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ORIGINAL ARTICLE

Evaluation of Thyroid Function in Patients with Chronic Renal Disease

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ABSTRACT:

The functions of thyroid and kidney are interrelated because thyroid hormones are essential for growth and development of the kidney and for maintaining electrolyte and water homeostasis. On the other hand, kidney plays an important role in the metabolism, degradation and excretion of thyroid hormone. Thus, aim of this study is to compare the mean value of thyroid hormones in chronic kidney disease patient as compare to normal individuals.

Material and method: A total of 150 participants were taken in this study. Out of which 75 were normal age matching control and 75 were known cases of chronic renal disease. Morning sample after 12 hours of fasting were drawn aseptically and serum TSH, FT_3 and serum FT_4 were analysed by using fully automated analyser and test value were recorded for further analysis. Statistical analysis of collected data has been determined by using SPSS (16.0). The results of laboratory tests of this study have been summarized as mean ± standard deviation. **Result:** According to the result of this study we can state TSH not usually influences the activity of FT4 statistically. But the value of FT3 is highly influence in cases and control by TSH. So, monitoring of these hormones and its treatment can influence the health of an individual.

Conclusions: 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 FT3 increases as TSH decreases significantly in cases as compared to controls.

Keywords: Hypothyroidism, CKD, TSH, FT4, FT3

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INTRODUCTION

The kidney normally plays an important role in the metabolism, degradation, and excretion of several thyroid hormones. It is not surprising that impairment in kidney function leads to disturbed thyroid physiology[1]. Chronic kidney disease is a clinical condition which occurs due to permanent loss of renal function leading to metabolic, endocrine, excretory and synthetic function resulting in accumulation of non protein nitrogenous substances which leads to metabolic derangements and ends up with distinct clinical manifestations[2,3]. Similarly, impaired renal clearance of iodine leads to elevated serum levels of inorganic iodide that potentially blocks thyroid hormone production. On the other hand thyroid diseases had also became common among general population affecting 750 million people worldwide according to the data provided by World health organization[4]. Thyroid hormones are produced by a butterfly- shaped thyroid gland located in the lower anterior neck[5]. Thyroxine (T4) is the primary hormone secreted by the thyroid gland which is relatively inactive and is converted to the highly active form triiodothyronine (T3) by the enzyme thyroxine 5-deiodinase[6]**.** Thyroid hormones are necessary for growth and development of the kidney and for maintenance of water and electrolyte homeostasis[7]. Thyroid hormone affects nearly all organ systems in the body. The risk of nephropathy, cardiovascular events increases in type 2 diabetes mellitus with SH[8]. 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 elevated plasma inorganic iodide concentration and an initial increment in thyroidal iodide uptake[9]. The kidney normally contributes to the clearance of iodide, primarily by glomerular filtration. Increases in total body inorganic iodide can potentially block thyroid hormone production (the Wolff-Chaikoff effect). Such a change may explain the slightly higher frequency of goiter and hypothyroidism in patients with chronic kidney disease[10].

So, we can say thyroid dysfunction is a commonly seen endocrine abnormality among CKD patients. It has been seen 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[11,12,13,14]. Several previous studies depict conflicting results both positive and negative. Thus, there are huge numbers of patients remaining to be diagnosed 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.

MATERIAL AND METHOD:

A total of 150 participants were taken in this study. Out of which 75 were normal age matching control and 75 were known cases of chronic renal disease. Patients were identified by the principal investigator at IPD, ICU, wards and OPD. Complete history and physical examination were taken to confirm diagnosis and cases were also confirmed from treating doctors. If participants meet the inclusion criteria, informed written consent was taken from the participant after explaining to him or her about the study. Morning sample after 12 hours of fasting were drawn aseptically. 3 ml of venous blood was drawn from the antecubital vein from each patient. The blood samples were then transported to the central laboratory within an hour of collection for analysis. Serum TSH, FT_3 and serum FT_4 were analysed by using fully automated analyser and test value were recorded for further analysis.

Statistical analysis of collected data has been determined by using SPSS (16.0). The results of laboratory tests of this study have been summarized as mean ± standard deviation. Mean difference (both participating groups) have be analysed by using student's t-test and chi-square test was used to show the co-relation. P value <0.05 was considered as statistically significant.

INCLUSION CRITERIA

For Cases:

1. Clinically confirmed cases of CKD

Control:

1. Age matching normal individual
2. Patient having no history of abnormal thyroid profile.

EXCLUSION CRITERIA

1. Patients with associated history of acute illness
2. Thyroidectomy/thyroid disorder recent surgery
3. Trauma or burns
4. Drugs altering Thyroid profile (like amiodarone, steroids, phenytoin, beta-blockers, estrogen pills, iodine containing drugs
5. Children's and ANC Patients were excluded from the study.

RESULT

Comparison of serum TSH level between controls and chronic renal disease patient by Student's t-test

Parameter	Control group (n=75) Mean ± SD	CKD Patients (n=75) Mean ± SD	p-value
Serum TSH level (µIU/ml)	2.2± 2.5	4.17± 2.7	0.001

Statistically significant differences were observed in the mean serum TSH level of controls (2.2± 2.5 µIU/ml) and chronic renal disease patients (4.17± 2.7 µIU/ml). (p = 0.001) but both are within a normal range.

Comparison of FT4 between controls and patients of chronic renal disease by Student's t-test

Parameter	Control group (n=75) Mean ± SD	Patients of CKD (n=75) Mean ± SD	p-value
Serum FT4 (ng/dl)	1.28 ± 1.1	0.81 ± 1.7	0.03

Statistically significant differences were observed in the mean serum FT4 level of controls (1.28±1.1 ng/dl) and chronic renal disease patients (0.81±1.7 ng/dl). (p = 0.03)

Comparison of FT3 between controls and patients of chronic renal disease by Student's t-test

Parameter	Control group (n=75) Mean ± SD	Patients of CKD (n=75) Mean ± SD	p-value
Serum FT3 (pmol/L)	4.67 ± 2.1	1.3 ± 2.8	0.002

Statistically significant differences were observed in the mean serum FT3 level of controls (4.67 ± 2.1 pmol/L) and chronic renal disease patients (1.3 ± 2.8 pmol/L). (p = 0.002)

Tabular representation showing Pearson correlation coefficient (r) and p-value

Parameters	r- value	p-value
TSH-FT4 (in Cases)	-0.210	0.07
TSH-FT4 (in Control)	0.072	0.23
TSH-FT3 (in Cases)	-0.410	0.002
TSH-FT3 (in Control)	-0.230	0.04

After applying Pearson's correlation coefficient it was found that there is a negative correlation between serum TSH and FT4 level (r = -0.310) in cases and slight positive correlation in controls but it was statistically not at the significant level (p=0.05). Whereas, FT3 shows negative relation in cases and control (r=-0.41), (r=-0.23) at the significant level (p=0.002) and (0.04) respectively. According to the result of this study we can state TSH not usually influences the activity of FT4 statistically. But the value of FT3 is highly influence in cases and control by TSH. So, monitoring of these hormones and its treatment can influence the health of an individual.

DISCUSSION

CKD is a clinical syndrome which occurs due to irreversible loss of renal function leading to metabolic, endocrine, excretory and synthetic function resulting in accumulation of non protein nitrogenous substances which leads to metabolic derangements and ends up with distinct clinical manifestations. The functions of thyroid and kidney are interrelated[15]. The thyroid hormones are essential for growth and development of the kidney and for maintaining electrolyte and water 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 elevated plasma inorganic iodide concentration and an initial increment in thyroidal iodide uptake. 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. On the basis of above mention statement this study was conducted and we found statistically significant differences the mean serum TSH level of controls (2.2± 2.5 µIU/ml) and chronic renal disease patients (4.17± 2.7 µIU/ml). (p = 0.001) but both were within a normal range. Which shows no clinically significant changes and it is similar to the study of Ramirez et al 11,21 whereas Quionverde et a1,[16] reported high preponderance of hypothyroidism in CKD. Similarly, in this study statistically significant differences were observed in the mean serum FT4 level of controls (1.28±1.1 ng/dl) and chronic renal disease patients (0.81±1.7 ng/dl). (p = 0.03) which is statistically significant whereas Schmidt et al,[17] have reported normal levels of FT4. On the other part this study shows significant differences in the mean serum FT3 level of controls (4.67 ± 2.1 pmol/L) and chronic renal disease patients (1.3 ± 2.8 pmol/L). (p = 0.002) which suggest towards hypothyroidism in patients of chronic renal disease. This is similar to the study of Hardy et al,[18] and Joseph et al[19], who had studied on 127 patients of CRF, showing low T3,T4,fT4 but had high TSH levels. On the other hand in our study after applying Pearson's correlation coefficient it was found that there is a negative correlation between serum TSH and FT4 level (r = -0.310) in cases and slight positive correlation in controls but it was statistically not at the significant level (p=0.05). Whereas, FT3 shows negative relation in cases and control (r=-0.41), (r=-0.23) at the significant level (p=0.002) and (0.04) respectively. According to the result of this study we

can state TSH not usually influences the activity of FT4 statistically. But the value of FT3 is highly influence in cases and control by TSH. So, monitoring of these hormones and its treatment can influence the health of an individual.

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 FT3 increases as TSH decreases significantly in cases as compared to controls. Meanwhile, the value of FT4 was not significantly altered in chronic renal patients as compared to normal controls. Thyroid dysfunction was studied in patients with CKD irrespective of the etiology of CKD therefore individual correlation of the etiology of CKD with thyroid dysfunction could not be studied. Thyroid dysfunction was not studied in patients on dialysis, as dialysis itself affects the thyroid profile independently of CKD.

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