Impact of hyperthyroidism on renal function.

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Abstract

Introduction: Thyroid dysfunction affects renal physiology and development, whereas kidney disease could result in thyroid dysfunction. A number of studies proved renal dysfunction in hypothyroidism but very few studies are available on hyperthyroidism. The aim of the present study is to see the impact of hyperthyroidism on kidney function.

Materials and methods: The present study included all 60 subjects. The control group comprising of 30 healthy age (25-45 years) and sex-matched subjects and the test group comprising of 30 clinically diagnosed hyperthyroidism patients (25-45 years). Thyroid Profile–T3, T4 and TSH are estimated by chemiluminescence immune assay. Renal profile-urea, creatinine and proteins are done by the kit method using autoanalyzer. Serum electrolytes were done by an AVL electrolyte analyzer. The Estimated Glomerular Filtration Rate (eGFR) is calculated according to the formula recommended by the National Kidney Foundation using creatinine levels. The results were expressed as mean ± SD. And student's unpaired t-tests were used for comparison the group.

Results: The statistically significant rise ($p<0.05$) in urea and decrease ($p<0.05$) in creatinine, total protein, and albumin concentration in hyperthyroidism as compared to the control group. It also shows a significant rise in the value of eGFR ($p<0.05$) and a nonsignificant reduction in serum electrolytes levels.

Conclusion: The present study concluded that there are significant changes in renal function tests which reflect kidney dysfunction inpatient with hyperthyroidism.

Keywords: Thyroid stimulating harmone, Urea, Creatinine, Hyperthyroidism, Kidney dysfunction.

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Introduction

The thyroid hormones secreted by thyroid gland affect each and every cell and organs of the body. Approximately 200 million people across the world have a thyroid disorder. All age of people can get thyroid disease but women are five to eight times more likely than men. Hyperthyroidism involves excess synthesis and secretion of thyroid hormone leads to hyper metabolic condition of thyrotoxicosis. Grave's disease is most common forms of hyperthyroidism [1].

The Interplay between thyroid and the kidney in each other's function is well known. For the growth and development of kidney and also for maintenance of water and electrolytes homeostasis require thyroid hormones [2].

The kidney plays a role in clearance of iodine, TSH, and Thyrotropin-releasing hormone [3]. Any dysfunction in the thyroid can affect the production of thyroid hormones (T3 and T4) which can be linked to various pathologies.

Thyroid dysfunction affects renal physiology and development, whereas kidney disease could result in thyroid dysfunction. Hence the treatment of one disorder may affect other organs, which is essential to optimally manage the patients.

Effects of hypothyroidism and hyperthyroidism on kidney function are the result of direct renal effects, as well as systemic hemodynamic, metabolic, and cardiovascular effects. Fortunately, most of the renal manifestations of thyroid disorders are reversible with treatment [4].

Numbers of studies are available on hypothyroidism but very few are available on hyperthyroidism. Hence the study will help to increase clinical knowledge and enable clinicians to provide better management for their patients who have thyroid or kidney dysfunction. Hence the aim of present study is to see effect of hyperthyroidism on the renal profile.

Materials and Methods

Materials

The present study included in all 60 subjects. The control group comprising of 30 age (25-45 years) and sex matched healthy subjects and the test group comprising of 30 clinically diagnosed hyperthyroidism patients of age group (25-45 years).

Patients suffering from chronic kidney disease, diabetes mellitus and on thionamides, lithium medications are excluded from the study.

All the subjects included in the study has given the consent and volunteered. The study was approved by institutional ethical committee.

Methods

The 5 ml fasting venous blood sample were collected in plain bulb under aseptic condition.

Thyroid profile: T3, T4, TSH is estimated by chemiluminescence immune assay [5].

Renal profile: Blood urea, serum creatinine and proteins are done by kit method using auto analyzer. Serum electrolytes were done by AVL electrolyte analyzer.

eGFR: The Estimated Glomerular Filtration Rate (eGFR) is calculated according to the formula recommended by the National Kidney Foundation using blood creatinine levels.

Statistical analysis: It was done using primer software. The results were expressed as mean ± SD. Comparison of control group and test group was done by unpaired students't' tests.

Results

The total 60 cases were included in the study of which 30 were control, 30 were hyperthyroidism.

Table-1 shows demographic data of study groups. The control group includes 6 males and 24 females of total number of 30 having average age (36.5 ± 10.56) years. The hyperthyroidism group includes 5 males and 25 females of total number 30 having average age (33.90 ± 11.50) in years. There is no statistically significant difference between control and hyperthyroidism age group.

Table 1. *Total distribution of subjects in group.*

	Control (n=30)	Hyperthyroidism (n=30)
Male	6	5
Female	24	25
Age (years)	36.5 ± 10.56	33.90 ± 11.50

Table 2 shows statistically significant decrease in levels of serum TSH ($p<0.05$), and significantly increased in T3 ($p<0.05$) and T4 ($p<0.001$) levels in hyperthyroidism group as compared to control group.

Table 2. *The comparison of thyr oid pr ofile in contr ol and hyperthyroidism.*

Parameters	Control (n=30)	Hyperthyroidim(n=30)
TSH (µIU/ml)	2.97 ± 1.20	0.48 ± 2.27*
T3 (ng/ml)	1.01 ± 0.20	3.14 ± 0.29*
T4 (µg/dl)	10.12 ± 3.28	13.51 ± 5.33**
Note: *p< 0.05 and **p<0.001		

Table 3 shows statistically significant increase ($p<0.05$) in concentration of BUL and significant decrease ($p<0.05$) in serum creatinine,

total protein and albumin concentration in hyperthyroidism group as compared to control.

It also shows significant rise in value of eGFR ($p<0.05$). But there is non-significant reduction in levels of sodium and potassium.

Table 3. *The comparison of renal profile in control and hyperthyroidism.*

Parameters	Control (n=30)	Hyperthyroidism (n=30)
Blood urea (mg/dl)	25.2 ± 6.1	27.8 ± 3.5*
Serum creatinine (mg/dl)	1.01 ± 0.21	0.76 ± 0.23*
Serum sodium (mmol/l)	1.36.13 ± 7.1	1.35 ± 6.0
Serum potassium (mmol/l)	4.59 ± 0.4	4.15 ± 0.23
Total protein (gm/dl)	6.92 ± 0.52	6.10 ± 0.62*
Albumin (gm/dl)	4.01 ± 0.53	2.40 ± 0.44*
eGFR (milliliters/minute/ 1.73 m2)	90 ± 20	110 ± 10*
Note: *p value<0.05		

Discussion

The present study has been done to ascertain whether thyroid dysfunction causes changes in renal profile in patients with hyperthyroidism. A lots of data is available on hypothyroidism but a very few study is contributed for hyperthyroidism.

The present study shows significant difference ($p<0.05$) in urea and creatinine concentration in hyperthyroidism as compared to control group. The serum creatinine, total protein and albumin concentration is significantly decreased ($p<0.005$) in hyperthyroidism as compared to control group.

Toshihide Shirota, et al. [6] also reported elevated blood urea and decreased serum creatinine in hyperthyroidism, present study shows similar results. The increase in BUL is due to increased production, whereas the decrease in creatinine is due to decreased production and increased renal clearance.

The serum creatinine has shown to be more sensitive and specific marker for renal dysfunction. The changes in creatinine level among hyperthyroidism are explained by changes occurring in hemodynamics [7].

Hyperthyroidism results in increased renal blood flow. The activation of renin-angiotensin system and the decrease in the resistance of afferent glomerular arterioles lead to an increase in the glomerular hydrostatic pressure and GRF in animals [7]. We can explain the rise in eGFR in present study by comparing with these previous experimental studies,

The present study shows that eGFR is significantly ($p<0.05$) increased in hyperthyroidism as compared to control group.

Ezgi Sönmez study reported that a decline in eGFR below 60 mL/min/1.73 m2 in 10 patients, which brings about the idea that hyperthyroidism, may be masking mild renal pathologies in some patients [8].

Hyperthyroidism is characterized by an increase in renal plasma flow and GFR, resulting in a reduction of serum creatinine levels [9]. The reduction of serum creatinine has also been reported in sub-clinical hyperthyroidism [10].

Intraglomerular hypertension is seen in hyperthyroidism because of increased renal blood which results in increased

filtration pressure. Proteinuria in hyperthyroidism is known cause of direct renal injury, increased mitochondrial energy metabolism along with down regulation of superoxide dismutase, which occurs in hyperthyroidism, contributes to an increased free radical generation that causes renal injury [11].

The present study shows non-significant changes in sodium and potassium levels in hyperthyroidism group as compared to control.

Hyperthyroidism is associated with polyuria, which is due to a combination of direct down regulation of aquaporin 1 and 2 along with increased BP, cardiac output, and renal blood flow. Food and water intake are also increased, as is catabolic rate. All of these factors may increase distal delivery of sodium, despite up regulation of the Na+-K+-2 Cl_2 co-transporter, other solutes, and water, resulting in increased urine flow rate [12].

Effects of hyperthyroidism on kidney function are the result of direct renal effects, as well as systemic hemodynamic, metabolic, and cardiovascular effects.

Patients with thyroid disorders are also at risk for immune-mediated glomerular diseases. Finally, patients with nephritic syndrome, as well as acute and chronic kidney injury, have alterations in thyroid gland physiology that can impact thyroid function and the testing of thyroid function status [13,14].

Conclusion

Hence the present study concluded that there is significantly decreased in concentration of serum creatinine and increased eGFR in hyperthyroidism patients, Also protein and albumin concentrations are significantly decreased in hyperthyroidism patients. So the present study shows that changes in renal profile in hyperthyroidism.

From clinical practical perspective, renal function test is very important in assessment of hyperthyroidism patients to prevent renal impairment.

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Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript.

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