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Original Research Article

Clinico-epidemiological profile and diagnostic procedures in suspected pediatric tuberculosis in a tertiary care centre in Tamil Nadu

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ABSTRACT

Background: Childhood tuberculosis (TB) remains a significant public health challenge, particularly in developing countries like India. Pulmonary TB is predominant in children, but a substantial proportion also present with extrapulmonary TB. This study aims to analyze clinico-epidemiological profile and diagnostic procedures in suspected pediatric TB cases at a tertiary care center in Cuddalore.
Methods: A hospital-based cross-sectional study was conducted from January 2023 to June 2024, involving 200 children suspected of having TB who presented to the pediatrics department. Data were collected using a pretested proforma, capturing socio-demographics, clinical features, and diagnostic procedures. Diagnostic confirmation was made using various diagnostic methods. Statistical analysis performed using SPSS version 25, with chi-square tests to assess associations.
Results: The study included 200 suspected children with a mean age of 7.47 years. Extrapulmonary TB was more prevalent (67.5%) than pulmonary TB (32.5%). Majority (85%) were from rural areas, with significant associations between extrapulmonary TB and malnutrition, lymph node involvement, and specific diagnostic modalities. 11.25% of cases were microbiologically confirmed through CBNAAT. Extrapulmonary TB was diagnosed primarily via cytopathology and imaging, whereas pulmonary TB cases were often identified by chest X-ray and CBNAAT.
Conclusions: The findings highlight high prevalence of extrapulmonary TB among children in rural, economically disadvantaged areas, with malnutrition being a significant risk factor. It underscores the need for enhanced diagnostic capabilities, especially in resource-limited settings, to improve TB detection. Expanding access to molecular diagnostics and integrating nutritional interventions are essential for better management.

Keywords: Pediatric TB, Extrapulmonary TB, CBNAAT, Malnutrition

INTRODUCTION

Childhood tuberculosis (TB) is a significant issue all over the world but mainly in developing countries like India.[1] Roughly 342,000 children (aged 0-14) in India are anticipated to contract tuberculosis each year, accounting for roughly 6% of the total tuberculosis cases reported to the national tuberculosis elimination programme (NTEP) in 2020. In 2020, the NTEP received reports of over 100,000 children aged 0 to 14 with TB, and an additional 140,000 children aged 15 to 18 with TB.

India accounts for around 30% of the worldwide population of children with tuberculosis, even though there is an estimated 56% gap in detecting cases. Individuals aged 14 and below make up 35% of the population in our nation and are projected to account for around 10% of the caseload.[2] However, the stated figures may underestimate the actual number of children affected, as numerous children receive treatment from sources other than national TB programme. Pulmonary TB is the predominant kind of TB seen in children. However, compared to adults, children have a higher proportion of cases with extra-pulmonary TB (EPTB).[1,3,4]

Adults and older children are more prone to have the contagious variant of TB, which can be verified by sputum testing.[2] Conversely, smaller children often exhibit TB forms that are not easily detectable through sputum smears.[4] Microbiological testing is necessary to confirm the presence of TB and determine its medication sensitivity. However, the complexity of diagnosing TB in children sometimes poses difficulties in decentralizing the testing to the community level. [1,5]

The NTEP has authorized and utilized advanced molecular diagnostic technologies such as newer generation cartridge-based nucleic acid amplification assays (Xpert-RifTM/TruenatTM) and line probe assays (LPA).[1] These tests have the ability to quickly detect Mycobacterium TB with far higher accuracy than traditional smear testing, especially in samples from youngsters. Utilizing chest imaging for early screening is beneficial in prioritizing patients for testing by NAAT, as the symptoms indicative of pulmonary TB are vague and can overlap with other conditions. [6]

The aim of this study was to study on the clinical and epidemiological profile of childhood TB and procedures used in diagnosis of suspected pediatric TB patients.

METHODS

The study was conducted in department of pediatrics, government Cuddalore medical college and hospital, Cuddalore over a period of 1 year 6 months as a hospital based cross sectional study after obtaining institutional ethical committee approval. Study population was children attending pediatrics OPD and admitted in ward/PICU with suspicion of TB at GCMCH, Cuddalore. Sample size was calculated based on TB management guidelines by NTEP in 2022 where the prevalence of pediatric TB was 6%; with 95% confidence interval, 10% absolute precision and with 10% excess sampling to account for non-response

Inclusion criteria

Any child <12 years with fever for 2 weeks or more, unremitting cough for 2 weeks or more, no weight gain despite adequate nutrition or loss of >5% of body weight in past 3 months or failure of nutritional rehabilitation in babies with SAM, recent history of measles, whooping cough or immunocompromised state, painless swelling in a group of superficial nodes, chest X-ray suggestive of pleural effusion, meningitis of insidious onset, spine gibbus and any non-specific symptoms in a contact of confirmed case of pulmonary TB were included.

Exclusion criteria

Patients with age group more than 12 years, children less than 12 years who are on ATT and n ot giving consent for the study were excluded.

Study method

Informed consent was obtained from the parents or caregiver of children with suspected TB. Pretested, semi-structured interviewer administered proforma was then completed. Careful methodological examination was done. Necessary investigations were taken and treatment was given according to the diagnosis. The children were monitored until they either recovered or died.

Data processing and analysis

Data were entered in Microsoft excel and SPSS version 25 was used for analysis. P value of less than 0.05 was considered as significant.

RESULTS

The mean age of the study participants was 7.47±3.20. One participant (1.25%) was less than 1 year, 30 participants (37.50%) were between 1 to 6 years and 49 participants (61.25%) were between 7 to 12 years (Table 1). The 41 participants (51.25%) were males and 39 participants (48.75%) were females (Table 2). The 34 participants (42.50%) were from the lower middle class, 33 participants (41.25%) were from the upper lower class, 8 participants (10%) were from the upper middle class, and 5 participants (6.25%) were from the lower class (Table 3). Seven participants (33.75%) experienced a fever lasting more than 2 weeks, 31 participants (38.75%) had a cough lasting more than 2 weeks, 18 participants (22.50%) reported appetite loss, and 41 participants (51.25%) experienced weight loss additionally, 19 participants (23.75%) reported breathlessness, 1 participant (1.25%) had meningitis, 3 participants (3.75%) experienced bone pain, 2 participants (2.50%) reported abdominal pain, and 1 participant (1.25%) had chest pain (Figure 1). The mean height of the study participants was 111.17±19.37. The mean weight of the study participants was 20.90±10.01 kg. The 39 participants (48.75%) were underweight, 21 participants (26.25%) had stunting, and 36 participants (45%) suffered from severe acute malnutrition (Table 4).

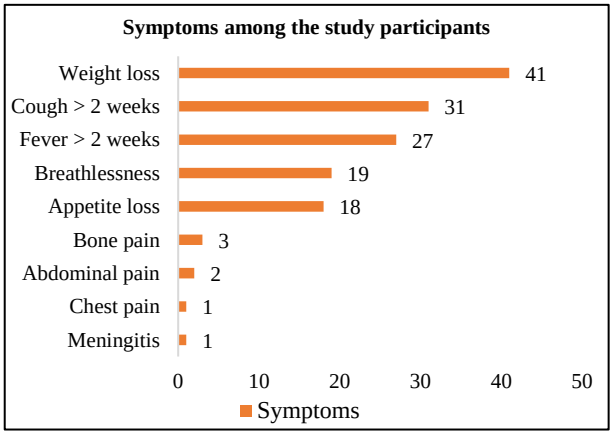

Figure 1: Symptomatology among study participants.

The 45 participants (56.25%) had diagnosis by cytopathology, 17 participants (21.25%) by a chest x-ray, 9 participants (11.25%) by CBNAAT, 3 participants (3.75%) by CT chest, 3 participants (3.75%) had by MRI, 2 participants (2.50%) by CT abdomen and 1 participant (1.25%) by MRI brain (Table 5). The 71 participants (88.75%) were clinically diagnosed, while 9 participants (11.25%) were microbiologically diagnosed (Table 6). The 45 participants (56.25%) had lymph node involvement, 26 participants (32.50%) had pulmonary involvement, 3 participants (3.75%) had pleural TB, 3 participants (3.75%) had bone involvement, 2 participants (2.50%) had abdominal TB and 1 participant (1.25%) had meningeal TB (Table 7). 54 participants (67.50%) were diagnosed with extrapulmonary TB, while 26 participants (32.50%) were diagnosed with pulmonary TB (Figure 2).

Among those who underwent cytopathology, 45 participants (100.0%) had extrapulmonary TB, and none had pulmonary TB. For participants who had a chest X-ray, 3 participants (17.65%) had extrapulmonary TB, while 14 participants (82.35%) had pulmonary TB. Among those who underwent CBNAAT, all 9 participants (100%) had pulmonary TB. Similarly, all 3 participants (100%) who had a CT chest scan had pulmonary TB. For those who had a CT abdomen scan, 2 participants (100%) had extrapulmonary TB. Among those who had an MRI, 3 participants (100%) had extrapulmonary TB, and the single participant who had an MRI brain also had extrapulmonary TB. This difference was statistically significant by Chi square test (Table 8). Among those clinically diagnosed, 54 participants (76.06%) had extrapulmonary TB, while 17 participants (23.94%) had pulmonary TB. All 9 participants (100.0%) who were microbiologically diagnosed had pulmonary TB. This difference was statistically significant by Chi square test (Table 9).

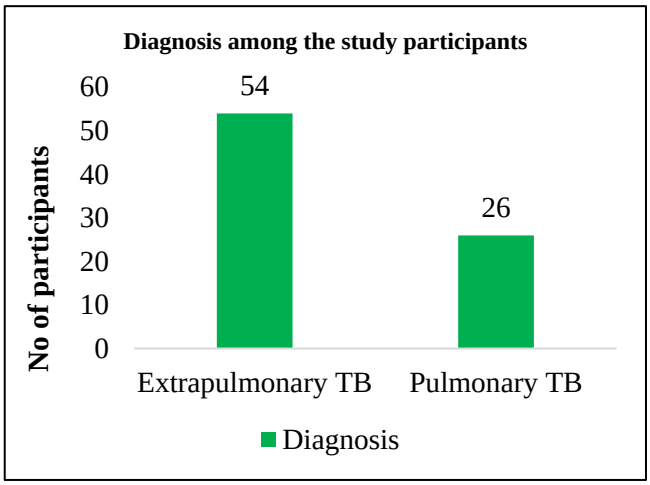

Figure 2: Types of tuberculosis among study participants.

Table 1: Age group of the study participants.

Variables	Age group (in years)			Gender		Total
	<1	1-6	7-12	Male	Female	
Frequency	1	30	49	41	39	80
Percentage (%)	1.25	37.50	61.25	51.25	48.75	100

Table 2: Socioeconomic status of the study participants.

Socioeconomic status	Lower middle	Upper lower	Upper middle	Lower	Total
Frequency	34	33	8	5	80
Percentage (%)	42.50	41.25	10	6.25	100

Table 3: Malnutrition among the study participants.

Malnutrition	Underweight	Stunting	Severe acute malnutrition
Frequency	39	21	36
Percentage (%)	48.75	26.25	45

Table 4: Diagnostic test among the study participants.

Diagnostic test	Cytopathology	Chest X-ray	CBNAAT	CT chest	MRI	CT abdomen	MRI brain	Total
Frequency	45	17	9	3	3	2	1	80
Percentage (%)	56.25	21.25	11.25	3.75	3.75	2.50	1.25	100

Table 5: Microbiologically confirmed among the study participants.

Microbiologically confirmed	Clinically diagnosed	Microbiologically diagnosed	Total
Frequency	71	9	80
Percentage (%)	88.75	11.25	100

Table 6: Site of disease among the study participants.

Site of disease	Lymph node	Pulmonary	Pleural TB	Bone	Abdominal TB	Meningeal TB	Total
Frequency	45	26	3	3	2	1	80
Percentage (%)	56.25	32.50	3.75	3.75	2.50	1.25	100

Table 7: Association between diagnostic test and diagnosis among the study participants.

Diagnostic test	Extrapulmonary TB, N (%)	Pulmonary TB, N (%)	Total, N (%)	Chi square value	P value
Cytopathology	45 (100)	0 (0.0)	45 (100)	68.73	0.001*
Chest X-ray	3 (17.65)	14 (82.35)	17 (100)		
CBNAAT	0 (0.0)	9 (100)	9 (100)		
CT chest	0 (0.0)	3 (100)	3 (100)		
CT abdomen	2 (100)	0 (0)	2 (100)		
MRI	3 (100)	0 (0)	3 (100)		
MRI brain	1 (100)	0 (0)	1 (100)		
Total	54 (67.5)	26 (32.5)	80 (100)		

*Statistically significant by Chi square test

Table 8: Association between Microbiologically confirmed and diagnosis among the study participants.

Microbiologically confirmed	Extrapulmonary TB, N (%)	Pulmonary TB, N (%)	Total, N (%)	Chi square value	P value
Clinically diagnosed	54 (76.06)	17 (23.94)	71 (100)	17..73	0.001*
Microbiologically diagnosed	0 (0.0)	9 (100)	9 (100)		
Total	54 (67.5)	26 (32.5)	80 (100)		

*Statistically significant by Chi square test

DISCUSSION

The study provides an in-depth examination of the socio-demographic, clinical, and diagnostic characteristics of paediatric TB patients.

The average age of the individuals included in the study was 7.47±3.20 years. A greater proportion of participants, specifically 61.25%, fell within the age range of 7-12 years. The age distribution seen in this study aligns with findings from earlier research, such as the studies conducted by Kumar et al and Nandarvawala et al.[7,8] The gender distribution was approximately balanced, with 51.25% men and 48.75% females, suggesting that TB affects both genders in a roughly equal manner. These results align with the findings of Gupta et al and Muley et al who also observed comparable gender distributions.[14,15]

The participants' socioeconomic status analysis indicated that 83.75% of them were from lower socioeconomic classes, with a notable fraction coming from the lower middle class (42.50%) and higher lower class (41.25%). The correlation between lower socioeconomic position and the prevalence of TB is extensively supported in the literature, as evidenced by research conducted by Nandarvawala et al and Sharma et al.[8,12] These studies highlight the significant influence of poverty and inadequate living circumstances on transmission of TB.

The study found weight loss (51.25%), persistent cough lasting more than 2 weeks (38.75%), and prolonged fever lasting more than 2 weeks (33.75%) as the most prevalent symptoms seen in the patients. The results align with the findings of Nandarvawala et al and Gosai et al who also observed comparable symptom patterns.[8,13] A notable discovery was the prevalence of malnutrition, with 48.75% of the subjects exhibiting underweight and 45.00% experiencing severe acute malnutrition. Multiple-research, such as those conducted by Rebecca et al and Kumar et al provide evidence for the link between malnutrition and TB.[7,9] These studies emphasise that malnutrition is a significant risk factor for TB in children.

The analysis of the chest X-ray data indicated that 40.00% of the subjects exhibited abnormal results, with cavities (13.75%) and fibro-cavitary lesions (11.25%) being the prevailing abnormalities. The radiography findings align with the findings published by Sharma et al and Gupta et al.[11,14]

The study revealed that cytopathology was utilized in 56.25% of cases, while chest X-ray was employed in 21.25% of cases, making them the most often employed diagnostic procedures. Only 11.25% of cases were confirmed with microbiological testing, which emphasizes the difficulties in detecting tuberculosis in youngsters. These findings align with the results published by Vasumathy et al and Rebecca et al who

similarly observed the challenges in obtaining microbiological confirmation for cases of tuberculosis in children.[9,10]

The prevalence of extrapulmonary TB was 67.50%, which was higher than the prevalence of pulmonary TB at 32.50%. Among the cases of extrapulmonary TB, the most common site of illness was lymph node involvement, accounting for 56.25% of cases. The prevalence of extrapulmonary TB aligns with the results of studies conducted by Nandarvawala et al and Muley et al which similarly found elevated rates of extrapulmonary TB in youngsters.[8,15] The study's results on the correlation between age, gender, locale, socioeconomic status, and TB type were mostly in line with existing research. However, the only statistically significant correlation was found between socioeconomic status and TB type.

The study's findings align well with prior studies on pediatric tuberculosis. Kumar et al found comparable age and gender distributions, symptom profiles, and difficulties in confirming microbiological results.[7] Nandarvawala et al and Rebecca et al emphasized the elevated occurrence of extrapulmonary TB and the substantial influence of malnutrition.[8,9] The study's results about the correlation between socioeconomic class and the type of tuberculosis, namely the greater occurrence of extrapulmonary tuberculosis in lower socioeconomic categories, are corroborated by Sharma et al and Gosai et al.[11,13]

Overall, this study offers significant knowledge on the socio-demographic, clinical, and diagnostic characteristics of children with tuberculosis. The results emphasize the substantial prevalence of TB in rural and economically disadvantaged groups, the crucial impact of malnutrition, and the difficulties in obtaining microbiological confirmation. These observations emphasize the necessity of focused public health efforts, enhanced diagnostic methods, and combined TB and nutrition initiatives to tackle the significant prevalence of paediatric TB. The study's results align well with other studies, emphasizing the significance of these variables in the epidemiology of paediatric tuberculosis. Subsequent investigations should priorities the advancement and use of economical diagnostic methods and public health approaches to alleviate the impact of tuberculosis in children, especially in areas with little resource

CONCLUSION

This study offers valuable insights into the socio-demographic, clinical, and diagnostic characteristics of paediatric TB patients, emphasizing a substantial prevalence of TB in rural and economically disadvantaged groups. 32.5% were pulmonary TB and remaining were extrapulmonary TB. 11.25% were microbiologically confirmed for TB. Among those suspected to have TB, 42.7% had Tuberculosis. The results highlight the significant occurrence of extrapulmonary TB in children, the connection with malnutrition, and the difficulties in confirming the presence of the TB bacteria in paediatric population. These findings emphasize the necessity of focused public health actions, such as better healthcare accessibility, expanded nutritional assistance, and the creation of affordable diagnostic methods. To mitigate the impact of TB in children and enhance health outcomes in settings with limited resources, it is crucial to address these aspects. Further studies should priorities longitudinal studies in order to provide a more comprehensive understanding of the causal connections and efficacy of combined tuberculosis and nutrition programmes.

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