A STUDY OF SERUM VITAMIN D LEVELS IN PATIENTS WITH HYPOTHYROID

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ABSTRACT

Background: Hypothyroidism, also known as underactive thyroid or low thyroid, is a disorder of the endocrine system, which is characterized by reduced production of thyroid hormones by thyroid gland. Hypothyroidism can be primary hypothyroidism or secondary /central hypothyroidism. On the basis of etiology, primary hypothyroidism can be further classified into autoimmune (AITD) and non-autoimmune thyroid diseases (NAITD). Vitamin D has an important role in the regulation of Th1, Th2 and Th17 cells and it also regulates the secretion of cytokines IFN-γ, Interleukin-4(IL-4) and IL-17.[24-27] These findings, though not conclusive, suggest the possible role of vitamin D in autoimmune thyroid disorders. Therefore, the present study aimed to study the status of Vitamin D in Hypothyroidism. Material and Methods: In “the present study, 50 hypothyroid patients aged 20 to 50 years were enrolled who were confirmed by the estimation of serum T3, T4 and TSH (>6.16μIU/ml) level were selected from the OPD of Teerthanker Mahaveer Hospital. The “serum total TSH, T3, T4, TPO-Ab and Vitamin D were estimated by ELFA technique (Enzyme Linked Fluorescent Assay) using fully automated VIDAS analyzer. Observations & Results: Mean levels of serum Vitamin D level in hypothyroid patients was 16.10±10.62 ng/ml, which was statistically lower than that of healthy group with serum Vitamin D level 24.77±16.85 ng/ml (p-value=0.003). Conclusion: Our findings indicate that patients with hypothyroidism suffered from deficiency of vitamin D. Moreover, the negative significant correlation between vitamin D levels and TSH levels, suggested that deficiency of serum vitamin D levels were significantly associated with degree and severity of the hypothyroidism which encourage the advisability of vitamin D supplementation.

KEYWORDS: Vitamin D, Hypothyroidism, Autoimmune thyroid diseases (AITDs).

INTRODUCTION

Hypothyroidism, also known as underactive thyroid or low thyroid, is a disorder of the endocrine system, which is characterized by reduced production of thyroid hormones by thyroid gland. Clinical features are tiredness, weakness, dry coarse skin, feeling of cold, hair loss, constipation, weight gain with poor appetite, menorrhagia, bradycardia, peripheral edema, delayed tendon reflexes.

Incidence of hypothyroidism varies depending on the population studied.[1,2] In the United States 0.3% of the population suffered from overt hypothyroidism and 4.3% have subclinical or mild hypothyroidism. Hypothyroidism is more common in women and elderly.[2] Neonatal hypothyroidism occurs in almost 1 in 3500 newborns.[3]

Hypothyroidism can be primary hypothyroidism or secondary /central hypothyroidism. On the basis of etiology, primary hypothyroidism can be further classified into autoimmune (AITD) and non-autoimmune thyroid diseases (NAITD). In areas of the world, where dietary iodine is sufficient, hypothyroidism is most commonly caused by an autoimmune condition – Hashimoto’s thyroiditis.[4,6]

AITDS are perhaps the result of an unbalanced ratio of T helper cell type 1 (Th1) and T helper cell type 2 (Th2) cells. Recent studies have shown that secretion of
cytotoxicity from TH1 cells and Th17 are involved in the development of AITDs. mRNA expression of cytokines Interferon (IF-γ) and IF-17A is significantly higher in patients of Hashimoto’s thyroiditis than in healthy controls. Interestingly, vitamin D has an important role in the regulation of TH1/TH2 and TH17 cells and it also regulates the secretion of cytokines IF-γ, Interleukin-4(IL-4) and IL-17. These findings, though not conclusive, suggest the possible role of vitamin D in autoimmune thyroid disorders.

Recently, it has been shown that vitamin D deficiency might be associated with many autoimmune conditions such as rheumatoid arthritis, systemic sclerosis, systemic lupus erythematosus and multiple sclerosis. Vitamin D receptors are not only found in intestine, bone and kidney but many studies have shown their presence in immune system (T and B cells, monocytes and macrophages), reproductive system, CNS, skin, lives and endocrine system.

Vitamin D acts through an intracellular receptor belonging to the family of steroid/nuclear receptors. In fact, molecular structures of vitamin D3 receptor ad receptor for thyroid hormones are similar. Activated vitamin D acts as an immuno-modulator by regulating T lymphocytes and inhibits the production and cytokine activity. Vitamin D inhibits proliferation of TH1 cells and increases the number of TH2 cells. Vitamin D also decreases the production of IL-2, IL-5, TNF-α and Interferon-γ, and increases production of transforming growth factor and IL-4 in TH2 cells. It also suppresses the production of IL-17 via direct suppression of transcription. In addition, vitamin D also promotes the apoptosis of dendritic cells and inhibits their differentiation and maturation. There is down-regulation of expression of MHC II on dendritic cells by vitamin D. In addition renal activity of 1-α hydroxylase and plasma 1, 25(OH)2 D levels are relatively affected by thyroid hormones.

Only few studies have examined the impact of vitamin D levels on the incidence of AITDs in humans and these studies have yielded conflicting results. Further investigations were required to clarify the causal relationship between serum vitamin D levels and hypothyroidism as serum vitamin D levels play an important role in prevention and treatment of Hypothyroidism.

MATERIAL AND METHODS

Subject Selection
In the present study, 50 hypothyroid patients aged 20 to 50 years were enrolled who were confirmed by the estimation of serum T3, T4 and TSH (>6.16μIU/ml) level were selected from the OPD of Teerthanker Mahaveer Hospital, Moradabad and 50 healthy individuals having comparable age and sex were used as controls. Informed consent was taken from each participants before the collection of blood sample.

Exclusion Criteria
- Treatment with medications affecting thyroid functions (L-thyroxine, antithyroid drugs, antiepileptic/ anticonvulsant drugs, antipsychotics, amiodarone, glucocorticoid, etc).
- Treatment with vitamin D or calcium supplements.
- Administration with immunomodulatory medications.
- Pregnant and lactating women.
- Subjects with abnormal liver and kidney function.
- History of any thyroid disease or thyroid surgery.
- Patients with diabetes mellitus, metabolic bone disorders, hyperparathyroidism, malignancy, oral contraceptive, antioestoporotic therapy.

METHODOLOGY

The serum total TSH, T3, T4, TPO-Ab and Vitamin D were estimated by ELFA technique (Enzyme Linked Fluorescent Assay) using fully automated VIDAS analyzer.

OBSERVATIONS AND RESULTS

Table-1 and figure-1 shows Mean value of serum TSH in hypothyroid patients as 43.74±59.24μIU/ml, which was found to be higher than that of control group with serum TSH levels 2.53±1.39μIU/ml (p-value=0.00). The mean difference among the two study groups has been found to be statistically significant.

Meanwhile, the Mean levels of serum Vitamin D level in hypothyroid patients was 16.10±10.62 ng/ml, which was statistically lower than that of control group with serum Vitamin D level 24.77±16.85 ng/ml (p-value=0.003).

Mean value of serum T4 in hypothyroid patients was 5.06±2.40 nmol/L, which was significantly lower than that of control group with serum T4 levels 7.43±1.35 nmol/L (p-value=0.00).

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Biochemical parameter</th>
<th>Control (mean ± S.D)</th>
<th>Hypothyroid patients (mean ± S.D)</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Serum TSH level (μIU/ml)</td>
<td>2.53±1.39</td>
<td>43.74±59.24</td>
<td>-4.91</td>
<td>0.00</td>
</tr>
<tr>
<td>2</td>
<td>Serum T3 level (μmol/L)</td>
<td>1.38±0.79</td>
<td>1.37±1.20</td>
<td>0.075</td>
<td>0.94</td>
</tr>
<tr>
<td>3</td>
<td>Serum T4 level (μmol/L)</td>
<td>7.43±1.35</td>
<td>5.06±2.40</td>
<td>6.06</td>
<td>0.00</td>
</tr>
<tr>
<td>4</td>
<td>Serum Vitamin D level (ng/ml)</td>
<td>24.77±16.85</td>
<td>16.10±10.62</td>
<td>3.07</td>
<td>0.003</td>
</tr>
</tbody>
</table>

Table 1: Comparison of biochemical parameters between Healthy controls and hypothyroid patients.
Fig. 1: Comparison of serum Vitamin D levels between hypothyroid patients and controls.

Demographic Distribution of Hypothyroid Patients

Vit. D status in Hypothyroid Patients
Correlation of serum vitamin D level with hypothyroidism. The deficiency is not associated with the effect of T3, and the benefit of vitamin D, and determine serum orders in the level when compared between Hypothyroid patients and Healthy controls. The Vitamin D level was lower in the Hypothyroidism patients (t-value = 11.13, p = 0.00).

In a Study conducted in Netherlands, It has been shown that Serum Vitamin D deficiency is not associated with the early stages of Thyroid disorders.

Our study demonstrates the presence of low vitamin D levels in hypothyroid patients. These findings merit further research on larger population using additional markers to investigate into the cause of deficiency, the factors involved, and the benefit of vitamin D supplementation in these patients.

The role of vitamin D in those patients with thyroid problems, should be examined by further prospective clinical studies on molecular basis and determine whether vitamin D deficiency is a causal factor in the pathogenesis of hypothyroidism or rather a consequence of the disease.

Further studies with large number of subjects are required to examine the effect of vitamin D supplementation on treatment of hypothyroidism.

DISCUSSION
Thyroid disorders being the most prevalent endocrinological disorder are expected to have a prevalence of 11% in Indian population in comparison to 2% in UK and 4.6% in American population. The insufficiency of Thyroid activity is termed as Hypothyroidism. There is reduced secretion of the thyroid hormones, T3 and T4. Decrease in T3 and T4 levels result in hyper secretion of Thyroid Stimulating hormone (TSH) and causes elevated serum TSH levels. [35]

All the test parameters were compared between hypothyroid patients and healthy controls. In our study(Table-1), mean value of Serum TSH in Hypothyroid patients was 43.74±59.24 µIu/ml and the healthy control group had mean serum TSH value of 2.53±1.39 µIu/ml. The mean value of other thyroid profile parameters like serum T3 and T4 was found to be 1.37±0.79 nmol/L and 5.06±2.40 nmol/L respectively in Hypothyroid patients while in Healthy controls, mean value of serum T3 and T4 was 1.38±0.79 nmol/L and 7.43±1.35 nmol/L respectively.

On comparing the serum Vitamin D levels between Hypothyroid and healthy groups, it was found that the serum vitamin D level in the Hypothyroid patients were significantly lower than the healthy controls. The mean value of serum vitamin D in Hypothyroidism was determined to be 16.10±10.62 ng/mL, while the healthy control group had a mean serum vitamin D level as 24.77±16.85 ng/mL. The mean difference of serum vitamin D level was statistically significant with a consistent lower values in Hypothyroid Disorders with t-value = 3.07 and p value= 0.003 which is highly significant.

In a study based on central Indian population by Lohokare et al 2016, similar observations have been shown. They found a significant lower level of serum vitamin D in hypothyroidism as compared to controls (p< 0.001). They forwarded firstly the poor absorption of vitamin D from small intestine and secondly the inability to activate vitamin D as the causative reasons for decrease in Serum vitamin D levels in Hypothyroidism.

Amal Mohammed Husein Mackawy et al 2013, have shown a significant mean difference in Serum Vitamin D level when compared between Hypothyroid patients and

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