



STATUS OF SERUM CALCIUM AND VITAMIN-D LEVEL IN HYPOTHYROIDISM IN ONE OF THE RURAL AREA OF CENTRAL MAHARASHTRA

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ABSTRACT

Introduction: Thyroid gland disorders are very common among endocrine diseases and incidence and prevalence increase with age but also affect younger age group. Thyroid disorders have direct and indirect effect on mineral metabolism. Peoples from rural area have lack of knowledge and awareness regarding thyroid disorders and its impact on calcium and Vitamin D status.

Aim & objectives: To evaluate status of serum Calcium and Vitamin D level in patients of hypothyroidism according to age and gender in rural area.

Material & methods: This prospective case control study was conducted in Department of Biochemistry, JNMC, Sawangi, Wardha in patients of hypothyroidism after obtaining informed consent. Study group comprises of 100 subjects. 50 cases of hypothyroidism of age group of 30 – 60 yrs both male and female and 50 controls of normal healthy persons same age and sex, from general population.

Results & Observations: The values of T3 and T4 were significantly lower in cases as compared to controls while TSH values were significantly high in cases as compared to control. Calcium and Vitamin D levels were also significantly low in cases.

Conclusions: Severity of vitamin D deficiency corresponds to the severity of thyroid disease, with progressive increase in TSH level from subclinical to overt hypothyroidism. Thus it may be suggested that vitamin D be supplemented to all hypothyroid patients including the subclinical cases.

KEYWORDS : Hypothyroidism, Vitamin D, Calcium,

INTRODUCTION:

Disorders of thyroid gland are among the most common endocrine disorders in India. ⁽¹⁾ Incidence and prevalence of thyroid diseases are increases with age. Research shows that 300 million people are suffering from thyroid disorders globally and about the 42 million peoples suffering from thyroid disease in India. ⁽²⁾ Prevalence of hypothyroidism has risen markedly in the last few decades affecting even younger age groups in the form of congenital hypothyroidism. Disturbance of calcium and phosphorus homeostasis were frequently observed with thyroid dysfunction. Thyroid hormones regulate calcium in blood by releasing it from the cells. ⁽³⁾ Recently the disorders of hypothyroidism is receiving greater attention as an important cause of disturbance in mineral metabolism by their direct action on bone turnover and also as one of the cause for secondary osteoporosis.

Thyroid hormones have important biological effects such as a regulation of body hemodynamic, thermoregulation, and various metabolism. It influences carbohydrate, proteins, lipids metabolism and maintenance of water and electrolyte homeostasis, which are well established. ^(5,6)

Bone remodeling is affected by direct or indirect effect of the thyroid hormones on the bone cells. ⁽⁷⁾ The bone is affected by the interaction of the thyroid stimulating hormone (TSH) and the TSH receptors expressed on the precursors of osteoblasts and osteoclasts. ⁽⁸⁾ In the early life, a deficiency of the thyroid hormone can lead to a delay in the bone development. An impaired mobilization of calcium into the bone can cause a depressed turnover in hypothyroidism, and this can often lead to a decrease in the blood calcium level. ⁽⁹⁾

Vitamin D has been known for decades for its role in bone mineral metabolism and development and maintenance of skeletal health and extra skeletal tissue also. ^(10,11) Vitamin D deficiency has been identified as a risk factor for autoimmune thyroid diseases. ⁽¹²⁾ It mediates its effects through binding to vitamin D receptor (VDR) and thus activation of respective genes. ⁽¹³⁾ The VDR are widely distributed in humans, presenting in more than 30 different tissues including pancreas myocardium, lymphocytes, thyroid gland etc.

signifying its importance in humans. ⁽¹⁴⁾ Both vitamin D and thyroid hormones also act through steroid receptors and may affect each other's action as they have similar response elements on gene. So a lower level of vitamin D is likely to exaggerate the systemic abnormalities associated with hypothyroidism. ⁽¹⁵⁾ Peoples from rural area have lack of knowledge and awareness regarding thyroid disorders and its impact on calcium and Vitamin D status. Also there is scanty of literature available about the knowledge of calcium and Vitamin D in hypothyroidism therefore we undertook the present study with aim to examine the alteration in calcium and Vitamin D status in hypothyroidism.

Aim and Objectives:

To evaluate status of serum Calcium and Vitamin D level in patients of hypothyroidism according to age and gender in rural area.

Method and materials:

This prospective case control study was conducted in Department of Biochemistry, JNMC, Sawangi, Wardha after obtaining clearance from the Institutional Human Ethical committee. Patients were taken from outpatient department as well from indoor admitted in Achrya Vinobha Bhawe Rural Hospital. Informed consent was obtained from each participant.

Study group comprises of 100 subjects. 50 cases of hypothyroidism of age group of 30 – 60 yrs both male and female and 50 controls of normal healthy persons same age and sex, from general population were included in the study. Cases of hypothyroidism are further divided into three sub groups – Euthyroid where TSH level is 0.25-5 μ U/ml, Sub clinical hypothyroid where TSH is $>5-7$ μ U/ml and Overt hypothyroid where TSH is >7 μ U/ml. We had 12 cases of euthyroid, 30 cases of sub clinical hypothyroid and 8 cases of overt hypothyroid group. Patients suffering with other serious medical conditions and patients on mineral and vitamins supplementation or drugs were excluded from study.

Serum separated by centrifugation was analyzed for serum T3, T4, TSH and Vitamin D using seimens autoanalyzer working under principle of chemiluminescence immunoassay. Serum calcium was analysed by Randox imola autoanalyzer using O – Arsenazo method.

Results:

Finding in the study was statistically analyzed and was done by using descriptive and inferential statistics using one way ANOVA , Multiple Comparison: Tukey Test and z-test for difference between two means and software used in the analysis were SPSS 22.0 version and EPI-INFO 6.0 version. $p \leq 0.05$ is considered as level of significance.

Table no 1: Status of thyroid hormones, calcium & vitamin D

Parameters	Controls (n = 50)	Cases (n = 50)	P Value
Age (Years)	35.78 ± 8.85	35.68 ± 8.91	–
Sex (M/F)	22/28	19/31	--
T3(pg/ml)	2.94 ± 1.01	1.80 ± 0.8	< 0.005
T4 (ng/dl)	1.59 ± 0.30	1.40 ± 0.25	< 0.005
TSH (µIU/L)	1.57 ± 0.91	11.03 ± 3.04	< 0.005
Calcium (mg/dl)	10.04 ± 0.56	9.23 ± 1.29	< 0.005
Vit.D (ng/ml)	44.53 ± 9.91	21.51 ± 3.37	< 0.005

Parameters	Euthyroid (12), TSH=(0.25-5)	Sub clinical hypothyroid (30), (TSH >5-7)	Overt hypothyroid (08), (TSH >7)
TSH (µIU/ml)	3.66 ± 0.91	6.92 ± 0.97	22.53 ± 7.25
T3(pg/ml)	2.87 ± 1.13	2.08 ± 1.02	0.40 ± 0.37
T4(ng/dl)	1.33 ± 0.21	1.98 ± 0.46	0.64 ± 0.16
Calcium (mg/dl)	10.37 ± 1.55	9.14 ± 0.56	8.19 ± 1.77
Vit D (ng/ml)	28.53 ± 4.91	22.79 ± 2.11	13.23 ± 3.08

Vitamin D: Euthyroid vs subclinical hypothyroid (P=0.005), Euthyroid vs overt hypothyroid (P=0.001), Subclinical hypothyroid vs Overt hypothyroid(P=0.272)

TSH: Euthyroid vs subclinical hypothyroid(P=0.000), Euthyroid vs overt hypothyroid(P=0.001), Subclinical hypothyroid vs Overt hypothyroid(P=0.002)

Calcium: Euthyroid vs subclinical hypothyroid (P=0.005), Euthyroid vs overt hypothyroid (P=0.001), Subclinical hypothyroid vs Overt hypothyroid (P=0.272)

Discussion –

Thyroid hormones are most essential for normal growth and maturation of the skeletal system. Recently, the disorders of thyroid function particularly hypothyroidism is receiving greater attention as an important cause of disturbance in calcium and Vitamin D metabolism by their direct action on bone turnover⁽⁴⁾, and also as one of the causes for secondary osteoporosis. In our study prevalence of hypothyroidism is more common in female than males and serum calcium and vitamin D levels in hypothyroid patients were significantly decreased when compared with controls. Similar results were found by D. Sridevi et al in a study of serum magnesium, calcium and phosphorus in hypothyroidism, also by Deena Mendez et al in their study.^(16,17) Shivaleela MB in 2012 and by Abdelgayoum A. et al concluded that there is decrease in mineral level in hypothyroid patient.⁽¹⁸⁾

In contrast to this Susanna TY et al does not found any statistically significant change in hypothyroid patients as compared to the control group.⁽¹⁹⁾ Several epidemiological studies have revealed that there is widespread prevalence of vitamin D deficiency of varying degrees (50-90%) in Indian population with low dietary intake of calcium.

We observed that the levels of Vitamin D and calcium were decreased in all the three groups of hypothyroidism significantly which suggests the relationship between vitamin D and calcium deficiency and hypothyroidism as shown in Table 2. It shows Degree of deficiency progressing from subclinical to overt hypothyroidism, with progressive increase in TSH level from subclinical to overt hypothyroidism.

Our result was quite similar with Nirensingh Koch et al in 2016 on Meerut peoples, Dr. Amal Mohammed Husein Mackawy et al in 2013 in Saudi Arabian peoples. They concluded that the levels of serum calcium and vitamin D were low as in hypothyroidism as compared to the normal healthy subjects.^(20,21) Another similar study was done by Swati Sonawane et al in 2017. They revealed progressive decrease in level of Vitamin D from subclinical to overt hypothyroidism.⁽²²⁾ Low levels of vitamin D may be due to poor absorption of vitamin D from the intestine. One possible explanation for these reduced levels of vitamin D in subclinical and overt hypothyroidism can be the slothful intestines which lead to reduced absorption of vitamin D. Primary source of vitamin D in body is its synthesis from cholesterol in skin with the help of sunlight, the body may not activate vitamin D properly. In hypothyroidism, decrease in the blood calcium levels because of impaired mobilization of calcium. So vitamin D and calcium plays important role in maintaining a euthyroid state by interacting with its receptor in the thyroid gland.

Conclusion

Vitamin D and calcium level are found to be significantly reduced in hypothyroidism as compare to normal person. Severity of vitamin D deficiency corresponds to the severity of thyroid disease, with progressive increase in TSH level from subclinical to overt hypothyroidism. Thus it may be suggested that vitamin D be supplemented to all hypothyroid patients including the subclinical cases. We hypothesize that the Subclinical cases might progress to overt hypothyroid if not timely supplemented with vitamin D and calcium.

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