown that in chronic kidney disease (CKD), as the glomerular filtration rate (GFR) falls, there is a higher possibility of developing clinical and subclinical hypothyroidism (SCH) [3]. Prevalence of Thyroid dysfunction in CKD is found to be ranging from 13% in early CKD to 70% in ESRD according to various studies [4-7]. Thus, the present study was conducted to find out possible association of CKD and thyroid dysfunction and to estimate the occurrence of thyroid dysfunction in patients with chronic kidney disease and its correlation with eGFR.

Objective

The objective of this study was to investigate the prevalence and correlation of thyroid dysfunction with estimated glomerular filtration rate (eGFR) in patients with chronic kidney disease (CKD).

Methodology

Study Design: Cross-sectional observational study

Participants: 150 patients diagnosed with chronic kidney disease (CKD).

Participants were recruited from a tertiary care hospital using a convenient sampling method

Inclusion criteria:

- Confirmed diagnosis of CKD based on established clinical and laboratory criteria.
- Age 18 years or older

Exclusion criteria:

- Participants with a history of thyroidectomy or thyroid-related disorders prior to CKD diagnosis.

Data Collection: Age, gender, ethnicity, and relevant medical history were recorded for each participant. Serum levels of thyroid-stimulating hormone (TSH), free thyroxine (FT4), and free triiodothyronine (FT3) were measured using standardized laboratory procedures. Estimated glomerular filtration rate (eGFR) was

calculated using established formulas (e.g., Modification of Diet in Renal Disease equation). Comorbidities (e.g., diabetes, hypertension), medication history, and other relevant clinical parameters (e.g., body mass index) were also collected.

Statistical Analysis: All analyses was conducted using statistical software, SPSS version 23. The prevalence of thyroid dysfunction in patients with CKD was calculated by determining the proportion of patients with abnormal thyroid function test results. The correlation between thyroid dysfunction markers (TSH, FT4, FT3) and eGFR was assessed using appropriate statistical tests (e.g., Pearson correlation coefficient). Statistical significance was set at $p < 0.05$.

Results

Table 1: Sex wise age distribution of patients

Age in years	Male		Female		Total	
	Frequency	%	Frequency	%	Frequency	%
30-39	23	21.6	0	0	23	15.3
40-49	12	10.8	16	38.4	28	18.6
50-59	29	27	19	46.2	48	32
60-69	44	40.5	7	15.4	51	34
Total	108	100	42	100	150	100
Median age	55(35-69)		55(40-62)		55(35-69)	
Mean ± SD	52.6±10.8		55.4±6.8		52.7±10.3	

The sex wise age distribution shown in the table 1 reveals that the median age of the males and females and total clinical trials was 55 years. The mean age of the total subjects was 52.7±10.3 years. The mean age of the 108 male and 42 female patients was 52.66±10.8 and 55.4±6.8 years respectively. The difference between the mean age of the male and female was statistically not significant P>0.05.

Table 2: Sex wise prevalence of thyroid dysfunction in CKD patients

Thyroid Hormone	Level of Hormone	No	Males(n=108)		Females(n=42)		t	p value
			Frequency	%	Frequency	%		
T3	Low	81	52	48.6	29	69.2	1.34	p>0.05
	Normal	69	56	55.4	13	30.8		
T4	Low	33	20	18.9	13	30.8	0.830	P>0.05
	Normal	117	88	81.1	29	69.2		
TSH	High	6	3	2.7	3	7.7	0.636	P>0.05
	Normal	144	105	97.3	39	92.3		

The prevalence of thyroid dysfunction among the sexes was shown in the Table 2. The prevalence of low T3 syndrome was 54% (81 cases) and the low T4 syndrome was 22 % (33 cases). The prevalence of high TSH in hypothyroidism range was 4 %. Among the males 48.6% of patients had low T3 syndrome. And among the females was 62.2%. The difference was not statistically significant P>0.05. The prevalence of low T4 among the males was 18.9 % and among the females was 30.8%. The difference among the sexes was not statistically significant i.e. P>0.05. The prevalence of high TSH in clinical hypothyroidism among males was 2.7% and among the females was 7.7%. The difference in prevalence between the sexes was not statistically significant (P>0.05).

Table 3: Distribution of total T3, free T4 and TSH in various stages of CKD

Stages of CKD	Frequency	Mean Total T3	Mean Free T4	Mean TSH
1-3	15	103±30.7	1.25±0.1	1.8±1.9
4	48	91±36.6	1.1±0.2	1.2±0.8
5	87	6.8±24	0.9±0.3	4.5±13.7

The above table 3 reveals the mean T3, free T4 and TSH levels in various stages of CKD. The mean T3 is decreased significantly with reduced creatinine clearance. The free T4 is also significantly decreased in stage 5 CKD.

Table 4: Relationship between creatinine clearance and total T3, free T4 and TSH

Relation with Cr. Clearance	r	Significance
Total T3	0.320	P<0.05
Free T4	0.381	P<0.01
TSH	-0.133	P<0.05

The table 4 shows positive correlation between total T3 and Creatinine clearance and it is statistically significant. The free T4 and creatinine clearance shows positive correlation and it is statistically significant. There was negative correlation of TSH with creatinine clearance, and it was not statistically significant.

Discussion

A large number of hormonal systems are affected by CKD, yet it remains unclear to what extent these changes are responsible for manifestations of uremic syndrome. Patients with CKD often have signs & symptoms suggestive of thyroid dysfunction & hence the diagnosis of thyroid disease in these patients has obvious prognostic implications. The data reported deals primarily with the biochemical parameters. In uremia the mean values of both serum T3 & T4 were significantly low. This is comparable to Ramiraz et al. [8] and Lim VS et al. study. [13] In our study, out of 150 patients 108 patients (54%) had low T3 syndrome. The prevalence of low T3 in stage 1- 3 is 20 %, for stage 4 is 38%, and stage 5 is 70%. This observation is consistent with Sang Heon Song et al. [9] in which the prevalence of low T3 will be increased according to the increase in stage of CKD. In our study there is a positive correlation between Total T3 and creatinine clearance and it is statistically significant P<0.05. This shows serum T3 levels were associated with severity of CKD even in the normal TSH level.

There was higher frequency of reduced free T4 values in our study (22%) which is consistent with Kaptein et al. [10] and Avasthi et al. [11] study but it is not statistically significant. In our study there is a positive correlation between Free T4, and creatinine clearance and it is statistically significant P<0.05.

In Mehta H.J. Joseph et al. [12] study low TT3, FT3 and TT4 values is seen in clinically euthyroid CKD patients. However, finding of normal T4 values and TSH would indicate functional euthyroid status. It can be presumed that free T4 values would fall if these patients develop hypothyroidism and TSH values would rise simultaneously. Thus Free T4 and TSH levels combined can be used for the diagnosis of hypothyroidism in presence of CKD.

Conclusion

In conclusion, this study highlights the age distribution among males and females in the study population, the prevalence of thyroid dysfunction in CKD patients, and the relationship between creatinine clearance and thyroid hormone levels. The findings suggest that age and sex may not

significantly influence the prevalence of thyroid dysfunction in CKD patients, but there is a correlation between thyroid hormone levels and renal function.

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