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Investigation of Thyroid Dysfunction in Individuals with Chronic Renal Disease Attending a Tertiary Care Hospital in the GMC Ongole

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Abstract

Background: Thyroid dysfunction is a commonly seen endocrine abnormality among CKD patients. CKD has been known to affect the pituitary-thyroid axis and peripheral metabolism of thyroid hormones. This study was conducted to find out possible association of CKD and thyroid dysfunction and to estimate the occurrence of thyroid dysfunction in patients with chronic kidney disease and its correlation with severity of renal disease.

Methods: A case control study was designed to study association of CKD cases and thyroid dysfunction. Total 75 CKD cases were recruited in case group and these cases were investigated, serum thyroid level measured by enzyme linked immune sorbent assay and their results were compared to a control group of 75 age/sex matched healthy subject.

Results: Results of this study showed that majority of the cases were 30-59 years age group (48.21 $\pm$13.7).The male to female ratio incase group was 1.08:1 and in control group 1.02:1. Thyroid dysfunction was found to have80% more occurrences in CKD Patients as compared to normal healthy controls. Most common thyroid dysfunction observed was overt hypothyroidism (42.66%) followed by Low T_3 syndrome (21.33%), subclinical hypothyroidism (13.33%) and hyperthyroidism (2.7%). With the increasing severity of CKD, overt hypothyroidism also increased i.e. from 16.66% in stage- III,38.8%instage-IVto47.06%inStage-

V.There was significant reduction of serum T3 level(69.58± 38.28ng/dl), T4 level (6.07± 2.55µg/dl) and elevation of TSH level (7.42± 4.25µIU/ml) in cases as compared to controls (p<0.001).

Conclusion: Thyroid dysfunction (overt hypothyroidism) showed a significant and strong correlation with CKD cases and various stage of CKD. Thus timely identification and treatment of these thyroid abnormalities could alter the course of the disease and help in reducing morbidity of CKD patients.

Keywords: Thyroid Function, Chronic Kidney Disease.

Introduction

Thyroid hormones are necessary for growth and development of the kidney and for maintenance of water and electrolyte homeostasis. On the other hand, Kidney plays an important role in the metabolism, degradation and excretion of thyroid hormone. The kidney normally contributes to the clearance of iodine, primarily by glomerular filtration. Thus iodide excretion is diminished in advanced renal failure, leading sequentially to an elevated plasma inorganic iodide concentration and an initial increment in thyroidal iodide uptake.[1] Increased total body inorganic iodide can potentially block thyroid hormone production by affecting the pituitary-thyroid axis and peripheral metabolism of thyroid hormones. Such changes explain higher frequency of hypothyroidism in patients with chronic kidney disease. So, Thyroid dysfunction is a commonly seen endocrine abnormality among CKD patients.[2]

It has been shown that in chronic kidney disease (CKD), as the glomerular filtration rate (GFR) falls, there is a higher possibility of developing clinical and subclinical hypothyroidism (SCH).[3] Prevalence of Thyroid dysfunction in CKD is found to be ranging from 13% in early CKD to 70% in ESRD according to various studies.[4-7] The relation between thyroid dysfunction and severity of CKD is not clear. Several previous studies depict conflicting results both positive and negative. Thus, there are huge numbers of patients remaining to be diagnosed and/or treated. The present study was conducted to find out possible association of CKD and thyroid dysfunction and to estimate the occurrence of thyroid dysfunction in patients with chronic kidney disease and its correlation with severity of renal disease and also see the clinical presentation of chronic kidney disease patients with thyroid dysfunction or without thyroid dysfunction.

Material and Methods

It is Hospital based Cross sectional study conducted in the department of Biochemistry at G.M.C. Ongole, A.P. A total of 150 patients included in this study out of which 75 patients were chronic kidney disease and 75 were normal healthy patients. The study period extended from April 2025 to August 2025.

Patients with associated history of acute illness, thyroidectomy/thyroid disorder recent surgery, trauma or burns, drugs altering Thyroid profile (like amiodarone, steroids, phenytoin, beta- blockers, estrogen pills, iodine containing drugs, children's and ANC Patients were excluded from the study.

All the subjects i.e. both cases & controls were subjected to medical examination as per a fixed proforma. Morning sample blood was drawn after 12 hrs fasting. The samples of blood were allowed to stand to clot. Serum was separated by centrifugation, and analyzed by the following methods. Serum Urea Estimated by Diacetyl Monoxide Method (DAM, Method), serum creatinine is estimated by Jaffe's method, and Estimation of T3, T4 & TSH by Enzyme

Linked Immuno Sorbent Essay (ELISA) method. Thyroid dysfunction was considered if patient's thyroid hormones level fall outside the reference range. Expected range of TT_3 is 70-204 ng/dl, expected range of TT_4 is 4.5- 11microgm/dl and expected ranges of values of TSH is 0.5-4.5mU/L.

Data analysis

The data was fed into an excel spreadsheet and then tabulated. Data was statistically analyzed using t-test, chi-square test, Fisher's exact test using SPSS and Microsoft excel. $p<0.05$ was considered to be statistically significant.

Results

The study population comprised 75 CKD patientsand75 normal healthy controls with 39 (52%) males and 36 (48%) females in case group and 38(50.7%) male and 37 (49.3%) female in control group. Male to female ratio in case and control group was1.08:1:1.02:1. The mean age of study population (Mean±SD) in cases was 48.21± 13.76 and in controls 45.93± 12.03 years. (p=0.2818). In the study of Klara Paudel[8] had mean age of case was47.2±15.6 years & Joan C. Lo et al[9] had mean age was 48.7 ± 18.9 years. Duration of symptoms of CKD ranged from3 months to 48 months.Themeandurationwas10.23±7.87and Median being 8 months. Kayimaet al[10] had mean duration of symptoms was 14.2±9.9months. According to eGFR, three groups were made in ours tudy; of which there were maximum 51 people (68%) having GFR <15ml/min/1.73m^2.18(24%) with GFR between 15-29 ml/min/1.73m^2 and 6 (8%) people with eGFR ≥30 ml/min/1.73m^2

Table 1: Thyroid function tests in cases and controls

Thyroid Profile	Cases(Mean)	Controls(Mean)	P value
Total T3(ng/dl)	69.58+ 38.2	113.9 + 15.4	<0.001
Total T4(g/dl)	6.07 +2.55	7.54 +1.38	<0.001
TSH (IU/ml)	7.42 +4.25	2.13+0.87	<0.001

Comparison of thyroid function between cases and controls

Overt Hypothyroidism found in 32 patients (42.66%) and Hyperthyroidism in 2 patients (2.67%) in CKD patients and controls were normal.

Correlation of T3, T4 and TSH with eGFR in cases and controls

With the increasing severity of CKD (decreased in eGFR), Overthypothyroidism also increase from 6.66% in stage-III,38.8%instageIVCKDto47.06%instage-V CKD and Hyperthyroidism 1present in stage-III and IVCKD patients. Chandra A[11] observed that the prevalence of overt hypothyroidism was increases from 6.28% in stage II, 11.87% in stage-III, and 40.68% in stage IV to 40.68% in stage V.

We found 60 out of 75 patients (80%), to be having some sort of thyroid dysfunction. Chandra A[11] and Prajapati et al[7] had 70% thyroid dysfunction in CKD patients. In our study, Low T_3 syndrome (Low T_3, Normal TSH) was found in 16 patients (21.33 %). Sub-clinical hypothyroidism (Raised TSH, Normal T_3, T_4) was found in 10 patients (13.33 %). Overt Hypothyroidism (Low T_3 or low T_4, raised TSH) was found in 32 (42.66 %) patients.

Thus, in our study a positive, significant correlation is seen with the fallin eGFR and the level of T3 and TSH.[3,12]

Table 2: Thyroid dysfunction (n=75)

S.No.	Type of Thyroid Dysfunction	No.of patients	%of thyroid dysfunction
1	Low T3(Normal TSH)	16	21.33 %
2	Hypothyroidism (Low T3, LowT4,high TSH)	32	42.66 %
3	Subclinical Hypothyroidism(Normal T3;High TSH)	10	13.33 %
4	High T4	2	2.66%
5	HighT^3	2	2.66%
6	Hyperthyroidism(low TSH, High T3&T4)	2	2.66%

Table 3: Correlation of eGFR with thyroid function tests

TFT	eGFR			P*1/2	P*1/3	P*2/3	Anova p-value
	<15 (51)	15– 29 (18)	≥30 (6)				
TT3	60.19± 25.60	78.19±39.30	123.58±72.21	0.181	0.020	0.001	<0.001
TT4	5.68±2.27	6.42± 2.73	8.26± 3.43	0.851	0.362	0.057	>0.05
TSH	8.38± 3.84	6.29± 4.37	2.59± 3.70	0.173	0.156	0.003	<0.002

Table 4: Symptoms and sign prevalence in other and overt hypothyroid groups in cases

Symptoms	Other*(n= 41)	Overt Hypothyroid (n=32)	P-value	OR
Dry Skin	11/41(26.8%)	23/32(71.8%)	<0.05	0.14
Fatigue	24/41(58.5%)	20/32(62.5%)	>0.05	0.85
Coldintolerance	5/41 (12.1%)	19/32(59.3%)	<0.001	0.10
Tinglingsensation	7/41 (17.07%)	17/32(53.1%)	<0.05	0.18
Hairloss	8/41 (19.5%)	7/32 (21.8%)	>0.05	0.87
Constipation	12/41(29.26%)	13/32(40.6%)	>0.05	0.60
Physical examination	Other*	Overt Hypothyroid	P-value	OR
Periorbital Edema	31/41(75.6%)	31/32(96.8%)	<0.05	0.10
Pleural Effusion	11/41(26.82%)	17/32(53.1%)	<0.05	0.32
Ascites	14/41(34.14%)	23/32(71.8%)	<0.01	0.20
Peri cardial Effusion	6/41 (14.6%)	15/32(46.8%)	<0.01	0.19

Table 5: Comparison of biochemical parameters in healthy controls and chronic kidney disease patients

S.No.	Parameters	Case	Control	Sig.(2 tailed) P value
1	Creatinine(mg/dl)	183.7+85.53	22.83 + 5.06	<0.001
2	Totalprotein(g/dl)	6.74 +3.84	0.70+0.09	<0.001
3	Albumin(g/dl)	6.15 +0.68	7.02 +0.60	<0.001
4	Sodium(meq/l)	3.23 +0.50	4.03 +0.48	<0.001
5	Potassium(meq/l)	133.2+4.72	140.4+4.07	<0.001

6	Calcium(mg/dl)	5.33 +0.62	4.23 +0.31	<0.001
7	eGFR(ml/min/1.73m^2)	8.62 +0.91	9.55 +0.67	<0.001
8	Creatinine(mg/dl)	12.25+8.22	114.95+23.41	<0.001

Discussion

There was significant reduction of serum T3 level, T4 level and elevation of TSH level in cases (CKD patients) as compared to controls (normal healthy patients. [13,14,16,17] In comparison, TT_3in 40 (53.33%) patients are more reduced thanTT_4 23 (30.67%) patients. Thyroid Stimulating Hormone levels were raised in 42 (56 %). Thus altered thyroid function was seen in 60 patients of which overt Hypothyroidism (Low T_3 or low T_4, raised TSH) was found in 32 (42.66%) patients, Low T_3 syndrome (Low T_3, Normal TSH) was found in16 patients (21.33%) and Sub- clinical hypothyroidism (Raised TSH, Normal T_3, T_4) was found in 10 patients (13.33 %). A significant correlation was found between fall in eGFR and the elevated level of TSH ($p<0.002$) and decreased in serum TT_3level ($p<0.001$) but not with TT4 level.

Among the symptoms, Cold intolerance ($p<0.001$), Dry Skin, Tingling sensation were significantly ($P<0.05$) more prevalent in overt hypothyroid group as compared to other.[8,18]

On Clinical Examination, Peri orbital edema ($p<0.05$), Pleural Effusion ($p<0.05$), Ascites and Pericardial Effusion were significantly ($P<0.01$) more prevalent in hypothyroid group as compared to other.[8,18]

Conclusion

The present study finds thyroid dysfunction to be very common in CKD patients and reveals the significant association between CKD progression and thyroid dysfunction and mean of T3, T4 decreases and TSH increases significantly in cases as compared to controls.

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