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ORIGINAL ARTICLE

Study of Co-relation between Clinical and Diagnostic Profile of Pediatric Tuberculosis in a Tertiary Care Hospital

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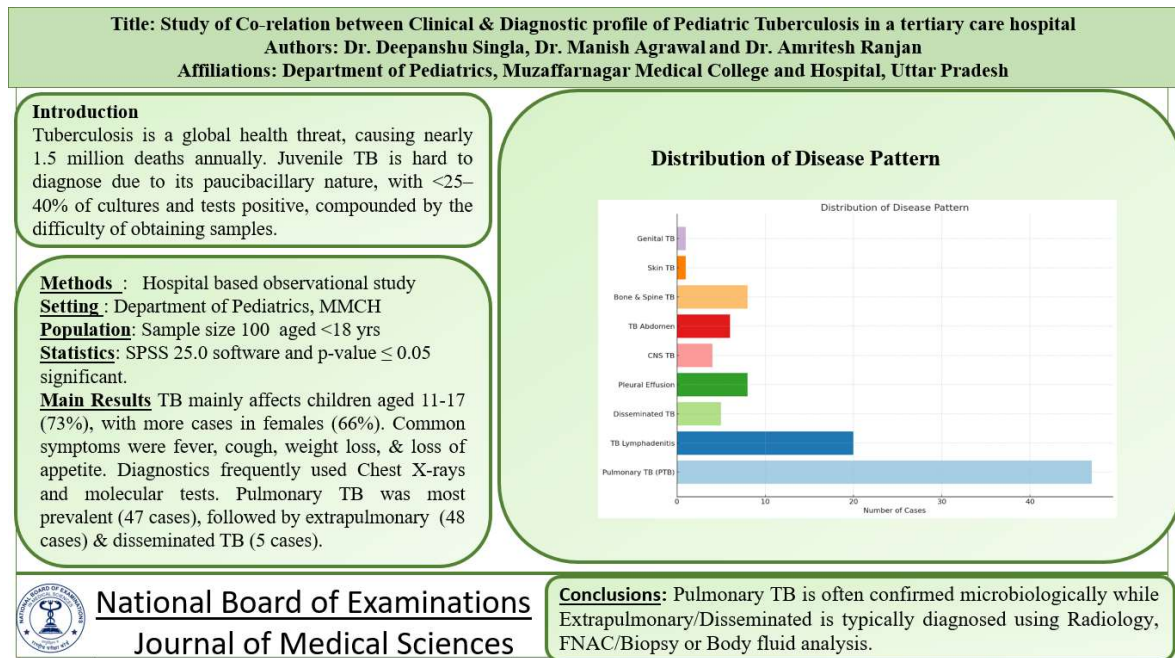
Abstract

Objective: Study of Co-relation between Clinical and Diagnostic profile of Pediatric Tuberculosis in a tertiary care hospital. **Methods:** This hospital-based observational study was conducted at the Department of Pediatrics, Muzaffarnagar Medical College and Hospital, covering a population of children aged <18 years diagnosed with TB. Data collection spanned 18 months, with a sample size of 100 children. **Results:** The study identified a predominant TB incidence in children aged 11-17 years (73%) with more females affected (66%) than males. Common symptoms included fever, cough, weight loss, and loss of appetite. Diagnostic findings showed a high use of Chest X-rays and Molecular tests. PTB was the most common form, accounting for 47 cases, EPTB accounting for 48 cases and Disseminated form was seen in 5 cases. **Conclusions:** Chest X-ray, Tuberculin Skin Test, Molecular Tests, and Blood Tests were universally performed on all patients. Microbiological confirmation is more common in pulmonary tuberculosis cases, while radiology, FNAC/Biopsy, and body fluid analysis are more utilized for extrapulmonary/disseminated cases. Diagnosing tuberculosis (TB) in children is often challenging due to several factors, including the difficulty in obtaining specimens and the typical paucibacillary nature.

Keywords: Tuberculosis, Pulmonary, Extra-Pulmonary, Children, Clinical, Diagnostic Tests

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Graphical Abstract



Introduction

Tuberculosis stands as a formidable global health challenge, claiming the lives of nearly 1.5 million individuals each year [1]. The primary causative agent behind this deadly disease is *Mycobacterium tuberculosis*, although *M. africanum* and *M. bovis* also contribute to its occurrence to a lesser extent [2]. The incubation period spans between 1 to 6 months. Notably, children tend to manifest EPTB more frequently than PTB, often presenting with a disseminated form that surpasses the prevalence observed in adults [3].

It is anticipated that 3.42 lakh children aged 0-14 years in India contract tuberculosis (TB) annually, making up nearly 6% of all TB cases reported to the National Tuberculosis Epidemic Report (NTEP) in 2020 [4]. In 2020, almost one lakh TB affected children (0–14 years old) were reported to the NTEP, and an additional 1.4 lakh children in the 15–18

age range were reported to the NTEP [5]. The transmission is linked to the exposure of children to MTB from infected adults in their environment, making childhood TB a reflection of ongoing transmission and the effectiveness of control programs [6].

The diagnosis of childhood TB hinges on keeping a sharp suspicion level and conducting thorough clinical and laboratory evaluations [7]. The intricacies of pediatric TB diagnosis are exacerbated by the less specific clinical and radiological presentations in toddlers to adults, frequently leading to confusion with bacterial pneumonia. Microbiologic confirmation of juvenile TB infections is made more difficult by the paucibacillary character of the disease, with less than 25–40% of patients often showing positive results from TB cultures and the more recent fast molecular tests. Furthermore, acquiring sufficient specimens from young children presents logistical constraints that exacerbate the diagnostic difficulties [8].

Based on these factors, this study seeks to elucidate the unique characteristics of tuberculosis in children. Furthermore, it aims to offer a thorough examination of current and emerging methods for diagnosis, treatment, and prevention. By identifying critical gaps for future research, this review aims to support ongoing endeavors to combat and mitigate the public health challenges associated with pediatric TB.

Methods

This hospital based observational study was conducted in Department of Pediatrics, Muzaffarnagar Medical College and Hospital over a period of 18 months, from August 2022 to January 2024. The study was approved by the Institutional ethics committee.

All children diagnosed with Tuberculosis aged <18 years visiting MMC, Muzaffarnagar. Sample size was taken as 100 based on the prevalence of disease in the Hospital in Pre Covid 3 years. Inclusion criteria included Children with age group less than 18 years attending the OPD and IPD in our Hospital with the following symptoms: Fever for more than 2 weeks or Unexplained Fever, Cough more than 2 weeks, Loss of weight more than 5% within 3 months, swelling over the neck, seizures, or altered level of consciousness and confirmed by various diagnostic tests. Children belonging to age group for more than or equal to 18 years, children less than 18 years who are on ATT without supporting evidence of TB, children on ART, not giving consent for the study were excluded from the study.

Study Procedure included detailed history and examination of the child for age, gender, fever, cough, weight loss, hemoptysis, abdominal pain, abnormal

body movements, pallor, lymphadenopathy, signs of meningeal irritation and raised ICT, respiratory Distress and various Diagnostic tests CBC, ESR, Tuberculin Skin Test, AFB Smear, Chest Xray, CBNAAT/ TRUNAAT were taken to find Co- Relation between Clinical Profile and Diagnostic Profile in Pediatric tuberculosis.

Statistical Analysis: Appropriate statistical significance test that was used for statistical analysis with SPSS 25.0 software. The P-value ≤ 0.05 was regarded as statistically significant.

Results

Pulmonary TB (PTB) is the most common form, accounting for 47 cases (47%). TB Lymphadenitis is the second most prevalent with 20 cases (20%). Other types include Pleural Effusion and Bone & Spine TB, each with 8 cases (8%), TB Abdomen with 6 cases (6%), Disseminated TB with 5 cases (5%), CNS TB with 4 cases (4%), and both Skin TB and Genital TB with 1 case each (1%) as shown in Figure 1.

In our study highest number of cases, 73 (73%), were seen in 11-17 years age group, followed by 6-10 years age group with 16 patients (16%), and the 0-5 years age group with 11 patients (11%) as shown in Table 1 and female to male ratio was 1.94:1.

Fever was reported by 83 patients (83%), loss of appetite by 75 patients (75%), and weight loss by 74 patients (74%). Cough is also prevalent, affecting 60 patients (60%). Other symptoms such as lymphadenopathy (21%), breathing difficulty (15%), and pallor (15%) are less common. Rarer symptoms include abdominal pain and nausea/vomiting (both 12%), joint pain and restriction of

movements (8%), chest pain (7%), neurological symptoms (5%), and hemoptysis (4%) as depicted in Figure 2.

The mean hemoglobin (Hb) level was 10.28 g/dL with a standard deviation of 1.64. The total leukocyte count (TLC) had a mean value of 9938.6 cells/mm³ with a standard deviation of 1696.9. The neutrophil count averaged 42.56% with a standard deviation of 9.2, while the lymphocyte count had a mean of 51.22% and a standard deviation of 11.6. The erythrocyte sedimentation rate (ESR) averaged 19.51 mm/hr with a standard deviation of 2.95. The tuberculin skin test

(TST) was positive in 87% of the patients as shown in Table 2.

31 cases (65.9%) of PTB were microbiologically confirmed, compared to only 3 cases (5.6%) of EPTB/Disseminated. Radiology was helpful in diagnosing 16 PTB cases (34%) and 27 EPTB/Disseminated cases (50.9%). FNAC/Biopsy was used for EPTB/Disseminated, diagnosing 22 cases (41.5%). Body fluid analysis was also exclusively used for EPTB/Disseminated, diagnosing 16 cases (30.1%) seen in Table 3.

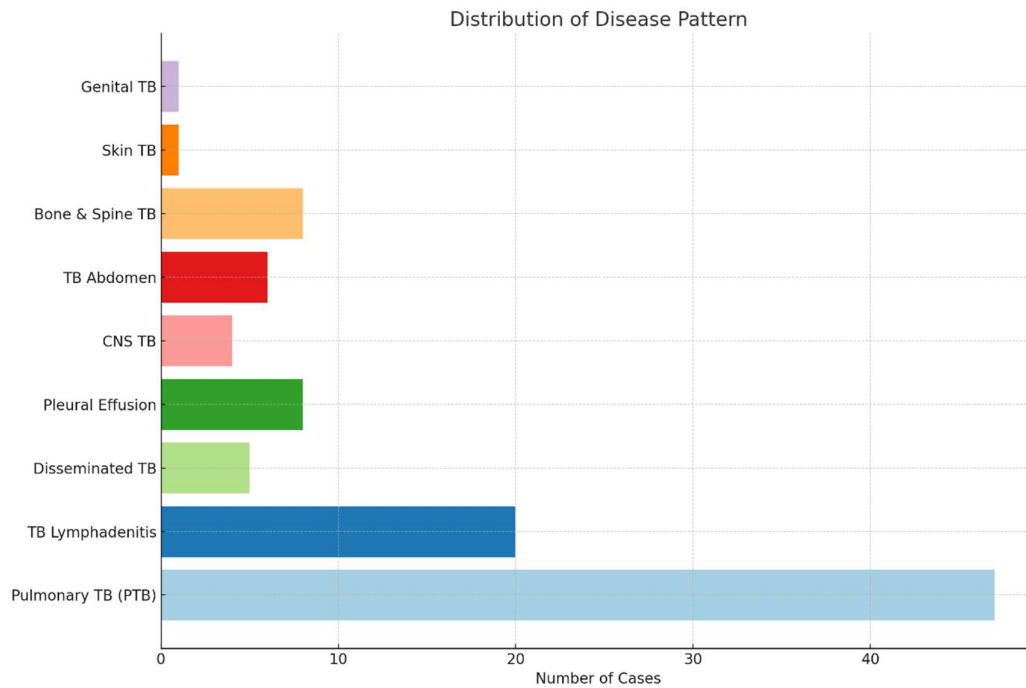


Figure 1. Distribution of Disease Pattern

Table 1. Age wise Distribution of Pediatric Tuberculosis Patients

Age Group (years)	Number of Patients (%)
0-5	11 (11%)
6-10	16 (16%)
11-17	73 (73%)

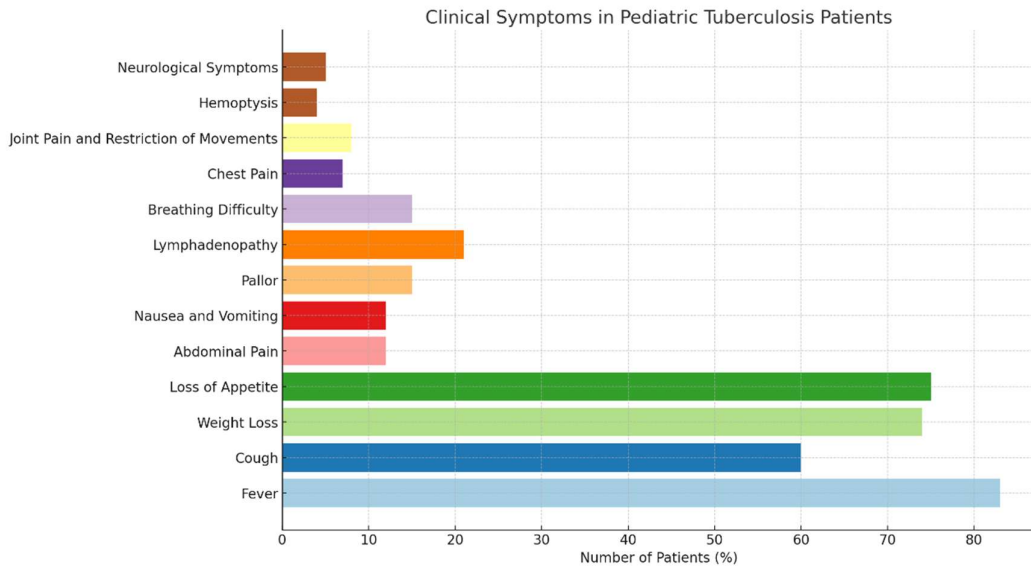


Figure 2. Clinical Symptoms in Pediatric Tuberculosis Patients

Table 2. Lab Investigations

Parameter	Values
Mean Hb(gm/dl)± SD	10.28 ±1.64
Mean TLC /mm ³ ± SD	9938.6 ± 1696.9
Mean Neutrophil (%)± SD	42.56 ± 9.2
Mean Lymphocyte (%)± SD	51.22 ± 11.6
Mean ESR(mm 1 st Hour) ± SD	19.51 ± 2.95
TST(>10 mm)	87

Table 3. Investigation Procedures Helpful in Diagnosis

Investigation	PTB	%	EPTB/Disseminated	%	TOTAL
Microbiologically Confirmed	31	65.9%	3	5.6%	34
Clinically Diagnosed					
Radiology	16	34%	27	50.9%	43
FNAC/Biopsy	-		22	41.5%	22
Body Fluid Analysis	-		16	30.1%	16

Discussion

The age-wise distribution of pediatric tuberculosis patients demonstrated a clear prevalence in older children. Particularly, the age group of 11-17 years accounted for the highest proportion, with 73% of the cases, equivalent to 73 patients. This can be because of greater exposure to infectious agents in school settings or community environments in contrast to younger children who tend to spend more time at home. The ratio of male to female was 1:1.9. This gender difference could potentially be influenced by gender inequality that still exists in many social aspects including health care. This could be attributed to parents delaying medical attention and opting to bring their daughters to tertiary care Center only when they are severely ill. This is also seen in other studies such as one conducted by Singh et al. (2021) [9] where male: female ratio was 1:2.8.

Among the clinical symptoms fever was the most prevalent symptom, affecting 83% of the patients. Similarly, substantial percentages of the study reported loss of appetite (75%) and weight loss (74%) and Cough in 60% of Patients. Other symptoms included

lymphadenopathy in 21% of the patients, which is indicative of an immune response to infection, and breathing difficulties in 15% of the cases, underscoring the respiratory compromise that tuberculosis can cause. A Research conducted by Sreeramareddy et al. (2010) [10] identified fever, cough, and lymph node swelling as the predominant presenting complaints among patients. Similarly, findings from a study by Loh et al. (2018) [11] reiterated the prevalence of fever, cough, and weight loss as common presenting symptoms.

Moreover, Laghari et al. (2019) [12] observed cough and weight loss as primary symptoms, with fever following closely. Additionally, a study conducted by Shrestha et al. (2011) [13] aimed at interpreting the clinical profile of Tuberculosis (TB) in children highlighted fever (75.6%), cough (63.4%), and weight loss (41.5%) as the most frequently encountered clinical manifestations.

Out of 100 patients evaluated, 32 (32%) reported having a history of contact with tuberculosis, suggesting that they were exposed to active TB cases in their environment. On the other hand, a larger group consisting of 68 patients (68%) had no such contact history.

A study conducted by Nandarvawala et al. 2023 [14], where known contact of TB cases was reported in 20.9% patients.

In our study, the distribution of tuberculosis types—Pulmonary Tuberculosis (47%), Extrapulmonary Tuberculosis (48%), and Disseminated Tuberculosis (5%)—across various age groups revealed that older children and adolescents (11-17 years) presented with the highest incidence of both PTB and EPTB, recording 37 and 35 cases respectively. Nandarvawala et al. [14] conducted a study in 2023 and reported that 32.7% had pulmonary TB, 50% had extrapulmonary TB, and the most prevalent kind of extrapulmonary TB was TB lymphadenopathy, and 17.27% of cases had disseminated illness. Mazta et al. (2012) [15] reported PTB in 55% of cases, with the remaining 45% diagnosed with EPTB.

Median Hb levels were slightly low and TST was positive in 87% of the patients as seen in other study by Singh et al. (2021) [9]

Chest X-ray findings were abnormal in 59% of patients. Significant findings included hilar lymphadenopathy in 30% of patients and Consolidation in 16%, with less common manifestations such as pleural effusion, cavitation and miliary patterns observed in 9%, 2% and 2% of the cases, respectively.

Microbiological confirmation is gold standard for the diagnosing TB. Microbiological confirmation is not always possible due to the paucibacillary nature of pediatric TB and difficulty to obtain sample. However, microbiological confirmation by CBNAAT/TRUNAAT was achieved in 65.9% of PTB cases and 60% of cases with Disseminated TB

whereas none of the EPTB cases were confirmed by Microbiology. A similar microbiological confirmation was reported by another study. [16]

The study's strength is that it is one of the few studies from India that studied the co-relation between clinical and diagnostic profile of Pediatric TB. The limitations of the study were that the data was collected from a single hospital, which may limit the generalizability of the findings to other regions or populations and the study depends heavily on the accuracy of clinical diagnoses and the completeness of medical records, which may vary and impact the reliability of the data collected.

Conclusion

Majority of pediatric tuberculosis patients (73%) fall within the age group of 11-17 years, with fewer cases in younger age groups. Fever, Cough, loss of appetite, and weight loss are the most common symptoms among patients, occurring in over 70% of cases. A significant proportion of patients (68%) have no history of contact with tuberculosis. Lower socio-economic status is associated with a higher prevalence of underweight patients.

Lab investigations show mean hemoglobin levels of 10.28 g/dL and positive Tuberculin Skin Test results in 87% of patients. Microbiological confirmation is more common in pulmonary tuberculosis cases, while radiology, FNAC/Biopsy, and body fluid analysis are more utilized for extrapulmonary/disseminated cases.

Conflict of Interest

The authors declare no conflicts of interest.

Ethical Approval

The study was approved by the Institutional ethics committee.

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