

Study of Thyroid Profile in Chronic Kidney Disease – A Case Control Study

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Abstract

Original Research Article

Chronic kidney disease (CKD) is a major complication of diabetes mellitus and hypertension. Cardiovascular disease (CVD) is the most common cause of mortality and morbidity in them. Risk factor such as hypothyroidism can cause premature development of CVD. Hence this study was done to measure thyroid profile in CKD patients and healthy controls. Statistical analysis was done and it was found that overt hypothyroidism is seen in CKD patients. Hence identifying hypothyroidism in early stage and treating them may help in reducing the CVD morbidity and mortality in CKD patients.

Keywords: Chronic Kidney Disease, Cardiovascular disease, hypothyroidism.

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INTRODUCTION

Chronic kidney disease (CKD) caused by different etiologies like diabetes, hypertension, etc., pose a greater need for the control of the primary diseases because it leads to end stage renal disease (ESRD) [1]. In India, It has been estimated that the prevalence of CRF in India may be up to 785 people per million population [2].

Cardiovascular disease (CVD) is the most common cause of morbidity and mortality in patients with chronic kidney disease (CKD). Although common risk factors such as diabetes mellitus, hypertension, dyslipidemia and old age are common in CKD, they may not be sufficient by themselves to account for the high prevalence of CVD in them. Hence the study of non-traditional associated risk factors that is involved in the pathogenesis of CVD in CKD patients becomes necessary [3]. One such factor that contributes to the pre-mature development of CVD are thyroid disorder like hypothyroidism [4-10]. Hence this study was undertaken to measure the levels of serum thyroid hormones to know the degree of hypothyroidism at different stages of CKD in the rural population of Kolar.

Aim & objectives

- To measure serum thyroid profile in chronic kidney disease cases and healthy controls.

- To compare the above parameters in different stages of CKD.

MATERIALS AND METHODS

This is a case control study done in RL Jalappa Hospital and Research Centre, Kolar. Data of 40 patients more than 18 years of age with CKD at stage II, III, IV based on eGFR were included as cases and 40 healthy subjects as controls. Both the cases and controls were age and sex matched. Patients with stage I & V CKD, ARF, CVD, Thyroid disorders, Hypoalbuminemia were excluded from the study.

After obtaining informed consent, 5ml of blood after 12 hours fasting from the study group and the control group was drawn under complete aseptic precautions. Samples were collected before dialysis.

Parameters estimated were blood glucose by glucose oxidase-peroxidase method, blood urea by glutamate dehydrogenase kinetic method, Serum creatinine by Jaffe's Kinetic method, Serum total tri-iodothyronine (TT3), total tetra-iodothyronine (TT4) and Thyroid stimulating hormone (TSH) by chemiluminescence.

eGFR was calculated using MDRD(Modification of Diet in Renal Disease) formula [6].

$$\text{GFR (mL/min/1.73 m}^2\text{)} = 186 \times (\text{SCr})^{-1.154} \times (\text{age})^{-0.203} \times (0.742 \text{ if female}) \times (1.210 \text{ if African American})^9$$

The results were obtained and values were tabulated. An Independent t test was done to compare between the cases and controls and for the comparison between the stages of the CKD.

RESULTS

- Mean age of the CKD cases was 59.83 ± 10.85 and control group was 58.93 ± 10.96 as shown in figure 1.
- The percentage of females in the cases and controls were 35% and the percentage of males were 65%.
- The mean serum TSH levels were raised in cases (11.09 ± 25.19 mIU/ml) compared to the controls (2.51 ± 1.35 mIU/ml) which was statistically significant ($p < 0.05$) as shown in the table 1.
- The mean serum TT3 levels were reduced in cases (0.84 ± 0.29 ng/ml) compared to the controls (1.16 ± 0.24 ng/ml) which was highly significant statistically ($p < 0.001$) as shown in the table 1
- The mean serum TT4 levels were reduced in cases (6.07 ± 2.25 mcg/dl) compared to the controls (7.74 ± 1.95 mcg/dl) which was highly significant statistically ($p < 0.001$) as shown in the table 1
- Out of 40 CKD cases 62.5% were in stage 3 and the rest 37.5% were in stage 4 as shown in figure 2.
- The mean serum TT4 levels were significantly ($p < 0.05$) reduced in the stage 4 (5.36 ± 2.31 mcg/dl) compared to the stage 3 (7.26 ± 1.59 mcg/dl) of the CKD cases as shown in the table 2 and figure 3.
- There was no significant difference in the serum levels of TSH and TT3 between the stage 3 and stage 4 of the CKD cases as shown in the table 2.

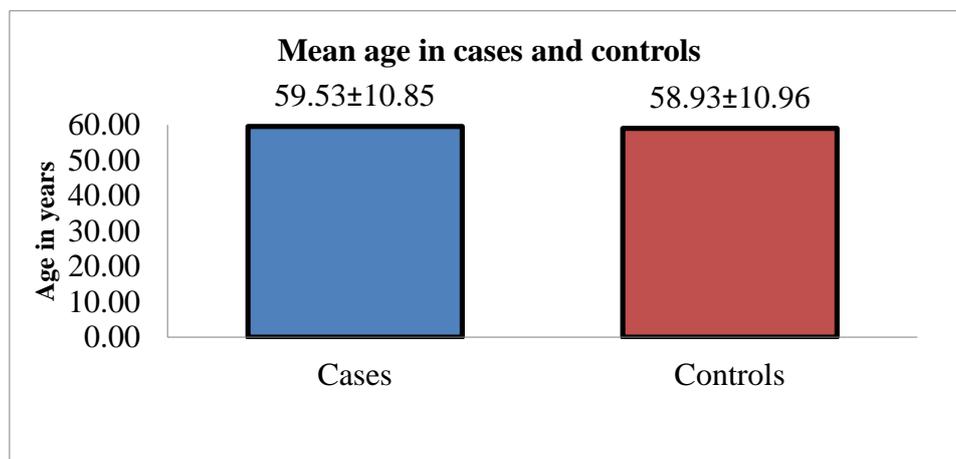


Fig-1: Mean Age of the Cases and Controls

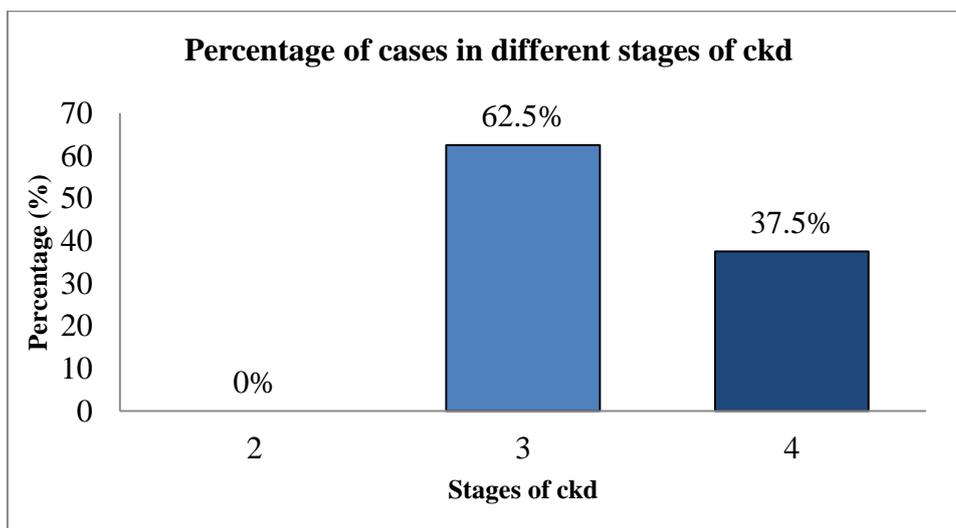


Fig-2: Percentage of the Cases in Different Stages of the CKD:

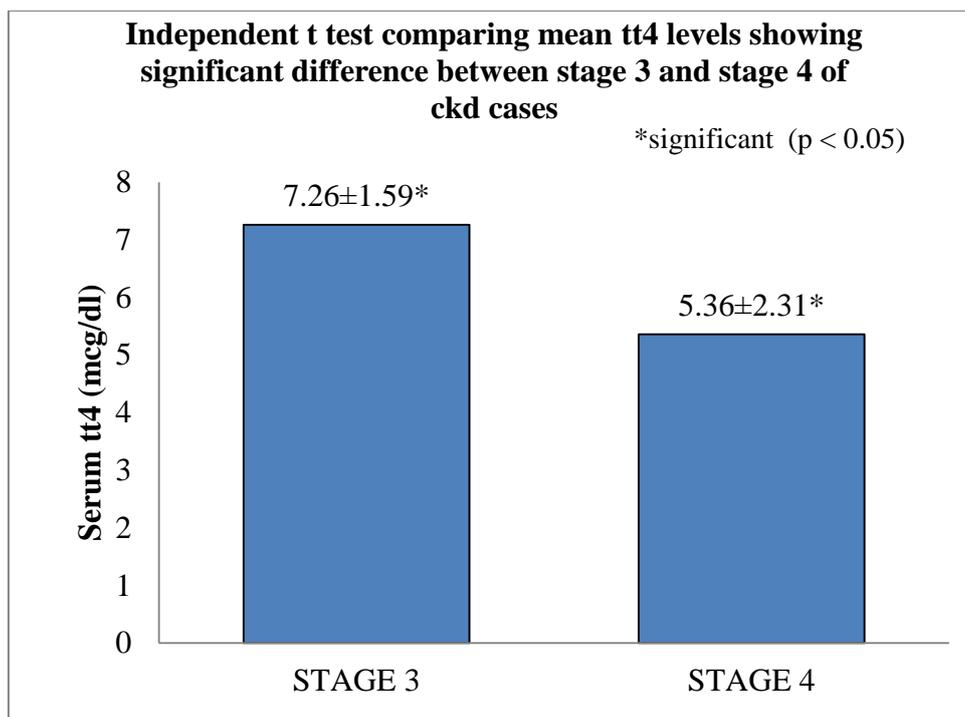


Fig-3: Independent t Test between Stages of CKD

Table-1: Independent t Test Comparing the Mean Values of the Parameters between the Cases of CKD and Controls

Parameters	Cases	Controls	T value	P value
Random Blood Sugar (mg/dl)	188.6 ± 91.25	107.75 ± 22.68	5.44	<0.001**
Blood Urea (mg/dl)	65.23 ± 24.51	30.60 ± 8.69	8.42	<0.001**
Serum Creatinine (mg/dl)	2.2 ± 0.51	0.82 ± 0.2	15.97	<0.001**
eGFR (ml/min/1.73m ²)	28.38 ± 8.10	94.08 ± 22.95	-17.07	<0.001**
Serum TSH (mcIU/ml)	11.09 ± 25.19	2.51 ± 1.35	2.15	0.03*
Serum TT3 (ng/ml)	0.84 ± 0.29	1.16 ± 0.24	-5.31	<0.001**
Serum TT4 (mcg/dl)	6.07 ± 2.25	7.74 ± 1.95	-3.54	<0.001**

* Significant ** Highly Significant

Table 2: Independent t Test Comparing the Mean Values of the Study Parameters between Different Stages of CKD

Parameters	Stage 3	Stage 4	T Value	P Value
Serum TSH (mcIU/ml)	9.24 ± 25.17	12.19 ± 25.65	-0.335	0.7
Serum TT3 (ng/ml)	0.93 ± 0.32	0.79 ± 0.25	1.551	0.1
Serum TT4 (mcg/dl)	7.26 ± 1.59	5.36 ± 2.31	2.794	0.008*

* Significant

DISCUSSION

The present study was a case control study done by selecting 80 subjects of which 40 were cases of CKD and 40 were age and sex matched normal healthy controls. The percentage of males in the cases and controls were 65% and females were 35%. Staging of CKD patients was done based on eGFR calculated using MDRD formula.

In the present study, measurement of TSH, TT3 and TT4 showed a significant difference among the cases and controls (table 2). Serum TSH was found to be increased significantly in CKD patients compared to

the controls. Serum TT3 and TT4 was reduced significantly in CKD patients compared to the controls.

Study done by El-Hana and his co-workers, showed increase in TSH levels and decrease in TT3 levels in children with CKD [11-16].

In a population based study done by Asvold *et al.* in Norway showed that high TSH levels were associated with higher prevalence of CKD [17]. Chonchol *et al.* in Denver, USA, found that subclinical hypothyroidism is a common condition among persons suffering from CKD showing normal TT3 and TT4 levels and increased TSH levels [18]. Lo and his co-

investigators found that there is elevated TSH in patients with CKD and their study did not show any significant difference in TT4 levels [19]. The number of people with CKD suffering from low T3 syndrome is increasing as the stage of the diseases progresses [20].

All these changes in thyroid hormone is seen because, of the disturbance in the hypothalamus–pituitary–thyroid axis due to uremia [21-24]. T3 tends to decrease due to the reduced deiodination by inhibition of 1 5’deiodinase causing decrease in peripheral conversion of T4 to T3 [25]. Low T4 levels in CKD patients are due to impaired protein binding of T4 [26].

Sub-endothelial inflammation caused by TNF- α and Interleukin-1 in hypothyroidism [27] increases the risk for cardiovascular complication in CKD patients.

CONCLUSION

Overt hypothyroidism was observed in CKD patients compared to controls with the levels of TT4 being reduced in stage 4 compared to stage 3. Identifying these abnormalities early in the disease process may help the clinician to effectively manage the developments of cardiovascular complications in CKD patients at an earlier stage and thereby bringing down the mortality due to CVD in CKD.

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