Original Research Article

Association of vitamin D deficiency and hypothyroidism

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Abstract

Prevalence of hypothyroidism is increasing in Indian urban population. Most of the females in their middle age 30s-40s are suffering with hypothyroidism. Hashimoto thyroiditis and Graves' disease predominates in hypothyroid patients. These are auto immune diseases and observed to be associated with vitamin D deficiency. The main role of vitamin D is regulating bone metabolism and calcium and phosphorus homeostasis. Over the past few decades, the importance of vitamin D in non-skeletal actions has been studied, including the role of vitamin D in autoimmune diseases, metabolic syndromes, cardiovascular disease, cancers, and all-cause mortality. Vitamin D alters genetic expression of various proteins and also play an important role in proper functioning of immune system. Urban Indian population is not well exposed to sun light and hence, suffers with vitamin D deficiency. Vitamin D is a key player in metabolism and has anti inflammatory properties. In deficiency of vitamin D, most of the inflammatory pathways get stimulated and in may attach thyroid gland leads to Hashimoto disease. Once damaged thyroid cell cannot come back to their normal form. Aim: To study the association of Vitamin D levels in hypothyroidism patients. Results: The present study observed significant chages in anthropometric measurements.

Key Word: Vitamin D deficiency, Hypothyroidism, autoimmune thyroid disease, Inflammation

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INTRODUCTION

Vitamin D is a steroid hormone which is synthesized in our body. Skin, Liver and Kidney play an important role in vitamin D synthesis in presence of sunlight of specific wavelength. It plays an important role in calcium-phosphate metabolism and bone formation. It has a steroid hormone like effect and modulates the genetic expression of various key enzymes[1]. Now it has also been identified that vitamin D plays an important role in non skeleton actions also. Various studies evaluated the involvement of vitamin D in autoimmune diseases, metabolic syndromes, cardiovascular disease, cancers, and all-cause mortality. Few studies has been carried out and suggested an association between lower levels of vitamin D and autoimmune thyroid diseases such as Hashimoto's thyroiditis and Graves' disease, and impaired vitamin D signalling has been reported in thyroid cancers[2,3,4]. Most of the tissues have vitamin D receptors (VDR) which are spread all over the body. Due to high rate of urbanization, less exposure to sunlight, a negligible amount of vitamin D is synthesized in our body. Vitamin D exists in two forms, vitamin D3 (or cholecalciferol) and vitamin D2 (or ergocalciferol). The former is mainly synthesized in the skin by 7-dehydrocholesterol reductase upon exposure to ultraviolet B (UVB) radiation, and can be also obtained from a few dietary sources (mainly fatty fish), while the latter is produced by plants and fungi[5,6]. Autoimmune thyroid

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diseases (AITDs), including hypothyroidism and Graves' disease, are the most common organ-specific autoimmune disorders[7]. These AITDs are polygenic diseases and are due to genetic predisposition (thyroid-specific genes and immune-modulating genes) and environmental triggers. Thyroid-specific autoantibodies are produced by lymphocytic infiltration into the thyroid gland[7,8]. Chronic autoimmune thyroiditis, or HT, is a typical T-cell-mediated autoimmune disease characterized by a diffuse goiter, the presence of anti-thyroid peroxidase (anti-TPO) and/or anti-thyroglobulin (anti-Tg) antibodies in serum which varies with degree of thyroid hypofunction of the gland. Vitamin D plays a significant role in modulation of the immune system, enhancing the innate immune response while exerting an inhibitory action on the adaptive immune system[5,9]. Most immune cells, including T cells, B cells, and antigen-presenting cells (APCs), such as dendritic cells (DCs) and macrophages, express VDR and 1α-hydroxylase[5,6,10]. The aim of this study is to evaluate serum levels of vitamin D in hypothyroidsm patients and compare them with controls.

METHODOLOGY

The present study included hypothyroidism patients and normal controls and the study was conducted in Dr. D.Y. Patil Medical College and Hospital, Nerul, Navi Mumbai. Informed consent was obtained from all the study participants. The study has been approved by the Institutional Ethics Committee.

Inclusion criteria: Hypothyroism patients with age and sex matched healthy controls (without clinical evidence of thyroid disorder and auto immune diseases)

Exclusion criteria: Pregnant women, patients < 20 years of age, with Congenital Heart disease, acute or chronic infection, other auto immune diseases, chronic liver and kidney disease.

Blood Sampling and Methodology: Routine biochemical tests were carried out on an autoanalyser using commercially available kits. Thyroid function tests, Liver function tests, lipid profile etc. were evaluated in clinical laboratory of D.Y Patil hospital and research center, Nerul, Navi Mumbai. Anthropometric measurements were also noted for all study participants. SPSS software (version 17) was used for Statistical analysis of the data.

RESULTS

The results of the present study showed a changed pattern of lipid profile and anthropometric measurements. Further it has been observed that low levels of vitamin D were found in hypothyroidism patients and normal controls.

Table 1: Demographical Characteristics of study subjects

Variables	Controls (n=180)	Patients (n=90)	*P* value
BMI	24.60 (±3.49)	27.30 (±4.22)	0.05
WC	95.3 (±10.7)	98.44 (± 10.46)	0.01
WHR	0.968(±0.55)	1.05(±0.32)	0.01
TG (mg%)	120.23 (±43.5)	135 (±70.18)	0.05
TC (mg%)	175.45 (±29.16)	195.30 (±51.21)	0.05
LDL (mg%)	100.23 (±30.21)	122.10 (±44.54)	0.05

The present study observed a significant increase anthropometric parameters and lipid parameters in patients than controls. TG and LDL have shown an increased pattern in circulatory levels in serum. TG [135 (±70.18)/ 120.23 (±43.5)] and LDL [122.10 (±44.54)/ 100.23 (±30.21)]

Table 2: Serum vitamin D levels in Hypothyroidism

Variables	Hypothyroidism	Controls	*P* value
Vitamin D	18.73(±4.34)	34.20(±11.65)	0.01

A significant difference was found in circulatory levels of vitamin D in hypothyroidism patients than controls [18.73(±4.34)/ 34.20(±11.65)].

DISCUSSION

Our study observed a significant difference in anthropometric measurements and lipid profile variables in hypothyroidism patients than control. It has been known that both vitamin D and thyroid hormone bind to similar receptors called steroid hormone receptors. Some previous studies have demonstrated that vitamin D play an important role in modulating pituitary TSH secretion by binding to specific binding sites[13] Smith *et al.*[14] found that vitamin D administration significantly suppressed TSH secretion in the basal state. It has been also observed that serum TSH levels of middle-aged and elderly women were higher than those of same-age men[14] the results of the study suggested that TSH secretion is regulated by sex hormones, genetic susceptibility or environmental factors,

which may also mediate the relationship between vitamin D status and serum TSH level. Vitamin D can be stored in and released from fat cells, and it is bound to the vitamin D binding protein (DBP)[5]. Vitamin D plays a significant role in modulation of the immune system, enhancing the innate immune response while exerting an inhibitory action on the adaptive immune system[5,15]. Autoimmune thyroid diseases, including HT and GD, are the most common organ-specific autoimmune disorders[15]. These AITDs are polygenic diseases resulting from a combination of genetic predisposition (thyroid-specific genes and immune-modulating genes) and environmental triggers which are characterized by lymphocytic infiltration into the thyroid gland and production of thyroid-specific autoantibodies[15,16]. Chronic autoimmune thyroiditis, or HT, is a typical T-cell-mediated autoimmune disease. It is characterized by a diffuse goiter, the presence of anti-thyroid peroxidase (anti-TPO) and/or anti-thyroglobulin (anti-Tg) antibodies in serum with hypofunction of thyroid gland. Intrathyroidal infiltration of B and T lymphocytes induce the production of antibodies to bind to the thyroid stimulating hormone (TSH) receptor. This stimulates the growth and function of thyroid follicular cells leading to hyperthyroidism, indicating a humoral immune response[15]. In summary, in genetically predisposed individuals, the disruption of these immune-endocrine interactions by environmental factors is able to shift the balance between Th1-Th2 immune response. This results in a Th1-cell-mediated autoimmune reaction with thyrocyte destruction and hypothyroidism in HT, but in a hyperreactive Th2-mediated humoral response against TSH receptor (TSHR) with stimulatory antibodies leading to hyperthyroidism in GD[16]. Various studies suggested a pleiotropic role of vitamin D.

CONCLUSION

The present study observed that low levels of vitamin D are associated with hypothyroidism. The study also respect the previous studies which have suggested a pleiotropic role of vitamin D and suggest a future long-term, randomized controlled trials to provide insight into the efficacy and safety of vitamin D as a therapeutic tool for these thyroid diseases.

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