

Original Research Article

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The Assessment of Renal Function Test in Perimenopausal Middle Aged Women with Hypothyroidism

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ABSTRACT

The objective is to study the Interactions between thyroid hormones and kidney functioning may coexist. The aim of this study was to investigate the renal function status in perimenopausal women with hypothyroidism. Total 60 perimenopausal women (30 cases and 30 controls) were recruited for the study. Thyroid hormones including thyroid stimulating hormone, thyroxin, and triiodothyronine were estimated by means of enzyme-linked immunosorbent assay. Renal functions test including (blood urea, creatinine, uric acid, and electrolytes) were investigated by a spectrophotometric method and ion selective electrolyte respectively. Significant results were obtained in this study. There was an increased concentration of blood urea, serum creatinine and uric acid in patients with hypothyroidism when compared to control. The results were statistically significant (<0.05) except urea. While in case of electrolytes there was a significantly (<0.01) decreased concentration of calcium and sodium in hypothyroidism women. There was positively significant (<0.05) association observed between TSH and parameters of renal function test including urea, serum creatinine and serum uric acid. Thyroid hormones play an important role in renal physiology and its functioning. The altered concentration of these hormones in patients with hypothyroidism may develop kidney disease which may progress with the progression of the disease.

Keywords

Hypothyroidism,
Perimenopause,
Creatinine

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Introduction

Endocrine disorders are quite common worldwide, hypothyroidism is one of them. It has been investigated that 1% to 2% people suffer from hypothyroidism (Vanderpump, 2011). In India, not an exception, its prevalence approximately 11% compared to 4.6% in the USA. Hypothyroidism is

commonly affected women compared to men (Bagcchi, 2014). Hypothyroidism is a clinical disorder, laboratory investigations confirms it by presenting increased concentration of thyroid stimulating hormone (TSH) along with decreased concentration of thyroid hormones including T3 and T4 (Gupta *et al.*, 2015). Thyroid Hormones are known to affect every organ in the body since it plays an important

role in regulating metabolism, maintenance of water and electrolytes homeostasis, protein synthesis and influence other hormone function since these hormones are essential for normal growth and development for the kidney (Punekar, 2017; Kimmel, 2012). Any disturbance of thyroid hormones can interrupt the biochemical and physiological changes of the kidney but the mechanistic link between thyroid and kidney disease remains unclear, although animal studies have demonstrated that hypothyroidism adversely affects kidney size and structure in both development and adulthood (Mariani, 2012). So the main objective of this study was to investigate the effect of thyroid hormones on renal functions of women with hypothyroidism.

Materials and Methods

This study was carried out in Department of Biochemistry, Government Medical College, Badaun, Uttar Pradesh. The age group criteria were kept from 20 to 45 years. Total 60 perimenopausal women were recruited for the study in which 30 females were with hypothyroidism and compared with 30 normal healthy females (Martinez-Abraun, 2012). The study was approved from the institutional ethical committee.

All the participants voluntarily participated in this study and consent were taken from them. Patients having known history of diabetes mellitus, renal impairment, liver diseases, cardiovascular disease and hypertension were excluded from the study. Patients having a family history of hypothyroidism or taking medicine affecting thyroid status were also excluded from the study. Pregnant women or having last two years history of pregnancy were also excluded from the study. Only recently diagnosed hypothyroidism patients were enrolled in the study.

Methods

Estimation of Thyroid Profile: TSH, T4 and T3 were estimated by (Avantor Performance Materials, India) using Enzyme Linked Immune sorbent Assay (ELISA) (Gan *et al.*, 2013).

Estimation of Urea: The estimation of blood urea was done by diacetyl monoxime method (Momose *et al.*, 1965).

Estimation of Creatinine: Serum creatinine estimation was done by Jaffe's method (Husdan *et al.*, 1968).

Estimation of Uric Acid: Uric acid estimation was also done by colourimetric method (Buchanan *et al.*, 1965).

Estimation of Phosphate: The estimation of SPO₄ was done by direct method (Daly, 1972).

Estimation of Sodium, Potassium & Calcium: The estimation of sodium, potassium and calcium were estimated by Ion selective electrode (Albert *et al.*, 2011).

Statistical analysis

All the baseline parameters of thyroid profile and kidney function tests were presented in Mean±SD. The unpaired student's t-test was used to comparing various parameters including (thyroid profile and renal function test) between the groups.

A Pearson correlation coefficient was used to the association of TSH with other parameters in patients with hypothyroidism. A p-value less than 0.05 were considered statistically significant. A statistical software SPSS (Statistical package for social sciences) was used for statistical analysis.

Results and Discussion

All the parameters investigated in this study were statistically significant between the groups. The serum concentration of TSH and thyroid hormones both T3 and T4 were significantly different. In a patient with hypothyroidism, the level of TSH was higher while the levels of thyroid hormones were decreased. There was an increased concentration of creatinine and uric acid in case group which was significantly different from control group. While the level of urea was insignificantly increased in the case group

compared to control group. In case of ions, sodium was found to be significantly different from control group while potassium was not. Sodium was significantly decreased in the case group compared to control group. The serum concentration of potassium was not significantly different between the groups (Table 1). There was positive association observed in various parameters with TSH in hypothyroidism patients. Urea, Creatinine and uric acid were positively correlated with TSH and their association was highly significant (Table 2).

Table.1 Baseline parameters between case and control groups

S. No.	Parameters	Case	Controls	P value
1.	TSH	7.09±3.41	2.51±0.93	0.000
2.	T3	0.95±0.29	1.15±0.21	0.009
3.	T4	6.61±2.48	7.85±1.19	0.018
4.	Urea	29.40±16.91	25.65±4.13	0.247
5.	Creatinine	0.97±0.29	0.79±0.18	0.009
6.	Uric Acid	6.47±1.51	5.56±1.47	0.022
7.	Calcium	9.31±0.47	9.56±0.46	0.022
8.	Sodium	133.68±4.76	140.21±3.14	0.000
9.	Potassium	4.63±0.51	4.61±0.47	0.883

Table-2 Association of various parameters with TSH in hypothyroidism patients

S. no.	Parameters	R value	P value
1.	Urea	0.84	0.00
2.	Creatinine	0.37	0.04
3.	Uric Acid	0.72	0.00

#the Pearson correlation coefficient was used. A p-value <0.05 was statistically significant

Thyroid hormones are known to affect the kidney by systemic or local hemodynamic changes and by a direct effect on the function of this organ or mediated by cardiovascular and systemic inflammation which may influence renal functions (Van Hoek *et al.*, 2009) in this study deranged renal functions were observed in patients with hypothyroidism. Since thyroid hormones are responsible the growth and development of the

kidney; this hormone deficiency can lead to renal disorders and increased with severity of the disease. An increased concentration of blood urea in patients with hypothyroidism supported by a study from Meenakshi *et al.*, which observed an increased concentration of urea in patients with hypothyroidism when compared with controls and it was concluded that thyroid hormones have a profuse effect on renal functions (Meenakshi *et al.*, 2016).

There was 33% prevalence of hyperuricemia in hypothyroidism patients since there was an increased concentration of uric acid in hypothyroidism with the positive association of TSH with uric acid due to declined renal plasma flow and urate excretion (Giordano *et al.*, 2001). A study based on Indian population also concluded a positive association of TSH with blood urea, serum creatinine and uric acid similar to this findings (Tayal, *et al.*, 2009). In support of this study, Vaneet *et al.*, also observed similar findings in terms of serum urea, creatinine and uric acid in hypothyroid patients and concluded that renal function should be regularly monitored (Kaur *et al.*, 2015).

Creatinine produced from muscle also dependent on thyroid status. In hypothyroidism, myopathy may occur, which results in enhanced release of creatinine from muscle. (Naz *et al.*, 2014) Increased concentration of serum creatinine in patients with hypothyroidism might be the reason of decreased glomerular filtration rate due to hemodynamic changes in hypothyroidism (Karanikas *et al.*, 2004). Additionally this increased concentration of serum creatinine might be the reason of elevated concentration of serum uric acid due to reduced levels of thyroid hormones (Jia *et al.*, 2015). The reason behind this increase of creatinine was the influence of thyroid hormones on the tubular secretion of creatinine. In addition to this, T4 affects the Na⁺/Ca⁺⁺ exchanger and Na⁺/K⁺-ATPase activity in the kidneys by regulating transcription in sarcoplasmic reticulum (McDonough *et al.*, 1988). Montenegro *et al.*, concluded that greater impairment in renal functions leads to the more occurrence of hyponatremia in patients with hypothyroidism in support of this study (Montenegro *et al.*, 1996). Although there was constant decrease and increase in the sodium and potassium level respectively along with a range of TSH in patients with

hypothyroidism but screening of these ions including sodium and potassium not necessary since it is not commonly associated with hypothyroidism (Sahoo *et al.*, 2017).

In conclusion, this study shows that patients with hypothyroidism present with deranged renal functions. The deficiency of thyroid hormones may lead to damage of the kidney which may aggravate with the severity of the disease. Persistent increase in the concentration of creatinine and urea may impair the functions of the kidney. The results conclude the kidney functions cannot be neglected during the treatment of hypothyroidism. The only limitation of this study was its sample size. So study with more sample size along with other parameters should also be conducted to establish this fact.

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