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Original Research Paper, Paediatrics Impact of Vitamin D Supplementation on Nutritional Status and Treatment Results in Pediatric and Adolescent Tuberculosis Patients

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Abstract: ***Tuberculosis (TB) is a communicable disease, one among the top 10 causes of death all over the world. Tuberculosis and malnutrition are usually interlinked. Vitamin D deficiency is observed in TB patients, among children, higher percentage is found in patients older than 10 years of age. This study was planned to compare the effect of vitamin D based on a case control study on weight gain, BMI and outcome of the disease. Hence through this study we aim to evaluate the effect of vitamin D supplementation on nutritional status and outcome of treatment in children and adolescents with TB. It was a Case control Study done at Department of Paediatrics and respiratory medicine, Christian Medical College & Hospital, Ludhiana.65 Newly diagnosed TB patients in the age group of 1 - 18 years. It was seen, that both cases and controls showed similar pattern of weight gain at end of 6 months, where 87% had weight gain while 13% had no gain in weight. When Vitamin D supplementation and weight gain was compared based on type of disease at the end of 6 months, subjects showed weight gain when Vitamin D was given. In this study all patients showed good outcome.***

Keywords: Tuberculosis, Vitamin D, weight gain, BMI, Treatment outcome

1. Introduction

India has an approximately 2 million new cases per year, leading to 18% of the burden of TB in the world.[1]Marginalized sections and the poorest are more affected by the disease.[2] Among the paediatric population majority of cases are seen among the adolescents.[3]

Tuberculosis and malnutrition are interlinked to each other. TB being an infectious disease increases the metabolic needs of the body.[4]Recent evidence suggests that vitamin D has influence on many immune pathways, by increasing the mucosal defences along with reducing the excessive inflammation caused by foreign organisms.5 Vitamin D helps in killing of the mycobacterium with the help of vitamin D/LL - 37 - axis which otherwise is silenced by the RNA interference of the bacterium.[5]

A metanalysis conducted in China showed that a serum Vitamin D level <25 nmol/L was significantly associated with an increased risk of tuberculosis while the range of 51–75 nmol/L was not.[6]

In another case control study by Elly Wijaya Nursyam, Zulkifli Amin, C Martin Rumende in 2006 in Jakarta, the addition of vitamin D in therapy of moderate advanced pulmonary tuberculosis has been proven to show a significant difference in sputum conversion.[7] This study was conducted to see the effect of vitamin D supplementation on disease outcome and nutritional status of patients diagnosed with tuberculosis from 1 year to 18 years of age.

2. Methods

After obtaining the ethical clearance from the Institutional Ethical Committee, the present study was conducted in the Department of Paediatrics, Christian Medical College, Ludhiana over a period of 1 year 6 months. A total of 65 patients were enrolled after fulfilling the inclusion criteria. The informed consent before their participation was obtained from all participants.

Inclusion criteria -
1) Newly diagnosed TB patients in the age group of 1 - 18.

Exclusion criteria -
1) Underlying chronic kidney disease and chronic hepatic diseases.
2) Underlying malabsorption syndrome, coeliac disease or any condition affecting absorption of the drug.
3) Patients who have received high dose of vitamin D in 6 months prior to enrolment.
4) Refused to participate.
5) ATT defaulters or loss to follow up.

Data Management
The weight of the child was taken to the nearest 0.1 kg using Salter Digital Electronic Weighing Scale Model 9000. For children under 2 years of age, infantometer was used while above 2 years height was measured to the nearest 1mm using Portable Stadiometer, Samso Height Scale by Doctor Beli Ram and Sons Pvt Ltd. Body Mass Index was calculated as BMI= weight (kg) / height^2 (m^2) and nutritional status will be classified using WHO growth charts in children less than 5 years of age and IAP growth charts in older children.

At enrolment in the study, Height, weight and BMI was noted prior to starting ATT and compliance along with weight and BMI was monitored every month for 6 months. The subjects were assigned alternatively to two groups by method of simple randomization: Case (They received vitamin D in form of supplementary dosage 3, 00, 000 per 6 months).8Control (They did not receive vitamin D supplements).

Treatment outcome follow up at completion of 6 months of ATT was noted as per WHO criteria as either successful or poor outcome. Successful outcome when TB patients are either cured defined by negative smear microscopy at the end of treatment and on at least one previous follow - up test or completed treatment with resolution of symptoms.9 Poor outcome if treatment of TB patients resulted in treatment failure explained by remaining smear - positive after 5 months of treatment, lost to follow - up (patients who interrupted their treatment for two consecutive months or more after being one month on treatment), or death.[9, 10]

Statistical Analysis: The data was entered in Microsoft excel sheet. Data was summarized using frequency distribution and descriptive analysis. Chi square test was used to find the association of categorical variables between the groups. Post hoc analysis was used with bonferroni correction. The P value <0.05 will be considered significant. All statistical analysis was performed using SPSS (Statistical Packages for Social Sciences, version 21.0. Armonk, NY: IBM corp.).

3. Result

During the study period, 65 newly diagnosed children of both gender with pulmonary and extrapulmonary tuberculosis were enrolled from 1 year to 18 years of age. Among, 65 enrolled patients, one expired and was not taken for comparisons. Out of 64 remaining patients, 32 received Vitamin D while the rest half did not.

Demographic distribution of study subjects
The data of this study shows that among 64 study subjects, 33 were males (51.5%) and 31 were females (48.4%). Age distribution showed 7 (11%) from 0 - 5 years of age, 20 (31%) from 5 - 10 years of age and 37 (58%) were 10 - 18 years of age (Table 5), which was statistically non - significant. Majority of the cases were adolescents.

Nutritional status distribution of study subjects
In this study, the nutritional status is assessed using Protein energy malnutrition for under 5 years and Body Mass Index above 5 years of age. In this study, PEM status was seen for 7 patients, out of which 3 (43%) were malnourished and all belonged to Grade 1 malnutrition. Based on BMI of study subjects, majority of the cases were normal while 14 patients (25%) were underweight and 6 (11%) were overweight.

In this study, after giving Vitamin D to cases, weight gain was compared every month the results of which were statistically not significant (Table 1). Among 32 case subjects, 24 (87%) showed weight gain at the end of our study while 4 (13%) had no gain in weight. Similar results were found in the control group which was found to be statistically non - significant (p value= 0.7).

Table 1: Weight gain comparison with Vitamin D supplementation

		Vitamin D					
		Given (N=32)		Not given (N=32)		df	p
		n	%	n	%		
1st month	Gain	19	59%	17	53%	11	1
	No gain	13	41%	15	47%		
2nd month	Gain	27	84%	26	81%		
	No gain	5	16%	6	19%		
3rd month	Gain	29	91%	29	91%		
	No gain	3	9%	3	9%		
4th month	Gain	29	91%	32	100%		
	No gain	3	9%	0	0%		
5th month	Gain	29	91%	32	100%		
	No gain	3	9%	0	0%		
Final	Gain	28	88%	28	88%		
	No gain	4	13%	4	13%		

p value <0.05 statistically significant; Chi square test used

Type of disease and Vitamin D comparison
In this study at the end of 6 months, among the pulmonary group, 46% of cases while 39% of controls gained weight. Among the extrapulmonary group, 42% of cases while 47% of controls showed weight gain. This result obtained was statistically significant. (Table 2).

Table 2: Weight status based on type of disease

	Vitamin D given		Vitamin D not given		df	p
Type	Gain	No Gain	Gain	No Gain		
Pulmonary (n=28)	13	4	11	0	3	0.04
Extrapulmonary (n=36)	15	0	17	4		

p value <0.05 statistically significant; Chi Square test used

Outcome of the study
All the 64 subjects in this study had good outcome, which was categorized as treatment completed and cured, 58% and 42% respectively.

4. Discussion

Tuberculosis is one of the communicable diseases with high mortality and morbidity in India. Vitamin D deficiency is seen to be associated with tubercular patients but with very less data available regarding the possible benefits from Vitamin D supplementation. There is very limited data available to confirm the benefits of Vitamin D supplementation in children with tuberculosis. This prospective, case control study was done in the Department of Paediatrics, Christian Medical College and Hospital, Ludhiana to study the effect of vitamin D supplementation on the nutritional status and outcome of treatment in children and adolescents with TB.

In majority of the studies, it is observed that males are more affected than females with Tuberculosis. Similar results were found in this study. This difference can be due to male seeking more medical attention than female. Age distribution in this study showed that 11% were 0 - 5 years, 31% were >5 - 10 years, 58% >10 - 18 years of age,

showing adolescent predominance. Indian Nikshay portal of 2021 also showed adolescent preponderance in the annual data review.[3]

In this study, majority of the patients belonged to extra - pulmonary group. It is a positive factor that both extrapulmonary and pulmonary groups were compared in this study as majority of the studies done previously are in Pulmonary TB patients when studied with comparison to Vitamin D. Here, at the end of 6 months, it is observed among cases, 54% extrapulmonary while 46% pulmonary subjects showed weight gain, which came to be statistically significant.

It was observed in the present study that similar results were obtained with 87.5% weight gain in both the groups but this result was proved to be statistically non - significant. A similar study in Pakistan, correlated weight and BMI gain after administration of Vitamin D and statistically significant weight gain was observed in both entities.[11]

All the study subjects completed the course of treatment.42% were cured (microbiologically confirmed) and 58% were in treatment completed (clinical resolution of symptoms) category.

The study of Vitamin D supplementation in tuberculosis patients give us a better picture and more opportunity to study benefits in children based on nutritional outcome. It will open new pathways to search for possiblemechanism of action of Vitamin D, to prevent the spread and to find newer modalities of treatment of Tuberculosis in children.

5. Conclusion

Tuberculosis being one the leading causes of death among population, childhood tuberculosis contributes 31% of the total burden. We observed in this study that adolescents were the most commonly affected age group. This could be attributed to enhanced social involvement leading to more exposure to pathogen. In paediatric population clinical symptoms are of paramount importance to make diagnosis of Tuberculosis as only 19% microbiological samples were tested positive for tuberculosis and majority had normal weight and BMI. Vitamin D supplementation may be given to tubercular paediatric patients although its positive association needs to be studied more. All study subjects had good outcome, which shows that TB if recognized early and managed appropriately has higher success rate.

Future Scope: Vitamin D levels can be done at the start and end of study for better comparison.

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

Declaration of Conflicting Interests: The author (s) declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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