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COMPARATIVE STUDY OF SERUM CREATININE, URIC ACID AND ZINC LEVELS IN HYPOTHYROID PATIENTS WITH HEALTHY CONTROLS

Biochemistry

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ABSTRACT

Background: Hypothyroidism is the common disorder of endocrine system in humans. They are encountered among all ethnic groups and in almost every country around the world. Mostly occur in the regions where iodineis scarce component ofsoillike typically remote inland areas where no marine foods are eaten and in mountainous regions of the world where food is grown in iodine-poor soil.Hypothyroidism is clinical syndrome caused by deficiency of thyroid hormones that cause generalized slowing of metabolic processes.The present study aimed to find out the serum creatinine, uric acid and zinc level in hypothyroid patients in the tertiary care hospital in Bikaner, western Rajasthan, India.

Material & methods: This study was conducted at Sardar Patel Medical College and associated hospital in Bikaner, Rajasthan from June 2016 to Feb 2017. There were 40 cases and 40 controls in the age groups from 18 to 65 years. Fresh samples were taken and required tests were performed following standard protocol. Creatinine and uric acid level was estimated by semi auto analyzer and zinc level was estimated by atomic absorption spectrophotometer.

Result: Level of serum creatinine and uric acid was significantly high and serum zinc was significantly low (p-value<0.0001) in hypothyroid patients.

Conclusion: In this study the role of serum creatinine, uric acid and zinc has been explored. The high level of creatinine and uric acid was found due to reduction in renal plasma flow and glomerular filteration 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.

KEYWORDS

Creatinine, Uric acid, Zinc, Hypothyroidism

INTRODUCTION

The importance of the thyroid gland in maintaining human health is well recognized. Thyroid gland is one of the largest endocrine glands in the body, which secrets thyroxine (T_4) and triiodothyronine (T_3) thyroid hormones.[1] The word "hypothyroidism" is from Greek word hypo-meaning "reduced", throes for "shield", and eidos for "form."Hypothyroidism is a common disorder of the endocrine system in which the thyroid gland does not produce enough thyroid hormone.[2] Thyroid diseases are common worldwide. About 200 million people in the world have some form of thyroid disease. Overall incidence of hypothyroidism is about 3% of the general population.[3]

Thyroid hormones (T_4 and T_3) regulate the rate of metabolism, affects growth and modulate energy utilization by increasing basal metabolic rate, increasing oxygen consumption and facilitating heat production.[4] Hypothyroidism is clinical syndrome that cause generalized slowing of metabolic processes,enlargement of thyroid gland or goiter, obesity, impairment of cognition, slowing of mental and physical performance and increased risk of coronary heart diseases.[5,6] hypothyroidism is associated with a reversible elevation of serum creatinine in both adults and children as it is associated with a reduction of glomerular filteration rate and renal plasma flow causing deficient creatinine excretion. This increase is observed in more than 55% of adults with hypothyroidism.[7].

A significant increase of uric acid was also found in the hypothyroid patients. In hypothyroidism the hyperuricemia is secondary to a decreased renal plasma flow and impaired glomerular filtration rate.[8] Zinc which is an essential trace element has important roles in thyroid metabolism.It involves in tri-iodothyronine binding to its nuclear receptors and in the formation and mechanism of action of Thyrotropine releasing factor. Zinc is required for the synthesis of thyroid hormones and deficiency of these can result in hypothyroidism. Conversely thyroid hormones are essential for the absorption of zinc and hence hypothyroidism can result in acquired zinc deficiency.[9]

As we have seen from above discussion that the level of serum creatinine and uric acid is increased and serum zinc level is decreased in hypothyroid patients. In this proposal work the serum levels of creatinine, uric acid and zinc will be determined in hypothyroid patients and will be compared with that of healthy controls.

MATERIAL AND METHODS

This study was carried out in department of Biochemistry of Sardar Patel Medical College and attached Hospital, Bikaner for the necessary tests and investigations. The hypothyroid patients, registered to the P.B.M Hospital satisfying both the inclusion criteria and exclusion criteria were selected for this study. The control group was taken from patient's attendants, staff, students and may be from personal request.

It was an observational cross sectional study which was conducted on 80 subjects. Out of 80 subjects, 40 subjects were patients of hypothyroidism and 40 were healthy controls having matched age and sex. Persons with signs and symptoms of hypothyroidism, age between 18-65 years and serum levels of TSH >4.20µIU/ml and T3 < 1.3nmol/l were considered as a hypothyroid patients. Patients with malignancy, pregnancy, any liver or renal disorder or any chronic disease, gastrointestinal disorder, endocrine disorder and Patients with thyroid surgery in past were excluded.

Serum TSH, T_4, and T_3 levels were estimated using electrochemilumine scence (ECL) technology. T_4 and T_3 levels were estimated by competitive method of ECL whereas TSH was estimated by sandwich method. Serum creatinine and uric acid level were assessed by colorimetric method using commercially available reagents and kits by semi auto analyzer. Serum creatinine was estimated using kinetic picrate jaffes method and serum uric acid was estimated using uricase enzymatic method. Serum Zinc level was assessed by using AAS (Atomic Absorption Spectrophotometer).

RESULT

The blood samples of healthy control group as well as study group were withdrawn and analyzed for serum creatinine, uric acid and zinc levels. Table no.1 shows plasma levels of creatinine, uric acid, zinc in cases and controls with significant difference (Figure 1 and 2).

Serum creatinine and uric acid levels were significantly increased in patients with hypothyroidism (2.30±0.88 and 8.49±0.57 mg/dL, respectively; p <0.001) and serum zinc level was significantly decreased in patients with hypothyroidism (66.70±7.50; p<0.001).

TABLE NO.- 1
LEVELS OF CREATININE, URIC ACID, ZINC IN CASES AND CONTROLS

Parameters	Mean ± SD		P-value	t-value
	Control group	Study group		
Creatinine	1.08±0.27	2.30±0.88	<0.0001	8.382
Uric acid	5.13±0.97	8.49±0.57	<0.0001	18.888
Zinc	99.60±12.07	66.70±7.50	<0.0001	14.642

FIGURE NO. -1 LEVELS OF CREATININE AND URIC ACID IN CASES AND CONTROLS

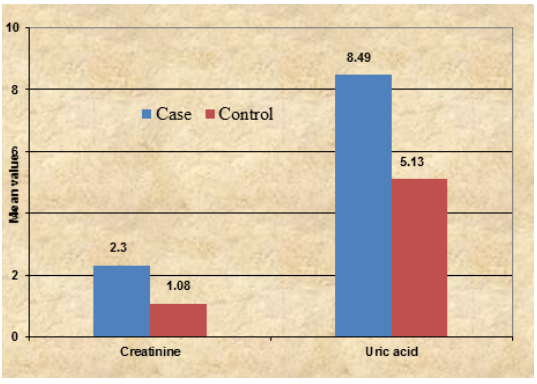
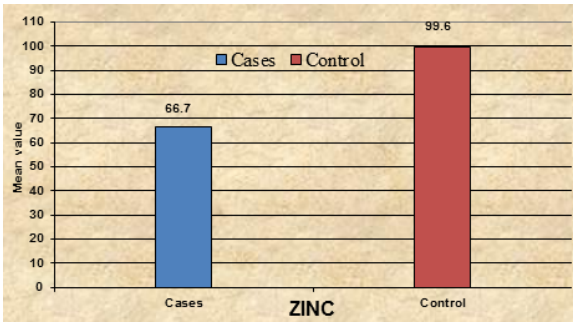


FIGURE NO. -2 ZINC LEVEL IN CASES AND CONTROLS



DISCUSSION

This study evaluated the possible interrelationship between Renal glomerular function, gastro intestinal function and thyroid endocrine disorders, mainly primary hypothyroidism. A statistically significant increase in serum creatinine and uric acid level were recorded in the present series of study in hypothyroid patients as compared to that of control groups. It might be possible due to reduction of glomerular filtration rate secondary to a decreased renal plasma flow because of hemodynamic changes in severe hypothyroidism.Serumcreatinine level may also be increased due to hypothyroid myopathy. The serum zinc level was found to be decreased significantly in hypothyroid patients as compared to that of control group. The decrease in serum zinc level might be due to impaired gastrointestinal absorption of zinc which can be due to malabsorption, myxedematousinfilteration of mucosa, decreased intestinal motility or associated autoimmune phenomena.

Giordano et al. conducted a study among 28 patients with primary hypothyroidism and showed 33.3% prevalence of hyperuricemia in patients with hypothyroidism.[8] Khan AH et al. studied serum creatinine, uric acid levels of hypothyroid patients and observed serum creatinine and uric acid level significantly higher in hypothyroid patients.[3]

Simbita Marwah et al. estimated correlation of serum uric acid and serum creatinine in hypothyroidism. There was significant increase in serum uric acid and creatinine as compared with control.[1] Ambookenbetsy et al. conducted study on zinc deficiency associated with hypothyroidism. They observed zinc deficiency may have contributed significantly to development of hypothyroidism.[10] Sibel et al. (2010) conducted study on 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.[11]

CONCLUSION

Mean serum creatinine and uric acid were found significantly higher and mean zinc was found significantly lower in hypothyroid patients compared to controls which indicates the profound influence of thyroid hormone on renal function and gastrointestinal function. By this information we can avoid unnecessary investigations, treatment cost and worry in patients presenting with either increased creatinine or gout with undetermined thyroid status.In hypothyroid induced renal dysfunctionthe 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 serumcreatinineand uric acid levels should also be routinely evaluated in patients with hypothyroidism. The effect of hypothyroidism on the metabolism of zinc should also not be overlooked as zinc deficiency may lead to mental depression, loss of appetite and taste and hair loss which are seen commonly in patients of hypothyroidism. An evaluation of zinc deficiency which is often under-recognized is warranted in all cases of hypothyroidism.

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