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Original Article

A Cross-sectional Study on the Evaluation of Thyroid Hormone Levels and Lipid Profile in Chronic Kidney Disease Patients and to Establish their Correlation with Disease Severity

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ABSTRACT

Background: Chronic kidney disease [CKD] is linked to poor kidney function and a persistent decrease in glomerular filtration rate. Almost no lipid profile anomalies in CKD to patho-physiologically notable variations in lipid profile in patients with CKD such as raised triglycerides and low high-density lipoprotein levels have been reported in Indian research proving the pathophysiological link of CKD with Lipid profile.

Aim of the Study: To estimate the thyroid hormone level and lipid profile in chronic kidney disease patients and to establish a correlation between them.

Patients and Methods: CKD patients with moderate to severe disease, irrespective of gender, within the age groups 20-90 years were included in the study. Moderate CKD [stage 3] is defined as an estimated glomerular filtration rate [eGFR] of 30-60 ml/min, whereas severe CKD [stages 4 and 5] is defined as an eGFR of less than 30 ml/min & patients on maintenance hemodialysis were included. Blood urea, Serum creatinine, Lipid profile, TSH, total T3, and total T4 values of subjects were obtained and analysed. CKD staging was done on eGFR.

Results: Our study included 123 CKD patients who met the criteria for the disease. 95 % of the patients had high TSH levels, 48% had low T3 levels, and 95 % had low T4 levels. Out of 123 patients, 87% [N=108] patients had deranged lipid profiles.

Conclusion: The study concluded that there is statistically significant association between Chronic Kidney disease and deranged lipid and thyroid profiles and hypothyroid state.

Keywords: Chronic kidney disease; Glomerular filtration rate; Lipid profile; Thyroid hormone.

INTRODUCTION

Chronic kidney disease [CKD] refers to a range of pathophysiological processes that are linked to poor kidney function and a persistent decrease in glomerular filtration rate [GFR] [1]. Distinct stages of chronic kidney disease are classified by both estimated GFR and the degree of albumin in the urine [2]. Due to the build-up of diverse nitrogenous compounds, multiple clinical processes in CKD result in the loss of renal excretory, synthetic, endocrine, and metabolic activities [1].

Almost no Lipid profile anomalies in CKD to pathophysiologically notable variations in lipid profile in patients with CKD such as raised triglycerides and low high-density lipoprotein [HDL] levels have been reported in Indian research proving the pathophysiological link of CKD with Lipid profile. Various studies have shown that lipid profile abnormalities exist in people with CKD, including considerable hypertriglyceridemia [3], elevated total cholesterol, and low HDL levels in CKD patients. Dry skin, cold sensitivity, low basal metabolic rate, lethargy, edema, and a sallow complexion are common indications and symptoms of thyroid dysfunction in patients with CKD [4-7]. Several investigations of thyroid function in uremic patients have been conducted, with varying outcomes. Various workers have documented hypothyroidism, hyperthyroidism, and euthyroidism [8]. Under physiological settings, glomerular filtration removes iodine from circulation, which is a key component in the creation of thyroid hormone. The 'Wolff Chaikoff effect' occurs in CKD when the GFR gradually decreases, causing a build-up of iodine in the blood and, as a result, reduced thyroid hormone production. As a result, serum total and Free Triiodothyronine [T3] concentrations were below normal. Total and free thyroxine [T4] concentrations are classified as low, normal, or high. In most CKD patients, serum TSH levels were found to be normal. Hypothyroidism is prevalent in patients with end-stage renal disease [ESRD] and is estimated to be between 0% and 9% [1]. Thyroid disorders such as hypothyroidism, hyperthyroidism, and euthyroidism have been found in individuals with CKD in previous studies [9]. This study was carried out because of the pathologically significant incidence of dyslipidaemia and thyroid disorders among CKD patients.

THE AIM OF THE WORK

The aim of the present study was to analyze thyroid dysfunction and lipid abnormalities in CKD patients and their co-relation with stages of CKD.

PATIENTS AND METHODS

A prospective cross-sectional study was conducted among 123 CKD patients admitted to the Department of General Medicine, R.D. Gardi Medical College & Associated C.R.G.H. Hospital.

CKD patients with moderate to severe disease; irrespective of gender, within the age groups 20-90 years were included in the study. Moderate CKD [stage 3] is defined as an estimated glomerular filtration rate [eGFR] of 30-60 ml/min, whereas severe CKD [stage 4 and 5] is defined as an eGFR of less than 30 ml/min. Patients on maintenance hemodilaysis were also included. Patients with known thyroid disorders, as well as those consuming medication affecting thyroid function were excluded from the research. Also, patients with conditions like nephrotic syndrome, pregnancy, and patients on antithyroid drugs, corticosteroid, and lipid-lowering agents were also excluded from the study.

All 123 study cases were subjected to a detailed history, thorough clinical examination. Also, the patients were subjected to laboratory investigations like blood urea nitrogen [BUN], creatinine, blood sugar levels were done to estimate the diabetic status of the patients, lipid profile, thyroid profile, estimated glomerular filtration rate [eGFR], urine routine microscopy, and urine ACR & Blood urea, to check the albuminuria in CKD patients. BUN and serum creatinine were estimated using the VITROS BUN/UREA slide technique on VITROS chemistry systems with VITROS BUN/UREA slides and VITROS chemistry products calibrator kit 1. eGFR was estimated by 2009 CKD-EPI Creatinine equation.

Lipid Profile was analysed by fasting blood sample on OCD's VITROS 250 Chemistry auto analyser by following methods; total cholesterol was analysed by Esterase/oxidase/peroxidase method, triglycerides were analysed by enzymatic end point method, HDL was analysed by direct measure and PTA/MgCl2-VITROS method. LDL and VLDL were calculated by the Friedewald formula.

Thyroid Profile; thyroid stimulating hormone [TSH], total T3, and total T4 were assessed by fasting blood sample by VITROS enhanced chemi-luminescence method. Total T3/T4 were used as it has been found that its values correlate more with CKD treatment vs. free hormone level [10]. Standard reference cut-off for normal ranges were taken in the study as per local guidelines for the population viz:- TSH Normal 0.46 to 4.6 mIU/L, TT3 0.97-1.69 ng/ml, TT4- 5.56-11ng/ml, Total Cholesterol 125-

200 mg/dl, LDL- 85-130 mg/dl, HDL- 35-80 mg/dl, TG- 25-200mg/dl, VLDL <30 mg/dl.

Statistical Analysis: The data were entered into statistical software for social science [SPSS] version 20.0 simultaneously and coded as indicated. The data were analysed using statistical tests keeping in view the aims and objectives of the study. Chi-square test and ANOVA test were used to interpret the data.

The study was approved by the Institutional Ethics Committee RD Gardi Medical College, Ujjain. Informed consent was obtained from all the participants included in the study.

RESULTS

In our study, a total of 123 patients with CKD, who passed the criteria for CKD were studied. Among 123 patients, 89 were males [72.4%] and 34 were females [27.6%], their age distribution differed from 20 to 90 years. 123 patients were categorized into the following age groups, 20 -30 years, 31-40 years, 41-50 years, 51-60 years and >60 years.

Table [2] shows that as the grade of CKD increases mean T3 decreases. It has been found as grades of CKD increase mean Serum T4 levels decreases. Table [3] and Table [4] show that as grades of CKD increase mean Serum TSH levels increase. It has been found as grades of CKD increase mean total cholesterol level increases [Table 5]. Out of 123 patients 88 [71.5%] patients were diabetic & 87 patients were hypertensive [70.7%].

Thyroid Profile in study population: Out of the 123 CKD patients who met the criteria for the study, 95% of the patients had high TSH levels, 48% had low T3 levels, and 95% had low T4 levels. Comparison of means by ANOVA found that mean TT4 and TT3 values were significantly different in different CKD stages from stage III to V with a significant p value <0.01 [Table 2 and 3].

Lipid Profile in study population: Out of 123 patients, 87% [N=108] patients were found to be having deranged lipid profile. Comparison of means by ANOVA in different CKD stages from stage III to V found significant differences in values of T Cholesterol, HDL , LDL and VLDL levels with a significant p value <0.01. [Refer Table 5, 7, 8 and 9]. We have not found any evidence of Dyslipidaemia paradox i.e. decrease of TC and LDL levels in CKD patients in our study.

Table [1]: Mean age of presentation and CKD stages

CKD Grade	Age in years	
	Mean	SD
Grade III	53.41	11.016
Grade IV	47.89	14.470
Grade V	51.25	11.930
ANOVA Value = 2.206, p- value 0.136 [not significant]		

Table [2]: Distribution of serum T3 levels in CKD

CKD Grade	Serum T3	
	Mean	**SD**
Grade III	1.36	0.39
Grade IV	1.06	0.43
Grade V	0.91	0.44
ANOVA Value = 7.69, p- value 0.001 [significant]		

Table [3]: Distribution of serum T4 levels in CKD

CKD Grade	Serum T4	
	Mean	**SD**
Grade III	4.53	1.38
Grade IV	2.45	0.83
Grade V	2.55	0.75
ANOVA Value = 50.86, p- value 0.001 [significant]		

Table [4]: Distribution of serum TSH levels in various grades of CKD

CKD Grade	Serum TSH	
	Mean	SD
Grade III	9.18	2.74
Grade IV	11.97	16.61
Grade V	11.57	1.76
ANOVA Value = 0.51, p- value 0.63 [not significant]		

Table [5]: Distribution of total cholesterol levels in various grades of CKD

CKD Grade	Total Cholesterol	
	Mean	SD
Grade III	193.38	14.45
Grade IV	230.60	38.96
Grade V	242.50	33.81
ANOVA Value = 16.97, p- value 0.001 [significant]		

Table [6]: Distribution of triglycerides levels in various grades of CKD

CKD GRADE	TGL LEVELS	
	Mean	**SD**
Grade III	161.66	33.266
Grade IV	197.51	79.402
Grade V	194.63	15.143
ANOVA Value = 3.53, p- value 0.32 [not significant]		

Table [7]: Distribution of high-density lipoproteins levels in various levels of CKD

CKD GRADE	HDL LEVELS	
	Mean	**SD**
Grade III	44.16	9.555
Grade IV	38.99	4.599
Grade V	32.31	4.191
ANOVA Value =19.83 , p- value 0.001 [significant]		

Table [8]: Distribution of low density lipoproteins levels in various grades of CKD

CKD GRADE	LDL LEVELS	
	Mean	SD
Grade III	135.41	10.995
Grade IV	144.91	23.027
Grade V	165.50	21.936
ANOVA Value =11,55 , p- value 0.001 [significant]		

Table [9]: Distribution of very low-density lipoproteins levels in various grades of CKD

CKD GRADE	VLDL LEVELS	
MEAN	Mean	SD
Grade III	33.41	11.418
Grade IV	53.19	35.310
Grade V	65.00	14.967
ANOVA Value =7.91 , p- value 0.001 [significant]		

DISCUSSION

The declining trend in T4 and the increasing trend in TSH were found to have a linear correlation with the progression of CKD in our study. The TSH response to TRH was decreased in studies conducted by Liu *et al.* [11], Ramirez *et al.* [12], Dudani *et al.* [13] and Karunanidhi *et al.* [14] indicating an anomaly in the hypophyseal mechanism of TSH release in individuals with Uraemia.

Quionverde *et al.* [15] found a significant percentage of hypothyroidism in CKD patients. In individuals with the last stage of CKD, it was predicted to be around 5%.

In our study, hypothyroidism symptoms were similarly distributed across hypothyroid and CKD patients. As a result, the TSH level, which must be very high [>20 IU/dl] with a low blood T4 level, is more essential in the diagnosis of hypothyroidism in CKD. None of the individuals in this research demonstrated clinical or biochemical signs of hyperthyroidism. In comparison to other research, the mean T3 level in our study was reduced when the GFR was less than 15 ml/min. T3 levels were found to be lower in individuals with lower GFR, indicating that there was a straight-line association between T3, T4, and GFR.

Low HDL levels and hypercholesterolemia was the most common lipid abnormalities found in this investigation. The low HDL levels seen in patients with chronic renal disease in our study matched those found by Lee *et al.* [16] who investigated lipid profile anomalies in CRF patients.

Abnormal serum triglycerides, TC, and LDL were shown to be significantly higher in the group with eGFR between CKD stages III, IV, and V. The level of blood triglycerides, total cholesterol, and LDL increases as the stage of CKD progresses, as does the level of serum TSH, which rises with a decrease in T3 and T4 levels, and there is a linear relationship between the stages of CKD.

Conclusion: A total of 123 CKD patients were investigated in this research, 95 % of the patients had high TSH levels, 48% had low T3 levels, and 95 % had low T4 levels. Mean T3, T4 levels were shown to be low in individuals with reduced GFR and thus higher CKD stage. The present study finds thyroid disorder & dyslipidemia to be common in CKD patients & shows the significant co-relation between CKD progression and Thyroid disorder & dyslipidemia.

Limitations of study: The sample size of the current study is 123 patients and hence cannot be extrapolated over a general population. Smoking, alcoholism, BMI, chronic liver disease, clinical profile, sick euthyroid syndrome status of patients were not included in the study.

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Conflict of interest: None declared

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