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Original Research Article

Study of Thyroid Profile and Lipid Profile in Chronic Kidney Disease Patients

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Abstract:

Background: The progression of chronic kidney disease (CKD) is linked to a multitude of comorbidities, such as thyroid dysfunction, dyslipidemia, and cardiovascular disease. Objective were to determine the thyroid and serum lipid profile of CKD patients and to establish correlation between severity of renal disease with these 2 metabolic parameters.

Methods: This was a prospective study conducted among the 100 CKD patients over 3 year admitted in the Department of general medicine, Government medical college and associated hospital Kota.

Results: There were 66 (66%) male patients and 34 (34%) female patients among the 100 patients. There were no patients in grade 1, whereas there were 2, 20, 66, and 12 patients in grades 2-5 CKD, respectively. In each grade of CKD, the mean age, eGFR, urea, creatinine, thyroid profile, and lipid profile were computed individually. The levels of urea, creatinine, and eGFR differed significantly across CKD grades 2-5. The thyroid profile differed significantly across CKD grades 2-5 with p=0.001, 0.006, 0.001 for serum T3, serum T4, serum TSH. The lipid profile differed significantly across CKD grades 2-5, with p=0.001, 0.171, 0.001, 0.199, 0.423 for total cholesterol, triglycerides, high-density lipoprotein (HDL), low-density lipoprotein (LDL), and very low-density lipoprotein (VLDL) levels, respectively.

Conclusions: The number of patients increases with decreasing T3 and T4 and increasing thyroid stimulating hormone (TSH) proportionate to the severity of the renal failure. In addition, hypothyroidism is becoming more common in people with chronic renal disease. Serum triglycerides, LDL, and VLDL levels rise statistically significantly in CKD grades 3-5 patients.

Keywords: CKD, Thyroid profile, Lipid profile

Introduction

Chronic kidney disease (CKD) encompasses group of distinct pathophysiological processes which are associated with abnormal kidney functioning and progressively reducing Glomerular Filtration rate (GFR).

Various pathological processes in CKD ultimately results in loss of Renal metabolic, excretory, endocrine, and synthetic functions due to accumulation of various protein nitrogenous substances.

Hyperlipidemia, an abnormally high level of lipids in blood ,is a well-known risk factor for early Atherosclerosis causing various cardiovascular diseases ,is frequently seen in patients with CKD.

Indian studies demonstrating pathophysiological relationship of CKD with Lipid profile have quoted almost nil Lipid profile abnormalities in CKD like high triglycerides and low HDL level.

There is also an evidence of thyroid hormone dysfunction in patients with CKD.CKD causes alteration in synthesis, secretion, metabolism & elimination of Thyroid hormones.

Iodine an important element in the synthesis of thyroid hormone is removed from circulation by glomerular filtration under physiological conditions. In CKD, the progressively decreasing GFR leads to accumulation of Iodine in blood which ultimately leads to decreased thyroid hormone synthesis by 'Wolff Chaikoff effect'.

This results in subnormal levels of serum total & free T3 concentration and normal reverse T3 & free T4 levels. But TSH level is mostly unaltered in CKD. Patients may also have symptoms of hypothyroidism in CKD.

Studies in the past have demonstrated all types of thyroid abnormalities like hypothyroidism, hyperthyroidism and euthyroidism in patients with

CKD. The prevalence of hypothyroidism is 0.9% in patients with ESRD. Goiter is also noted in patients with CKD.

Because of this pathologically significant occurrence of dyslipidemia and thyroid abnormalities in patients with CKD, a prospective study of lipid profile & thyroid abnormalities in CKD has been undertaken in the Department of General Medicine, Government Medical College and Hospital, Kota.

Materials and Methods

Study site:

Dept. of General Medicine, Govt Medical College, and Associated Group of Hospitals, Kota

Ethical approval:

Approval was obtained from the Institute ethical committee in order to perform the study.

Sample size: 100 patients

Study duration: 3 years.

Types of study: A prospective cross-sectional study

Sampling method: simple random sampling

- The subjects are selected based on the inclusion and exclusion criteria.
- The details of the patient are obtained in the pre-set proforma after getting informed consent in the regional language.
- Routine laboratory investigations, Thyroid function tests and Lipid profile will be done.
- Analysis shall be made using SPSS software.

Inclusion Criteria: Patients admitted in Dept. of Medicine, Govt. Medical College and Associated Group of Hospitals, Kota and diagnosed as chronic kidney disease patients.

Exclusion Criteria:

- Known cases of thyroid dysfunction
- Known cases of dyslipidemia
- Patients undergoing dialysis
- Pregnant women

Results

Table 1: CKD grade in study population:

CKD Grade	No of Patients	Percentage
Grade II	2	2%
Grade III	20	20%
Grade IV	66	66%
Grade V	12	12%

Table 2: Distribution of serum T3 levels in chronic kidney disease:

	Serum T3	
CKD Grade	**Mean**	**SD**
Grade II	1.5	0.14
Grade III	1	0.26
Grade IV	0.82	0.34
Grade V	0.76	0.29
P Value - 0.001		
Significant		

Table 3: Distribution of serum T4 levels in various grades of chronic kidney disease:

	Serum T4	
CKD Grade	**Mean**	**SD**
Grade II	7.05	0.77
Grade III	3.79	0.72
Grade IV	2.59	1.07
Grade V	2.48	0.99
P VALUE - 0.006		
SIGNIFICANT		

Table 4: Distribution of serum THS levels in various grades of chronic kidney disease:

	Serum TSH	
CKD Grade	**Mean**	**SD**
Grade II	7.92	0.59
Grade III	9.1	2.78
Grade IV	10.87	2.45
Grade V	11.39	2.17
P Value - 0.001		
Significant		

Discussion

The mean value of serum T3 among CKD patients was 0.98 ± 0.25 ng/ml in our study. The p-value was 0.001 which was statistically significant. The similar finding was observed in study conducted by Vinayak R et al [1] in which the mean value of free T3 level in CKD patients and control were 1.07 ± 0.35 and 1.73 ± 1.21, respectively. The serum free T3 levels were found to be significantly lower in chronic kidney disease patients when compared to controls with p-value of 0.0003. In study done by Srivastava S et al [2] reported that the mean free T3 level was low in CKD patients (1.4727 ± 0.3577) than controls (2.6613 ± 0.6155) which was statistically significant (p-value < 0.001).

In our study, the mean value of serum T3 was 1.5± 0.14 ng/ml in stage 2, 1 ± 0.26 ng/ml in stage 3, 0.82 ± 0.34 ng/ml in stage 4 and 0.76 ± 0.29 ng/ml in stage 5 [table 14]. The p-value was 0.001 which was statistically significant. Free T3 levels were found to be decreased with severity of chronic kidney disease. In study conducted by Khatiwada S et al [3] observed the mean value of free T3 was 3.47 ± 0.855 pmol/l in stage 3, 2.515 ± 0.962 pmol/l in stage 4 and 2.807±1.287 pmol/l in stage 5 (p-value < 0.005). In study done by Kumudha P et al [4] found that the mean values of free T3 was 2.9 ± 0.89 pg/ml in stage 3, 1.8 ± 0.78 pg/ml in stage 4 and 1.1 ± 0.63 pg/ml in stage 5. Free T3 levels decreased significantly with progression of stages (p-value < 0.001).

In present study, serum T4 levels were significantly decreased in CKD patients. The mean value of serum T4 value among CKD patients was 2.9 ± 0.88 ug/dl. The p-value was 0.006 which was statistically significant. In study done by Vinayak R et al [5] observed that the mean serum T4 level in CKD patients and control were 6.53 ± 2.93 pmol/l and 8.66 ± 2.00 pmol/l, respectively. Serum free T4 levels were found to be significantly lower in chronic kidney disease patients when compared to controls with p-value of < 0.001. In the study conducted by Punekar J et al [6] had reported that the mean value of free T4 in CKD patients group was 6.07 ± 2.55 pmol/l and in control group was 7.54 ± 1.38 pmol/l. The p- value was < 0.001 which was statistically significant.

In our study, the mean value of serum T4 decreased with progression of chronic kidney disease stages. The mean value of serum T4 was 7.05 ± 0.77 ug/dl in stage 2, 3.79 ± 0.72 ug/dl in stage 3, 2.59 ± 1.07 ug/dl in stage 4 and 2.48 ± 0.99 ug/dl in stage 5 [table 16]. The p-value was 0.006 which was statistically significant. In study done by Kumudha P et al [7] found that the mean values of serum T4 was 10.29 ± 0.41 pmol/l in stage 3, 9.0 ± 0.33 pmol/l in stage 4 and 6.6 ± 0.09 pmol/l in stage 5 of chronic kidney disease. Free T4 levels decreased significantly with progression of stages (p-value < 0.001). In study done by saroj Khatiwada et al [8] found that the mean values of serum T4 was 11.9 ± 3.2 pmol/l in stage 3, 11.5 ± 3.3 pmol/l in stage 4 and 11.0 ± 2.6 pmol/l in stage 5 having p value < 0.001 which was statistically significant. This may be due to chronic kidney disease associated impaired binding of T4 to thyroid hormone binding globulin which further leads to low T4 levels.

In present study, the mean serum TSH levels in chronic kidney disease patients was 9.53 ± 1.99 mlIU/l. The p-value was 0.001 which was statistically significant. TSH levels were found to be increased among CKD patients. In study done by Vinayak R et al [9] observed that the mean TSH level in CKD patients was 5.11 ± 2.73 mlIU/l and in controls was 2.17 ± 1.57 mlIU/l. Serum TSH levels were significantly higher in chronic kidney disease patients when compared to controls. The p-value was < 0.001 showing significant difference between both CKD patients and control. In the study conducted by Punekar J et al [10] had reported that the mean value of serum TSH in case group was 7.42 ± 4.25 mlIU/l and in control group was 2.13 ± 0.87 mlIU/l (p value < 0.001).

In present study, the mean value of serum TSH levels was 7.92 ± 0.59 mlIU/l in stage 2, 9.1 ± 2.78 mlIU/l in stage 3, 10.87 ± 2.45 in stage 4 and 11.39 ± 2.17 mlIU/l in stage 5 of chronic kidney disease patients [table 18]. The p value was 0.001 which was statistically significant. The serum TSH levels showed increasing trend with progression of chronic kidney disease stages. In study done by Sinha V et al [11] found that the mean values of TSH in stage 3 was 2.5 ± 1.6 mlIU/l, in stage 4 was 3.3 ± 1.7 mlIU/l and in stage 5 was 5.4 ± 2.3 mlIU/l. TSH levels were found to be increased significantly with progression of stages (p-value < 0.001).1 In study by Kumudha P et al [12] found that the mean TSH was 5.3 ± 1.89 mlIU/l in stage 3, 6.6 ± 1.73 mlIU/l in stage 4 and 6.4 ± 1.96 mlIU/l in stage 5 of chronic kidney disease. The p-value was < 0.001 which was statistically significant. In the study conducted by Punekar J et al [13] had reported that the mean value of serum TSH was 2.59 ± 3.70 in stage 3 mlIU/l, 6.29 ± 4.37 mlIU/l in stage 4 and 8.38 ± 3.84 mlIU/l in stage 5 (p-value < 0.001). This may be due to chronic kidney disease associated blunting of pituitary receptor response to TRH leading to reduction in release of TSH from pituitary gland.

In our study, the decreasing trend in T4 and increasing Trend in TSH showed linear correlation with progressing stages of CKD.

Another study which was done by Joseph et al [14]and Hardy et al [15] showed up low T3 T4 level with high TSH level indicating maintenance of pituitary thyroid axis. Several studies in CKD patients showed low T3 values. [16,17]

Conclusion

In my study population, 100 CKD patients who were on conservative line management were studied. Among them 88% the patients had high TSH values,12% had low T3 values & 89% had low T4 values.

The modification in the serum levels of T3 and T4 in patients with CKD can be considered protective mechanism, favoring conservation of protein.

There is progressive increase in count of patients with a decreasing T3 and T4 and increasing TSH proportional to the severity of renal failure.

There is also increase in incidence of hypothyroidism found in patients with chronic kidney disease.

As the age progresses, there is increase in incidence of Low T3 syndrome in patients with CKD.

In patients with low GFR the serum T3, T4 levels was found to be low. This shows a direct linear relationship between GFR and T3, T4 levels.

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