

A Study of Calcium Level in Hypothyroidism and Hyperthyroidism

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Abstract—

Objective: To compare calcium level in hypothyroidism and hyperthyroidism.

Methods: This was a comparative study. Patients with hypothyroidism and hyperthyroidism of all the age groups and irrespective of gender were included in the study. About 2ml of venous blood was drawn in a plain bulb for serum calcium analysis. Serum was separated by centrifugation and was kept at 4-8°C till the estimation of calcium level. Serum calcium was estimated on semiautoanalyzer (Erba Chem-5 plus v2) by using commercially available kits.

Results: The mean age of subjects of hypothyroidism and hyperthyroidism was 39.70±13.65 and 40.20±13.32 years respectively. Calcium level was significantly ($p=0.005$) higher in the patients of Hyperthyroidism (9.63 ± 0.69) compared to hypothyroidism (8.95 ± 1.06). Decreased level of calcium was in 33.3% patients in hypothyroidism compared to hyperthyroidism (23.3%). However, increased calcium level was in 6.7% patients of hypothyroidism compared to hyperthyroidism (10%)

Conclusion: The serum calcium level is significantly altered in thyroid disorders. Therefore, it is important to check the levels of this mineral in all the thyroid disorders. Treatment of the primary cause should be done. If necessary, the supplementation of mineral should be given in order to prevent further bone complications.

Keywords— Hypothyroidism, Hyperthyroidism, Calcium level.

I. INTRODUCTION

Disorders of thyroid gland are among the most abundant endocrine disorders in India. Thyroid dysfunction has widely spread systemic manifestations which include the effects on bone and mineral metabolism. Mineral metabolisms (calcium and phosphorous) are commonly disturbs in the hyperthyroidism (1). Thyroid hormones are exerted by its effects on the osteoblasts through the nuclear receptors in stimulating osteoclastic bone resorptions (2, 3). Hyperthyroidism is therefore, becomes the major causes of secondary osteoporosis. Thyroid hormones stimulate the bone resorption directly through increasing the serum calcium, phosphorous levels and suppressing PTH (4). Negative effects are found in hypothyroidism.

Thyroid disorders are found to be the most common endocrine disorders. Bone remodeling is influenced by direct/indirect effect of thyroid hormones on bone cells (5). The bone is influenced by interaction of the thyroid stimulating hormones (TSHs). TSH receptors are expressed on the precursors of osteoblasts and osteoclasts. In early life, the insufficiency of the thyroid hormones may lead to delay in the bone development (6).

The prevalence of hypothyroidism in 8 major cities of India has been reported to be 10.95%. This is significantly higher among females than males (15.86% vs. 5.02%). This is also higher older individuals than youngers (13.11% vs. 7.53%). (7). A study showed the prevalence of hypothyroidism being 3.9%. Urinary iodine status in the same population revealed to be iodine adequate. (8). Earlier, the endemic goiter has been connected to the iodine insufficiency by several prominent researchers. But despite iodization in large scale, its prevalence has not been decreased. Therefore,

thyroid auto-immunity and other goitrogens seem to play an important role in the causation of goiter (9). Genetic predisposition has been reported to be 70-80% of autoimmune thyroid diseases. Hence, the knowledge of environmental factors that influence the autoimmune thyroid disease can be helpful in decreasing the risk (10).

This study was designed to compare the calcium level in hypothyroidism and hyperthyroidism.

II. MATERIAL AND METHODS

This was a comparative study conducted in the Department of Biochemistry, RML Institute of Medical Sciences, Lucknow. The Ethical Committee of the institute had approved the study. Consent was taken from each participant before including in the study.

Patients with hypothyroidism and hyperthyroidism of all the age groups and irrespective of gender were included in the study. About 2ml of venous blood was drawn in a plain bulb for serum calcium analysis. Serum was separated by centrifugation and was kept at 4-8°C till the estimation of calcium level. Serum calcium was estimated on semiautoanalyzer (Erba Chem-5 plus v2) by using commercially available kits.

Statistical Analysis

The results are presented in Mean \pm S.D. Student's 't' test was used to compare the calcium levels between hypothyroidism and hyperthyroidism. Chi-square test was used to find the association between the groups. P-value<0.05 was considered significant. All the analysis was carried out on SPSS 16.0 version (Chicago, Inc., USA).

III. RESULTS

The mean age of subjects of hypothyroidism and hyperthyroidism was 39.70±13.65 and 40.20±13.32 years respectively. There was no significant (p>0.05) in the age between patients of hypothyroidism and hyperthyroidism. There was no significant (p>0.05) in the gender between patients of hypothyroidism and hyperthyroidism (Table I).

TABLE I. Age and gender distribution of study subjects

Age and gender	Hypothyroidism (n=30)	Hyperthyroidism (n=30)	p-value
Age in years, mean±SD	39.70±13.65	40.20±13.32	0.88
Gender, no. (%)			
Male	17 (56.7)	13 (43.3)	0.30
Female	13 (43.3)	17 (56.7)	

Calcium level was significantly (p=0.005) higher in the patients of Hyperthyroidism (9.63±0.69) compared to hypothyroidism (8.95±1.06) (Table II).

TABLE II. Comparison of calcium level between hypothyroidism and hyperthyroidism patients

Groups	Calcium level (mg/dl) (Mean±SD)
Hypothyroidism	8.95±1.06
Hyperthyroidism	9.63±0.69
p-value ¹	0.005*

¹Unpaired t-test, *Significant

Decreased level of calcium was in 33.3% patients in hypothyroidism compared to hyperthyroidism (23.3%). However, increased calcium level was in 6.7% patients of hypothyroidism compared to hyperthyroidism (10%) (Table III).

TABLE III. Comparison of calcium level between hypothyroidism and hyperthyroidism patients

Calcium level (mg/dl)	Hypothyroidism (n=30)		Hyperthyroidism (n=30)		p-value ¹
	No.	%	No.	%	
Decreased	10	33.3	7	23.3	0.65
Increased	2	6.7	3	10.0	
Normal	18	60.0	20	66.7	

IV. DISCUSSION

Hyperthyroidism is characterized by accelerated bone turnover. This is caused from direct stimulation of bone cells through high thyroid hormone concentrations (11, 12). Majority of patients with hyperthyroidism have normal serum calcium levels. The mean calcium concentration is reported to higher in cases than controls (13).

Few studies have also found hypercalcemia in thyrotoxicosis. Baxter and Bandy (14) have found the prevalence of hypercalcemia being 23% in hyperthyroidism. In another study, the percentage of patients with hypercalcemia in thyrotoxic varied between 5%-27%. The frequency of hypercalcemia increased to be 50% when ionized calcium was measured instead of total serum calcium (15).

The finding of high serum calcium level among hyperthyroidism patients in this study is in agreement with the studies Manicourt et al. (1) and Mosekilde et al. (4). In

disagreement with the present study, Dhanwal et al. (2010) found 26% hypocalcemia in Indian patients.

It has been reported that negative calcium balance present during hyperthyroid status is converted to positive just after euthyroidism is gained (16). Calcium levels in hypothyroidism are usually normal. But calcium may be slightly elevated. Calcium balance is also variable, however, any changes are slight. The exchangeable pool of calcium and its rate of turnover are decreased (17; 18). In this study, Calcium level was significantly (p=0.005) higher in the patients of Hyperthyroidism (9.63±0.69) compared to hypothyroidism (8.95±1.06). Hypocalcemia can cause neuromuscular irritability which includes perioral paraesthesia, tingling of toes, fingers, spontaneous or latent tetany. At some instances, hypercalcemia can be severe enough to induce anorexia, polyuria and occasionally impairment of renal function (17).

Although the changes in serum calcium levels may be slight in thyroid disorders, it is possible that these disturbances will be important for patient for long duration. Negative calcium balance in hyperthyroidism can finally lead to hyperthyroid osteopenia and increase the risk of secondary osteoporosis (19). In hypothyroidism, opposite mechanisms are seen. The clinical significance requires further investigation. The studies with larger sample size can be extended by measuring serum ionized calcium instead of total calcium levels and correlating it with the duration as well as severity of thyroid disorders.

V. CONCLUSION

The serum calcium level is significantly altered in thyroid disorders. Therefore, it is important to check the levels of this mineral in all the thyroid disorders. Treatment of the primary cause should be done. If necessary, the supplementation of mineral should be given in order to prevent further bone complications.

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