

Study of uric acid levels in hypothyroid patients

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Received: 8th December, 2018

Accepted: 27th December, 2018

Abstract

Introduction: The thyroid gland produces two hormones, Thyroxin (T4) and Triiodothyronine (T3). These hormones play a critical role in cell differentiation during development and help maintain thermogenic and metabolic homeostasis in the adult. Hypothyroidism is a clinical condition in which the thyroid hormones production is below normal. It affects approximately 2% of the population.

Materials and Methods: This study was conducted over a period of one year among subjects having hypothyroidism at Sri Siddhartha Medical College and Hospital, Tumkur, Karnataka. Ethics committee approval obtained prior to the study. Both female and male subjects were included in the study and all of them in the age group of 20-60 years. Patients (N = 120) who were diagnosed clinically and biochemically as hypothyroid for the first time who were attending OPD or admitted were enrolled for the study. 60 normal healthy individuals working in Sri Siddhartha Medical College were included as control group.

Results: Serum uric acid levels were significantly increased in hypothyroid subjects when compared to controls (p value = 0.0001).

Conclusion: It is important to evaluate serum uric acid levels routinely in hypothyroidism patients, to correct the possible altered purine nucleotide metabolism and to prevent the onset of gout. It may also help to observe set in myopathic changes in advanced hypothyroidism.

Keywords: Uric acid, Hypothyroidism, Triiodothyronine and Tetraiodothyroxin.

Introduction

The thyroid gland synthesis of two hormones, Thyroxin (T4) and Triiodothyronine (T3).¹⁻³

Uric acid is the end product of purine metabolism in humans due to loss of uricase activities.^{4,5} The evolutionary advantages of uric acid Anti-oxidantinc life expect and BP control in times of low salt ingestion, Intelligence along with Neurodegenerative protective effects. Uric Acid pathologically associated with vascular damage & inflammation.^{6,7}

Recent studies shows that hyperuricemia is associated with CVD & premature death from MI & stroke.⁸⁻¹⁰ Lowering uric acid levels associated with reduced risk. In hypothyroidism, because of low metabolic profile ADP levels will be more as against ATP. Hence adenine is oxidised through xanthine oxidase system and liberates more uric acid.¹¹⁻¹³

Uric acid is the final breakdown product of purine degradation in humans. Uric acid production varies with the purine content of the diet, rates of purine biosynthesis, degradation, and salvage.^{14,15} The present study was undertaken to evaluate serum uric acid levels in subjects along with hypothyroidism.

Materials and Methods

This study was conducted over a period of one year at Sri Siddhartha Medical College and Hospital, Tumkur, Karnataka. Ethics committee approval was obtained prior to the study. Both male and female subjects were included and all age group of 20-60 years.

Patients who were diagnosed clinically and biochemically as hypothyroid (n=120) attending Out Patient Department or admitted in the wards were enrolled for the

study. 60 normal healthy individuals working in Sri Siddhartha Medical College were included as control group. Patients with diabetes mellitus, hypertension, renal disease and those on drugs that affect uric acid excretion like thiazide diuretics were excluded. Highly lipaemic and haemolysed specimens were also excluded.

Informed consent was taken from all subjects. 5 ml of blood collected in a plain vacutainer. Serum obtained after centrifugation was divided into two aliquots – one for thyroid profile and the other for uric acid, and were stored at -20 °C until batch analysed.

Serum fT3, fT4, TSH were assayed using ELISA (enzyme linked immuno sorbent assay) kit obtained from HUMAN GmBH, GERMANY. Serum uric acid was estimated by PAP method (enzymatic colorimetric test for uric acid with lipid clearing factor) in semi-automated Chemistry Analyser [Erba Chem 7 (Transasia)] using available commercial kit. Normal values of fT3, fT4, TSH, and Uric acid are 1.4-4.2pg/ml, 0.8-2ng/dl, 0.3-6.2mIU/L and 2.5-6.2mg/dl respectively.

Statistical Analysis

Our data suggested that values were mean \pm standard deviation. The mean and SD of all the parameters of the study were calculated in patients and control subjects. The p value was used to compare the patient mean value with control mean value and A p value of <0.05 was considered statistically significant.

Results

The study designed in Indian population for estimation of uric acid levels in hypothyroid patients. In the literature,

the correlation between hypothyroidism and hyperuricemia is well established.

Table 1: Comparison of study parameters in hypothyroid patients (cases) and control subjects

| Parameter | Hypothyroid (n=120) Mean \pm SD | Controls (n = 60) Mean \pm SD | p value |
|-------------------------------|--------------------------------------|------------------------------------|---------|
| Serum FT ₃ (pg/ml) | 2.02 \pm 0.10 | 2.63 \pm 0.11 | <0.0001 |
| Serum FT ₄ (ng/dl) | 0.55 \pm 0.09 | 1.23 \pm 0.12 | <0.0001 |
| Serum TSH (mIU/ml) | 26.3 \pm 1.68 | 2.34 \pm 0.16 | <0.0001 |
| Serum uric acid (mg/dl) | 6.1 \pm 0.29 | 4.33 \pm 0.29 | <0.0001 |

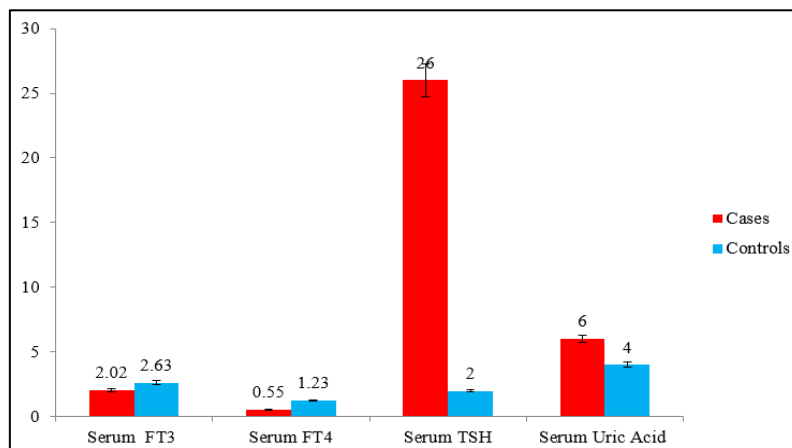


Fig. 1: Biochemical variation in cases along with controls

Serum Free T₃ *p* value and the 2-tailed *p* value is < 0.0001, this difference is highly statistically significant.

Serum Free T₄ *p* value and the 2-tailed *p* value is < 0.0001, this difference is highly statistically significant.

Serum Thyroid Stimulating Hormone *p* value and the 2-tailed *p* value is < 0.0001 by conventional criteria, this difference is highly statistically significant.

Serum Uric acid *p* value and the 2-tailed *p* value is <0.0001 by conventional criteria, this difference is highly statistically significant.

Discussion

In hypothyroidism, because of low metabolic profile ADP levels will be more as against ATP. Hence adenine is oxidized through xanthine oxidase system and liberates more uric acid. The purpose of the present study was therefore to determine the relationship between renal function and thyroid status. Thurman JM et al shows Long-standing hypothyroidism can cause significant reversible changes in renal function such as a decrease in sodium resorption in the proximal tubules, impairment in the concentrating and diluting capacities of the distal tubules, a decrease in urinary urate excretion, and a decrease in renal blood flow and glomerular filtration rate (GFR).¹⁶ del Greco FR, et al¹⁷ shows in hypothyroid state, hypovolemia occurs due to decreased cardiac output shows fall in renal blood flow. Thyroxine was to an high in systemic and renal vasoconstriction and also finally leading to decreased renal blood flow.¹⁸

The cause of the low renal plasma flow and GFR observed is believed to be normally due to the commonly hypodynamic state of the Cardio vascular system in hypothyroidism. K Reisman SH et al¹⁹ and Kaptein EM.²⁰ Hypothyroidism was related with low plasma renin, which

might cause an high levels of creatinine and uric acid ranges.

Cause & effect not entirely clear. Data available are insufficient for proof. Challenge – adjusting for multiple comorbidities. Do reveal trends– more studies indicated the present study, based on a limited number of cases, showed a increased prevalence in hyperuricemia in hypothyroid patients. Hence analysis of uric acid levels in hypothyroid subjects may be used as an associated biochemical parameter to follow the course of the disease. It may also used to assess any myopathic changes are going on, as seen in advanced hypothyroidism.

Conclusion

Uric acid levels within physiological limits are elevated in hypothyroid subjects. Hypothyroidism affects renal blood flow, GFR, tubular function and also water and electrolyte balance.

Therefore, our assumption was the importance of the routine estimate of serum uric acid ranges in hypothyroid patients. The possible corrected purine nucleotide metabolism and also to prevent the onset of gout. It may also help to observe set in of myopathic changes in advanced hypothyroidism.

Acknowledgements

Cooperation with Dept. of Biochemistry, Narayana Medical College and Hospital, Chinthareddyaleem Nellore, AP. India. 524003.

Conflict of Interest: None.

References

1. Mullur R, Liu YY, Brent GA. Thyroid hormone regulation of metabolism. *Physiol Rev* 2014;94(2):355-382.
2. Ahmed OM, El-Gareib AW, El-Bakry AM, El-Tawab SA, Ahmed RG. Thyroid hormones states and brain development interactions. *Int J Dev Neurosci* 2008;26(2):147-209.
3. Malik R, Hodgson H. The relationship between the thyroid gland and the liver. *QJM: Int J Med* 2002;95(9):559-569.
4. Zoeller RT, Tan SW, Tyl RW. General background on the hypothalamic-pituitary-thyroid (HPT) axis. *Crit Rev Toxicol* 2007;37(1-2):11-53.
5. Zhdankin VV, Stang PJ. Chemistry of polyvalent iodine. *Chem Rev* 2008;108(12):5299-358.
6. Burrow GN. Thyroid hormone biosynthesis. *Thyroid Function and Disease*. 1989:11-40.
7. Targovnik HM. Thyroglobulin structure, function and biosynthesis. *Werner and Ingbar's The Thyroid: A Fundamental and Clinical Text*, Tenth ed. Lippincott Williams & Wilkins, Philadelphia, USA. 2012 Jul 12:74-92.
8. Marchesini GR, Meulenber E, Haasnoot W, Mizuguchi M, Irth H. Biosensor recognition of thyroid-disrupting chemicals using transport proteins. *Anal Chem* 2006 ;78(4):1107-1114.
9. Cameron JS, Simmonds HA. 6.4 Uric acid and the kidney. *Oxford Textbook of Clinical Nephrology* 2005;2:1059.
10. Bianco AC, Kim BW. Deiodinases: implications of the local control of thyroid hormone action. *J Clin Investig* 2006;116(10):2571-2579.
11. Kostoglou-Athanassiou I, Ntalles K. Hypothyroidism-new aspects of an old disease. *Hippokratia* 2010;14(2):82.
12. Iglesias P, Diez JJ. Thyroid dysfunction and kidney disease. *Eur J Endocrinol* 2009;160(4):503-515.
13. Kahaly GJ, Dillmann WH. Thyroid hormone action in the heart. *Endocr Rev* 2005;26(5):704-728.
14. Maseoud D, Rott K, Liu-Bryan R, Agudelo C. Overview of hyperuricaemia and gout. *Curr Pharm Des* 2005;11(32):4117-4124.
15. Rafeq MA, Lipkowitz MS, Leal-Pinto E, Abramson RG. Uric acid transport. Current opinion in nephrology and hypertension. 2003;12(5):511-516.
16. Terkeltaub R, Bushinsky DA, Becker MA. Recent developments in our understanding of the renal basis of hyperuricemia and the development of novel antihyperuricemic therapeutics. *Arthritis Res Ther* 2006;8(1):S4.
17. Thurman JM, Berl T. Disorders of water metabolism. In *Core concepts in the disorders of fluid, electrolytes and acid-base balance* 2013 (pp. 29-48). Springer, Boston, MA.
18. del Greco FR, Krumlovsky FA. Role of the laboratory in management of acute and chronic renal failure. *Ann Clin Lab Sci* 1981;11(4):283-291.
19. Kreisman SH, Hennessey JV. Consistent reversible elevations of serum creatinine levels in severe hypothyroidism. *Arch Intern Med* 1999;159(1):79-82.
20. Tang WW, Kaptein EM, Feinstein EI, Massry SG. Hyponatremia in hospitalized patients with the acquired immunodeficiency syndrome (AIDS) and the AIDS-related complex. *Am J Med* 1993;94(2):169-174.

How to cite this article: Bhargavi SK, Kumar S, Prasad M. Study of uric acid levels in hypothyroid patients. *Int J Clin Biochem Res* 2019;6(1):64-66.