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A Study on Renal Function Tests in Subclinical Hypo and hyperthyroid Disorders

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Abstract: Thyroid hormones have many important biological functions in our body. One of the major functions is control of the basal metabolic rate and calorigenesis. Thyroid dysfunction causes remarkable changes in glomerular and tubular functions. In recent studies, it was found that hypo and hyperthyroidism associated with renal derangement resulting in abnormal serum creatinine and uric acid levels. Thus, this study was conducted for estimation and observation of changes in urea and creatinine in subclinical hypo and hyperthyroidism.Total 90 subjects were included in the study. Out of which 30 cases were clinically diagnosed subclinical hypothyroid patients and 30 were subclinical hyperthyroid, remaining 30 were controls. Triiodothyronine (T3),Thyroxine(T4), and TSH were estimated by fully automated Beckman coulter Access-2 analyser. Urea, uric acid and creatinine parameters were measured using automated clinical chemistry analyser. Statistical data analysis was performed by using SPSS 18.2 software. Patients with subclinical hypothyroidism showed significant increase in serum uric acid and creatinine levels ($p<0.0001$) and patients with subclinical hyperthyroidism showed significant decrease in serum creatinine levels ($p<0.0001$). When correlated with TSH, serum creatinine showed positive correlation where it has negative for serum uric acid in case of SC hypothyroidism cases. For SC hyperthyroid cases, correlation was negative for serum creatinine and uric acid levels.The overall result of our study indicate that the urea, creatinine, uric acid levels were significantly impaired in subclinical hypo and hyperthyroidism. Therefore, we would emphasize the importance of the routine evaluation of these biochemical parameters in thyroid disorders.

Keywords: Subclinical (SC) Hypothyroidism, Subclinical (SC) Hyperthyroidism, Thyroid stimulating hormone (TSH), Urea, Creatinine.

INTRODUCTION

Thyroid disease is a most common endocrine disorder in the world population. The prevalence of thyroid disease increases with age. Hypothyroidism and hyperthyroidism are the two primary pathological conditions that involve the thyroid glands. In India, hypothyroidism is the major thyroid dysfunction disorder[1].Subclinical hypothyroidism is diagnosed when peripheral thyroid hormone levels are within normal reference laboratory range but serum thyroid stimulating levels are mildly elevated. Subclinical hyperthyroidism may be defined as the presence of free thyroxine and tri-iodothyronine levels within the reference range and a reduced serum thyroid stimulating hormone level.

Thyroid hormones play a very important role regulating metabolism, development, protein synthesis, and influencing other hormone functions. The two main hormones produced by the thyroid are triiodothyronine (T3) and thyroxine (T4). These hormones can also have significant impact on kidney disease so it is important to consider the physiological association of thyroid dysfunction in relation to chronic kidney disease[2].

Thyroid dysfunction causes significant changes in renal function. Hypothyroidism is the most common pathological hormone deficiency among the endocrine disorders. Hypothyroidism is associated with many biochemical abnormalities among which serum creatinine and uric acid levels are affected and the reason for the same has been shown to result in a decrease in GFR. Hyperthyroidism is another thyroid disorder characterized by decrease in TSH level. Very few studies showed the effect of hyperthyroidism on renal function [3].

The objective of this study was to study the renal function tests like urea and creatinine levels in subclinical thyroid disorders and also its correlation.

MATERIALS AND METHODS

Total of 60 clinically established patients and 30 controls of 18-75 years were included in this study. The study was conducted in Victoria hospital attached to BMC&RI from May2016- Dec2016. The patients were divided into three groups depending on thyroid hormone levels as euthyroid (Controls), subclinical hypothyroid and hyperthyroid respectively. Patients with history of intake of thyroid drugs, hypertensive, diabetes mellitus, obesity, renal disorders and hepatic disorders were excluded from the study.

Method of Analysis

After obtaining written informed consent, 5ml of venous blood was obtained by venepuncture under aseptic conditions, Samples were centrifuged and separated serum was used for estimation of thyroid hormones and serum urea, creatinine and uric acid. Triiodothyronine (T3), Thyroxine (T4), and TSH were estimated by fully automated Beckman coulter Access-2 analyser. Urea, uric acid and creatinine parameters were measured using automated clinical chemistry analyser.

The results were tabulated. Results on continuous measurements are presented on Mean±SD (Min-max). The results of cases and controls were compared by student't' test. A '*p*' value of <0.05 was considered significant. A '*p*' value of <0.0001 was considered as highly significant. All three parameters were compared with TSH levels. Pearson's correlation and t test of coefficient were calculated.

RESULTS

Table-1:Comparison between Controls and SC Hypothyroid cases

Lab variables	Controls	Cases	p value
T3(tri-iodothyronine) ng/ml	1.45±0.90	1.94±0.98	<0.0483
T4 (thyroxine) µg/dl	8.98±1.90	9.09±1.78	<0.8178
TSH (Thyroid stimulating hormone) µIU/ml	2.86±0.14	20.02±14.43	<0.0001
Urea(mg/dl)	26.00±2.78	25.99±4.09	<0.4854
Creatinine(mg/dl)	0.82±0.04	1.23±0.78	<0.0001
Uric acid(mg/dl)	4.90±0.16	6.09±0.89	<0.0001

Table-2: Comparison between Controls and SC Hyperthyroid cases

Lab variables	Controls	Cases	p value
T3(tri-iodothyronine) ng/ml	1.45±0.90	1.59±0.89	<0.5470
T4 (thyroxine) µg/dl	8.98±1.90	10.05±1.34	<0.0145
TSH (Thyroid stimulating hormone) µIU/ml	2.86±0.14	0.20±0.30	<0.0001
Urea(mg/dl)	26.00±2.78	26.1±2.45	<0.7768
Creatinine(mg/dl)	0.82±0.04	0.71±0.03	<0.0001
Uric acid(mg/dl)	4.90±0.16	5.01±0.62	<0.3506

Table-3: Pearson's correlation coefficient (r) between lab parameters and TSH

TSH	Correlation coefficient (SCHypothyroidism)	Correlation coefficient (SCHyperthyroidism)
Urea(mg/dl)	0.3909	-0.0798
Creatinine(mg/dl)	0.1998	-0.3890
Uric acid(mg/dl)	-0.0476	-0.1623

DISCUSSION

Thyroid dysfunction causes significant changes in renal function. Both hypothyroidism and hyperthyroidism affect renal blood flow, GFR, tubular function and electrolyte homeostasis [4].

In Table no.1, Cases with SChypothyroidism showed significant increase in serum uric acid and creatinine levels ($p<0.0001$) and there is no significant correlation among urea levels. In Table no.2, Cases with SChyperthyroidism showed significant decrease in serum creatinine levels ($p<0.0001$) and there is no significant correlation among urea and uric acid levels. In Table no.3, when correlated with TSH, serum creatinine showed positive correlation where it has negative for serum uric acid in case of SChypothyroidism cases. For SChyperthyroid cases, correlation was negative for serum creatinine and uric acid levels.

Kreisman and Hennessey in their study found that mean serum creatinine level in hypothyroid cases were significantly greater in comparison to control value[5]. The pathophysiology of renal function in hypothyroidism is multifactorial and many theories had been proposed. First, in hypothyroid state, cardiac output is decreased causing hypovolameia, resulting in

a decreased renal blood flow. In addition, the increase in systemic and renal vasoconstriction, probably from direct effect of thyroxine, may further lead to decrease renal blood flow. Second, it has also been suggested that thyroxine may mediate tubular secretion of creatinine. Thyroxine may regulate transcription in the sarcoplasmatic reticulum, affecting the Na+/Ca2+exchanger and the Na+/K+-ATPase activity in the kidneys and these processes are related to the active secretion of creatinine [6, 7].

Another possible mechanism of action of thyroid hormone on renal function could be explained by its influence on maturation of the renin-angiotensin system (RAAS). Plasma renin activity and plasma levels of angiotensinogen, angiotensin II and aldosterone are directly related to plasma levels of thyroid hormones. Hypothyroidism is associated with low plasma renin. In contrast, hyperthyroidism is accompanied by hyperactivity of the RAAS [8, 9].

CONCLUSION

This study was designed to evaluate the role of renal function tests in Subclinical hypo and Subclinical hyperthyroidism and correlate the changes with TSH. Our study confirms that subclinical hypothyroidism is associated with increased creatinine and uric acid levels and decreased creatinine levels in subclinical hyperthyroidism. Therefore, the assessment of thyroid function should be routinely carried out for evaluation of patients presenting with deranged renal function and vice-versa.

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