Student's Journal of Health Research Africa
e-ISSN: 2709-9997, p-ISSN: 3006-1059
Vol.6 No. 6 (2025): June 2025 Issue
https://doi.org/10.51168/sjhrafrica.v6i6.1875
Original Article

Clinical profile of paediatric extrapulmonary tuberculosis (EPTB) in a tertiary care hospital of Eastern India- A prospective study.

Imman Kalyani Jena[1*], Sunil Kumar Agarwalla[2]
Junior Resident, Department of Pediatrics, SCB MCH & SVPPGIP, Cuttack, Odisha, India[1]
Professor, Department of Pediatrics, SCBMCH & SVPPGIP, Cuttack, Odisha, India[2]

Abstract

Background
Extrapulmonary tuberculosis (EPTB) in children remains a significant health challenge with diverse clinical presentations and diagnostic difficulties. Given the diagnostic complexity and potential severity of pediatric extrapulmonary TB, particularly in high-burden regions like India, it is crucial to better understand its clinical presentation and epidemiological profile.
Objectives: This study aimed to evaluate the clinical profile, diagnostic methods, and outcomes of pediatric EPTB cases admitted to a tertiary hospital in Odisha.

Methods
A prospective observational study was conducted over 21 months at SCB Medical College, enrolling 196 pediatric patients aged 1 month to 14 years diagnosed with EPTB. Data on demographics, clinical features, diagnostic approaches, and outcomes were collected using structured proformas. Diagnoses were confirmed based on national guidelines through clinical, radiological, microbiological, and histopathological methods. Statistical analysis was performed using SPSS v24 with significance set at $p < 0.05$.

Results
Most patients were aged 5–10 years (40.8%) with a male predominance (57.7%). CNS tuberculosis was the most common diagnosis (50.5%), especially among males (59.3%). Fever was the predominant symptom (84.7%), with seizures in 45.9% of cases. Neurological symptoms were also prominent, with seizures present in 45.9% and altered sensorium in 25% of the cases, reflecting central nervous system involvement. Respiratory symptoms such as cough and chest pain were reported in 25.5% and 16.8% respectively. The association between diagnosis and gender showed significant differences across various forms of EPTB, with a p-value of 0.000.

Conclusion
Pediatric EPTB presents with varied clinical and diagnostic profiles, necessitating age-tailored approaches for early detection and management.

Recommendations
As this was a short-term study, further research is needed with a longitudinal study design and a larger sample to achieve more definitive results.

Keywords: Pediatric extrapulmonary tuberculosis, CNS TB, Diagnosis, Clinical profile, Odisha
Submitted: *2025-05-19* ***Accepted:*** *2025-06-21* ***Published:*** *2025-06-30*

Corresponding author: *Imman Kalyani Jena**
Email: ***immanjena@gmail.com***
Junior Resident, Department of Pediatrics, SCB MCH & SVPPGIP, Cuttack, Odisha, India

Introduction

Tuberculosis (TB), caused by *Mycobacterium tuberculosis*, remains a significant public health challenge globally, especially in low- and middle-income countries

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[1]. Despite advances in diagnostics, prevention, and treatment, TB continues to be the leading cause of death from a single infectious agent, surpassing HIV/AIDS and malaria. In 2019, it accounted for approximately 1.2 million deaths worldwide [2]. TB primarily affects the lungs but can spread to other parts of the body. Countries with high population density, poverty, and limited healthcare infrastructure—like India—are particularly burdened by TB due to conditions that favor its transmission, such as overcrowding and poor ventilation [3,4].

Among the estimated 10 million TB cases globally in 2019, about 12% occurred in children. Pediatric TB, especially extrapulmonary TB (EPTB), often goes unrecognized due to nonspecific symptoms and the difficulty of obtaining bacteriological confirmation [5]. EPTB involves organs beyond the lungs—such as lymph nodes, bones, joints, or the meninges—and is more diagnostically demanding. These challenges are compounded in resource-poor settings where laboratory support is minimal and clinical suspicion is low. Children are also at greater risk of severe complications such as TB meningitis and disseminated TB, particularly when their immune systems are weakened by malnutrition, HIV, or other chronic conditions [6,7].

Given the diagnostic complexity and potential severity of pediatric extrapulmonary TB, particularly in high-burden regions like India, it is crucial to better understand its clinical presentation and epidemiological profile. This study aims to evaluate the clinical profile and varied presentation of pediatric EPTB. The primary objective is to assess the different types and clinical features of pediatric EPTB. Secondary objectives include evaluating the demographic distribution of affected children and analyzing various outcomes and complications associated with the disease.

Methods

Study design and setting

This was a prospective, observational, hospital-based study conducted in the Department of Pediatrics at SCB Medical College and Hospital (SCBMCH), SVPPGIP, Cuttack, Odisha. The study was carried out over 21 months, from August 2023 to April 2025. The study included sociodemographic and clinicopathological profiles, outcomes, and complications of study participants.

Study population

The study population comprised pediatric patients aged 1 month to 14 years who were admitted to the department and diagnosed with extrapulmonary tuberculosis (EPTB). Diagnosis was established according to the national guidelines for the diagnosis and treatment of pediatric EPTB. Children with a confirmed diagnosis during hospital admission were included in the study after meeting the defined eligibility criteria.

Sampling method

A convenience sampling method was employed for patient recruitment. All eligible cases admitted during the study period and meeting the inclusion criteria were enrolled consecutively.

Inclusion and exclusion criteria

Inclusion criteria consisted of all children between the ages of 1 month and 14 years who were admitted and diagnosed with EPTB based on clinical, radiological, and microbiological assessments aligned with national guidelines. Exclusion criteria included children diagnosed with pulmonary TB, those diagnosed in the outpatient department but not admitted (due to incomplete data), cases diagnosed using non-recommended diagnostics such as serological tests (IgM, IgG, IgA), unvalidated PCR assays, or BCG tests, and children with other immunocompromised or opportunistic diseases.

Efforts to reduce bias

In order to reduce recollection bias and guarantee real-time data collection from admissions over 21 months, a prospective observational strategy was employed. Data on demographics, clinical characteristics, diagnostics, and outcomes were collected consistently using a pretested, standardized proforma. This lessened the prejudice of the interviewer and the information.

Diagnostic approach

Diagnosis of EPTB aimed to be supported by bacteriological evidence whenever feasible. Appropriate clinical samples such as lymph node aspirates or pus, pleural fluid, and cerebrospinal fluid (CSF) were collected for diagnostic confirmation. Tuberculin Skin Testing (Mantoux test) was performed using 2 TU (RT23 or equivalent), and a positive result was defined as an induration of 10 mm or more.

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Sample size

Based on previous regional studies and available literature, the estimated prevalence of pediatric EPTB was assumed to be approximately 15%. With a 95% confidence level and an absolute precision (margin of error) of 5%, the minimum required sample size was calculated to be 165 participants using the formula:

$n=d2Z2\times p\times(1-p)$

Where:

n = required sample size

Z = 1.96 (standard normal deviate at 95% confidence level)

p = estimated prevalence (0.15)

d = margin of error (0.05)

Data collection procedure

Data were collected using a structured and pretested proforma developed for the study. This included detailed information on demographics, clinical symptoms, physical examination findings, nutritional and socioeconomic status, diagnostic investigations, treatment regimens, and clinical outcomes. Each patient was assessed upon admission, and relevant laboratory and imaging data were recorded. Follow-up data were collected where applicable during hospitalization.

Assessment of nutritional status

The nutritional status of the enrolled children was assessed using Body Mass Index (BMI), calculated based on weight and height measurements taken at the time of admission. The BMI

Values were interpreted according to standard pediatric growth charts to determine nutritional classification, such as underweight, normal, or overweight, relative to age and sex.

Socioeconomic status assessment

Socioeconomic status was determined based on per capita monthly family income, using a classification system outlined in standard public health literature. This provided insight into the background and living conditions of each patient, which is relevant to understanding disease prevalence and healthcare access.

Statistical analysis

Data were analyzed using IBM SPSS Statistics version 24.0. Descriptive statistics were used to summarize clinical and demographic data, and significance testing was conducted with a threshold of $p < 0.05$.

Ethical considerations

The study protocol was reviewed and approved by the Institutional Ethics Committee, SCB Medical College and Hospital (SCBMCH), Cuttack, Odisha, India.

Written informed consent was obtained from all participants before their enrolment in the study.

Results

During the 21-month study period, a total of 245 pediatric patients presenting with suspected extrapulmonary tuberculosis (EPTB) were initially assessed for eligibility. Of these, 215 patients met the preliminary inclusion criteria and were further evaluated. After applying the final eligibility criteria based on national diagnostic guidelines—including exclusion of pulmonary TB cases, outpatient cases without admission, and those diagnosed using non-standard tests—a total of 196 children were confirmed eligible and included in the study. Among these, all 196 participants were successfully followed up during their hospital stay, and complete data were collected for all patients. Therefore, no cases were lost to follow-up, and all 196 participants were included in the final analysis. The most common reasons for exclusion (n = 49) were diagnosis of pulmonary TB (n = 20), outpatient-only cases (n = 17), and use of non-recommended diagnostic modalities (n = 12).

The sociodemographic profile of the pediatric EPTB patients showed that the largest proportion of cases (40.8%) were in the 5 to 10-year age group, followed by 34.2% in children aged 4 years or younger, and 25% in those above 10 years. The mean age was 7.0 years with a standard deviation of 4.1 years, indicating a fairly wide age distribution within the sample. Male patients constituted 57.7% of the total study population, suggesting a slight male predominance. The average weight and height were 17.6 kg and 109.4 cm, respectively, with considerable variation reflected by the standard deviations. These anthropometric measures provide context for the growth status of these children affected by extrapulmonary tuberculosis. Overall, the data indicate a young pediatric population with varied growth parameters impacted by the disease (Table 1).

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Table 1. Socio demographic profile of pediatric EPTB patients (N = 196)

Variables	Category	Frequency (n)	Percentage (%)
Age Group (years)	≤ 4	67	34.2
	5 – 10	80	40.8
	> 10	49	25.0
Mean Age ± SD	7.0 ± 4.1		
Median (IQR)	6 (4–10.8)		
Age Range	0.5 – 14 years		
Gender	Male	113	57.7
	Female	83	42.3
Weight (kg)	Mean ± SD	17.6 ± 7.8	
Height (cm)	Mean ± SD	109.4 ± 23.1	

Clinical signs and symptoms among the pediatric EPTB patients were diverse, with fever being the most common symptom, observed in 84.7% of cases. Weight loss was reported in nearly half of the patients (45.4%), indicating a significant systemic impact of the disease. Neurological symptoms were also prominent, with seizures present in 45.9% and altered sensorium in 25% of the cases, reflecting central nervous system involvement. Respiratory symptoms such as cough and chest pain were reported in 25.5% and 16.8% respectively, highlighting pulmonary or pleural involvement in some cases. Gastrointestinal symptoms were less frequent but still notable, with abdominal pain in 13.3% and distension in 7.7%. This range of symptoms underscores the multisystem nature of extrapulmonary tuberculosis in children (Table 2).

Table 2. Clinical signs and symptoms of pediatric EPTB patients (N = 196)

Clinical Feature	Frequency (n)	Percentage (%)
General Symptoms		
Fever	166	84.7
Weight Loss	89	45.4
Lymphadenopathy	34	17.3
Central Nervous System Symptoms		
Seizures	90	45.9
Altered Sensorium	49	25.0
Headache	38	19.4
Focal Neurological Deficit	9	4.6
Respiratory Symptoms		
Cough	50	25.5
Chest Pain	33	16.8
Gastrointestinal Symptoms		
Abdominal Pain	26	13.3
Abdominal Distention	15	7.7

The association between diagnosis and gender showed significant differences across various forms of extrapulmonary tuberculosis (EPTB) ($p = 0.000$). Central nervous system (CNS) TB was the most common diagnosis overall, accounting for 50.5% of cases, with a notably higher proportion in males (59.3%) compared to females (38.6%). In contrast, TB lymphadenopathy and abdominal TB were more frequent among females, representing 24.1% and 18.1% respectively, while males showed lower percentages for these diagnoses. Pleural TB and disseminated TB had relatively balanced distributions between genders. Skeletal TB was predominantly seen in males (8%) compared to females (2.4%), and pericardial TB was reported only in males. These findings suggest

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that certain forms of EPTB, such as CNS TB and skeletal TB, are more prevalent in males, whereas lymph node and abdominal TB tend to occur more frequently in females, indicating possible gender-based differences in disease manifestation or exposure risk (Table 3).

Table 3. Association of diagnosis with gender

Diagnosis	Gender				Total		Chi-square, p
CNS TB	Male		Female				
	No	%	No	%	No	%	
CNS TB	67	59.3	32	38.6	99	50.6	Chi-square value=32.027 p-value= 0.000
TB Lymph Node	11	9.7	20	24.1	31	15.8	
Pleural TB	17	15	11	13.3	28	14.3	
Disseminated TB	2	1.8	3	3.6	5	2.6	
TB Abdomen	2	1.8	15	18.1	17	8.7	
Skeletal TB	9	8	2	2.4	11	5.6	
Pericardial TB	3	2.7	0	0	3	1.5	
CNS TB + Skeletal TB	2	1.8	0	0	2	1	
Total	113	100	83	100	196	100	

Out of 196 cases, 88 (44.9%) were ON ATT, 77 (39.3%) treatment was completed, and 31 (15.8%) died. Table 4 depicts outcomes observed among participants.

Table 4. Outcomes observed among participants

Outcome	No. of Cases	%
ON ATT	88	44.9
Completed	77	39.3
Death	31	15.8

Out of 196 children, 40 had complications and 156 didn't have complications. Among the complication cases, the most common complication had seizures, i.e. 20(50%), followed by hemiplegia, 10(25%), hydrocephalus, 5(12.5%), drug-induced liver injury, 3(7.5%), and each blindness & drug induced lupus 1(2.5%). Table 5 shows complications observed among participants.

Table 5. Complications observed among participants

Complication	No. of Cases	%
Hydrocephalus	05	12.5
Blindness	01	2.5
Seizures	20	50.0
Hemiplegia	10	25.0
Drug-induced liver injury	03	7.5
Drug-induced lupus	01	2.5

Discussion

This study analyzed 196 pediatric cases of extrapulmonary tuberculosis (EPTB), highlighting important demographic and clinical characteristics. The majority of cases were in the 4-10-year age group, with a slight male predominance of 57.7% [8,9]. The predominance of males may reflect gender-related health-seeking behaviors and environmental exposures [10]. Undernutrition was highly prevalent, with 63.3% of children underweight, aligning with who reported growth retardation as a common effect of chronic TB in children

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[11]. The socioeconomic profile revealed that 83.2% of patients belonged to lower socioeconomic classes, mainly Class IV and III, reinforcing the link between poverty, malnutrition, and delayed healthcare [12].

Clinically, fever was the most common presenting symptom (84.7%), followed by seizures in 45.9% of cases, predominantly among CNS TB patients. These neurological manifestations are in agreement with findings, confirming CNS TB's significant neurological impact [13,14]. Weight loss (45.4%), altered sensorium (25%), and focal neurological deficits (4.6%) further illustrate the systemic and neurological severity of the disease, consistent with previous pediatric CNS TB studies [10,12]. CNS TB was the predominant diagnosis (50.5%), followed by TB lymphadenitis and pleural TB, which stresses the importance of clinical vigilance for CNS involvement in pediatric EPTB [9,11]. The low Mantoux positivity rate (2.6%) and elevated ESR (mean 89.4 mm/hr) in this cohort reflect the known diagnostic challenges, reinforcing the limitations of traditional tests [8,9,15].

Regarding diagnosis and outcomes, clinical evaluation and microbiological testing comprised the majority of diagnostic methods, supporting the role of tools like CBNAAT in improving detection as recommended [16]. Younger children (≤4 years) were more often diagnosed via radiological and histopathological methods, consistent with Marais et al. (2006) who emphasized the paucibacillary nature of TB in this age group [17]. Complications occurred in 40 children, with seizures (50%) and hemiplegia (25%) being the most frequent, followed by hydrocephalus and drug-induced liver injury, matching the neurological sequelae pattern [11]. The findings underscore the need for early detection, integrated nutritional and social support, advanced diagnostic techniques, and robust treatment protocols, especially given the 15.8% mortality rate and high complication burden in CNS TB cases.

A number of factors affect this study's generalizability. The results may not be entirely generalizable to larger populations because the study was carried out at a single tertiary care facility in eastern India, particularly in primary care or community settings where access to healthcare and diagnostic resources is restricted.

Conclusion

This study highlights that pediatric extrapulmonary tuberculosis predominantly affects children aged 4–10 years, with a slight male predominance and a strong association with undernutrition and lower socioeconomic status. CNS TB emerged as the most common and severe form, frequently presenting with neurological complications such as seizures and hemiplegia. Traditional diagnostic methods showed limitations, emphasizing the need for advanced tools like CBNAAT to improve early detection. The high prevalence of complications and mortality underscores the urgent need for integrated management approaches combining timely diagnosis, nutritional support, social interventions, and tailored treatment strategies to improve outcomes in this vulnerable population.

Limitations

Since this study was conducted in a single urban tertiary care facility, it may not be feasible to extrapolate the findings to the broader population. Additionally, the study's sample size was too small to draw conclusions and extrapolate findings.

Recommendations

As this was a short-term study, further research is needed with a longitudinal study design and a larger sample to achieve more definitive results.

List of abbreviations

CSF- Cerebrospinal fluid
EPTB- Extrapulmonary tuberculosis
CNS- Central nervous system
BMI- Body Mass Index
TB- Tuberculosis
AIDS- Acquired Immunodeficiency Syndrome
HIV- Human Immunodeficiency Virus

Source of funding

There was no external funding; the study was self-funded by the department.

Conflict of interest

The authors declare no conflict of interest.

Author contributions

All authors contributed to the study design, data collection, analysis, and manuscript preparation.

Data availability

The data generated during this study are available from the corresponding author upon reasonable request.

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https://doi.org/10.51168/sjhrafrica.v6i6.1875
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PUBLISHER DETAILS

Student's Journal of Health Research (SJHR)
(ISSN 2709-9997) Online
(ISSN 3006-1059) Print
Category: Non-Governmental & Non-profit Organization
Email: studentsjournal2020@gmail.com
WhatsApp: +256 775 434 261
Location: Scholar's Summit Nakigalala, P. O. Box 701432, Entebbe Uganda, East Africa