ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 6, Issue – 1, February - 2023, Page No. : 132 - 138

Study of Thyroid profile in chronic kidney disease

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How to citation this article: Dr. E. Bharati Devi, Dr. Srirekha. P, Dr. Y. Ruth Lavanya, Dr. A. Manugna, Dr. P. Jyoshna, "Study of Thyroid profile in chronic kidney disease", IJMACR- February - 2023, Volume – 6, Issue - 1, P. No. 132 – 138.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: It is crucial to investigate the pathophysiological relationship between thyroid dysfunction and chronic kidney disease, as thyroid hormones have a substantial impact on individuals with chronic kidney disease. This study aims to determine the significance of relationships between thyroid gland function and renal function in patients with chronic kidney disease**.**

Aim of the study: To determine the prevalence of thyroid dysfunction in chronic renal failure patients in stages 3,4 and5. To correlate the prevalence of thyroid hormone abnormalities with increasing degrees of renal insufficiency.

Materials and methods: This cross-sectional study was conducted in the year 2021-2022, at GGH, Kurnool. 100 patients were included in this study. Patients who fulfill the criteria for CRF and who were on conservative management were taken for the study. A thyroid profile was done in all patients who fulfill the criteria. Serumcreatinine, Bloodsugar, Blood urea was estimated in AU 480 Fully Automated Analyser. Thyroid Profile was estimated in Beckmann Access.

Results: In our study, a total of 100 individuals with CKD who underwent a Thyroid function test exhibited aberrant thyroid profiles; therefore, the incidence rate is 60%. Using the unpaired Student's t test, clinical variables were compared. We observed statistically

significant increases in Serum urea, Serum creatinine, and Serum TSH, and significant decreases in eGFR, serum T3 and T4 in CKD patients with thyroid dysfunction compared to those without thyroid dysfunction. We also discovered that eGFR had a substantial inverse relationship with serum creatinine.

Conclusion: This finding suggests that thyroid dysfunction is extremely prevalent among CKD patients and reveals a substantial connection between thyroid dysfunction and CKD development**.**

Keywords: Chronic kidney disease, ThyroidProfile, GFR

Introduction

Chronic kidney disease is characterised by a spectrum of distinct pathophysiological processes associated with abnormal kidney function and a progressive decrease in glomerular filtration rate. [1, 2.]

CKD is a clinical syndrome caused by irreversible loss of renal function, which results in metabolic, endocrine, excretory, and synthetic dysfunction, accumulation of non-protein nitrogenous substances, metabolic derangements, and distinct clinical manifestations.

End-stage renal disease is defined as the terminal stage of chronic kidney disease, which, in the absence of any replacement therapy, would result in death.

CKD is the final common pathway of irreversible loss of nephrons ultimately resulting in alteration of "milieu interior" affecting every system in the body, including the thyroid hormonal system, despite diverse a etiologies.

Thyroid and kidney functions are interrelated [3-6]. Thyroid hormones are essential for kidney growth and development, as well as electrolyte and water homeostasis. On the other hand, kidney has its vital role in metabolism and elimination of thyroid hormones.

In CKD patients reduction of renal function leads to change in the synthesis, secretion, metabolism and elimination of thyroid hormone. And also treatment strategies of one organ affect the other organ.

The kidney helps in the clearance of iodine mainly by glomerular filtration. So excretion of iodine is reduced in advanced renal failure. Impaired renal iodine clearance results in elevated serum levels of inorganic iodide, which may inhibit thyroid hormone production, resulting in the "Wolff Chaikoff effect."

Chronic kidney disease is associated with abnormalities in thyroid function, resulting in low concentrations of serum total and free T3 and normal concentrations of reverse T3 and free T4. In the majority of patients, TSH levels are close to normal, indicating a state of Euthyroidism.

Patients with chronic kidney disease may exhibit symptoms and signs of hypothyroidism, such as cold intolerance, dry coarse skin, a sallow complexion, lethargy, fatigue, edoema, a reduced basal metabolic rate, alopecia, hyporeflexia, and asthenia. Therefore, it is difficult to rule out abnormal thyroid function in patients with chronic kidney disease based solely on clinical background.

Several studies have examined thyroid function abnormalities in patients with chronic kidney disease. Previous studies have documented all abnormalities, including hypothyroidism, hyperthyroidism, and euthyroid state.

There is no clear connection between the severity of renal failure and thyroid dysfunction. Between 0 and 9 percent of patients with end-stage renal disease are estimated to have hypothyroidism. In ESRD, a higher incidence of thyroid enlargement (goitre) has also been observed.

A prospective biochemical study on thyroid function in chronic kidney disease has been conducted at the 24hrs Clinical Biochemistry,GGH,Kurnool.

Aim of the study

1. To determine the prevalence of thyroid dysfunction in chronic renal failure patients in stages 3,4 and5.
2. To correlate the prevalence of thyroid hormone abnormalities with increasing degrees of renal insufficiency.

Materials and methods

Subjects

Patients admitted in the department ofmedicineand nephrology who fulfilled the inclusion and exclusioncriteria.

Study design

Cross sectional study.

Ethical committee approval

Approval was obtained to carry out the study in GGH, Kurnool.

Study setting

Govt. General Hospital, Kurnool

Study Duration

August 2021 to October 2022

Study Criteria

Inclusion Criteria

Newly detected CRF patients with chronic renal insufficiency defined as

1. An estimated creatinine clearance of < 60 ml/mt. (Stages3,4 & 5).

Exclusion Criteria

- Previously known hypothyroidpatients
- Patients on high dose of frusemide therapy > 100mg/day.
- On heparintherapy
- On steroidtherapy
- On antiepileptics like phenytoin,phenobarbitone
- On sulphonylureas.
- Onpropranolol.

Study Protocol

Patients admitted in the department of medicine or nephrology in GGH were included in the study according to the criteria after getting informed consent. A well designed proforma was used to collect the demographic and clinical details ofthe patients.

Limitations of the study

1. Sample size. (Only 80patients)
2. Prevalenceofhypothyroidismincreasesastheageadvances.

So we have to consider the influence of age on hypothyroidism.

Geographical variation of goiter and thyroidproblems

Sample collection

A sample of 100 patients was collected defining the stage 3 to 5 CKD.

Serum creatinine was measured using the modified kinetic Jaffe method.

Kidney function was assessed by estimated creatinine clearance which was calculated by using the Cockcroft – gault formula

$$\frac{(140 - \text{Age}) \times \text{Body Weight in kg}}{72 \times \text{Pcr (mg/dl)}}$$

multiply by 0.85 for women.

Thyroid function was assessed by measuring TT_3, TT_4, and TSH level in serum.

Methods

Blood Sugar Estimation was done by GOD –POD method.Blood urea estimation was done by using diacetyl monoxime (DAM) method.Serum creatinine estimation was done by modified kinetic Jaffemethod.

Serum TT_3, TT_4, TSH were estimated by chemilumines cent immunoassay.

Statistical Analysis

The information collected regarding all the selected cases were recorded in the master chart. Data analysis was done with the help of computer using Epidemiological Information Package - 2002 (EPI Info 2002).

Using this software range, frequencies, percentages, means, standard deviations, Chi-square and 'p' values were calculated. Kruskul wallis chi-square test was used to test the significance of difference between quantitative variables and Yate's tests for qualitative variables A 'p' value less than 0.05 is taken to denote significant relationship.

Observation and results

Table 1: AgeDistribution

Age Group(yrs)	Cases	
	Numbers	%
21 – 30	10.0	10.0
31 – 40	18.0	18.0
41 – 50	25.0	25.0
51 – 60	35.0	35.0
>60	12.0	12.0
Total	100	100
Range	23 to 75 yrs	
Mean	48.5 yrs	
S. D	12.6 yrs	

Most of the patients in the sample were in the age group of 51-60 years. The range was from 23 to 75years

Table 2: Sex

Sex	Cases	
	Numbers	%
Male	78	78
Female	22	22
Total	100	100

Of the 100 patients in the sample 78 patients were males, and 22 patients were females

Table 3: Symptoms of Hypothyroidism

Symptoms	Cases	
	Numbers	%
Yes	20	20
No	80	80
Total	100	100

Of the 100 patients with CRF, 20 patients (20%) only were symptom matic and majority (80%) were asymptomatic.

Table 4: CRF Stage

Crf stage	Cases	
	Numbers	%
3	15	15
4	28	28
5	57	57
Total	100	100

Of the 100 patients in this sample, 15 patients belonged to stage 3,28 patients to stage 4 and 57 patients to stage 5.

Table 5: Thyroid dysfunction

Impression	Cases	
	Numbers	%
Hypothyroidism	7	7.
Sub clinical hypothyroidism	15	15.0
Some hormone abnormalities	43	43
Normal	35	35.0
Total	100	100

Of the 100patients in this sample, 7 patients (7%) had hypothyroidism 15patients (15%) had subclinical hypothyroidism 43 patients (43) had some thyroid

hormone abnormalities. Totally 65 patients (65%) had some thyroid dysfunction.

Table 6: Relationship between CRF Stage & hematological parameters and their significance.

Parameter	CRF STAGE						
	3		4		5		'p' value and its significance
	Mean	SD	Mean	SD	Mean	SD	
Blood Sugar	89	10.1	110.8	34.5	95.4	32.5	0.35notsignificant
Blood Urea	73.6	13.5	98.6	12.3	134.5	32.7	0.0001significant
Serumcreatinine	2.05	0.11	3.58	0.54	7.53	2.49	0.0001significant
TT_3	106.3	15.7	95	47.6	78.2	24.5	0.04significant
TT_4	6.35	0.85	5.24	1.3	4.59	1.65	0.03significant
TSH	2.05	0.50	3.48	2.36	5.4	3.39	0.004significant

Table 7: Relationship between Thyroid dysfunction and hematological parameters and their significance

Parameter	Thyroid dysfunction								
	Hypothyroidism		Subclinical Thyroidism		Other abnormalities		Normal		'p' value and its significance
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
Blood Sugar	107	27.7	90.0	13.9	105.1	32.4	92.9	17.9	0.8NotSignificant
Blood Urea	136	11.1	125.8	35.0	128.5	43.4	92.6	18	0.02Significant
Serum creatinine	9.0	2.55	6.53	2.63	6.64	3.4	3.81	1.61	0.009Significant
TT_3	43.0	5.2	85.7	9.2	75.3	35.3	107.7	23	0.0003Significant
TT_4	1.89	1.07	5.28	0.27	3.96	0.69	6.25	0.86	0.0001Significant
TSH	10.4	0.64	9.62	1.44	3.56	1.45	2.68	0.98	0.0001Significant

Discussion

Many patients with chronic kidney disease have mild reduction in thyroid function or subclinical hypothyroidism – a condition that becomes more common as kidney function declines (CJASN).[7]

Prevalence of thyroid dysfunction in CRF

According to the article published by the University of Southern California school of medicine, Los Angeles, USA, overall, 9.5% of patients with CKD had subclinical hypothyroidism. 7% of patients with mild CKD had low thyroid function, compared to 18% of those with moderate CKD. After adjustment for other factors, patients with moderate CKD were 73% more likely to have abnormal thyroidfunction.

Recently, Quion- verde et al have also reported higher prevalence of up to 5% of frank hypothyroidism in patients with chronic renal failure, in comparison with hospitalized patients with normal renal function (0.6%).8In an Indian study, conducted by Dept. of Nephrology,K.E.MHospital,Mumbai,Maharashtra,of127 patientswithCRF studied,93 patients (73%) showed significant ['p' value (<0.05)] reduction in their TT_3, TT_4, FT_3 levels in serum.[9]

In our study,of the 100 patients studied, 7 pts (7%) had hypothyroidism, 15 patients (15%) had subclinical

hypothyroidism and 43 patients (43%) had some thyroid hormone abnormalities in the form of reduction in TT_3, TT_4 and FT_3 levels. So totally 65% of patients with CKD had thyroid hormoneabnormalities.

Prevalence of symptomatic hypothyroidism in CKD

Most of the CKD patients have low TT3, TT4, but normal TSH levels in serum and they are clinically euthyroid. Some have overt hypothyroidism and even among them many patients are asymptomatic.[4]

In our study,20% were symptomatic and majority ,80% were asymptomatic.

Relationship between CRF stage and thyroid dysfunction

Higher the stage of CKD, there is an increased prevalence of thyroid dysfunction in CRF patients.

In our study,Of the 100patients in this sample, 7 patients (7%) had hypothyroidism 15patients (15%) had subclinical hypothyroidism 43 patients (43) had some thyroid hormone abnormalities. Totally 65 patients (65%) had some thyroid dysfunction. Overall, the prevalence of thyroid hormone abnormalities in stage 3,4 and 5 CKD pts were 16.7%, 63.6% and 78.2% respectively in our study. This is correlated with other various studies conducted by,Chandra.A (2016)[12] Dr. J. Punekar1(2017)[13] Swati Srivastava (2018) [14], Pan B (2019) K[15]. Manickam (2020)[16], MadhaviTrivedi (2021)[17] and etc.

Despite the recent considerable improvements in renal replacement therapy, cardiovascular disease still remains the main cause of morbidity and mortality in CRF patients.[11]., So many traditional and non-traditional risk factors are there for cardiovascular disease and its related morbidity and mortality.

Apart from them hypothyroidism and subclinical hypothyrodism are linked to an increased risk of cardiovascular disease and reduced cardiacfunction.

Patients with CKD are at greatly increased risk of thyroid dysfunction. “Thyroid hormone abnormalities could represent a risk factor for cardiovascular disease and might also be implicated in kidney disease progression” – comments by authors Dr.Michel Chonchol of University of Colorado, Health Sciences Centre and Dr.Giovanni Targher of University of Verona, Italy.[10]

Conclusion

In our study, the overall prevalence of thyroid dysfunction is 65% in patients with chronic kidneydisease.7. %Of CKD patients hadhypothyroidism.15% had subclinicalhypothyrodism.43% had some thyroid hormoneab normalities.

There was a significant correlation between the prevalence of thyroid dysfunction and the stage of chronic kidneydisease. Higher the degree of renal insufficiency, the higher was the prevalence of thyroid hormoneabnormalities.

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