

A comparative study of vitamin d level in pulmonary tuberculosis at institute of respiratory diseases, SMS Medical College, Jaipur

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Abstract

Background: Tuberculosis (TB) remains a major challenge to global public health. Tuberculosis is the second most common cause of death from infectious disease (after HIV/AIDS). To study the levels of vitamin D in patients with pulmonary TB as compared to healthy controls (case – control).

Methods: In this study we enrolled 60 study subjects (30 cases with PTB and 30 controls without PTB). We compared the levels of serum vitamin D of the cases with the controls. We evaluated further for the presence

of any correlation between serum vitamin D levels and PTB characteristics.

Results: Mean vitamin D level among the case and control group was 17.14 ± 9.21 and 34.73 ± 14.43 respectively with statistically significant difference as $p < 0.05$.

Conclusion: The present study suggests that PTB patient with low BMI have lower levels of serum vitamin D. These results provide an improved understanding of vitamin D deficiency in pulmonary tuberculosis development and progression.

Keywords: TB, Vitamin D, BMI

Introduction

Tuberculosis (TB) remains a major challenge to global public health. Tuberculosis is the second most common cause of death from infectious disease (after HIV/AIDS).¹ Growing frequency of TB is an alarming situation for the community wellbeing of underdeveloped and industrial nations. 75% of tuberculosis cases in developing countries are in the economically productive age group (15-50 years).²

Serum levels of vitamin D in TB patients are lower than in healthy controls^{2,3} Paradoxically, prolonged treatment of TB also causes a decline in serum vitamin D levels. Previous clinical studies have indicated that "Vitamin D deficiency" is associated with an increased risk of tuberculosis; however, the criteria for Vitamin D deficiency differed among these studies.⁴

Some of these studies used a concentration of vitamin D < 50 nmol/L as a cut-off value for Vitamin D deficiency, while some other studies used a concentration below 25 nmol/L, but the exact range of serum Vitamin D for low serum Vitamin D was not defined. Explicit "dangerous" serum Vitamin D should be more practical in clinical and referable for future studies. It is therefore important to compare levels of vitamin D in Tuberculosis patients and healthy controls.

Material & Methods

Study Design- This was a hospital-based case control study carried out on pulmonary tuberculosis patients attending OPD or hospitalized at Department of Respiratory Medicine, Institute of Respiratory Diseases, SMS Medical College, Jaipur, done over a period of one year (2019 - 2020). Institute of Respiratory Diseases is a tertiary care center for tuberculosis and Respiratory diseases in Rajasthan.

Sample Size- Based on results of seed article a minimum sample of 30 patient in each group (case-

Pulmonary TB and control) can be taken as sample for this study. **Study Approval-** This study was approved by the Ethical Committee and Institutional Review Board, SMS medical college, Jaipur.

Inclusion Criteria

1. All notified new PTB patients both clinically diagnosed and microbiologically confirmed.
2. PTB patients both clinically diagnosed and microbiologically confirmed on treatment with first line drugs including treatment failures.
3. Those who gave written informed consent.

Exclusion Criteria

1. Age less than 18 years and more than 70 years old.
2. Significant smoker (>10 cigarettes/day)
3. Obese patient
4. MDR patients
5. Extra pulmonary tuberculosis
6. Patients prone to Vitamin D deficiency like malabsorption, liver, renal, thyroid disorder and those on drugs that can decrease vitamin D levels.
7. Patients with HIV, Diabetes, on immunosuppressive treatment, severe protein energy malnutrition, malignancy

Data Collection

Patients name, age, sex, race, marital status, occupation and address were recorded.

Symptoms such as dyspnoea, cough, fever, expectoration, haemoptysis, chest pain, loss of appetite, loss of weight and night sweats were recorded and analysed.

Past history of anti-tubercular treatment, associated comorbidity including liver, renal and thyroid disorders was recorded.

Personal history had been taken for smoking and any other addiction. History of diabetes, malignancy or intake of immunosuppressive drugs was noted.

General physical examination & respiratory, abdomen, central nervous and cardiovascular examination also had been done.

For diagnosis of tuberculosis, sputum samples were examined for microscopy and CBNAAT (Cartridge Based Nucleic Acid Amplification Test) or LPA (Line Probe Assay) if needed.

Methods for diagnosis of TB

Microbiologically confirmed TB

For diagnosis of pulmonary tuberculosis we sent sputum samples for microscopy and CBNAAT. Sputum microscopy for AFB smears. It was done by Fluorescence staining. In this method 0.1% Auramine, 0.5% acid alcohols, 0.5% potassium permanganate solution were used. 0.5% acid alcohol was used as decolourising agent and 0.5% potassium permanganate solution was used as counter stain. Acid fast bacilli appear bright yellow against dark back ground material.

Collection of Serum Vitamin D sample was as follows:

Specimen type: Blood serum

Container: BD Vacutainer, red top

Collection method: Venipuncture

Specimen volume: 4.0 mL

Analysis was done using chemiluminescence method by COBAS analyser

Patients were then classified based on their vitamin D levels into deficient, insufficient and normal when vitamin D levels are 30 ng/ml respectively

Statistical Analysis

Data so collected was tabulated in an excel sheet, under the guidance of statistician. The means and standard deviations of the measurements per group were used for statistical analysis (SPSS 22.00 for windows; SPSS inc, Chicago, USA). Difference between two groups was determined using student t-test as well as chi square test and the level of significance was set at $p < 0.05$.

Results

Table 1: Socio-demographic profile

Variable	Case	Control	p-value
Age in yrs	38.37±10.43	47.97±11.98	0.06
Male: Female	20:10	21:9	0.76
BMI in kg/mt ²	21.26±1.91	22.52±1.52	0.004

Mean BMI (kg/m²) among the case and control group was 21.26±1.91 and 22.52±1.52 respectively with statistically significant difference as $p < 0.05$.

Table 2: Comparison of vitamin D level among the study groups

vitamin D level	Case	Control	p-value
Mean	17.14	34.73	<0.01
SD	9.21	14.43	

Mean vitamin D level among the case and control group was 17.14±9.21 and 34.73±14.43 respectively with statistically significant difference as $p < 0.05$. Hence vitamin D level was comparatively less in case group.

Discussion

Tuberculosis (TB) remains a major challenge to global public health. Tuberculosis is the second most common cause of death from infectious disease (after those due to HIV/AIDS). Growing frequency of TB is an alarming situation for the community wellbeing of underdeveloped and industrial nations.

In this study we enrolled 60 study subjects (30 cases with PTB and 30 controls without PTB). We compared the levels of serum vitamin D of the cases with the controls. We evaluated further for the presence of any

correlation between serum vitamin D levels and PTB characteristics.

In our study, the mean vitamin D level among the case and control group was 17.14 ± 9.21 and 34.73 ± 14.43 ng/ml respectively with statistically significant difference as $p < 0.05$. Hence vitamin D level was comparatively less in case group. This may be attributed to low vitamin D intake and lack of sun exposure as most of our patients are of low socioeconomic class.

In the study by Vandana Balgi et al.⁵, the vitamin D levels were assessed in both TB and Non-TB controls and those with values less than 20 pg/ml were considered to be Vitamin D deficient in both cases and controls. The mean Vitamin D in cases was 24.82 ± 12.33 and controls were 34.41 ± 6.19 . Among the cases 25(31.3%) subjects had Vitamin D levels < 20 pg/ml and none of the controls had levels the difference in both group was found statistically significant.

In a study by Nina O. Nielsen et al.,⁶ he found out that mild deficiency (25–49 nmol/l) was observed in 13 % of the patients and 1 % of the controls, whereas insufficiency (50–75 nmol/l) was found in 22 % of the patients and 15 % of the controls. No individuals had severe deficiency (< 25 nmol/l). As there was only one control with 25(OH) D < 50 nmol/l, the categories < 50 nmol/l and 50–75 nmol/l were merged into one category. As there was only one control with 25(OH) D < 50 nmol/l, the categories < 50 nmol/l and 50–75 nmol/l were merged into one category. After adjusting for ethnicity and alcohol, the association between 25(OH)D and risk of TB was U-shaped, with an OR of 6.5 (95 % CI 1.8, 23.5) among individuals with a 25(OH)D concentration < 75 nmol/l, and an OR of 6.5 (95 % CI 1.9, 22.2) among those with a

concentration > 140 nmol/l, when compared with individuals presenting concentrations between 76 and 140 nmol/l. J Y Hong et al.,⁷ found that the median baseline 25-hydroxyvitamin D (25[OH]D) level in the TB group (9.86 ng/ml, IQR 7.19-14.15) was lower than in controls (16.03 ng/ml, IQR 12.38-20.30, $P < 0.001$). The prevalence of severe vitamin D deficiency was higher in patients with TB (51.1%) than in controls (8.2%, $P = 0.001$). The median 25(OH) D level increased from 11.40 ng/ml (IQR 7.85-15.73) to 13.18 ng/ml (IQR 10.60-19.71) after treatment completion ($P = 0.037$). On multivariate analysis, they concluded that presence of TB and histories of TB were independently associated with severe vitamin D deficiency.

Conclusion

The present study suggests that PTB patient with low BMI have lower levels of serum vitamin D. These results provide an improved understanding of vitamin D deficiency in pulmonary tuberculosis development and progression.

Awareness of association between serum vitamin D and PTB in clinical practice may benefit disease outcomes.

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