

Effect of Hypothyroidism on renal function tests in Indian patients in 2012

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Abstract:

Background: *Thyroid dysfunction causes significant changes in kidney function, both hypothyroidism and hyperthyroidism affect renal blood flow, GFR, tubular function, electrolytes homeostasis, electrolyte pump functions, and kidney structure*

Objective: *The aim of this study was to investigate the effect of thyroid dysfunction (hypothyroidism) on biochemical markers of kidney in hypothyroid patients. TSH was used as a marker of the thyroid status.*

Methods: *Thyroid function tests (T3, T4 and TSH levels) were assayed in 70 subjects. Based on TSH levels, subjects were classified as euthyroid (n=47), hypothyroidism (n=23). BUN, serum CTN, UA, serum Na, serum K and serum Cl were studied in patients with hypothyroidism and euthyroid subjects.*

Results: *BUN, serum CTN, UA and K levels were significantly increased in hypothyroid patients as compared to euthyroid subjects, whereas serum Na and Cl levels were significantly decreased in hypothyroid patients as compared to controls.*

Conclusion: *This study demonstrated a significant effect of thyroid dysfunction (hypothyroidism) on biochemical markers of kidney.*

Key words: hypothyroidism, renal function tests, Indian patients

INTRODUCTION:

Thyroid hormones (TH) are necessary for growth and development of the kidney and for the maintenance of water and electrolyte homeostasis. On the other hand, kidney is involved in the metabolism and elimination of TH (1). Thyroid hormones may directly affect the kidney, and altered kidney function may also contribute to Thyroid disorders. Thyroid dysfunction causes significant changes in kidney function, both hypothyroidism and hyperthyroidism affect renal blood flow, GFR, tubular function, electrolytes homeostasis, electrolyte pump functions, and kidney structure (2–6).

Hypothyroidism has been associated with increased serum creatinine (Scr), decreased GFR (7-9), reduction of renal plasma flow (RPF), disruption of the capacity to excrete free water and hyponatremia (10).

MATERIALS AND METHODS:

This study include 70 participant between the age 16-82 of both sex (male & female), collected from Asian institute of medical science at Faridabad region, They were divided into two groups, group 1 (n= 23 subjects) for the patients having hypothyroidism (T3, T4 & TSH) and group 2 (n= 47 subjects) for control.

Five ml of blood samples were collected from each participants, and it were investigated for T3, T4, TSH, BUN, serum Creatinine, serum Sodium, serum Potassium, serum Chloride and Uric Acid, in the clinical biochemistry lab of Asian hospital, Faridabad.

Biochemical analysis:

a-Thyroid Function Tests:

- FT3: The method used is CMIA method.
- FT4: The method used is CMIA method.
- TSH: The method used is CIMA method.

These tests were done by fully automatic analyzer (ARCHITECT I 1000 SR).

b- Renal Function Tests:

- BUN: The method used is (Enzymatic-Urease Kinetic).
- Creatinine serum: The method used is (Jaffe's Reaction).
- Uric acid: The method used is (Enzymatic-Uricase).

These tests were done by fully automatic analyzer (UNICEL DXC 600).

c- Electrolytes:

- Na⁺: The method used is (Indirect Ion-Selective Electrode).
- K⁺: The method used is (Indirect Ion-Selective Electrode).
- Cl⁻: The method used is (Indirect Ion-Selective Electrode).

These tests were done by fully automatic analyzer (UNICEL DXC 600).

Statistical analysis:

The data was analyzed by graph pad software. Student t-test was used for the calculation. $P \leq 0.05$ was considered statically significant.

RESULTS

Thyroid hormone influences 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. A significant difference was

observed in TSH, T3 and T4 levels of euthyroid subjects and hypothyroid patients. On evaluation, it was observed that 8.7% of the patients were mild hypothyroid ($T4 < 0.35$ mIU/ ml) and another 97.1% were subclinical hypothyroid. This study shows that there is significant increase in blood urea nitrogen, serum creatinine and uric acid levels as well as decrease in serum sodium in hypothyroid patients as compared to euthyroid subjects.

The various data which have been obtained during the study subjected to statistical analysis in order to find out the mean, standard deviation, standard error of the mean (SEM), P value and t test of each group of study. All the results obtained are shown in table 1 and whether there is statistical significant or not between the two groups for each parameter were indicated.

In the present study it was found that there is significant difference in the BUN level between the two groups. There is significant increase in the BUN level in group II compared to the group I. Also there is an extremely significant difference in the serum creatinine levels between the two groups. There is significant increase in the serum creatinine level in group II compared to the group I.

In the present study it was found that there is significant difference in the serum sodium levels between the two groups (group I & group II). There is significant decrease in the serum sodium level in group II compared to the group I. Potassium levels were also show significant difference between the two groups (group I & group II), it was increased in group II compared to the group I. Serum chloride levels were decreased in group II compared to the group I.

In the present study it was found that there is significant difference in the uric acid levels between the two groups (group I & group II). There is significant increase in the uric acid levels in group II compared to the group I.

Table 1: The mean, standard deviation and SEM of renal parameters in normal and hypothyroidism patients.

Parameter	Groups	Mean±SD	SEM
Blood Urea Nitrogen levels	I (Euothy)	11.68±4.65	0.68
	II (Hypothy)	35.70±17.25	3.60
statistically significant, t test 8.9615			
Serum Creatinine	I (Euothy)	0.757±0.164	0.024
	II (Hypothy)	3.183±1.837	0.383
statistically significant, t test 9.0452			
Sodium levels	I (Euothy)	138.617±1.836	0.268
	II (Hypothy)	132.235±4.208	0.877
statistically significant, t test 8.8624			
potassium levels	I (Euothy)	4.387±0.347	0.051
	II (Hypothy)	5.057±0.619	0.129
statistically significant, t test 5.7947			
Chloride	I (Euothy)	103.91±2.78	0.41
	II (Hypothy)	101.43±3.72	0.77
statistically significant, t test 3.1300			
Uric Acid	I (Euothy)	4.7170±1.1351	0.1656
	II (Hypothy)	7.6283±1.2280	0.2561
statistically significant, t test 9.8121			

DISCUSSION

The main finding of this study was that serum creatinine, blood urea nitrogen, uric acid and potassium were higher, while serum sodium was lower in hypothyroid status when compared to the euthyroid status or normal controls.

Electrolytes, thyroid hormones have significant effects on renal handling of salt and water on the active tubular transport of electrolytes (11).

Serum creatinine, serum creatinine levels in our study were higher in hypothyroidism as compared with the values of the same individual in the euthyroid state. The creatinine data presented here confirm previous studies showing reduced values in untreated hyperthyroidism and increased values in hypothyroidism (12, 13). Thyroid dysfunction is known to influence serum creatinine levels. Decrease creatinine release by eventually increased creatinine released by muscle cells seem to be responsible for elevated serum creatinine levels observed in patients with hypothyroidism (12-14). It is possible

that tubular creatinine secretion is diminished in hypothyroidism, thereby increasing the serum creatinine concentration (15).

Uric acid, the uric acid level in serum was significantly elevated in hypothyroid cases when compared to controls (p value less than 0.0001). Previous study noticed elevated serum uric acid levels in hypothyroidism similarly to our finding (16). The increase in uric acid levels in hypothyroid state may result from either increased production due to myopathy or due to decrease renal clearance of uric acid (17). Hyperuricemia associated with hypothyroidism has been shown to be due to decreased renal clearance of uric acid in earlier studies (18, 19).

BUN, during the hypothyroidism clinical condition, the protein catabolism is more frequently occur, so that more production of BUN is there in hypothyroid patients.

CONCLUSIONS

It is concluded from the present study that thyroid dysfunction specially hypothyroidism raise the risk of renal dysfunction by changing in the kidney biomarkers as serum uric acid, serum creatinine, and some electrolytes such as serum sodium and potassium. Knowledge of the association between thyroid dysfunction and renal impairment is important for the clinician.

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