Original Research Article

Case control study on vitamin d deficiency and risk of hypothyroidism

Manish Kumar Sinha[1], Ram Binay Sinha[2]

[1]Tutor, [2]Professor & Head, Department of Biochemistry, Patna Medical College, Patna, Bihar, INDIA.
Email: drmanish.123@rediffmail.com

Abstract

Indian population has been found to be deficient in Vitamin D. Vitamin D deficiency is supposed to be associated with hypothyroidism. The present study was conducted to find the association between Vitamin D deficiency and hypothyroidism. The study design was case-control. The cases were selected from the patients suffering from hypothyroidism and controls were selected from those accompanying patients with age and sex matching in the ratio of 1:1. It was observed that there is significant association between hypothyroidism and Vitamin D deficiency ($p<0.05$). The risk of hypothyroidism is increased with Vitamin D deficiency.

Key Word: Case Control Study, Hypothyroidism, Vitamin D Deficiency

Address for Correspondence
Dr. Manish Kumar Sinha, Tutor, Department of Biochemistry, Patna Medical College, Patna, Bihar, INDIA.
Email: drmanish.123@rediffmail.com
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INTRODUCTION

Vitamin D deficiency is emerging as important health problem globally. Nearly one billion people are estimated to be suffering from this condition worldwide[1]. It has multifarious functions right from its role in calcium and phosphorus metabolism to actions on myocardium, pancreas, and thyroid etc[2]. Its actions are mediated through Vitamin D receptors which are present throughout the body. Vitamin D deficiency is an established risk factor for diabetes mellitus[3], atherosclerosis[4], infections[5] and autoimmune diseases[6]. India, being a tropical country has plenty of sunshine available. But, Indian population has been found to be deficient in Vitamin D[7]. Prevalence of hypothyroidism is reported to be 11% in India[8] and 42 million people are estimated to suffer from this condition in India[9]. Vitamin D deficiency is supposed to be associated with hypothyroidism. But, different researchers have found varying results[10]. Hence, the present study was conducted to explore this issue. *Research question*- Is Vitamin D deficiency associated with hypothyroidism? *Aims & objectives*- The present study was conducted to find the association between Vitamin D deficiency and hypothyroidism.

MATERIAL AND METHODS

The present study was conducted at the Department of Biochemistry, Patna Medical College in case-control design. The cases were selected from the patients suffering from hypothyroidism who came for treatment at Medicine OPD of Patna Medical College and were found to be suffering from hypothyroidism on clinical examination and biochemical confirmation. Cases were selected in the age group of 18-35 years. The patients who were getting treatment for hypothyroidism and those suffering from kidney & liver diseases, diabetes and joint diseases were excluded. Controls were selected from those accompanying patients who were healthy, were not suffering from hypothyroidism and did not have family history of thyroid diseases. Age (± 1 year) and sex matching of cases and controls was done in the ratio of 1:1. Detailed clinical history was taken from all the study subjects and thorough clinical examination was done. This was followed by collection of venous blood after 12

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hours fast for estimation of plasma glucose, serum creatinine and blood urea using Photometer 5010[11]. It is Semi-automated Analyser of single beam filter photometer type. It has halogen lamp of wavelength340 nm to 800 nm. Roche electrolyte analyzer[12] was used for serum calcium. It is designed to quickly and accurately conduct whole blood electrolyte testing in the laboratory or point of care. The six electrodes in the Electrolyte Analyzer measure sodium, potassium, chloride, ionized calcium, lithium with the use of the reference electrode. It gives electrolyte results from just 95 ul of whole blood, serum, plasma, acetate or bicarbonate dialysate, or pre-diluted urine. Several kinds of sample container - collection tube, syringe, capillary or sample cup, Roche Microsampler - can be presented to the instrument probe for sampling. AccuLite CLIA analyzer was used for estimation of levels of T3, T4, TSH and Vitamin D. Vitamin D levels < 20 ng/ml was considered to be the level for labelling as Vitamin D deficiency as per Endocrine Society Clinical Practice Guidelines[13]. A total of 60 controls matched for age and sex along with equal number of cases were selected for the present study. Data was entered into Microsoft Excel 2007 and analyzed using SPSS v 16.0. Frequency and percentage were calculated for categorical variables and Mean ± SD for continuous variables. For the tests of hypothesis, Chi-Square test, Student T test, Fischer test and Mann-Whitney test was done as appropriate for the variables. p-value < 0.05 was considered as statistically significant.

RESULTS AND DISCUSSION

The present study included 60 age and sex matched cases and controls. Table-1 shows the background profile of cases and controls. The controls were matched for age with cases up to ± 1 year. Mean age of cases was 29.7 ± 3.4 years and that of controls was 29.1 ± 3.7 years and this difference was not significant statistically (p= 0.4). The sex distribution of cases and controls was similar (p=1). The differences in religion (p=0.5) and economic status (p=0.7) was not significant statistically. This indicates that the socio-demographic profile of cases and controls was similar.

Table 1: showing comparison of cases and controls

Characteristics	Cases (n=60)	Controls (n=60)	Significance
Mean age	29.7 ± 3.4 years	29.1 ± 3.7 years	t= -0.9, p=0.4
Sex			
- Male	19 (31.7%)	19 (31.7%)	p=1
- Female	41 (68.3%)	41 (68.3%)	
Religion			
- Hindu	49 (81.7%)	46 (76.7%)	$\chi 2 = 0.46$, p = 0.5
- Muslim	11 (18.3%)	14 (23.3%)	
Economic status - BPL	22 (36.7%)	20 (33.3%)	$\chi 2 = 0.15$, p = 0.7

Table-2 shows the findings of biochemical analysis. Mean TSH in cases was 5.8 ± 0.8 µIU/ml and that among controls was 3.2 ± 0.9 µIU/ml and this difference was statistically significant (p=0.00). The differences regarding Serum T3 (p=0.00) and Serum T4 (p=0.00) were also significant statistically as cases consisted of hypothyroid and controls consisted of euthyroid individuals. Cases showed lower levels of Serum Calcium and Vitamin D levels as compared to controls and these differences were statistically significant (p=0.00).

Table 2: showing biochemical profile of cases and controls

Characteristics	Cases (n=60)	Controls (n=60)	Significance
Serum TSH (µIU/ml)	8.3±1.4	4.7±1.7	t= -12.7, p=0.00
Serum T3 (ng/ml)	0.6±0.2	1.1±0.2	t= 13.7, p=0.00
Serum T4 (µg/dl)	5.9±1.2	7.3±1.3	t= 6.1, p=0.00
Serum Ca (mg/dl)	7.4 ± 1.9	9.5 ± 1.6	t= 6.5, p=0.00
Serum Vit D (ng/ml)	13.2 ± 2.4	40.6 ± 9.8	t= 21.0, p=0.00

Table-3 shows the association between Vitamin D deficiency and Hypothyroidism. It is found to be statistically significant (p=0.00). There was 9.14 times risk of hypothyroidism in cases of Vitamin D deficiency as compared to those with normal Vitamin D levels (Odds ratio = 9.14, 95% CI= 3.98-21.0).

Table 3: showing association between Vit D deficiency and Hypothyroidism

Vit D status	Cases	Controls	Significance
< 20 ng/ml	43 (71.7%)	13 (21.7%)	p=0.00
≥ 20 ng/ml	17 (28.3%)	47 (78.3%)	OR = 9.14 (95% CI= 3.98 - 21.0)

Similar observations have been reported by other researchers in the studies conducted at different places of India. Koch *et al*[14] in their study done in Meerut found that the mean value of vitamin D in subclinical hypothyroid and overt hypothyroid were significantly lower than the euthyroid (29.07±19.01 ng/ml). There was significant negative correlation between vitamin D and TSH (r=-0.314, P<0.01). Jayakumari *et al*[15] explored vitamin d deficiency as a risk factor for auto immune thyroiditis in south Indian population and concluded that Serum25-OH-D levels < 20 ng/ml was more common in patients with autoimmune thyroiditis than controls (odds ratio=17.9). Idiculla *et al*[16] have observed that 96% hypothyroid individuals had Vitamin D deficiency as compared to 90% controls. Sonawane *et al*[17] concluded that Vitamin D deficiency correlated with increase in levels of TSH. There was progressive decrease in level of Vitamin D from subclinical to overt hypothyroidism. A negative and significant correlation was observed by Lohokare *et al*[18] between 25(OH) Vitamin D and TSH levels (r= -0.45, p < 0.001). The findings of this study are in line with studies conducted at other parts of the country and it estimates the risk of hypothyroidism to be 9.14 times. It has been found that Vitamin D has important role in various metabolic processes of the body[2]. Its etiological role in causation of autoimmune diseases is being explored[6]. VDR gene variations are supposed to mediate susceptibility to various endocrinal autoimmune diseases[19]. Vitamin D and thyroid hormones both act via steroid receptors and hence, any alteration in the level of Vitamin D is likely to increase problems associated with hypothyroidism[20].

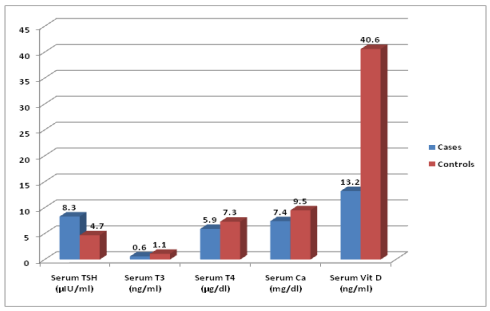

Chart 1: showing biochemical profile of cases and controls

CONCLUSION

The findings of the present study indicated that there is significant association between hypothyroidism and Vitamin D deficiency (p<0.05). The risk of hypothyroidism is increased with Vitamin D deficiency. Large scale studies are needed to find the causality of hypothyroidism. Interventional studies can also be conducted to assess the effectiveness of Vitamin D supplementation in preventing hypothyroidism.

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