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A study on comparison of serum creatinine, serum uric acid and serum zinc levels in hypothyroid and healthy controls-at a tertiary care hospital

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Abstract

Background: Hypothyroidism is associated with many biochemical abnormalities including increased serum creatinine, uric acid, and decreased serum zinc levels. Many studies were done abroad regarding serum creatinine and uric acid levels in hypothyroid patients. We designed this study in our population for evaluation and comparison of serum creatinine, uric acid, and zinc levels in hypothyroid and healthy patients.

Aim & Objective of the study: The main aim of the current study is to estimate and comparison of changes in serum creatinine, uric acid and zinc levels in hypothyroid patients and healthy controls.

Materials and Methods: It is an observational prospective comparative study. This study was conducted at Mamatha Academy of Medical Sciences & Hospital, Bachupally, Hyderabad, Telangana from January 2019 to July 2019. There were 50 cases and 50 controls in the age groups from 18 to 65 years. Fresh samples were taken and required tests were performed following standard protocol. Creatinine and the uric acid level was estimated by semi auto analyzer and zinc level was estimated by atomic absorption spectrophotometer

Results: In the present study, mean serum creatinine and uric acid levels in cases were 3.20 ± 0.65 and 9.20 ± 0.47 mg/dL respectively compared to 1.04 ± 0.22 and 5.15 ± 0.77 mg/dL in controls. Mean serum zinc levels in cases were 62.50 ± 7.50 mg/dL compared to 95.45 ± 11.05 mg/dL in controls. The level of serum creatinine and uric acid were significantly high and serum zinc was significantly low (p -value < 0.0001) in hypothyroid patients compared to healthy controls.

Conclusion: Mean serum creatinine and uric acid levels were found significantly higher in hypothyroid patients compared to controls. It leads to a reduction in renal plasma flow and glomerular filtration rate and low serum zinc was found due to impaired gastrointestinal absorption of zinc in hypothyroid subjects or change in zinc distribution due to sequestration of zinc by the liver. These findings suggest that hyperuricemia and hypercreatininemia are associated with hypothyroidism. Therefore, patients presenting with these biochemical abnormalities are recommended to be investigated to explore hypothyroidism.

Keywords: Hypothyroidism, creatinine, uric acid, hyperuricemia, zinc levels, spectrophotometer

Introduction

Hypothyroidism is a clinical syndrome resulting from a deficiency of thyroid hormones which, in turn, results in a generalized slowing down of metabolic processes. Hypothyroidism is associated with kidney derangement resulting in high serum creatinine and uric acid levels [1].

Thyroid diseases are common worldwide. About 200 million people in the world have some form of thyroid disease. The overall incidence of hypothyroidism is about 3% of the general population [3].

Hypothyroidism is associated with many biochemical abnormalities including increased serum creatinine and uric acid levels. The serum creatinine concentration increases in hypothyroid patients due to reduction of glomerular filtration rate because of hemodynamic changes in severe hypothyroidism [1, 2].

Trace elements are known to influence hormones at the level of activity, including hormone secretion and activity and binding to target tissue. Zinc has important roles in thyroid metabolism. Zinc levels in serum were significantly reduced in hypothyroidism. Low zinc levels were found due to severely impaired gastrointestinal absorption in hypothyroidism [3]. As hypothyroidism is associated with many biochemical abnormalities, it is of paramount clinical importance to have proper knowledge of these abnormalities and accurate estimation

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of these biochemical parameters is very important and useful for clinical management of the patients [4].

This study is designed for estimation and comparison of changes in serum creatinine, uric acid and zinc levels in hypothyroid patients and healthy controls.

Materials and Methods

Source of data

Clinically newly diagnosed and confirmed cases of hypothyroidism, attending the medicine outpatient department at Mamatha Academy of Medical Sciences & Hospital, Bachupally Hyderabad. Age and sex-matched healthy subjects will be taken as controls.

The duration of the study will be from January 2019 to July 2019.

Method of collection of data

Design of study: It is a case-control study.

Newly diagnosed patients of hypothyroidism attending the medicine outpatient department will be selected randomly. Age and sex-matched healthy subjects will be taken as controls.

Methodology: The sample size is calculated by using Open Epi, version 2.3.1. At (95%) Confidence interval, the power of the study $(1-\beta)=80\%$. The sample size calculated is 50 in each group. 50 cases and 50 controls.

Informed and written consent will be taken from the cases and controls, respectively, after explaining the procedure.

A sample of 5 ml of venous blood will be collected to study the following parameters. Serum creatinine and Uric acid was Mindray BS-240 pro auto analyzer. Serum zinc will be estimated by Nitro-PAPS method [5].

Inclusion criteria

1. Patients with newly diagnosed hypothyroidism.
2. Age group between 20 years to 59 years.

Exclusion criteria

1. Patients with chronic kidney diseases and gastrointestinal disorders.
2. Patients with muscular dystrophies and rhabdomyolysis.
3. Pregnancy and patients on drugs.
4. Patients with gout and hypertension.
5. Patients were not willing to participate in the study.

Statistical methods

The data will be analyzed by using appropriate statistical tests (Paired t-test) by using SPSS package version 19. Data will be expressed in terms of mean \pm SD.

Results

Table 1: Comparison of levels of serum creatinine, serum uric acid and Zinc in control and study group

Parameter	Control (Mean \pm SD)	Study group (Mean \pm SD)	P-value
Creatinine	1.04 \pm 0.22	3.20 \pm 0.65	<0.0001
Uric acid	5.15 \pm 0.77	9.20 \pm 0.47	<0.0001
Zinc	95.45 \pm 11.05	62.50 \pm 7.50	<0.0001

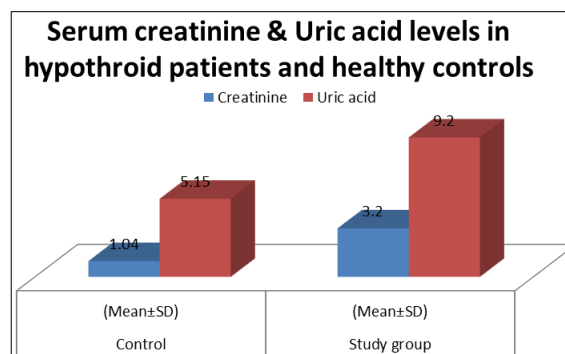


Fig 1: Levels of serum uric acid and creatinine in control & Hypothyroid patients

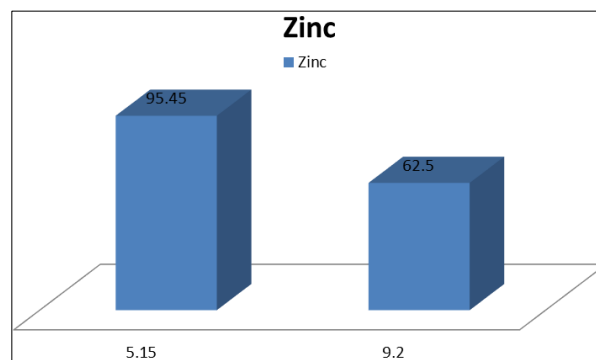


Fig 2: Zinc levels in control and hypothyroid patients

Table I shows the comparison of the serum creatinine, uric acid and zinc levels between the cases and the controls. Mean serum creatinine and uric acid levels in study group were 3.20 ± 0.65 and 9.20 ± 0.47 mg/dL respectively compared to 1.04 ± 0.17 and 5.15 ± 0.77 mg/dL in controls (Fig 1). Mean serum creatinine and uric acid levels were significantly increased in cases as compared to controls. Whereas zinc levels significantly decrease in cases compared to controls. Mean serum zinc levels in cases were 62.50 ± 7.50 and 95.45 ± 11.05 in the control group (Fig 2).

Discussion

This study mainly is proven that the possible interrelation between the levels of serum uric acid, creatinine and zinc levels in hypothyroid patients compared to healthy controls. In this study, mean serum creatinine value in cases was found significantly higher than in the control subjects. It might be possible due to the reduction of glomerular filtration rate secondary to a decreased renal plasma flow because of hemodynamic changes in severe hypothyroidism. Serum creatinine level may also be increased due to hypothyroid myopathy our findings similar to previous studies done by other investigators [6, 7]. Mean serum creatinine level in hypothyroid cases was found significantly greater in comparison to the euthyroid value in a study done by Kreisman & Hennessey [8]. In another study on 14 newly diagnosed hypothyroid patients in Switzerland mean serum creatinine level was found elevated and decreased after thyroxine replacement therapy. The results of our study also suggest the findings of hyperuricemia in hypothyroid patients. Therefore, patients presenting with these biochemical abnormalities are recommended to be investigated to explore hypothyroidism.

In the present investigation, there was a significant decrease in serum zinc levels in hypothyroidism patients compared to healthy controls. The decrease in serum zinc level might be due to impaired gastrointestinal absorption of zinc which can be due to malabsorption, myxedematous infiltration of mucosa, decreased intestinal motility or associated autoimmune phenomena. Ambookenbetsy *et al.* conducted a study on zinc deficiency associated with hypothyroidism. They observed zinc deficiency may have contributed significantly to the development of hypothyroidism^[9]. Sibel *et al.* (2010) conducted a study on the relationship between zinc levels, thyroid hormones and thyroid volume following successful iodine supplementation. They found significant relationships between thyroid volume and serum zinc levels in nodular goiter patients^[10].

Conclusion

Mean serum creatinine and uric acid were found significantly higher and mean zinc was found significantly lower in hypothyroid patients compared to a control which indicates the profound influence of thyroid hormone on renal function and gastrointestinal function. In hypothyroid induced renal dysfunction, the adverse clinical consequences can be seen, especially among patients on medications cleared by the kidneys. Therefore thyroid function should be routinely assessed in patients presenting with deranged renal function and serum creatinine and uric acid levels should also be routinely evaluated in patients with hypothyroidism. Evaluation of zinc deficiency which is often under-recognized is warranted in all cases of hypothyroidism.

Acknowledgment

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Conflict of interest: None

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