Original Article

Clinico-Epidemiological Profile of Paediatric Tuberculosis Patients Attending a Tertiary Care Centre in Central India: A Cross-Sectional Study

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Abstract

Background: Paediatric tuberculosis (TB) remains a major public health problem in India, characterized by various clinical manifestations and strong epidemiological determinants. Understanding the clinico-epidemiological profile is essential for early diagnosis and effective management. **Material and Methods:** This hospital-based cross-sectional study was conducted at a tertiary care centre in Central India and included 150 paediatric TB patients diagnosed as per NTEP guidelines. Data on demographic characteristics, socioeconomic status, BCG vaccination, contact history, nutritional status, clinical presentation, and type/site of TB were analyzed using descriptive statistical methods. **Results:** The majority of cases were aged >10 years (36%), followed by 5–10 years (30.7%). A male predominance was observed (60%). Most patients were from urban areas (79.3%) and belonged to lower or upper-lower socioeconomic classes (58.7%). BCG vaccination scar was present in 76% of children, while 21.3% had a positive contact history. Malnutrition was observed in 21.3% of cases. Fever (69.3%), cough > 15 days (50.7%), and weight loss (45.3%) were the most common symptoms. Extrapulmonary TB constituted a substantial proportion, with CNS (24.0%), lymph node (15.3%), abdominal (12.7%), and pleural (9.3%) involvement, while pulmonary TB accounted for 31.3%. **Conclusion:** Paediatric TB predominantly affects socioeconomically disadvantaged urban populations and presents with diverse clinical manifestations. Malnutrition and contact history remain important risk factors. Strengthening early detection and comprehensive evaluation is essential to improve outcomes.

Keywords: Epidemiology, Paediatric TB, clinical profile, extrapulmonary TB, Central India.

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Introduction

Tuberculosis remains a significant global health problem, with India bearing the highest burden worldwide. Paediatric tuberculosis represents a critical subset of the disease, often reflecting ongoing transmission within the community.[1,2]

Children are particularly vulnerable due to immature immunity, malnutrition, and close household exposure. The clinical presentation is often non-specific, leading to delays in diagnosis. Furthermore, the high proportion of extrapulmonary TB in children adds to diagnostic complexity.[3-5]

Although paediatric tuberculosis remains a major public health concern in India, region-specific data describing the clinico-epidemiological profile of affected children are limited, particularly from Central India, including Madhya Pradesh. Variations in socioeconomic conditions, healthcare access, nutritional status, and disease patterns across regions necessitate localized data to better understand disease presentation.

In this context, understanding the demographic characteristics, risk factors, and clinical patterns of paediatric TB patients at tertiary care centres is essential for improving early diagnosis, optimizing management strategies, and guiding public health interventions.

Aim and objectives

To describe the clinico-epidemiological profile of paediatric tuberculosis patients, including demographic characteristics, epidemiological risk factors, and clinical presentation, at a tertiary care centre in Central India using a cross-sectional study design.

Materials and Methods

Study Design and Setting: This observational cross-sectional study was conducted over a period of 12 months (from January 2025 to January 2026) in the Department of Paediatrics, Maharaja Yeshwantrao Hospital (MYH) and Chacha Nehru Bal Chikitsalaya (CNBC), Indore, which are tertiary care teaching hospitals attached to Mahatma Gandhi Memorial Medical College (MGMMC), Indore.

Study Population: Children aged ≤18 years attending the paediatric outpatient department (OPD) and inpatient department

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(IPD) of the study centre confirmed with paediatric TB as per NTEP guidelines during the study period.

Sample Size and Sampling: A total of 150 children were enrolled using selection criteria. The sample size was determined based on the feasibility of patient availability during the study period and previous hospital-based studies on pediatric TB conducted in similar settings.

Inclusion Criteria: Paediatric TB cases of Age ≤18 years with confirmed paediatric TB as per NTEP guidelines and parents willing to give Informed consent.

Exclusion Criteria: Conditions mimicking TB such as congenital chest deformities, cystic fibrosis, or other chronic pulmonary diseases and parents refused to give consent.

Data Collection tools: Data were collected using a pre-tested proforma containing Socio-demographic details, Clinical presentation and site of TB, contact history and nutritional status, BCG vaccination status and radiological findings.

Study Procedure and Data Collection: After confirmation of diagnosis as per NTEP guidelines, a detailed clinical history was obtained and a thorough physical examination was performed for each participant. Data were collected prospectively using a pre-designed, structured proforma.

All relevant investigations, including haematological, microbiological, and radiological tests, were carried out as part of standard patient care. No additional procedures were performed solely for research purposes. Patient management was conducted according to national guidelines (NTEP) and was not influenced by study participation.

Statistical Analysis: Data were entered in Microsoft excel and analyzed using SPSS 25.0 trial version, descriptive statistics were used for analysis. Continuous data was expressed in terms of mean and standard deviation. Categorical data was expressed in terms of frequencies and percentages.

Results

Table 1: Socio-Demographic profile of subjects

Sl. No.	Variable	Number (n=150)	Percentage (%)
1.	Age group		
	0–1 year	16	10.7
	1–5 years	34	22.7
	5–10 years	46	30.7
	>10 years	54	36.0
	Mean ± SD		
	7.53 ± 4.34		
2.	Sex		
	Male	90	60.0
	Female	60	40.0
3.	Residence		
	Urban	119	79.3
	Rural	31	20.7

36% of participants belongs to >10 years age and 30.7% of participants belongs to 5-10 years age group. Participants had a mean age of 7.53 years (SD 4.34). Males predominate with 60% of participation. 79.3% of participants residing at urban areas.

Table 2: Socioeconomic and Epidemiological Factors

Sl. No.	Parameter	Number (n=150)	Percentage (%)
1.	Socio-Economic class		
	Lower class	36	24.0
	Upper lower	52	34.7
	Lower middle	32	21.3
	Upper middle	30	20.0
2.	BCG scar status		
	Present	114	76.0
	Absent	36	24.0
3.	Contact history		
	Present	32	21.3
	Absent	118	78.7

Majority of the participants belongs to lower socioeconomic strata (24.0% lower & 34.7% upper lower class). Majority (76.0%) of the participants have taken BCG vaccine. Contact history with TB cases present in 21.3% of participants.

Table 3: Nutritional Status of subjects

Sl. No.	Status	Number (n=150)	Percentage (%)
1.	Normal	118	78.7
2.	Undernutrition (>5 yrs)	24	16.0
3.	SAM (<5 yrs)	8	5.3

16% of participants are undernourished and 5% are with Severe Acute Malnutrition (SAM).

Table 4: Clinical Presentation of paediatric TB cases

Sl. No.	Symptom	Number (n= 150)	Percentage (%)
1.	Fever	104	69.3
2.	Cough >15 days	76	50.7
3.	Weight loss	68	45.3
4.	Lymphadenopathy	62	41.3
5.	Seizures	32	21.3
6.	Altered sensorium	28	18.7
7.	Respiratory distress	18	12.0
8.	Abdominal distension	14	9.3
9.	Paraparesis	4	2.7

Fever was the most common (69.3%) presenting symptom followed by cough >15 days (50.7%), weight loss (45.3%) and lymphadenopathy (41.3%).

Table 5. Type and Site of Tuberculosis in subjects

Sl. No.	Site of involvement	Number of cases	Percentage (%)
1.	Pulmonary	47	31.3
2.	CNS	36	24.0
3.	Lymph node	23	15.3
4.	Abdominal	19	12.7
5.	Pleural	14	9.3
6.	Musculoskeletal	4	2.7
7.	Disseminated	4	2.7
8.	Congenital	3	2.0
Total		150	100

- Pulmonary TB: 31.3%
- Extrapulmonary TB: 68.7%

Most common extrapulmonary TB site is CNS (24.0%), followed by lymph node (15.3%), abdomen (12.7%), and pleura (9.3%). Out of the 150 cases, 52 cases were CBNAAT positive and rest were diagnosed clinically or on the basis on blood investigations, imaging and histopathological examination.

Discussion

This study provides a comprehensive overview of the clinico-epidemiological profile of paediatric tuberculosis (TB) patients attending a tertiary care hospital in Central India, highlighting the influence of demographic, socioeconomic, immunological, nutritional, and clinical factors on disease presentation.

Socio-demographic Profile: In the present study, tuberculosis was more commonly observed in older children, with the highest prevalence in those more than 10 years, followed by the 5-10 years age group. This age distribution is aligned with studies by Zahra Movahedi et al. and Rosina Ksoo et al., who stated increased disease burden in school-aged children and adolescents, likely due to greater environmental exposure and evolving immune responses.[6,7]

A male predominance (60.0%) was found in present study, aligning with findings from Movahedi Z et al. and Aygun D et al.[6,8] This pattern may be ascribed to a combination of biological susceptibility, socio-cultural factors, and differential healthcare-seeking behaviour favouring male children in many settings.

The majority of patients in this study belonged to urban areas (79.3%) and lower socioeconomic strata. Similar associations have been documented by Aygun D et al. and Sharma S et al., who reported poverty, overcrowding, and limited access to healthcare as key determinants of paediatric TB [8,9]. The urban predominance observed in current cohort likely reflects both higher transmission rates in densely populated areas and improved access to tertiary care facilities, resulting in increased case detection.

Immunization Status and Contact History: Despite relatively high Bacillus Calmette-Guérin (BCG) vaccination coverage (76%), tuberculosis occurred in a large proportion of vaccinated children. This finding is aligned with Jain SK et al., who documented that while BCG provides protection against severe forms such as tuberculous meningitis and miliary TB, it does not prevent primary infection.[10]

Only a minority of children in present study had a documented history of contact with a known case of TB. Similar findings have been observed by Movahedi Z et al. and Sreeramareddy CT et al., underlining the limitations of relying solely on reported contact history for diagnosis.[6,11] Similarly, Santiago-García B et al. also emphasized that the source case often remains unknown, particularly in extrapulmonary TB.[12]

The low proportion of identifiable contact in present cohort may indicate under reporting of adult TB cases, gaps in contact tracing, or significant community transmission. These findings underline the need for strengthening active case finding and systematic household screening.

Nutritional Status and Clinical Presentation: Malnutrition was present in a notable proportion (21.3%) of children in this study, indicating its role as both a risk factor for infection and a determinant of disease severity. Similar findings have been reported by Jain SK et al. and Aygun D et al., who stated a strong association between poor nutritional status and severe or disseminated TB.[8,10] Likewise, Sharma S et al. also identified malnutrition as a key predictor of mortality in paediatric TB

patients.[9]

Clinically, fever, cough>15 days, and weight loss were the most common presenting symptoms, in-line with findings of studies by Sreeramareddy CT et al., Ksoo R et al., and Loh SW et al.[7,11,13] The non-specific nature of these symptoms results in diagnostic delays, particularly in resource-limited settings.

A significant proportion of children came with neurological manifestations, reflecting central nervous system (CNS) involvement. This finding is in agreement with Ksoo R et al. and Liang L et al., who observed a high burden of CNS TB and its association with increased morbidity and mortality, especially in younger children.[7,14]

Pattern of Disease Involvement: Extrapulmonary tuberculosis accounted for a significant proportion (68.7%) of cases in this study, with CNS involvement being the most common site, followed by lymph node and abdominal and pleural TB. This predominance of extrapulmonary disease aligns with findings from Sreeramareddy CT et al., Ksoo R et al., and Hamdar H et al., who have reported a high burden of extrapulmonary TB in paediatric populations.[7,11,15]

The high prevalence of CNS TB in this study aligns with documentations by Jain SK et al. and Movahedi Z et al., highlighting the propensity for hematogenous dissemination in children.[6,10] Studies done by Loh SW et al. and Gaifer Z have further demonstrated that extrapulmonary and disseminated TB are associated with greater disease severity, prolonged treatment duration, and poorer clinical outcomes.[13,16]

These findings underscore the complex and heterogeneous nature of paediatric TB, in which extrapulmonary involvement often predominates and poses significant diagnostic challenges.

The findings of this study emphasize the need for:

- High index of clinical suspicion in children with non-specific symptoms
- Routine nutritional assessment as an integral component of TB evaluation
- Strengthened contact tracing and active TB case finding
- Comprehensive assessment for extrapulmonary involvement, particularly CNS disease

Addressing these factors is crucial for improving early diagnosis and reducing the disease burden in paediatric populations.

Conclusion

This study highlights the multifaceted clinico-epidemiological profile of paediatric tuberculosis in a tertiary care setting in Central India. The disease predominantly affects older male children from socioeconomically disadvantaged urban backgrounds, underscoring the critical role of social factors such as poverty, overcrowding, and limited healthcare access.

Despite high BCG vaccination coverage, tuberculosis continues to occur, emphasizing that vaccination primarily protects against severe forms rather than preventing infection. Clinical presentation is often non-specific, with fever, cough >15 days, and weight loss being the most common symptoms, while a significant proportion of children presented with neurological manifestations indicative of central nervous system involvement.

Extrapulmonary tuberculosis constitutes a major component of disease burden, with CNS, lymph node, and abdominal involvement being the most frequent ones. The coexistence of malnutrition further exacerbates disease susceptibility and severity.

Overall, these findings highlight the need for early recognition, improved nutritional support, strengthened contact tracing, and comprehensive clinical evaluation to enhance diagnosis and management of paediatric tuberculosis. Targeted public health interventions addressing socioeconomic disparities are essential to reduce transmission and improve outcomes in this vulnerable population.

Ethical Approval

Taken from ethical committee of MGMMC, Indore. Informed consent from parents obtained. In addition, Assent was obtained from children above 12 years of age where applicable.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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