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Effects of Hypothyroidism on Renal Physiology

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Abstract
Objectives: *To assess the effects of hypothyroidism on renal physiology.*
Methodology: *The study was conducted on subjects in the age group of 20-65 years. Subjects were divided into two subgroups: Euthyroid and hypothyroid on the basis of thyroid function tests. Bodyweight and height was taken. Data was subjected to one way analyses of variance. In all the cases, means are used as units of analyses. Individual values for each subject were taken as one replicate. A P-value of less than 0.05 was considered statistically significant.*
Conclusion: *This study shows that there is significant increase in creatinine and uric acid levels in hypothyroid patients as compared to euthyroid subjects.*
Keywords: *Hypothyroidism, renal function tests.*

Introduction

Thyroid gland produces hormones that influence the function of all body organs. Disorders of thyroid results primarily from autoimmune processes that either stimulate the overproduction of thyroid hormones or cause glandular destruction and hormone deficiency[1]. Thyroid hormones play an important role in growth, development and physiology of kidney[2]. It has been observed that congenital hypothyroidism have an increased prevalence of congenital renal anamolies[3]. Also, kidneys also play a role in the regulation of metabolism and elimination of thyroid hormones and is an important target organ for thyroid hormone actions[4,5]. Thyroid disorders adversely influence the kidney structure and function[6,7].So, the present study is planned to see the effects of lowering of thyroid hormone levels on the physiology of kidney.

Material and Methods

The present study was conducted in the Department of Physiology in collaboration with the Department of Medicine and Department of Biochemistry, Government Medical College, Jammu.

Selection Procedure: The study was undertaken in subjects of age group 20-65 years. Subjects were taken from outpatient department of medicine in Government Medical College,

Jammu. Detailed explanation of the purpose and methodology of the tests was given to all subjects and all eligible subjects were requested to participate in the study. Subjects willing to participate were divided into two groups:

Group A: Euthyroid. Group B: Hypothyroid.

Eligibility criteria

Inclusion criteria: Fresh cases of hypothyroidism were detected by their clinical presentation and biochemical parameters. Patients of both sexes and 20 years of age were included.

Exclusion Criteria: Pre-existing diseases like diabetes mellitus, renal disorders, liver disorders or any other chronic inflammatory medical condition were excluded from the study. Weight and height were recorded as per standards recommended by WHO.

Biochemical Measurements

Thyroid function tests (T3, T4 and TSH) were performed by chemilumniescent microparticle immunoassay for the quantitative determination of thyroid hormones in human serum and plasma[8,9]. Renal function tests (Sr. urea, creatinine, uric acid, sodium and potassium) were estimated on fully automated analyzer (Siemens Dimensions Xp and Plus).. Handling and storage of blood samples were done as per criteria furnished by National Committee for Clinical Laboratory Standard (NCCLS).

Statistical Analysis

Data was subjected to one way analyses of variance (ANOVA, kyplot version 2). In all cases, means are used as units of analyses and are represented as mean+-SD. Individual values for each subject were taken as one replicate and for each parameter 40 replicates were used in total. A p-value of less than 0.05 was considered statistically significant.

Results

Comparison of mean serum urea of group A and group B subjects

Classification of subjects	S.urea(mg%)	Statistical inference F-value	Statistical inference P-value	Significant difference
Euthyroid	18±3.49	F=3.1739	P=0.0787	Not significant as P>0.05
Hypothyroid	19±3.46			

Table shows group A (Euthyroid) subjects with mean S.Urea 18 (SD ± 3.49) mg%. Group B (Hypothyroid) subjects with mean S.Urea 19.39 (SD ± 3.46) mg%. There is no significant difference in mean S. Urea between euthyroid and hypothyroid subjects.

Comparison of mean serum creatinine of group A and group B subjects

Classification of subjects	Serum creatinine(mg%)	Statistical inference F-value	Statistical inference P-value	Significant difference
Euthyroid	0.61±0.15	F=45.6251	P=0.0001	Significant as p<0.05
Hypothyroid	0.93±0.26			

Table shows group A (Euthyroid) subjects with mean S.Creatinine 0.61 (SD ± 0.15) mg%. Group B (Hypothyroid) subjects with mean S.Creatinine 0.93 (SD ± 0.26) mg%. There is significant difference in mean S.Creatinine between euthyroid and hypothyroid subjects.

Comparison of mean S.Uric acid of Group A and Group B

Classification of subjects	S.Uric acid	Statistical inference F value	Statistical inference p value	significant difference
Euthyoid	4.77±1.01	F=14.4387	P=0.0001	Significant as p<0.05
Hypothyroid	5.93±1.66			

Table shows mean S.Uric acid of subjects of Group A and Group B . Group A (Euthyroid) subjects with mean S.Uric acid 4.77 (SD ± 1.01) mg%. Group B (Hypothyroid) subjects with mean

S.Uric acid 5.93 (SD ± 1.66) mg%. There is significant difference in mean S.Uric acid between euthyroid and hypothyroid subjects.

Comparison of mean S.Na$^+$ of Group A and Group B

Classification of subjects	Serum sodium	Statistical inference F value	Statistical inference P value	significant difference
Euthyoid	141±2.02	F=2.0409	P=0.1571	Not significant as p>0.05
Hypothyroid	140±1.89			

Table shows mean S.Na$^+$ of subjects of Group A and Group B. Group A (Euthyroid) subjects with mean S.Na$^+$ 141.03 (SD ± 2.02) meq/l. Group B (Hypothyroid) subjects with mean S. Na$^+$140.4 (SD ± 1.89) meq/l. There is no significant difference in mean S. Na$^+$ between euthyroid and hypothyroid subjects.

Comparison of mean S.K$^+$ of Group A and Group B

Classification of subjects	Serum potassium	Statistical inference F value	Statistical inference P value	significant difference
Euthyoid	3.98±0.23	F=0.0263	P=0.8717	Not significant as p >0.05
Hypothyroid	3.99±0.17			

Table shows mean S.K$^+$ of subjects of Group A and Group B. Group A (Euthyroid) subjects with mean S.K$^+$ 3.98 (SD ± 0.23) meq/l. Group B (Hypothyroid) subjects with mean S.K$^+$ 3.99 (SD ± 0.17) meq/l. There is no significant difference in mean S.K$^+$ between euthyroid and hypothyroid subjects.

Discussion

Thyroid hormones influence the function of all body organs and cells. The data presented here clearly indicates how biochemical markers of kidney may be affected by alteration in the level of thyroid hormones in the body. Thyroid hormones influence renal development, kidney structure, renal hemodynamics, glomerular filtration rate (GFR), the function of many transport systems along the nephron and sodium and water homeostasis. Hypothyroidism is often associated with kidney diseases[10]. A reduction in GFR and RBF could conceivably be another mechanism for the diminished renal excretion of free water. These renal abnormalities occur because the deficiency of thyroid hormones reduces the cardiac output. Consequently, this deficiency reduces the renal blood flow and, finally, the glomerular filtration rate [11].

This study shows that there is significant increase in creatinine and uric acid levels in hypothyroid patients as compared to euthyroid subjects. The changes in biochemical markers of renal function were found to be reversible after thyroxine replacement therapy. Similar changes in serum creatinine with hypothyroidism and improvement with treatment have been reported in a few scattered studies and case reports[12,13]. There is significant increase in s.creatinine levels in hypothyroid patients[14]. Mean serum creatinine level in hypothyroid cases was significantly greater in comparison to euthyroid value[15]. Elevated serum urea and creatinine is found in patients with overt and sub-clinical hypothyroidism in Delhi[16]. The present study also showed a significant increase in s.uric acid levels in hypothyroid patients as compared to euthyroid subjects.

Conclusion

The present study was conducted to assess kidney function tests in thyroid dysfunction. The findings of the study indicate that the kidney and thyroid functions are interrelated through many metabolic pathways and the two vital organs are biochemically interactive by various metabolic pathways and any harm to either of them eventually will lead to the malfunction of the other organ. Thyroid hormones play an

important and vital role in kidney growth and development, biochem-physiological functions of nephron the kidney structural unit. Thyroid hormones affect kidney, hemodynamic, blood circulation and renal glomerular filtration rate. Thyroid hormones influence tubular function, various transansport system, electrolyte balance and related physiological functions occur by the kidney. Thyroid hormones influence renal function and growth as early as embryonic life. Hypothyroidism reduce renal blood flow mainly as result of vasoconstriction. It is important for the clinician to consider an evaluation of thyroid function in the workup of the patient with altered liver function tests and altered kidney function tests and vice visa.

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