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Original Research Article

Association Between Serum Vitamin D And TSH Status Levels And Thyroid Stimulating Hormone (TSH) In Postmenopausal Women

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Abstract

Introduction: Vitamin D (VitD) insufficiency is present in over half of population worldwide. Over a billion people worldwide are vitamin D deficient or insufficient. It has been long known that VitD insufficiency contributes to development of osteopenia and osteoporosis. ***Objective:*** To assess the serum vitamin D and TSH status in postmenopausal women who have undergone routine blood investigations. ***Methods:*** We performed a retrospective review of data of 61 patients in postmenopausal age group (45-75yrs) during their routine blood investigation for the first time at Dept. of Obstetrics and Gynaecology, Shaheed Tajuddin Ahmad Medical College Hospital, Gazipur, Bangladesh from January to March 2021. The data was collected from medical record section and appropriate statistical analysis was done using percentage and frequency. ***Results:*** Out of 61 patients Vitamin D was insufficient (10-30 ng/mL) in 34.4% and deficient (<10 ng/mL) in 18.0%, and remaining normal. In 4.9%, TSH was low (less than 0.3 mIU/L) and in 18.0% TSH was high (more than 4.5 mIU/L), while the remaining 77.0 had normal TSH levels (0.3-4.5 mIU/L). 54.5%(n-11) patients with high TSH, had vitamin D deficiency and 18% patients with high TSH had insufficient vitamin D. 100% (n-3) of patients with low TSH had normal vitamin D. 22 patients had normal TSH and normal vitamin D. ***Conclusion:*** Prospective longitudinal studies with larger subject numbers and more comprehensive measurement of thyroid function along with examining the indicators of innate immunity may shed light into the underlying pathophysiology and mechanisms involved in the interaction between thyroid function and VitD metabolism. High TSH levels was associated with low vitamin D levels, low TSH levels was associated with normal serum vitamin D level. Hence association was linear between TSH and vitamin D in post-menopausal women.

Keywords: Vitamin D Receptor, Hypovitaminosis D, Hypothyroidism, Thyroid Autoimmunity.

INTRODUCTION

Vitamin D (Vit D) insufficiency is present in over half of population worldwide [1]. Over a billion people worldwide are vitamin D deficient or insufficient. It has been long known that VitD insufficiency contributes to development of osteopenia and osteoporosis [2, 3]. As the VitD receptors are present in all human cells regardless of their different embryologic origins, several studies have focused on the extra-skeletal effects of VitD and the way it affects general health of patients [4]. In addition to the limited oral intake and age-related decline in its absorption, decreased exposure to sunlight is among the leading cause of VitD insufficiency in women [5]. VitD has been recognized to be involved in various immune functions as well as bone and muscle development [6]. Vitamin D deficiency is associated with increased risk of diabetes Mellitus [7, 8], infectious diseases [9], atherosclerosis [10] and autoimmune condition like autoimmune thyroiditis [11, 12]. Since both Vitamin D

and thyroid hormones act via steroid receptors; so any alteration in the level of Vitamin D is likely to increase problems associated with hypothyroidism [13]. Prevalence of high levels of thyroid stimulating hormone (TSH) increases with age, especially after menopause [14]. Therefore, routine screening of thyroid function in postmenopausal women is important. Thus we aim to estimate the serum vitamin D and TSH status and to find association between serum levels of VitD and thyroid stimulating hormone (TSH) in postmenopausal women. Thyroid hormonal level abnormally increases in this group because of decrease in serum oestrogen levels. Moreover, symptoms occurring due to thyroid disease are similar to postmenopausal symptoms, that differentiating these two diseases is difficult. VitD insufficiency is very common among women in the geographic region where this study is conducted [15]. In view of these conflicting reports, we aim to examine the association between serum levels of VitD and thyroid stimulating hormone (TSH) among postmenopausal women.

MATERIALS AND METHODS

A retrospective review of data of 61 patients in postmenopausal age group (45-75yrs) during their routine blood investigation for the first time at Dept. of Obstetrics and Gynaecology, Shaheed Tajuddin Ahmad Medical College Hospital, Gazipur, Bangladesh from January to March 2021. Laboratory investigations, including: Serum 25-OH VitD levels below 10ng/ml were considered 'deficient', where as those with levels between 10-30 ng/ml were considered 'insufficient' and normal if its 30-100 ng/ml. Serum TSH reference range of age below 55yrs is 0.3-4.5mlU/L and above 55yrs is 0.5-8.9mIU/L is considered normal.

Inclusion Criteria

- Patients in postmenopausal age group (45-75yrs).

Exclusion Criteria

- Diagnosed and treated cases of vitamin D deficiency.
- Diagnosed and treated cases of thyroid disease.
- Surgical menopause.
- Women receiving hormonal replacement therapy (HRT).
- Who is on Vitamin D and calcium supplementation.

RESULTS

Out of 61 patients included in this study. Vitamin D was insufficient (10-30 ng/mL) in 34.4% and deficient (<10 ng/mL) in 18.0%, and remaining normal. In 4.9%, TSH was low (less than 0.3 mIU/L) and in 18.0% TSH was high (more than 4.5 mIU/L), while the remaining 77.0 had normal TSH levels (0.3-4.5 mIU/L). 54.5%(n-11) patients with high TSH, had vitamin D deficiency and 18% patients with high TSH had insufficient vitamin D. 100% (n-3) of patients with low TSH had normal vitamin D. 22 patients had normal TSH and normal vitamin D (table-1-3).

Table 1: Vitamin D status according to age of the patients (N=61)

Age (in yrs)	Vitamin D status		
	Normal	Insufficient	Deficient
45-50	15	9	6
51-55	5	3	1
56-60	6	5	1
61-65	3	3	3
66-70	0	1	0
71-75	0	0	0
Total	**29 (47.5%)**	**21(34.4%)**	**11(18.0%)**

*34.4% of patient had insufficient Vit D and 18.0% had deficient VitD.

Table 2: Thyroid status according to age of the patients (N=61)

Age (in yrs)	Thyroid status		
	Normal TSH	Hyperthyroid	Hypothyroid
45-50	28	0	5
51-55	5	1	2
56-60	10	1	1
61-65	4	1	3
66-70	1	0	0
Total	**47**	**3**	**11**

*18.0% of patients were hypothyroid and 4.9% were hyperthyroid.

Table 3: Correlation of Vitamin D and Thyroid status (N=61)

Age (in yrs)	Thyroid status		
	Normal TSH (N=47)	Hyperthyroid (N=3)	Hypothyroid (N=11)
Normal	23	3	3
Insufficient	19	0	2
Deficient	5	0	6

*9.5% of patients with insufficient vitamin D had hypothyroidism and 54.5% of patients with deficient vitamin D had hypothyroidism.

DISCUSSION

VitD inadequacy was found to be very common in the current study. As the main finding of this study, suppressed levels of TSH have been associated with higher VitD levels, though no linear association between TSH and VitD has been noticed in postmenopausal women. Though higher levels of VitD in women with suppressed TSH levels might presumably be due to an increased absorption of VitD in hyperthyroid state, the concept has not been studied. Vitamin D has potent immunomodulatory effects and plays an important role in the pathogenesis of autoimmune diseases [16]. In the classical endocrine pathway, vitamin D enters the circulation attached to a D-binding protein, is first hydroxylated in the liver to 25-hydroxy vitamin D (25(OH) D) and then in the kidney to form the active metabolite, 1, 25 dihydroxy vitamin D (1, 25-(OH)2 D) or calcitriol [17]. Serum 25(OH)D has a half-life of approximately two to three weeks, in contrast, 1,25-(OH)2D has a short circulating half-life and is tightly regulated over a narrow range by parathyroid hormone, calcium and phosphate [18]. Serum 1,25-(OH)2D is not a good measure of vitamin D status since a decrease may not occur until vitamin D deficiency is severe [19]. Vitamin D mediates its effect through binding to vitamin D receptor (VDR), which is present on many cells of immune system and thereby regulating the activity of the immune cells [20]. Individuals with genetic polymorphisms of these receptors are particularly prone to autoimmune thyroid disorders [21]. Metabolism of VitD is also reciprocally regulated by thyroid hormones. Provitamin D3 is synthesized from 7-dehydrocholesterol and the enzymatic reaction takes place principally in keratinocytes located in the basal and spinous strata of the epidermis layer [22]. In hypothyroid patients skin changes occur in the form of epidermal thinning and hyperkeratosis [23]. This suggests that epidermal barrier function is probably impaired in hypothyroidism with a hypothesizing that synthesis of VitD is decreased in patients with overt hypothyroidism and high TSH [24]. Thyroid disorders are more common in women by 5–10 times [25], while their frequency increases with age [26]. Thyroid function is diagnosed by measuring serum TSH (Thyrotropin) and it is the best and most reliable test to diagnose thyroid disease [27, 28]. Prevalence of both vitamin D and TSH levels are more among postmenopausal women. Menopause is a natural aging process causing oestrogen deficiency. It is known that oestrogen influence on serum thyroid hormone by increasing the level of thyroxin binding globulin, with the decrease of its clearance [29]. Therefore, routine screening of thyroid function in menopausal period to determine thyroid disease is required. Present study showed that most of the patients with insufficient and deficient Vitamin D also have hypothyroidism. Similarly Amal Mohammed *et al.,* stated that patients with hypothyroism suffered from hypovitaminosis D with hypocalcaemia. A study done by Mitra Niafar *et al.,* included 229 postmenopausal women in that 12% had insufficient VitD, deficient in 60.9% of the participants. And in 11.3% TSH was low and in 7.6% of women, TSH was high, while the remaining 80.1% had normal TSH levels. Subjects with low TSH had significantly higher VitD concentration compared to the other 2 groups [30]. Byron Richards [31] studied the effect of vitamin D deficiency on thyroid gland in experimental study; he reported that a lack of vitamin D contributed to the possibility of low thyroid hormone. K. Vondra *et al.,* concluded that significant vitamin D deficiency would occur in the most of the subjects suffering from various forms of thyroid autoimmunity [32]. Swati Sonawane *et al.,* observed that out of 90 subjects, there were 58.8% patients who had Vitamin D deficiency. There were 21.1% patients who had insufficiency of Vitamin D. Only 20% subjects have sufficient levels of Vitamin D. There were 73 cases of euthyroid in which the TSH levels were between 0.25-5 U/U/ml. There were 10 cases of subclinical hypothyroid and 7 cases of overt hypothyroidism. The mean levels of Vitamin D in subclinical and overt hypothyroidism were 16.23± 10.47 and 13.11±10.48 ng/ml respectively [33].

CONCLUSION

Prevalence of VitD deficiency and hypothyroidism are common in postmenopausal women and our study will also confirm this. There is no linear correlation between TSH (increased) and VitD (decreased) levels. So all postmenopausal women should be submitted for estimation of thyroid function test and serum vitamin D levels. Since both are treatable diseases and proper treatment of these diseases will prevent the complication related to cardio-metabolic disease and mortality in postmenopausal women. Prospective longitudinal studies with larger subject numbers and more comprehensive measurement of thyroid function along with examining the indicators of innate immunity may shed light into the underlying pathophysiology and mechanisms involved in the

interaction between thyroid function and VitD metabolism.

LIMITATION

Limitation of this study was that it included small number of subjects. Since our study was retrospective we couldn't comment about Anti TPO antibodies status. Further prospective longitudinal studies with large number and of participants and more comprehensive measurement of thyroid function may help to understand whether low VitD levels is a another factor in determining the pathophysiology of thyroid disorders.

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