Section: Pulmonary Medicine

Original Research Article

ASSOCIATION OF VITAMIN D AND TUBERCULOSIS IN NEWLY DETECTED TUBERCULOSIS: PULMONARY AND EXTRA PULMONARY PATIENTS ATTENDING TO TERTIARY CARE TEACHING HOSPITAL

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Abstract

Background: Mycobacterium tuberculosis, the infectious disease that causes tuberculosis, has continually presented treatment challenges to humanity because it is becoming more resistant to drugs and taking longer to heal. The more recent strategy looks to boost the human immune system while also suppressing the organism. The study's objectives were to determine whether vitamin D deficiency existed in TB patients and to support the creation of new, improvised strategies for the treatment of TB. The objectives of this research included measuring vitamin D levels in tuberculosis (pulmonary and extrapulmonary) patients and determining whether there is a link between vitamin D and pulmonary or extrapulmonary tuberculosis. **Materials and Methods:** This research is descriptive and cross-sectional. 50 extrapulmonary and pulmonary tuberculosis patients participated in the research. Vitamin D levels in blood samples were assessed, and the findings were compared to 26 age- and sex-matched controls. **Result:** Of the 50 TB patients, 26 had pulmonary tuberculosis that was confirmed by imaging and microbiology, and 24 had extrapulmonary tuberculosis. Pleural fluid made up 66.0% of the 26 EPTB patients, followed by meningitis (22.0%), TB abdomen (8.0%), and lymph node (4.0%). **Conclusion:** This research has focused on the need to address nutritional deficiencies in TB patients in order to increase their chance of curing the disease.

INTRODUCTION

A crucial clinical function in calcium homeostasis and bone metabolism is played by vitamin D, also known as calciferol, which is a fat-soluble vitamin. The liver converts vitamin D from the diet and the skin into 25-hydroxyvitamin D (25(OH)D), which is used to assess the vitamin D level of the patient. In the kidneys, the enzyme 25-hydroxyvitamin D-1hydroxylase transforms this 25(OH)D into its active version, 1,25-dihydroxy vitamin D (1,25(OH)2 D).[1] Mycobacterium tuberculosis, the infectious disease that causes tuberculosis, has continually presented treatment challenges to humanity because it is becoming more resistant to drugs and taking longer to heal. The current TB-HIV outbreaks have increased the treatment's commitments. India has significantly contributed to the worldwide burden of TB, accounting for one-fourth of it.[2] Even though DOTS has reduced mortality and morbidity, more study is required to lessen the severity of the disease in the future. Mycobacterium tuberculosis was first discovered 150 million years ago.[3] The term "Phtisis" was used by the Ancient Greeks to refer to tuberculosis. Hippocrates' writings characterise Phtisis as a fatal illness that strikes young adults, and he elaborates on the classic signs and symptoms as well as the distinctive lung lesions.[4] Rober Koch's discovery of Mycobacterium tuberculosis bacillus in 1882 marked the beginning of a new era in the study of TB. Prior to the development of antibiotics, TB was first managed by isolating patients in sanitoriums. Today, a variety of cutting-edge techniques including lung resection, plombage, fake pneumothorax, and thoracoplasty are used.[5] In the days before antibiotics, vitamin D, a fat-soluble vitamin, was used as an adjunct in the therapy of tuberculosis. Increased recovery rates were linked to the use of cod liver oil that contained vitamin D.[6,7] Waksman made a major advancement in the treatment of tuberculosis with the invention of

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streptomycin in 1943.[8] Several additional medications were added to the list, including PAS, isoniazid, and rifampicin. The first Tb programme was introduced in 1962, and until 1993, when RNTCP was introduced, it experienced gradual changes.[9] This transformed the condition of feared TB into a treatable and manageable illness. Since the introduction of RNTCP, the roster of medications has been expanded by numerous newer molecules. Drug resistance is a growing worry as the number of available medications rises. The more recent strategy looks to boost the human immune system while also suppressing the organism. One such strategy for treating TB is vitamin D therapy. It is well known that vitamin D affects calcium balance and bone metabolism. Additionally, vitamin D is known to have an immunomodulatory impact and certain cellular activity.[10,11] It is well-known that vitamin D improves cellular and adaptive immunity, boosting the host immune system. Thus, the research was carried out to determine whether there was a Vitamin D deficiency among TB patients and to support the creation of newer, improvised strategies for the treatment of TB.

MATERIALS AND METHODS

This descriptive cross-sectional prospective research was carried out at the World College of Medical Sciences Research and Hospital, Jhajjar, in the department of pulmonary medicine. The research included 26 age- and sex-matched healthy controls and 50 extrapulmonary and pulmonary tuberculosis patients. The research included all newly diagnosed TB patients who visited the hospital during the aforementioned time period and provided informed consent. Patients with newly diagnosed TB were those who had been treated with ATT for less than a month and had been detected for the first time. Sputum AFB, CBNAAT, pleural fluid analysis, CSF analysis, ascitic fluid analysis, FNAC, lymph node biopsy, and imaging techniques, as necessary, were used to assist make the diagnosis of TB.

Inclusion Criteria

Age >20 years, newly diagnosed lymph node tuberculosis and extrapulmonary TB, newly diagnosed tubercular pleural effusion, newly diagnosed sputum-positive/radiologically proven pulmonary tuberculosis, and patients on ATT for one month were all inclusion criteria for this research.

Exclusion Criteria

Exclusion criteria for the research included recurrent or reactivated TB, chronic lung disease, patients with chronic kidney disease, diabetes or hypertension, other immune compromised states, and pregnancy.

The Vitamin D levels of all recently diagnosed TB patients were also evaluated by taking 3 millilitres of venous blood. Using a chemiluminescence technique, the centrifuged material was examined for 25 (OH) vitamin D (active form). Results were expressed in pg/ml, with values 20 Pg/ml being deemed vitamin D deficient (VDD) and values between 20 and 30 pg/ml being considered insufficient. Patients with chronic lung disease, chronic renal disease, and chronic liver disease were not included in the research.

Analysis and Comprehension of Data

Analysis and understanding of data Microsoft Excel (Windows 7; Version 2007) was used to input the data, and the Statistical Package for Social Sciences (SPSS) for Windows programme was used to conduct the analyses. (version 20.0; SPSS Inc, Chicago). For categorical variables, frequencies and percentages were computed, while descriptive statistics such as mean and Standard Deviation (SD) for continuous variables were calculated. Chi-Square test for classified variables was used to analyse associations between variables. Using an unpaired t test, the mean comparison of quantitative factors was examined. Pie charts and bar charts were used to visually depict the data that had been analysed. The significance threshold was fixed at 0.05.

RESULTS

50 cases, 26 healthy controls, and 76 research participants made up the sample size. Patients in the instances ranged in age from 20 to 60 years, with the mean age in [Table 1] being 44.42 years. As shown in [Table 2], the demographic information for both the cases and the controls is tallied.

Table 1: shows the age distribution of study population.

Age group in years	Cases (N) %	Control (N) %
≤ 30	14 (28.0%)	06 (23.07%)
30-40	13(26.0%)	07 (26.92%)
40-50	12 (24.0%)	10 (%)38.46
50-60	06 (12.0%)	02 (7.69%)
>60	05 (10.0%)	01 (3.8%)

Table 2: Shows the demographic parameters of study population.

Variables	Cases (N) %	Control (N) %
Age	44.42±10.6	38.21±7.65
Sex		
Male	36 (72%)	20(76.92%)
Female	14 (28%)	06(23.07%)
BMI	21.02±6.32	24.32±7.48

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Tobacco exposure	46%	42.3%
Alcohol	26%	34.6%
Diabetic	03(6.0%)	-

The following table, [Table 3], shows the clinical profile of the study group. In order to compare the clinical parameters between cases and controls, an unpaired t-test was used. The total WBC count and albumin levels showed a statistically significant difference between the two groups, indicating the presence of a significant infection as indicated by an increased WBC count and indirectly a chronic malnutrition state through a lower albumin level.

Table 3: Shows the clinical profile of study population.

Parameters	Cases Mean±S.D.	Control Mean±S.D.	P-value
Haemoglobin	9.94±2.46	11.08±1.72	0.34
Oxygen saturation	93.24±12.6	98.81±13.62	0.21
WBC count	7659±216.4	5879±212.6	0.01
Albumin	3.24±0.64	3.94±0.82	0.01

Table4: Shows the vitamin- D levels in TB and EPTB.

Vitamin- D (Pg/ml)	Pulmonary TB n (%)	Extra- Pulmonary TB n (%)
<20	08 (30.76%)	07(29.2%)
20-30	11 (42.3%)	8 (33.3%)
>30	07 (26.9%)	09 (37.5%)
Mean±S.D.	23.36±8.21	24.7±8.36
Range	6.28-56.2	0.84-60.4

{Note: Unpaired 't' test, P value = 0.05, Significant.}

When compared to controls, the mean vitamin D amounts shown in the graph above [Figure 2] show significantly lower values. Patients with extra-pulmonary Tb had a mean Vitamin D level of 24.7±8.36 pg/ml and those with pulmonary Tb had a mean Vitamin D level of 23.36±8.21 pg/ml. With a p value of 0.05, the single t-test was statistically significant. 08 (30.76%) and 07 (29.2%) of the 15 research participants with vitamin D deficiency had pulmonary and extrapulmonary TB, respectively. [Table 4] shows that 11 (42.3%) and 8 (33.3%) of those with pulmonary and extrapulmonary TB, respectively, had values of 20 to 30 Pg/ml of vitamin D.

Table5: Shows the mean vitamin D levels in EPTB.

Extra pulmonary TB	Mean vitamin -D Levels (Mean±S.D.
Meningitis	8.65±3.35
Abdomen	17.64±8.92
Lymph node	36.46±12.6
Pleural effusion	29.58±10.32

Of the 50 TB patients, 26 had pulmonary tuberculosis that was confirmed by imaging and microbiology, and 24 had extrapulmonary tuberculosis. Pleural fluid made up 66.0% of the EPTB in the 26 EPTB patients, followed by meningitis (22.0%), TB abdomen (8.0%), and lymph node (4.0%) in [Figure 1].

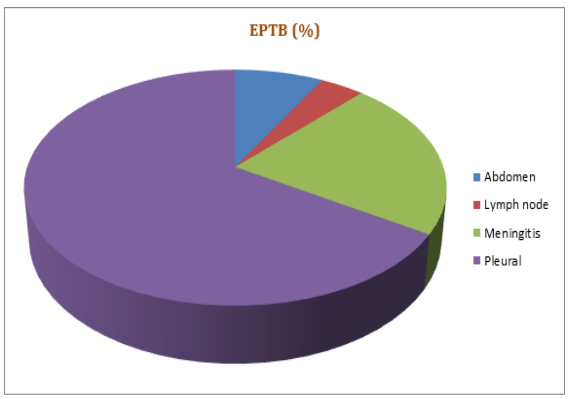

Figure 1: Shows the distribution of EPTB in study population.

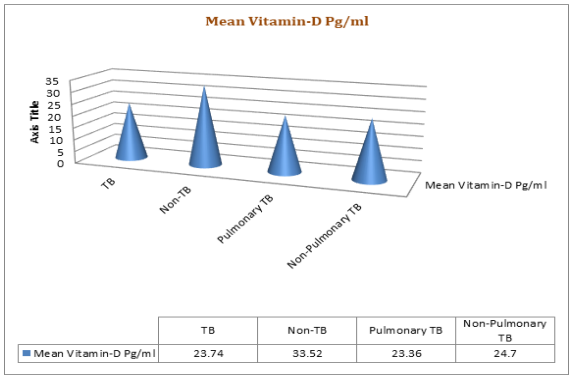

Figure 2: Shows the mean vitamin –D Level in Pg/ml.

Both TB and non-TB controls had their vitamin D levels checked, and those with readings under 20 pg/ml were deemed vitamin D insufficient in both cases and controls. In patients, the mean Vitamin D level was 23.74±10.26, while in controls, it was 33.52±13.21. 15 (30.0%) of the case patients had vitamin D levels below 20 ng/ml, while none of the controls did. When an unpaired-t test was run, there was a statistically significant difference in the levels

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of vitamin D between the cases and the controls (p value 0.05), showing that the cases had a significant vitamin D deficiency.

Further analysis of vitamin D levels in various EPTB types was conducted. When compared to other types of EPTB in [Table5], it was discovered that the mean Vitamin D levels in cases of tubercular meningitis (8.653.35) were considerably lower.

DISCUSSION

Vitamin D insufficiency is present in TB patients, but it is more pronounced in pulmonary TB patients than in extra-pulmonary TB patients. The majority of the patients in this research were male, with a mean BMI of 21.02 and hypoalbuminemia. This indicates malnutrition, which may result in vitamin D and other nutrient deficiencies, increasing the risk of developing the disease. Disease-related nutritional deficiency creates a vicious loop that lowers the likelihood of recovery. Similar studies have been carried out all over the nation, but the majority of them only included patients with pulmonary TB. The current research included both pulmonary and extrapulmonary TB patients.[12-15] Comparing Tubercular meningitis to other forms of TB, the mean vitamin D levels were considerably lower on average, suggesting a higher vitamin D deficiency linked to a more serious illness. In related research, Karoli et al. found that pulmonary tuberculosis patients frequently had hypovitaminosis, and that prompt treatment and vitamin D supplementation would result in early sputum negativity.[16] Generally speaking, vitamin D has immunomodulatory properties. VDRE (Vitamin D receptor element), which are found in lung epithelium and are found throughout the body, are the targets of the active form of vitamin D. Through them, vitamin D increases cathelicidin expression, which then triggers the release of cytokines and the activation of macrophages, resulting in antimicrobial and antiviral activity. Respiratory system infections rise when this is lacking.[17-19] The study has some drawbacks, including the inability to follow up with patients and the absence of interventions like vitamin D supplementation to measure sputum conversions. The study was conducted on a smaller population, so it might not accurately reflect the complete neighbourhood.

CONCLUSION

The research concludes by showing that both pulmonary and extrapulmonary TB patients have vitamin D deficiency. A study has focused on the need to rectify low vitamin D levels in TB patients in order to increase the cure rate. To determine the sputum conversion rates with vitamin D supplementation, more interventional trials are needed.

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