Journal of Cardiovascular Disease Research

ISSN: 0975-3583, 0976-2833 VOL 13, ISSUE 04, 2022

Original Research Article

A Study on Thyroid Dysfunction and Lipid Metabolism among Chronic Kidney Disease Patients in tertiary Care Center

[1]Dr. Ch.Sara smitha, [2*]Dr. P. Kranthikumar, [3]Dr Kiran Chiluka, [4]Dr. A Madhav

[1, 2] Assistant Professor, Department of General Medicine, Government Medical College, Siddipet, Telangana, [3]Assistant Professor, Department of General Medicine, MGM Hospital, Warangal, [4]Professor & HOD, Department of General Medicine, Government Medical College, Siddipet Telangana State

Corresponding Author: Dr. P. Kranthikumar

Abstract

Background: Chronic Kidney Disease (CKD) is a condition in which the kidneys are damaged and cannot filter blood as well as they should. Progression of CKD is associated with having a number of complications, including thyroid dysfunction, dyslipidaemia and cardiovascular diseases.

Aim and Objectives : To know the thyroid profile and Lipid metabolism among CKD patients. **Material and Methodology**: A prospective cross-sectional study was conducted among the 60 CKD patients admitted in the Department of General Medicine, Government Medical College, Siddipet for the period of one year after getting ethical approval from Institutional Review Board and fulfilling bellow Inclusion and Exclusion Criteria. Data was anlysed by using ANOVA and association between the variables were assessed using chi-square test. P-value less than 0.05 was considered to be significant.

Results: Our study comprised of 60 CKD patients, had mean age 48.02 years with standard deviation of 14.92. 61.7% of the patients were male and 38.3% of the patients were female. 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 a statistically significant rise in the level of serum triglycerides, serum LDL, serum VLDL in CKD grade III,IV and V patients.

Conclusion: thyroid dysfunction to be very common in CKD patients and reveals that, there was a progressive increase in the count of patients with a decreasing T3 and T4 and increasing TSH proportional to the severity of the renal failure. The study also finds dyslipidaemia as a common disorder in CKD.

Keywords : Chronic Kidney Disease, LDL, VLDL TSH

Introduction

Chronic Kidney Disease (CKD) is a condition in which the kidneys are damaged and cannot filter blood as well as they should. Because of this, excess fluid and waste from blood remain in the body and may cause other health problems, such as heart disease and stroke. Kidney disease also increases risk of having heart and blood vessel disease. These problems may happen slowly over a long time. Early detection and treatment can often keep chronic kidney

ISSN: 0975-3583, 0976-2833 VOL 13, ISSUE 04, 2022

disease from getting worse. When kidney disease progresses, it may eventually lead to kidney failure, which requires dialysis or a kidney transplant to maintain life.

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.

Recent reports, however, suggest an abrupt rise in CKD in developing countries from Asia due to increase in concomitant diseases such as type 2 diabetes, hypertension and cardiovascular diseases (CVDs) [1]. Associated with rise in CKD numbers is the extensive increase in the health cost for management of CKD especially of 5th stage [2].

Reports also suggest that progression of CKD is associated with having a number of complications, including thyroid dysfunction, dyslipidemia and CVD [3]. The kidney normally plays an important role in the metabolism, degradation and excretion of thyroid hormones. CKD affects the hypothalamus pituitary thyroid axis. CKD affects thyroid function in many ways, including low circulating thyroid hormone levels, altered peripheral hormone metabolism, insufficient binding to carrier proteins, reduced tissue thyroid hormone content and altered iodine storage in the thyroid gland. Thus, in CKD, thyroid hormone metabolism is impaired [4]. CKD is associated with a higher prevalence of primary hypothyroidism, both overt and subclinical, but not with hyperthyroidism.

Indian studies demonstrating pathophysiological relationship of CKD with Lipid profile have quoted almost nil Lipid profile abnormalities in CKD to pathophysiologically significant alterations in lipid profile in patients with CKD like high triglycerides and low HDL level. B Shah, S Nair studied the occurrence of lipid profile abnormalities in CKD and have demonstrated the significant hypertriglyceridemia in patients with CKD. Increased level of triglycerides, total cholesterol and low levels of HDL-C in patients with CKD managed conservatively has been shown in study by Sumathi M.E, Manjunath, M.Tempad. There is also an evidence of thyroid hormone dysfunction in patients with CKD. CKD causes alteration in synthesis, secretion, metabolism & elimination of Thyroid hormones.

Thus due to the pathologically significant occurrence of dyslipidaemia and thyroid abnormalities in patients with CKD, we have undertaken this study to know thyroid dysfunction and Lipid metabolism among the CKD patients in tertiary care centre.

Material and Methodology:

A prospective cross-sectional study was conducted among the 60 CKD patients admitted in the Department of General Medicine, Government Medical College, Siddipet for the period of one year after getting ethical approval from Institutional Review Board and fulfilling bellow Inclusion and Exclusion Criteria.

Inclusion criteria:

- Patients admitted in Dept. of Medicine and diagnosed as Chronic kidney disease patients.

Exclusion criteria:

- Known cases of thyroid dysfunction
- Known cases of dyslipidemia

ISSN: 0975-3583, 0976-2833 VOL 13, ISSUE 04, 2022

- Patients undergoing dialysis
- Pregnant women

Methodology

The details of the patientswere obtained in the pre-set proforma after getting informed consent in the regional language. Routine laboratory investigations, Thyroid function tests and Lipid profile weredone.

Statistical Analysis : Data collected was entered in Microsoft excel 2016 for further analysis. Qualitative data was expressed in frequency and percentage while quantitative data was expressed in terms of mean and standard deviation. Mean difference of various parameters among the CKD stages were obtained by using ANOVA and association between the variables were assessed using chi-square test. P-value less than 0.05 was considered to be significant .

Results and Observation :

Our study comprised of 60 CKD patients, had mean age 48.02 years with standard deviation of 14.92. 61.7% of the patients were male and 38.3% of the patients were female, study showed male dominance, over female. In the study 63.3% of the patients from Grade IV of CKD, followed by Grade III (20%), 13.3% of the Grade V, we didn't get any grade I CKD patients in the study. We observed 70% of the patients had hypertension and diabetes mellitus shown in the table number 1 given bellow.

Table 1: Basic Characteristics of the study population

Parameters	Mean/Frequency	SD/Percentage
Age	48.02	14.92
Gender		
Male	37	61.7
Female	23	38.3
CKD Grade		
Grade II	2	3.3
Grade III	12	20
Grade IV	38	63.3
Grade V	8	13.3
Diabetes Mellitus		
Positive	42	70
Negative	18	30
Hypertension		
Positive	42	70
Negative	18	30

When we have distributed mean values of thyroid profile T3, T4 and TSH levels among the grades of CKD patients we have observed that T3 levels of the patients were decreasing as the level of the CKD grade increases, while T4 and TSH levels were increasing as the CKD levels increased. We have observed there was statistically significance difference in the mean of T3, T4 and TSH level among CKD grades of the patients given in the table No. 2.

We have observed in the lipid profile of the patients that Total Cholesterol level was increasing as the grades of the CKD patients was increases, similarly it was observed in

ISSN: 0975-3583, 0976-2833 VOL 13, ISSUE 04, 2022

triglyceride level. HDL was observed decreasing as the level of CKG increases. Even LDL and VLDL was increased as the CKD levels increases. Mean difference of Total Cholesterol, HDL and VLDL among CKD grade was found statistically significant showed in the table No. 3 given bellow

Table 2: Thyroid Profile of the CKD Patients

Thyroid Parameters	Stage	Mean	SD	Minimum	Maximum	F-value	P-value
T3	Grade II	1.5	0.14142	1.4	1.6	2.887	0.044
	Grade III	1.0767	0.31506	0.6	1.9		
	Grade IV	0.9447	0.34928	0.5	1.8		
	Grade V	0.7875	0.33139	0.3	1.2		
	Total	0.9687	0.35376	0.3	1.9		
T4	Grade II	7.05	0.77782	6.5	7.6	21.34	<0.001
	Grade III	3.885	0.6635	3.04	4.98		
	Grade IV	2.5639	0.98477	1.22	4.9		
	Grade V	2.6463	0.62994	1.9	3.67		
	Total	2.9887	1.26578	1.22	7.6		
TSH	Grade II	7.92	0.59397	7.5	8.34	3.42	0.027
	Grade III	9.7875	3.22908	6.6	16.7		
	Grade IV	12.2579	16.25878	6.4	109		
	Grade V	11.8125	1.88334	9.4	14.5		
	Total	11.5598	13.02148	6.4	109		

We have observed 28.30% of the patients were with Dyslipidaemia in which 18.30% of the patients were form grade IV and 10% of the patients were from Grade V of the CKD, and the association between CKD grade and Dyslipidaemia was statistically significant.

Table 3: Lipid Profile of the CKD Patients

Lipid Profile	Stage	Mean	SD	Minimum	Maximum	F-value	P-value
Total Cholesterol	Grade II	182.5	17.678	170	195	4.49	0.007
	Grade III	201.42	23.047	163	263		
	Grade IV	231.5	38.762	120	300		
	Grade V	249.13	30.917	204	284		
	Total	226.2	37.934	120	300		

ISSN: 0975-3583, 0976-2833 VOL 13, ISSUE 04, 2022

TGL	Grade II	148	5.657	144	152	1.249	0.301
	Grade III	163.33	33.47	102	241		
	Grade IV	193.18	65.815	144	574		
	Grade V	194.75	12.407	175	214		
	Total	185.92	56.046	102	574		
HDL	Grade II	52	5.657	48	56	10.134	<0.001
	Grade III	41.08	9.811	29	57		
	Grade IV	37.13	3.371	31	44		
	Grade V	31.5	3.464	26	35		
	Total	37.67	6.459	26	57		
LDL	Grade II	132.5	17.678	120	145	2.599	0.061
	Grade III	137.83	15.55	120	175		
	Grade IV	148.5	25.288	119	196		
	Grade V	165.75	23.566	128	187		
	Total	148.13	24.276	119	196		
VLDL	Grade II	16.5	2.121	15	18	2.785	0.049
	Grade III	37.08	9.737	21	55		
	Grade IV	49.18	29.776	21	210		
	Grade V	63.25	15.935	39	80		
	Total	47.55	26.344	15	210		

Table 4: Association between Dyslipidaemia and CKD Patients

CKD	Dyslipidaemia		Total	Chi-square	P-value
	Yes	No			
Grade II	0(0%)	2(0%)	2(0%)	13.16	0.002
Grade III	0(0%)	12(20%)	12(20%)		
Grade IV	11(18.30%)	27(45.0%)	38(63.30%)		
Grade V	6(10.0%)	2(3.30%)	8(13.30%)		
Total	17(28.30%)	43(71.70%)	60(100%)		

Also other lab parameter like Urea and creatinine were increased as the CKD grade increases and EGFR was decreasing as the CKD increases. Mean difference of Urea was statistically not significant but Creatinine and EGFR was statistically significant shown in the table no. 5

Table 5: Lab Parameter among CKD Patients

Lab Parameter	Stage	Mean	SD	Minimum	Maximum	F-value	P-value
Urea	Grade II	93	12.7279	84	102	0.642	0.591
	Grade III	116.95	85.3756	15.6	328		
	Grade IV	135.276	43.5393	21.2	204		

ISSN: 0975-3583, 0976-2833 VOL 13, ISSUE 04, 2022

	Grade V	137.163	66.4498	95.7	292		
	Total	130.453	56.3926	15.6	328		
Creatinine	Grade II	1.2	0	1.2	1.2	25.466	<0.001
	Grade III	1.8717	0.31651	1.39	2.3		
	Grade IV	3.5021	0.68363	2.17	4.56		
	Grade V	5.2775	2.0712	3.76	10.1		
	Total	3.336	1.39298	1.2	10.1		
EGFR	Grade II	67	1.41421	66	68	144.704	<0.001
	Grade III	43.5833	8.49019	32	58		
	Grade IV	18.6316	3.78061	15	29		
	Grade V	11.25	2.81577	6	14		
	Total	24.25	14.30376	6	68		

Discussion :

To determine the pathological interrelationship between thyroid dysfunction and severity of renal disease, numerous studies were conducted about thyroid function abnormality and severity of CKD and different results have been shown.

In our study, only those CKD patients on conservative line of therapy were studied. This can be attributed to the fact that thyroid profile undergoes changes due to dialysis independent of the presence due to chronic kidney disease. Numerous studies have been studied by comparing CKD patients on conservative line of management and patients on HD by Ramirez [5] and Kayima et al[6].

In our study, 60 patients of CKD, who were on conservative management fulfilling the criteria for CKD were studied, among these 60 patients, 37 were males and 23 were females, their age distribution varied from <30 yrs to >60 years.

In our study out of 60 patients, all the patients had low serum T3 levels (100%). 52 patients had low T4 levels in our study (87.6%). Also all the patients patients had low TSH (100%).

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

One study done by Spector [7] and Ramirez et al [5] Dudani et al[8], Karunanidhi et al[9]. These studies showed abnormality in hypophyseal mechanism of TSH release in patients with Uraemia as the TSH response to the TRH was reduced.

Another study which was done by Joseph et al and Hardy etal 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. Low T3 had also been reported in Ramirez et al[5], Hegedus et a1, Beckett et al[10] PonAjil Singh et al, P Iglesias and JJ Diez and many others.

Detailed study by Kaptein et al[11] showed the prevalence of primary hypothyroidism was

ISSN: 0975-3583, 0976-2833 VOL 13, ISSUE 04, 2022

about 2.5 times much higher in chronic kidney disease and dialysis than in normal population. The incidence of hypothyroidism in CKD was estimated to range in between 0 and 9.5%

The symptoms of hypothyroidism were distributed equally in both hypothyroid and CKD patients in our study.

So, diagnosis of hypothyroidism in CKD more importantly depends on TSH level which must be very high (>20 µIU/dl) with low level of serum T4. In this study, none of the patients had clinical or biochemical features of hyperthyroidism.

As a go with other studies, mean T3 level in our study was decreased in GFR less than 15 ml/min. In patients with reduced GFR, T3 level was found to be reduced and it shows that there was straight line relationship between level of T3,T4 and GFR, which is consistent with Avinashi et al study.

In our study, 57 out of 60 patients with CKD had low levels of HDL. The low HDL levels in patients with chronic kidney disease in our study were in match with Diana M Lee LG et al [12] who studied the abnormalities of lipid profile in CRF patients.

This low HDL cholesterol levels were also an isolated independent risk factor for the development of CKD in the Framingham spring study.

Triglyceride levels were essentially elevated in our study than in control group. Abnormal triglyceride values were found in 6 out of 60 patients in our study. The present study demonstrates that CRF is commonly accompanied by lipid dysfunction manifesting as hypertriglyceridemia. This is in co-ordinance to the observations made in Western studies and recent Indian studies[13-16] by Gupta DK,Das BS and Bagdae J. Elevated triglyceride levels are implicated to impaired activity lipoprotein lipase (LPL)[17] and direct inhibitory action of various uremic 'toxins' on the enzymes involved in lipid metabolism[18] pinpointing the most important pathophysiological mechanisms causing the development of hypertriglyceridemia in renal failure.

In our study 37 out of 60 patients showed raised LDL levels. Most studies point out that Uraemic Patients commonly have normal to slightly decreased concentrations of LDL-C levels and they exhibit significant disturbance in the density distribution of LDL sub fraction that is characterized by presence of predominantly small dense LDL particles.[19]

In the present study, we find significantly high levels of LDL cholesterol in the group with CKD stages IV & V

Total cholesterol levels were raised in 14 out of 60 patients in our study group with CKD results in acquired LDL receptor deficiency, which plays a vital role in the cause of associated hypercholesterolemia. [20]

Conclusion:

From above results and observation we can conclude that, thyroid dysfunction to be very common in CKD patients and reveals that, there was a progressive increase in the count of patients with a decreasing T3 and T4 and increasing TSH proportional to the severity of the renal failure. The study also finds dyslipidemia as a common disorder in CKD.

HDL levels were reduced and triglycerides, total cholesterol and TGL levels, LDL, VLDL were raised in the study population. There was a statistically significant rise in the level of serum triglycerides, serum LDL, serum VLDL in CKD grade III,IV and V patients.

Acknowledgement : None
Funding : None
Conflict of Interest : None

References:

1. Tsukamoto Y, Wang H, Becker G, Chen HC, Han DS, Harris D, et al. Report of the Asian Forum of Chronic Kidney Disease Initiative (AFCKDI) 2007. "Current status and perspective of CKD in Asia": Diversity and specificity among Asian countries. Clin Exp Nephrol. 2009;13(3):249–56.
2. Trivedi H. Cost implications of caring for chronic kidney disease: are interventions cost-effective? Adv Chronic Kidney Dis. 2010;17(3):265–70
3. Thomas R, Kanso A, Sedor JR. Chronic kidney disease and its complications. Prim Care. 2008;35(2):329–44.
4. Malyszko J, Malyszko J, Wolczynski S, Mysliwiec M. Adiponectin, leptin and thyroid hormones in patients with chronic renal failure and on renal replacement therapy: are they related? Nephrol Dial Transplant. 2006;21(1):145-52.
5. Ramirez G et al. Thyroid abnormalities in renal failure. A study of 53 patients on chronic dialysis. Ann Internal Medicine, 1973; 79, 500-4.
6. 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.
7. Spector DA et al. Thyroid function and metabolic rate in chronic renal failure. Ann Intern Med. 1976; 85: 724-30.
8. Dudani RA et al. Thyroid dysfunction in Ureaemia J Assoc Physicians India. 1981; 29: 1037-40.
9. Karunanidhi A et al. Thyroid function in patients with chronic renal failure. Indian J Med Research, 1979; 69: 792-7.
10. Beckett G et al. Thyroid status in patient with chronic renal failure. Clinical Nephrology, 1983; 19: 172-8.
11. Kaptein E et al. The Thyroid in end stage renal diseases, Medicine, 1988;187-9
12. DIANA M.LEE et al:Lipoprotein particle abnormalities and the impaired lipolysis in renal insufficiency,*kidney international*, vol.61,2002,pp209-218
13. Gupta DK. Hypedipidemia in patents of chronic renal failure. Bombay Hospital J transplantation on plasma lipids and lipoproteins. J Clin Invest1976;87:3741991; 33:45 50.
14. Das BS, Mishra SK, Rao DVP. Serum lipids in chronic renal failure. J Assoc Physicians India 1984; 32:1019 1021.
15. Bagdade J, Casaretto A. Effect of chronic uremia, haemodialysis and renal Chan MK, Varghese Z, Moorhead JF. Lipid abnormalities in'uremia. Kidney Int 1981; 19:625
16. Kes P. Lipid abnormalities in CRF, nephritic syndrome and dialysis. Acta Med Crotica 2001; 55(4-5): 177-86
17. Cheung AK, Parker CJ, Ren K, Iverius PH. Increased lipase inhibition in uremia: I dentification of pre-beta HDL as a major inhibitor in normal and uremic plasma. Kidney Int 1996; 49 (5): 1360-7)
18. Rajman I, Harper L, McPake D, Kendall MJ, Wheeler DC. Low- density lipoprotein subfraction profiles in chronic renal failure. *Nephrol Dial Transplant.* 1998;13:2281–7
19. Vaziri ND and Liang K. Downregulation of hepatic LDL receptor expression in

ISSN: 0975-3583, 0976-2833 VOL 13, ISSUE 04, 2022

experimental nephrosis. *Kidney Int(*1996)50: 887–893