

Thyroid Function Assessment in Patients with Chronic Kidney Disease

Dr.Ch Sudhakar ,Associate Professor, General medicine, Siddhartha Medical College, Vijayawada

Dr.T Lakshmi Prasanna, Post graduate ,General Medicine, Siddhartha Medical College, Vijayawada.

Dr. Pranay Jonathan C J ,Postgraduate ,General Medicine, Siddhartha Medical College ,Vijayawada.

Dr Anvitha Gaddam ,Postgraduate, General Medicine, Siddhartha Medical College ,Vijayawada.

Abstract:

Chronic Kidney Disease (CKD) is a global health issue with a rising incidence and prevalence. In individuals with Chronic Kidney Disease, abnormalities in the structure and function of the thyroid gland, as well as the metabolism and plasma levels of thyroid hormones, are common. Because thyroid function tests in patients with CKD have been inconsistent in prior research, a prospective investigation of various thyroid functions is being conducted to see if there is a link between thyroid malfunction and the severity of renal disorders.

Method: A prospective study was carried out on 50 patients with chronic kidney disease who were being treated conservatively. The Enzyme Linked Immunosorbent Assay was used to measure T3, T4, and TSH quantitatively, and the results were examined.

Results: 24 patients had low T3 syndrome (0.2-1.9ng/ml, mean 0.665), accounting for 48% of the patients; 11 patients had low T4 syndrome (0.5-9.5g/ml, mean 5.631), accounting for 22% of the patients; and 5 patients had primary hypothyroidism TSH >20IU/ml, accounting for 5% of the patients. With the exception of Primary Hypothyroidism, the significance of serum T3, T4, and TSH in the research participants is quite high ($\chi^2 = 20.82$, $p < 0.001$). The number of patients with low T3 syndrome rose as glomerular filtration rate decreased ($\chi^2 = 8.47$, $p < 0.05$, significant difference) in this study among varied creatinine clearance levels. The mean TSH values in patients with low T3 syndrome are within the normal range in various stages of renal disease, averaging 4.85. TSH values did not show any linear correlation with GFR. The number of patients with low T4 syndrome had no link to the severity of their renal impairment. In our study, thyroid dysfunction was found in 58 percent of patients with chronic renal disease.

Conclusion: Thyroid malfunction is a result of chronic illness/malnutrition rather than hypothyroidism. The low T3 condition of CKD can be considered as protective, as it promotes protein conservation. With the degree of renal failure, the number of patients with low T3 syndrome increases.

Date of Submission: 27-03-2022

Date of Acceptance: 07-04-2022

I. Introduction:

Chronic renal disease is characterised by a variety of pathophysiological manifestations that are associated to impaired kidney function and a progressive decline in glomerular filtration rate^{1,2}. CKD is a clinical syndrome caused by permanent loss of renal function, which leads to metabolic, endocrine, excretory, and synthetic failure, resulting in the accumulation of non-protein nitrogenous chemicals and manifesting itself in a variety of ways. CKD is the final common pathway of permanent nephron loss, resulting in a shift in milieu interior, which affects every bodily framework, including thyroid hormonal framework. Thyroid and renal functions are interrelated.

The link between kidney and thyroid function has been known for years^{7,10}. Thyroid hormones (TH) are necessary for kidney growth and development, as well as maintaining fluid and electrolyte equilibrium. The kidney, on the other hand, is involved in TH metabolism and elimination. Changes in TH production, secretion, metabolism, and elimination accompany the decline in renal function. In people with advanced kidney illness, thyroid dysfunction takes on new characteristics¹¹.

Thyroid function problems are linked to chronic kidney illness, resulting in low serum total and free T3 concentrations, as well as different reverse T3 and free T4 levels. Most patients' TSH levels are within normal ranges, indicating that they are in a euthyroid state. Thyroid illnesses, such as goitre, hypothyroidism, thyroid nodules, and thyroid cancer, may be more common in ESRD patients than in the general population, and may be underdiagnosed due to a lack of clinical awareness^{12,13}.

Thyroid function anomalies in chronic renal disease patients have been studied in a number of research. All anomalies, such as hypothyroidism, hyperthyroidism, and euthyroidism, have been documented in previous investigations. There is no obvious link between the degree of renal failure and thyroid abnormalities. In end-stage renal illness, hypothyroidism is predicted to affect 0-9 % of patients. Increased thyroid swelling (goitre) has also been observed in patients with ESRD.

AIM:

1. Determine the prevalence of thyroid dysfunction in chronic kidney disease patients.
2. To look into the link between thyroid problems and the severity of kidney disease.
3. To distinguish between primary thyroid disease and thyroid dysfunction caused by chronic kidney disease.

II. Methodology:

STUDY SUBJECTS: Between June 2021 and January 2022, a prospective study was done on 50 patients who were diagnosed with chronic renal disease and were admitted to the Government General Hospital in Vijayawada. A basic random sampling procedure was used to select these samples. For the analysis, the statistical metrics mean, standard deviation (SD), and correlations were utilised, as well as parametric and non parametric tests. All of the patients gave their informed consent.

INCLUSION CRITERIA: The study included patients with chronic renal disease who met the CKD criteria and were on conservative treatment. The presence of uremia symptoms for three months or longer was a criterion for Chronic Kidney Disease. Blood urea, serum creatinine, and creatinine clearance are all elevated. Bilateral contracted kidneys — size less than 8 cm in male and less than 7 cm in female — are ultra sound proof of chronic renal disease. Corticomedullary differentiation is poor. Renal parenchymal alterations of type 2 or 3. Anemia, low specific gravity, changes in serum electrolytes, and other laboratory indications of CKD, as well as radiographic evidence of renal osteodystrophy.

EXCLUSION CRITERIA are peritoneal dialysis or hemodialysis patients Proteinuria in the nephrogenic range. Low levels of serum protein, particularly albumin. Other factors include acute sickness, recent surgery, trauma or burns, diabetes, liver disease, and thyroid-altering medications such as amiodarone, steroids, dopamine, phenytoin, beta-blockers, oestrogen pills, and iodine-containing medications.

DIGNOSITIC TESTS: Thyroid and renal disorders were prioritised during the clinical history and examination. Urine routine and microscopic examination, peripheral smear for anaemia and burr cells, and renal parameters such as blood urea, serum creatinine, and creatinine clearance (using Cockcroft — Gault formula) are also recommended. ECG, chest X and 2D-ECHO, X-ray wrist, forearm, and spine for evidence of renal osteodystrophy, USG abdomen for evidence of chronic kidney illness, FNAC in individuals presenting with thyroid swelling Following the selection of patients who meet the above criteria, a blood sample of around 5 mL is taken in a non-heparinized serum container and sent for thyroid profiling. Thyroid profile components included serum triiodothyronine (T3), serum thyroxine (T4), and serum thyroid stimulating hormone in this investigation (TSH). Enzyme Linked Immunosorbent Assay is used to determine T3, T4, and TSH in a quantitative manner. The researchers looked at 50 individuals with Chronic Kidney Disease (CKD) who met the CKD criteria and were being treated conservatively.

III. Results:

These 50 patients were 39 percent male and 11 percent female, with ages ranging from 12 to 70 years. Patients under 30 years old accounted for 8, patients between 30 and 60 years old for 25, and patients over 60 years old for 6. Of the 50 patients, 21 had a GFR of less than 10 ml/min, accounting for 42 percent, 19 had a GFR of 11-20 ml/min, accounting for another 38 percent, and the remaining 10 had a GFR of more than 20 ml/min, accounting for 20 percent. In all of the patients in our study, blood urea levels ranged from 64 to 177 mg/dl, and creatinine levels ranged from 3 to 17.2 mg/dl. 24-hour urine protein excretion was less than 1 gramme per day.

All of our patients' serum calcium and phosphorus levels were normal, but 80% of them had anaemia, with a peripheral smear demonstrating normocytic normochromic anaemia in 72% of them and hypochromic anaemia in 8%. Burr cells were seen in 40% of the cases, one patient had pleural effusion, two patients had osteodystrophy, and none of the patients had pericardial effusion, according to our findings. All of the patients had CKD, a contracted kidney was seen in 90% of the patients, and the remaining patients had poor corticomedullary distinction on ultrasound.

In our study, 24 of the 50 patients had low blood T3 levels (48%) and 5 of the low serum T3 patients also had a high TSH value of >20IU/ml, low T4 levels, and symptoms suggestive of hypothyroidism. As a result, these five patients were classified as having "Primary Hypothyroidism" according to the criteria (10 percent). Low T4 levels were found in 11 patients, accounting for 22% of the total.

The sample population was also tested for hypothyroidism symptoms such as weariness, somnolence, weight gain, cold intolerance, and hoarseness of voice. 72 percent of the patients (36 patients) had the symptoms listed in the table. Symptoms were present in 17 of the 24 patients with low T3 syndrome, accounting for 70.83 percent, while symptoms were present in 5 of the hypothyroid patients, accounting for 100%. There were 21 individuals with CKD who did not have thyroid dysfunction, although 14 of them had hypothyroidism symptoms, accounting for 66.67 percent of the total.

Dry, flaky skin was found in 15 patients, only 4 of whom were hypothyroid; sinus bradycardia was found in 7 patients, only 2 of whom were hypothyroid; and delayed ankle jerk was found in 8 patients, only two of whom were hypothyroid.

GFR and hypothyroidism did not have a linear relationship. In GFR 11-20ml/min, an increased number of hypothyroid patients (about 4) were found, whereas only two patients had hypothyroidism in GFR 10ml/min. There was no generalised thyroid swelling in any of the participants in our research. As shown in the table, 30 percent of the CKD patients with low T3 levels were 30 years of age or younger, and 54.8 percent of the patients were between the ages of 31 and 60 years. As the patient's age increased, the number of patients with low T3 increased as well, with 44.4 percent of the patients with low T3 being over 60 years old.

According to one study, 51.3 percent of males have low T3 syndrome and 38.7% of females have low T4 syndrome (Table). T3 levels ranged from 0.2 to 1.9ng/ml (Fig), with a mean of 0.665. The mean value, excluding those with primary hypothyroidism, was 0.706, which was within the low normal range. T3 levels were evaluated in relation to GFR, excluding hypothyroidism, and the mean value of serum T3 was low (0.534ng/ml) exclusively in individuals with GFR 10ml/min (Table). In patients with a GFR of more than 10 ml/min, the mean value was low normal. Despite low T3, the number of patients with low T3 rose with the severity of renal failure (Table), according to our research. The Serum T4 levels varied from 0.5 – 9.5µg/dl. Mean Value of serum T4 among 50 patients was 5.631, Excluding hypothyroidism patients the mean value was 5.98µg/ml. this value is within low normal Level of T4.

Except for 5 hypothyroid patients with low T4 values, 11 other hypothyroid patients (22%) had T4 levels below normal and low T3 syndrome (Table). The number of patients with low T4 levels is unrelated to the severity of their kidney disease (Table 8). At all phases of CKD, the mean T4 levels, excluding hypothyroidism patients, was normal (Table). T4 levels were not above normal in any of the subjects. TSH levels ranged from 0.6 to 27 IU/ml, with a mean of 7.28 IU/ml. When hypothyroidism was excluded, the mean value was 4.85. TSH levels in the blood are normal.

TSH was normal in 38 (76%) of the 50 individuals, with levels ranging from 7.1 to 20 IU/ml in seven others (14 percent). It was raised >20IU/ml in all five patients (100%), three of whom were female and two of whom were male. According to our findings, mean TSH levels in individuals with low T3 syndrome are within normal ranges at various stages of renal illness, and TSH levels have no linear relationship with GFR.

		No. of pts	Percentage	Low T3 syndrome	Percentage
Sex	Male	39	78%	20	51.3%
	Female	11	22%	4	38.7%
	Total	50	100%	24	48%
Age	<30	10	20%	3	30%
	31-60	31	62%	17	54.8%
	>60	9	18%	4	44.4%
	Total	50	100%	24	48%

Creatinine clearance ml/min	No. of patients		Low T3 syndrome		Low T4 syndrome		Hypothyroidism	
	No	%	No	%	No	%	No	%
<10	21	42	14	66.67	7	31.3	3	14.3
11-20	19	38	7	36.84	3	15.82	2	10.50
>20	10	20	3	30.00	1	10	0	0.00

IV. Discussion:

In our study, patients only on conservative management were studied. This is because thyroid profile undergoes changes due to dialysis independent of that due to chronic kidney disease. Dialysis also affects the prior thyroid hormone serum status in patients with renal failure. Ramirez¹⁴ and Kayima et al.¹ conducted numerous investigations comparing CKD patients on conservative management and patients on hemodialysis¹⁵.

In our study, mean T3 levels were lowered below normal in GFR less than 10 ml/min, as in other investigations. It was present in low normal in greater GFR, and there was no linear association between T3 level and GFR, which is consistent with the findings of Avasthi et al.¹⁶. In our investigation, the mean T4 level was within normal limits at all GFR levels, however it was low and did not correlate with the degree of renal failure. Not all CKD patients in our study had low T3 and T4 levels. Only 58 percent of individuals (29 patients) are thought to have a Thyroid Profile abnormality. The thyroid profiles of the remaining 42% of patients are normal.

Not all of the patients in our study had CKD. T3 and T4 levels are low. Only 58 percent (29%) of the population is thought to be aware of the situation. Thyroid Profile Abnormality affects a large number of patients. The thyroid profiles of the remaining 42% of patients are normal. 58 percent of these patients, excluding those with primary hypothyroidism, have only a low T3 level with a normal T4 level, whereas 28 percent have only a low T3 level with a normal T4 level. The remaining 20% of people have low T3 and T4 levels. With a decline in GFR, the percentage of patients with low T3 and T4 steadily rises. It is unknown which patients will experience such changes in their thyroid profile.

With the exception of hypothyroidism, the average TSH level in our group was the research was within usual bounds. The average TSH the various amounts are likewise within typical norms. GFR ranges are a term used to describe a group of people who have TSH, on the other hand, does not appear to have a direct relationship with the degree of renal failure. This is in line with the findings of a study done by Ramirez et al., Spector et al., Ramirez et al., Ramirez et al. In uraemic individuals, abnormalities in the hypothalamic mechanism of TSH release were discovered in these studies. The TRH-induced TSH response was stifled. Seven individuals in our study exhibited modest TSH rise with low T3 levels, excluding those with hypothyroidism. Four of these patients had T4 levels that are within normal norms. T4 is below normal in the remaining three individuals.

In these patients, there were no clinical signs or symptoms of hypothyroidism. In these patients, tests such as FT4, FT3, TRH response, and anti thyroid auto antibodies can be used to diagnose hypothyroidism. Our findings are in line with those of Ramirez et al.¹¹⁴, who found low T3, low T4, and normal or mild TSH increase. However, it is unknown how much these changes are to blame for the symptoms of Uraemic syndrome. According to several research, this thyroid profile derangement is a component of the body's adaptive mechanism.

Quion verde et al.¹¹⁸ reported in previous investigations that hypothyroidism is very common in people with CKD. In individuals with terminal renal failure, the rate was estimated to be around 5%. Hypothyroidism was found in 10% of the patients in our study, although it had no relation to the severity of the renal failure. In our study, hypothyroidism symptoms were similarly distributed among hypothyroid and CKD patients. Hypothyroidism symptoms were more common in CKD patients without hypothyroidism than in those with hypothyroidism. So, in CKD, the TSH level, which should be very high (>20 IU/dl) with low blood T4, is used to diagnose hypothyroidism. None of the individuals in this study demonstrated clinical or biochemical signs of hyperthyroidism.

V. Conclusion:

Thyroid dysfunction was seen in 58 percent of patients with chronic kidney disease. Hypothyroidism is more common in people who have chronic renal disease. With the severity of chronic kidney disease, the number of individuals with low T3 and T4 syndrome rose. T3 and T4 levels in the blood had no link to the severity of chronic renal disease.

References:

- [1]. Andrew S. Levey, Josef Coresh, Ethan Balk, Annamaria T. Kausz, Ronald D. Perrone. National Kidney Foundation Practice Guidelines for Chronic Kidney Disease: Evaluation, Classification, and Stratification. *MD Ann Intern Med.* 2003;139:137-147.
- [2]. Joanne M. Bargman, Karl S. Korecki. Chronic kidney disease. In: Dan L. Lango, Anthony S. Fauci, Dennis Kasper et al. *Harrison's Principles of Internal Medicine*, Vol. 2, 18th edn., 2011; McGraw Hill, USA, pp. 2289-2293; 2308-2313.
- [3]. Feinstein EI, Kaptein EM, Nicoloff JT & Massry SG. Thyroid function in patients With nephrotic syndrome and normal renal Function. *American Journal of Nephrology* 1982 2 70-76.
- [4]. Kaptein EM, Quion-Verde H & Massry SG. Hemodynamic effects of thyroid Hormone. *Contributions to Nephrology* 1984 41 151-159.
- [5]. Kaptein EM. Thyroid function in renal Failure. *Contributions to Nephrology* 1986 50 64-72.
- [6]. Robert W Schrier. Abnormalities in the Thyroid gland and hypothalamo pituitary Thyroid axis in patients with CKD –Diseases of the kidney and urinary tract, Eighth edition 2007; volume 3: page Number 2518
- [7]. Feinstein EI, Kaptein EM, Nicoloff JT & Massry SG. Thyroid function in patients With nephrotic syndrome and normal renal Function. *American Journal of Nephrology* 1982 2 70-76.

- [8]. Kaptein EM, Quion-Verde H & Massry SG. Hemodynamic effects of thyroid Hormone. *Contributions to Nephrology* 1984 41 151–159.
- [9]. Kaptein EM. Thyroid function in renal Failure. *Contributions to Nephrology* 1986 50 64–72.
- [10]. Kaptein EM, Feinstein EI & Massry SG. Thyroid hormone metabolism in renal Diseases. *Contributions to Nephrology* 1982 33 122–135.
- [11]. Kaptein EM, Quion-Verde H, Chooljian CJ, Tang WW, Friedman PE, Rodriquez HJ & Massry SG. The thyroid in endstage Renal disease. *Medicine* 1988 67 187–197.
- [12]. Parameswaran S. Chronic kidney disease In India. *Health Sci* 2012;1:JS001
- [13]. Kaptein EM. Thyroid hormone Metabolism and thyroid disease in chronic Renal failure. *Endocrin Rev* 1996;17:4563.
- [14]. Ramirez G et al. Thyroid abnormalities in Renal failure. A study of 53 patients on Chronic dialysis. *Ann Internal Medicine*, 1973; 79, 500-4
- [15]. Kayima JK et al. Thyroid hormones profile In patients with chronic renal failure on Conservative management and regular Hemodialysis. *East Afr Med J*, 1992; 69:333-6

Dr.Ch Sudhakar, et. al. “Thyroid Function Assessment in Patients with Chronic Kidney Disease.” *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 21(04), 2022, pp.30-34.