International Journal of Contemporary Pediatrics
Patel KG et al. Int J Contemp Pediatr. 2025 Oct;12(10):1624-1628
http://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20252956

Original Research Article

Screening of tuberculosis in hospitalized severely acute malnourished children in a tertiary care hospital

Kinjal G. Patel[1]*, Chintan B. Pandya[1], Sujeet S. Chaudhari[2]

[1]Department of Paediatrics, GMERS Medical College, Valsad, Gujarat, India
[2]Department of Paediatrics, Government Medical College, Surat, Gujarat, India

Received: 01 September 2025
Revised: 17 September 2025
Accepted: 18 September 2025

***Correspondence:**
Dr. Kinjal G. Patel,
E-mail: dr.kinjal.c.p@gmail.com

ABSTRACT

Background: Tuberculosis (TB) remains one of the leading causes of infectious disease-related morbidity and mortality worldwide. There is an increase susceptibility to TB due to impaired immunity in malnourished children.
Methods: This is a cross-sectional study done at a tertiary care hospital over a period of 1 year. Children aged 6 months to 5 years diagnosed with severe acute malnutrition (SAM) based on World Health Organization (WHO) criteria were enrolled in the study. Screening for tuberculosis was performed using: Monteux test, chest X-ray, sputum or gastric aspirate microscopy or cartridge-based nucleic acid amplification test (CBNAAT) for *Mycobacterium tuberculosis* detection.
Results: A total of 165 SAM patients were screened for TB. Prevalence of TB in SAM patient was 3.63%. Among the 6 cases, 4 were extra pulmonary and 2 were pulmonary TB. The most frequent symptoms were cough (34.56%), vomiting (26.66%), and diarrhoea (25.45%). Fever was seen in 24.24%, and weight loss in 14.54%. The Monteux test results was negative in all patients. CBNAAT testing was positive in only 2 patient (1.21%). Out of 165 children, 2.42% had elevated erythrocyte sedimentation rate (ESR) and 14.55% had an abnormal chest X-ray. Mesenteric lymphadenitis was observed in 9 patients (5.45%) in abdominal ultrasonography.
Conclusions: This study highlights that clinical features of tuberculosis were nonspecific. Diagnostic limitations were evident as the Monteux test yielded 0% positivity, and CBNAAT only in 1.21%. This study emphasizes the need for high clinical suspicion in paediatric TB, particularly in malnourished children.

Keywords: Tuberculosis, Malnutrition, CBNAAT, Children

INTRODUCTION

Tuberculosis (TB) remains one of the leading causes of infectious disease-related morbidity and mortality worldwide.[1] The World Health Organization (WHO) estimates that approximately 10.6 million new cases of TB occur annually. Paediatric TB constitutes approximately 11% of all TB cases globally, with an estimated 1.1 million children developing TB each year.[2] Severe cases of TB in children, including miliary TB and TB meningitis, have devastating consequences, in the form of neurological impairment or death.[3] The emergence of multidrug-resistant TB (MDR-TB) has further complicated disease management, making early detection and treatment critical for reducing mortality.[4]

Severe acute malnutrition (SAM) affects an estimated 45 million children globally, malnourished children have higher rates of TB infection and disease progression due to immune system dysfunction.[1,5] Studies have demonstrated that malnourished children have lower levels of protective immune markers, including interferon-gamma (IFN-γ) and tumour necrosis factor-alpha (TNF-α), which are crucial for TB control.[6,8] The synergy between TB and malnutrition creates a vicious cycle, where TB exacerbates

malnutrition and vice versa, leading to worsening outcomes.[4,7]

Traditional TB diagnostic tools, including sputum smear microscopy and chest X-ray, have limited sensitivity in malnourished children.[9] GeneXpert assay improves TB detection but remains limited by its reliance on adequate sample collection and access in resource-limited settings.[4] Tuberculin skin testing (TST) has reduced sensitivity in SAM children due to suppressed immune response.[6,9]

Objectives of the study were to estimate the prevalence of tuberculosis in hospitalized severe acute malnourished children, to assess the various clinical presentation of pulmonary and extra pulmonary tuberculosis in severely acute malnourished children, and to estimate various relevant diagnostic parameters of tuberculosis in SAM patients.

METHODS

This study was conducted at GMERS Medical College and Hospital, Valsad over a period of 12 months (February 2024 to February 2025). SAM children aged 6 months to 5 years were identified based on WHO guidelines. All the hospitalized SAM children were enrolled in this study. A structured proforma was used to record demographic details like age, sex, and socioeconomic status. Clinical history and examination were done. Anthropometric measurements were performed using standard WHO guideline.[1] Weight was measured with an electronic scale to the nearest 10 grams. Height/length was recorded using a stadiometer with 1 mm precision. Mid-upper arm circumference (MUAC) was measured using a non-stretchable tape.

Systematic screening for tuberculosis was performed using Mantoux test (PPD 2 TU, induration measured at 48-72 hours), chest X-ray, sputum or gastric aspirate microscopy for acid-fast bacilli (AFB) or GeneXpert MTB/RIF (CBNAAT) for mycobacterium tuberculosis detection. Additional tests (CSF, FNAC, CT/MRI) were done as clinically indicated. Children diagnosed with TB were initiated on anti-tubercular therapy (ATT) as per Revised National TB Control Programme (RNTCP) guidelines. TB screening results were classified as, bacteriologically confirmed TB (AFB positive or GeneXpert MTB/RIF positive) or clinically diagnosed TB (based on symptoms, radiological findings, and Monteux positivity).

All the collected data was entered into Microsoft Excel and analyzed using statistical package for social science (SPSS) version 25. The data presented in the document predominantly comprises descriptive statistics, including frequencies, percentages, means, and standard deviations.

These statistics used to summarize the demographic distribution, clinical findings, and diagnostic parameters of the study population.

RESULTS

A total of 165 patients with SAM were screened for TB. Among these, 6 patients were diagnosed with TB, resulting in a prevalence of 3.63% in the study group. This suggests that TB was present in a small but significant portion of the paediatric population (Table 1).

Table 1: Prevalence of tuberculosis in study population.

Total patient screened	TB diagnosed	Prevalence (%)
165	06	3.63

The highest TB prevalence was noted in the 6–12 months age group, with 2 out of 58 children affected (35.15%). In the 3–4 years group, 3 (20.6%) cases were found, while the 4–5 years group had 1(2.42%) case. The results suggest TB affects infants more commonly, possibly due to immature immunity (Figure 1).

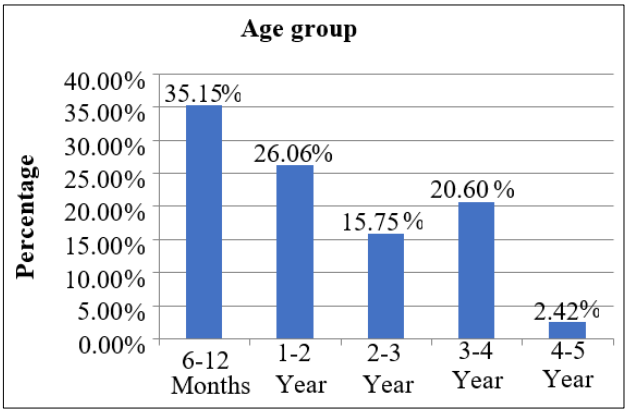

Figure 1: Age wise distribution of tuberculosis in study population.

Among the 165 screened patients, 97 were male and 68 were female. TB was diagnosed in 2 males and 4 females (Figure 2). Out of 165 patients, 91 belonged to urban regions and 74 to rural areas. TB was diagnosed in 2 urban and 4 rural patients. Interestingly, the urban group had a higher absolute count, but the prevalence was higher in rural patients. TB burden was 55.15% urban and 44.85% rural among the diagnosed cases with p=0.03 (Figure 3).

Of the 6 TB cases diagnosed, 2 were pulmonary TB, and 4 were extrapulmonary TB. Among these, 2 were microbiologically confirmed (1 pulmonary and 1 extrapulmonary). Most cases were clinically diagnosed, indicating limitations in microbiological tools.

Among the 165 screened patients, the most commonly reported symptom was cough (34.56%). Vomiting (26.66%) and diarrhoea (25.45%) followed as frequent complaints. Fever was also common, seen in 24.24% of

patients. Weight loss (14.54%) and abdominal pain (8.48%) were less common but relevant (Table 2).

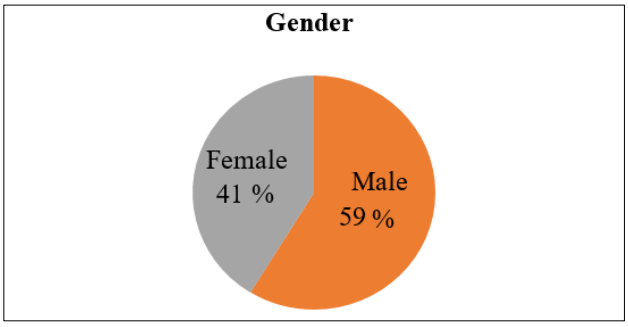

Figure 2: Gender wise distribution of tuberculosis in study population.

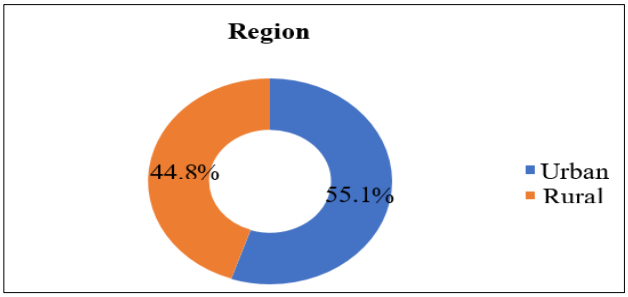

Figure 3: Region wise distribution of tuberculosis in study population.

Table 2: Clinical presentation of tuberculosis in screened population.

Clinical presentation	Present numbers	Percentage (%)
Cough	57	34.56
Fever	40	24.24
Weight loss	24	14.54
Abdominal pain	14	8.48
Diarrhoea	42	25.45
Vomiting	44	26.66

The Montoux (tuberculin skin) test results were negative in all 165 patients, yielding 0% positivity. Out of the 165 patients screened, only 2 tested positive (1.21%) using CBNAAT, while the rest (163) were negative. In this population, only 4 patients (2.42%) had elevated ESR, while 161 (97.57%) had normal ESR values. All 165 patients screened for tuberculosis were also tested for HIV, and none were found to be HIV positive. Out of 165 children, 141 (85.45%) had normal chest X-rays, while 24 (14.55%) showed some abnormalities. The most common abnormal finding was consolidation seen in 23 cases (13.94%). Ultrasound abdomen was normal in 144 cases (87.27%). Mesenteric lymphadenitis was observed in 9 patients (5.45%), followed by conglomerated lymph nodes and mild hepatomegaly in 2 patients each (1.21%). Single cases of transient intussusception and mild ascites were also noted (Table 3).

Table 3: Tuberculosis screening results in hospitalized SAM children.

Diagnostic test	No. of patients tested	Positive numbers (%)	Negative numbers (%)
Chest X-ray	165	23 (13.94)	141 (85.45)
Montoux test	165	0	165 (100)
ESR	165	4 (2.42)	161 (97.58)
CBNAAT	165	2 (1.21)	163 (98.79)
USG abdomen	165	21 (12.73)	144 (87.27)
FNAC of cervical lymphnode	02	2 (100)	0
CT scan	02	2 (100)	0

Computed tomography scans were done in 2 patients and both showed necrotic lymph nodes, a hallmark of tuberculosis lymphadenitis. FNAC was conducted in 2 patients, revealing epithelioid cells in one and necrotic material in another both findings suggestive of TB. The remaining 163 patients did not undergo FNAC, which limits the diagnostic yield of cytology.

Table 4: Tuberculosis positive cases in study population.

Age	Gender	Region	Types of tuberculosis	Diagnosis based on
5 years	Female	Rural	Abdominal TB	Clinically
8 months	Female	Rural	Pulmonary TB	Clinically
4 years	Female	Urban	Pulmonary TB	Clinically and micro-biological
3 years	Female	Rural	Abdominal TB	Clinically and micro-biological
9 months	Male	Rural	Lymph node TB	Clinically
4 years	Male	Urban	Lymph node TB	Clinically

Among the 6 children diagnosed with TB, 4 were females and 2 males, with 4 cases from rural areas and 2 from urban regions. The most common forms of TB were abdominal (2 cases), pulmonary (2 cases), and lymph node TB (2 cases). Microbiological confirmation was achieved in only 2 cases, while the rest were diagnosed clinically, highlighting the challenges of confirming TB in children (Table 4).

DISCUSSION

In this study, the prevalence of TB among 165 screened paediatric patients was found to be 3.63%. In comparison, a study conducted by Goyal et al in northern India reported a TB prevalence of 5.4% in children attending outpatient departments in tertiary care hospitals.[10] Our lower prevalence may be attributed to regional differences, improved immunization coverage, or early detection efforts. The highest prevalence was observed in the 6–12 months age group in our study, with 2 out of 58 children (35.15%) diagnosed with TB. In a study by Marais et al., the highest incidence of TB occurred in children aged <2 years, with severe forms such as disseminated TB being more frequent in infants.[11]

Among the 6 TB cases in our study, 4 (66.7%) were extrapulmonary TB and 2 (33.3%) were pulmonary TB. This is in line with data from Yadav et al, who reported that more than 60% of paediatric TB cases are extrapulmonary in nature.[12] The World Health Organization also notes that up to 70% of TB in children under 5 years may be extrapulmonary due to disseminated forms like lymph node TB and abdominal TB.[13]

The most frequent symptoms were cough (34.56%), vomiting (26.66%), and diarrhoea (25.45%), followed by fever in 24.24%, and weight loss in 14.54%. These nonspecific symptoms are consistent with findings from a study by Swaminathan et al where cough and fever were the most common symptoms, but presentations varied widely.[14] Another study by Das et al confirmed that in younger children, TB symptoms are often subtle and mimic common childhood infections, leading to delayed diagnosis.[15]

In this study, all 165 children tested negative for Mantoux (0% positivity). Published studies like Dhingra et al have highlighted that Mantoux test sensitivity is lower in malnourished or immunocompromised children, sometimes dropping below 40%.16 Only 2 children (1.21%) tested positive via CBNAAT in this study. This low positivity reflects the paucibacillary nature of paediatric TB. Elevated ESR was found in only 2.42% of our study population, this is significantly lower than that reported by Lodha et al where ESR was elevated in 78.7% of children with TB.[17] This discrepancy could be due to timing of sample collection, site of TB involvement, or methodological differences in ESR measurement.

The younger age, female preponderance, rural predominance, and higher incidence of extrapulmonary TB all reflect known trends in paediatric TB literature. However, the limited microbiological confirmation also underscores the diagnostic gap that continues to affect early and accurate TB detection in children. It reinforces the urgent need for capacity building in sample collection, better diagnostic tools, and clinical training, especially in rural and peripheral health centres.

Limitations

Small sample size of TB-positive cases which limits the statistical power of subgroup comparisons such as gender-wise, region-wise, or type of TB distribution. The study was conducted at a single centre, which may not be representative of the broader community. Advanced diagnostic tools like CT scan and FNAC were used in only a small subset of patients, potentially leading to underdiagnoses of extrapulmonary TB forms.

CONCLUSION

This study found a TB prevalence of 3.63% in hospitalized SAM children, with a predominance of extrapulmonary forms and clinical diagnoses. The Montoux test and CBNAAT showed limited sensitivity, highlighting the challenges of bacteriological confirmation in malnourished paediatric populations. Most cases required clinical suspicion supported by imaging and basic laboratory tests such as ESR and complete blood count (CBC). These findings emphasize the importance of adopting a multimodal diagnostic approach rather than relying solely on microbiological confirmation. Strengthening diagnostic capacities in peripheral and rural healthcare settings can aid in early detection, timely treatment, and reduced transmission of TB among vulnerable paediatric populations.

ACKNOWLEDGEMENTS

Authors would like to thank guide, teachers, Head of Department, Dean and The Medical Superintendent, Department of Paediatrics, GMERS Medical College and Hospital, Valsad, Gujarat for giving the opportunity to work on this study.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. World Health Organization. Tuberculosis. 2023. Available at: https://www.who.int/news-room/fact-sheets/detail/tuberculosis. Accessed on 08 March 2025.
2. World Health Organization. Global Tuberculosis Report 2023: TB Disease Burden. 2023. Available at: https://www.who.int/teams/global-tuberculosis-programme/tb-reports/global-tuberculosis-report-2023/tb-disease-burden/1-1-tb-incidence. Accessed on 08 March 2025.
3. Chisti MJ, Graham SM, Duke T, Ahmed T, Faruque AS, Ashraf H, et al. Post-discharge mortality in children with severe malnutrition and pneumonia in Bangladesh. PLoS One. 2014;9(9):e107663.

4. Sinha P. Undernutrition and tuberculosis: public health implications. J Infect Dis. 2019;219(9):1356-63.
5. Bhargava A, Chatterjee M, Jain Y, Chatterjee B, Kataria A, Bhargava M, et al. Nutritional status of adult patients with pulmonary tuberculosis in rural central India and its association with mortality. PLoS One. 2013;8(10):e77979.
6. Gupta KB. Tuberculosis and nutrition. Lung India. 2009;26(1):9-16.
7. Cegielski JP, McMurray DN. The relationship between malnutrition and tuberculosis. Int J Tuberc Lung Dis. 2004;8(3):286-98.
8. Karakousis PC, Bishai WR, Dorman SE. Mycobacterium tuberculosis cell envelope lipids and the host immune response. Cell Microbiol. 2004;6(2):105-16.
9. Bhargava A, Gupta A. Nutritional status of tuberculosis patients in India. Indian J Med Res. 2014;140(4):475-7.
10. Goyal S, Makkar A, Jain R, Goyal S, Singh S. Prevalence of tuberculosis in children attending outpatient department in a tertiary care hospital in northern India. Indian J Tuberc. 2016;63(1):26-30.
11. Marais BJ, Gie RP, Schaaf HS, Hesseling AC, Obihara CC, Starke JR, et al. The natural history of childhood intra-thoracic tuberculosis: a critical review of literature from the pre-chemotherapy era. Int J Tuberc Lung Dis. 2004;8(4):392-402.
12. Yadav S, Rawal G. Extrapulmonary tuberculosis in children in Western India. Int J Tuberc Lung Dis. 2017;21(12):1297-302.
13. World Health Organization. Global Tuberculosis Report 2023. 2023. Available at: https://www.who.int/teams/global-programme-on-tuberculosis-and-lung-health/tb-reports/global-tuberculosis-report-2023. Accessed on 08 March 2025.
14. Swaminathan S, Rekha B. Paediatric tuberculosis: global overview and challenges. Clin Infect Dis. 2010;50(Suppl 3):S184-94.
15. Das P, Singh MK, Jaiswal N, Srivastava DK, Kushwaha RA, Nath G, et al. Clinical and microbiological profile of tuberculosis in children in Northern India. J Trop Pediatr. 2014; 60(6):466-70.
16. Dhingra VK, Rajpal S, Aggarwal N, Aggarwal JK, Shadab K, Jain SK. Tuberculosis trend among household contacts of TB patients. Indian J Community Med. 2004;29(1):3-5.
17. Lodha R, Kabra SK. Tuberculosis in children with severe acute malnutrition: challenges in diagnosis and management. Indian J Pediatr. 2016;83(1):43-6.

Cite this article as: Patel KG, Pandya CB, Chaudhari SS. Screening of tuberculosis in hospitalized severely acute malnourished (SAM) children in a tertiary care hospital. Int J Contemp Pediatr 2025;12:1624-8.