

Original Research Article

Association of low serum vitamin D level among pulmonary tuberculosis patients

Babulal Bansiwal*, Jitendra Phulwari, Anil Saxena, Shinu A.

Department of Pulmonary Medicine, Government Medical College, Kota, Rajasthan, India

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*Correspondence:

Dr. Babulal Bansiwal,

E-mail: drblbansiwal99@gmail.com

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ABSTRACT

Background: Recent studies suggest that the incidence and severity of tuberculosis is associated with low levels of Vitamin D, this is especially important in developing countries like India which carries a major portion of global Tuberculosis burden. Therefore, this study aimed to determine the prevalence of Vitamin D deficiency in newly diagnosed tuberculosis patients in our institute. Aims and objective is to study the deficiency of Vitamin D In newly diagnosed sputum positive pulmonary TB and to compare the level of Vitamin d with that of age matched healthy control population.

Methods: This was a descriptive cross-sectional case control study to assess Vitamin D deficiency among 140 cases which included 2 categories of patients (a) Group 1: 70 sputum AFB positive newly diagnosed pulmonary TB patients, (b) Group 2: 70 apparently healthy people who came to the hospital with regular checkup.

Results: Mean age of study groups and control in years were, Control: 40.3857 ± 10.231 , Cases: 36.885 ± 11.076 . Mean BMI was significantly higher in controls when compared with new TB cases (19.27 ± 2.455 vs 15.215 ± 1.774) kg/m^2 $p < 0.05$).

There was significant decrease in mean Vitamin D3 value when new cases TB patients were compared with controls (18.212 ± 9.3027 vs 36.1267 ± 8.410) $p < 0.05$).

Conclusions: Patients with tuberculosis are significantly Vitamin D deficient as compared to normal people. This deficiency is more marked in females and those with low BMI. The present finding favours the role of Vitamin D in the prevention and treatment of tuberculosis in developing countries like India.

Keywords: Hypovitaminosis D, Malnutrition, *Mycobacterium tuberculosis*, Pulmonary tuberculosis, Vitamin D

INTRODUCTION

Tuberculosis is most common cause of death world over due to single infectious agent in adult and account for over a quarter of all avoidable death globally. India accounts for nearly one third of global burden of tuberculosis. As per the Global TB report 2017 the estimated incidence of TB in India was approximately 2.8 million accounting for about a quarter of world TB cases.¹ Major factor that contribute to resurgence of tuberculosis in developing countries include

immunosuppression, HIV, multi drug resistant tuberculosis, inadequate treatment, malnourishment, overcrowding, increasing number of displaced population, social insecurities and conflicts etc.^{2,3}

Mycobacteria are highly antigenic, and they promote a vigorous, nonspecific immune response. The antigenicity of mycobacterium is due to multiple cell wall constituents, including glycoproteins, phospholipids, and wax D, which activate langerhans cells, lymphocytes, and polymorphonuclear leukocytes.⁴ The lungs are the most

common site for the development of TB; 85% of patients with TB present with pulmonary complaints. The typical lesion in tuberculosis is an epithelioid granuloma with central caseation necrosis.⁴

There is evidence to suggest that hypovitaminosis D increases the risk of tuberculosis (TB). Vitamin D binds to nuclear receptors in macrophages, leading to an oxidative burst which is important for the intracellular antimycobacterial activity, and vitamin D metabolites also upregulate nitric oxide synthase which serves to suppress mycobacterial growth.^{5,6} The major natural source of the vitamin is synthesis of cholecalciferol in the skin from cholesterol through a chemical reaction that is dependent on sun exposure (specifically UVB radiation). There were reports of association between lower levels of Vitamin D and Tuberculosis.^{6,7} The role of vitamin D in modifying the treatment course of pulmonary tuberculosis is still a matter of debate.

Aim and objective is to study the deficiency of Vitamin D in newly diagnosed sputum positive pulmonary TB and to compare the level of vitamin D with that of age matched healthy control population.

METHODS

This present study was conducted in the department of respiratory medicine, New Medical College, Kota on 70 newly diagnosed sputum AFB positive pulmonary TB patients and 70 apparently healthy control subjects over a period of one year (July 2016- June 2017). It's a Descriptive case control study.

Inclusion criteria

Include 2 categories of patients

- Group 1:70 sputum AFB positive newly diagnosed pulmonary TB patients
- Group 2:70 apparently healthy people who came to the hospital with regular checkup.

Exclusion criteria

- Authors excluded patients with extrapulmonary TB, HIV, Diabetes, alcoholic liver disease, Chronic Kidney disease, malabsorption, patients on immunosuppressive therapy, intake of drugs that can alter vitamin D Level.

After taking an informed consent, through history was taken, physical examination and relevant investigation were done to rule out exclusion criteria and detect other comorbidities. Age, gender, weight and height of the patient were noted. Their clinical details including the symptoms of hypovitaminosis D were recorded.

Nutritional intake was assessed. Samples for Vitamin D were collected and sent for Lab and all the samples are analysed in duplicate for 25OH vit D3 Using a sensitive RIA technique. All data were tabulated and analysed using IBM SPSS version 16 software.

RESULTS

Mean age of cases were 36.38 whereas mean age for controls was 40.38. Majority of patients were males in both cases and control group. The mean BMI was significantly higher in controls when compared with Cases. (19.27±2.455 vs 15.215±1.774) kg/m². BMI has significant correlation between cases and controls (p value <0.05). Cough was the major presenting complaints among cases (87%) followed by Fever (81%). For control group Fever was the major symptoms.

Consolidation was the major x-ray finding among cases (61%) Cavitation was present in 22.85% of cases and other x ray findings like effusion, Pneumothorax and collapse were present in 38.5% of cases. Mean Value of Vit D among cases and controls were 18.212 and 36.12 respectively. There was a significant decrease in mean Vitamin D3 value when new cases TB patients were compared with controls (18.212±9.3027 vs 36.1267±8.410 p <0.05).

Table 1: Mean±standard deviation of vitamin D value in controls and cases.

Parameter	Controls n=70 (M±SD)	Cases n=70 (M±SD)	t-value	p-value
Vit D3	36.1267±8.410	18.212±9.3027	11.951	0.000

DISCUSSION

In our study groups most of the cases where came under the 31 to 40 years of age. Mean age of study groups and control in years were, Control: 40.3857±10.231, Cases: 36.885±11.076. Majority of the study subjects were males. Only 6 patients were in average BMI, rest all

patients were undernourished. Kassim M. Sultan et al, showed a similar result which has said that there is a significant decrease in BMI in pulmonary TB patients when compared with controls.⁸ Deficiency of Vitamin D was markedly high among both male and female subjects. Undernourishment and lack of subcutaneous fat was further linked with Vitamin D deficiency in study

subjects. Similar association was found in various ethnic populations around the globe.

It was found that in our study, there was a significant decrease in mean Vitamin D3 value when new cases of TB patients were compared with controls (18.212±9.3027 vs 36.1267±8.410 p<0.05). Raheel Iftikhar et al, in his study of vitamin D in pulmonary tuberculosis observed a mean Vitamin D levels of 23.23±6.81 ng/ml in cases, 29.27±8.89 ng/ml in controls (p<0.0001).⁹ Syed Fawad Mashhad, in his study on vitamin D levels on tuberculosis patients had a mean vitamin D was much lower (20.688±14.065 nmol/l) in cases as compared to the controls (57.917±18.197 nmol/l).¹⁰

Forward association study between low serum Vitamin D and Pulmonary tuberculosis could be explained by two facts firstly, the active form of vitamin D enhances the ability of macrophages to suppress the intracellular growth of *Mycobacterium tuberculosis*.^{11,12} Secondly, on triggering of toll-like receptors by molecules of the tubercle bacillus, the production of microbe-killing catholising is impaired in the absence of adequate.¹³ Our findings raise the possibility that adequate 25(OH)D levels may protect against primary infection due to *Mycobacterium Tuberculosis*, and this is supported by the work of Martineau et al, in which a single dose of vitamin D improved immunity to *Mycobacteria* in vitro in contacts of patients with TB serum vitamin D.¹⁴

CONCLUSION

Patients with tuberculosis are significantly Vitamin D deficient as compared to normal people. Low serum Vitamin D along with Low BMI could be important predictor of Tuberculosis is susceptible individuals the present finding favors the role of Vitamin D in the prevention and treatment of tuberculosis in developing countries like India.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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