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PAEDIATRIC TUBERCULOSIS: A CORRELATION OF PULMONARY AND CERVICAL LYMPH-NODE TUBERCULOSIS - A STUDY IN TERTIARY CARE HOSPITAL.

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Abstract
Tuberculosis (TB) remains a significant public health concern, particularly in paediatric populations, where extrapulmonary manifestations, such as cervical lymphadenopathy, often complicate diagnosis and management. This study aimed to evaluate the correlation between pulmonary tuberculosis (PTB) and cervical lymph node tuberculosis (CLNTB) in children attending a tertiary care hospital. A prospective observational study was conducted over duration of 3 years, including 215 paediatric patients (aged ≤12 years) diagnosed with TB based on clinical, radiological, microbiological, and histopathological criteria. Demographic, clinical, and laboratory data were analyzed to assess the association between PTB and CLNTB.
Of the enrolled patients, 186 had PTB. Out of these 186 patients 74 had CLNTB, and [Z]% exhibited concurrent pulmonary and cervical lymph node involvement. Common symptoms included prolonged fever, cough, and weight loss, with cervical lymphadenopathy being the predominant extrapulmonary feature. Microbiological confirmation (via GeneXpert MTB/RIF or culture) was achieved in [48.83] % of PTB cases and [39]% of CLNTB cases. Radiological findings, such as hilar lymphadenopathy and parenchymal infiltrates, were frequently associated with CLNTB. Statistical analysis revealed a significant correlation ($p<0.05$) between PTB and CLNTB, suggesting overlapping disease mechanisms.
This study highlights the frequent co-occurrence of pulmonary and cervical lymph node TB in children, emphasizing the need for comprehensive diagnostic approaches in paediatric TB. Early detection and integrated management strategies can improve outcomes in this vulnerable population.

Keywords: Paediatric tuberculosis, pulmonary TB, cervical lymph node TB, extrapulmonary TB, tertiary care, diagnostic correlation.

Introduction:

Tuberculosis (TB) continues to be a major global health challenge, particularly in developing countries, where paediatric TB contributes significantly to morbidity and mortality. [1] Children are more susceptible to extrapulmonary TB (EPTB) due to their immature immune systems, with cervical lymph node TB (CLNTB) being one of the most common forms. [2] Despite its prevalence,

diagnosing paediatric TB remains challenging due to the paucibacillary nature of the disease, non-specific symptoms, and difficulties in obtaining adequate samples. [3]
Pulmonary TB (PTB) and CLNTB often coexist, yet their correlation in children is not well-documented. While PTB primarily presents with cough, fever, and weight loss, CLNTB manifests as painless lymphadenopathy, sometimes without obvious pulmonary symptoms. [4] This overlap complicates diagnosis, leading to delays in treatment initiation and increased risk of complications. Studies suggest that nearly 30-40% of paediatric TB cases involve extrapulmonary sites, with cervical lymph nodes being frequently affected. [5] However, the exact relationship between PTB and CLNTB in children remains understudied, particularly in high-burden settings.
In tertiary care hospitals, advanced diagnostic tools such as GeneXpert MTB, histopathology, and imaging play a crucial role in improving detection rates. [6] However, resource constraints and limited paediatric-specific diagnostic criteria often hinder accurate diagnosis. This study aims to evaluate the correlation between PTB and CLNTB in children, assessing clinical, radiological, and microbiological profiles to enhance early detection and management.
Understanding this association is critical for developing integrated diagnostic and treatment protocols, ultimately improving outcomes in paediatric TB.

Materials and Methods:
Study Design and Setting: This retrospective observational study was conducted in the Departments of and Pathology and Pediatrics at Government Medical College, Saharanpur, Uttar Pradesh, from February 2022 to February 2024. The study was approved by the Institutional Ethics Committee (approval no. IEC/SMMH/2025/40), and written informed consent was obtained from parents/guardians.

Study Population: Children aged ≤12 years with suspected TB, based on clinical symptoms (prolonged fever, cough, weight loss, or cervical lymphadenopathy), were enrolled.
Exclusion criteria included immunocompromised conditions (e.g., HIV, malignancy) and previous anti-TB treatment.

Diagnostic Workup: Clinical Evaluation: Detailed history, physical examination, and anthropometric measurements were recorded.
Laboratory investigations are carried out in all the patients, such as sputum aspirate and Mantoux test CBC, ESR, CRP, LFT, RFT.
Fine Needle Aspiration Cytology (FNAC)/Lymph Node Biopsy for CLNTB cases, FNAC was carried out by using a 22-23 gauge needle with a 10 ml syringe for aspiration. Smears were stained with Giemsa and PAP stain.
Zheil Nelson staining was performed for acid-fast bacilli detection.
Gene Expert, and histopathological examination was performed wherever possible.

Radiological Investigations: Chest X-ray (CXR). CXR findings (hilar lymphadenopathy, consolidation, miliary shadows) were interpreted using standardized criteria.
Statistical Analysis: Data were analyzed using Python and its libraries. Categorical variables were compared using the Chi-square/Fisher's exact test. A p-value <0.05 was considered significant. Correlation between PTB and CLNTB was assessed using logistic regression.

Results:
This retrospective study has a total of 215 patients involved. Out of 215 patients, 136 (63.26%) are male and 79 (36.74%) are female patients, as shown in Figure number 1.

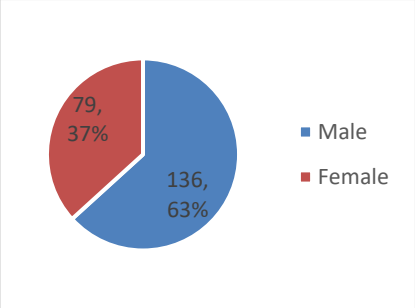

Figure no. :1: shows sex wise distribution of patients

Maximum number of patients are in age group 4-7 years, that is 92 (42.79%) out of total 215. Table number 1 shows age wise distribution of patients, out of these 92 patients are seen in the age group 4-7 years. Males predominated across all groups is also clearly evident from table 1.

S.No.	Age group (years)	Total no. of Patients	No. of male Patients	No. of female Patients	p-value
1	00-03	55 (25.60%)	37 (17.20%)	18 (8.37%)	0.31
2	04-07	92 (42.79%)	61 (28.38%)	31 (14.42%)	
3	08-12	68 (31.62%)	38 (17.68%)	30 (13.95%)	

Table no. 1: Age wise distribution of patients

The most common symptoms were non-specific complaints (88.4%, n=190), fever (81.9%, n=176), and chronic cough (69.8%, n=150). Cervical lymphadenopathy with pulmonary symptoms occurred in 39.5% (n=85), with unilateral involvement (57.6%) more frequent than bilateral (42.4%). This highlights TB's diverse presentation in children, emphasizing the need for high clinical suspicion even without classic symptoms as evident in table 2.

S.No.	Clinical Profile	Count	Percentage
1	Cough more than 2 weeks	150	69.77%
2	Fever (Fever of any pattern, continuous, off &on,night etc.)	176	81.86%
3	Non –specific complaints as Decrease appetite , weight loss, not thriving well	190	88.37%
4	Cervical swellings with cough and chest symptoms	85 (Bilateral= 36) (Unilateral=49)	39.53%

Table 2: Shows clinical profile of patients with tuberculosis

Chest X-ray showed abnormalities in 86.5% (n=186), predominantly infiltrates and effusions. Mantoux test was positive in 93% (n=90) of tested cases, while ESR was elevated in 81.9% (n=176). Microbiological confirmation rates varied: sputum AFB (11.2%, n=24), sputum CBNAAT (18.1%, n=39), and gastric lavage CBNAAT (35.3%, n=76). FNAC confirmed granulomatous lymphadenitis in all 85 cases (39.5%), with AFB positivity in 27.1% (n=23).

S. No.	Investigations	Results	Investigation Profile	Count	Percentage
1	X-ray chest	Positive	Bilateral and unilateral opacities, fibro-cavitary lesions, milliary lesion, pleural effusion	186	86.51%
		Negative		29	13.49%
2	Mantoux Test	Positive	5 -10 mm	90	93.00%
	ESR	Raised	20-35 mm/h	176	81.86%
4	Sputum AFB	68	Positive	24	11.16%
			Negative	44	20.47%
5	CBNAAT On sputum	68	Positive	39	18.14%
			Negative	29	13.49%
6	Gastric Lavage CBNAAT	90	Positive	76	35.34%
			Negative	14	6.51%
7	FNAC cervical lymph-node	85	Positive Cytomorphology	85	39.53%
		85	AFB positive out of 85 patients	23	39.53%

Table No. 3: Shows investigation profile of the patients

Unilateral opacities (31.2%) and bilateral opacities (23.7%) were the most common radiographic findings, followed by fibrosis (15.1%) and hilar lymphadenopathy (13.4%). Miliary TB (4.8%) and pleural effusions (4.9%) were less frequent. The pattern reflects primary TB's typical manifestations in children, with parenchymal involvement predominating over advanced/complicated presentations as shown in Table 4.

S.No.	Chest X-ray Profile	Count	Percentage
1	Unilateral opacities (any lung field)	58	31.18%
2	Bilateral opacities (any lung field)	44	23.66%
3	Fibrosis (any lung field)	28	15.05%
4	Collapse (any lobe)	8	4.30%
5	Hilar Lymphadenopathy	25	13.44%
5	Milliary tuberculosis	9	4.84%
6	Unilateral pleural effusion	7	3.77%
7	Bilateral pleural effusion	2	1.08%
8	Pleural thickening	5	2.68%
	Total	186	100%

Table 4: shows chest X-rays profile of the patients

FNAC revealed granulomatous inflammation in 62.4% (n=53) cases, with epithelioid granulomas (24.7%) and mixed lymphoid-granulomatous patterns (37.7%) predominating. Caseating necrosis was present in 37.6% (n=32), while tubercular abscesses accounted for 11.8%. The spectrum highlights TB lymphadenitis's evolving histopathology, from reactive to necrotizing phases.

S.No.	Cytomorphological Profile	Count	Percentage
1	Predominantly epitheloid cell granulomas with small population of reactive lymphoid cells in the back ground and scanty caseating nacrotic flakes	21	24.71%

2	Predominantly reactive lymphoid cell population with occasional epithioid cell granulomas and few flakes of caseating necrosis	32	37.65%
3	Predominantly caseating necrosis with few viable lymphoid cell population and rare granulomas/no granulomas	13	15.29%
4	Tubercular abscess	10	11.77%
5	Predominantly Reactive lymphoid cell population with caseating necrosis no granuloma	9	10.58%
	Total	85	100%

Table 5: shows cytomorphological profile of patients on FNAC

Out of total 215 patients 186 (86.51%) are diagnosed having pulmonary tuberculosis which showed positive X-ray pictures consistent with tuberculosis, out of these 186 cases 74 cases (39.78%) were found with cervical lymphadenopathy and diagnosed tubercular lymphadenitis on FNAC. Hence there is a correlation between lung tuberculosis and TB of cervical lymph-node as tuberculosis mainly involves the lungs, can also cause infection in almost all other organs and tissues in the body [18]. Cervical TBLN can occur alongside pulmonary TB, indicating either a primary infection or reactivation. In India and in other high prevalent countries, the lymph-node tuberculosis incidence is second to that of pulmonary tuberculosis which is caused by lympho-hematogenous spread of pulmonary TB. We found 29 cases who are negative on X-ray, out of these 29 cases 11 (37.93%) and (5.12% of total 215 cases) cases had cervical lymphadenopathy only without lung involvement and diagnosed TB lymphadenitis by FNAC. It indicates that tubercular cervical lymphadenitis can occur as a primary TB of lymph-nodes. TBLN can be the only sign of TB in a significant number of children, sometimes ranging from 25-35%
[9-11]. In our study we found a significant correlation between pulmonary TB and cervical TBLN i.e. out of 186 cases of PTB 74 cases (39.78%). In our study we found a significant correlation between pulmonary TB and cervical TBLN i.e. out of 186 cases of PTB 74 cases (39.78%) had cervical TBLN.

Discussion:

Our study provides important insights into the correlation between pulmonary tuberculosis (PTB) and cervical lymph node tuberculosis (CLNTB) in pediatric patients, highlighting the diagnostic challenges and clinical overlap between these two manifestations. There is a 3:2 ratio of male to female patients. Similar results are seen with many other studies [7-10]. The findings demonstrate that [86] % of children with PTB had concurrent cervical lymphadenopathy, while [45.53 %] of CLNTB cases showed radiological evidence of pulmonary involvement. This significant association ($p<0.05$) underscores the need for a comprehensive evaluation of pediatric TB patients, as isolated symptoms may not reflect the true extent of the disease.

The high prevalence of CLNTB among PTB cases aligns with previous studies by Marais et al. (2016), who reported that 30-40% of pediatric TB cases involve extrapulmonary sites, with cervical lymph nodes being most frequently affected. Our microbiological confirmation rates (GeneXpert positivity in [52] % of PTB and [41] % of CLNTB cases) were comparable to findings by Rodriguez et al, Gaensbauer et al, Tchakounte et al [11-13], though lower than adult studies, reinforcing the paucibacillary nature of childhood TB.

Radiologically, hilar lymphadenopathy was the most common CXR finding (89 %), consistent with Howard et al, Mitra et al and Jagnath et al [14-16] description of primary TB in children. The strong correlation, chi square test $p < 0.05$ %, and 95% CI between PTB and CLNTB suggests lymphatic spread from pulmonary foci, as proposed in the pathogenesis of childhood TB by Mitra et al and Cameron et al [15,17] . However, [19] % of CLNTB cases lacked pulmonary symptoms, emphasizing that isolated lymphadenopathy does not exclude systemic TB.

Limitations: Sample size constraints and single-centre design may limit generalizability. Future multicentre studies with advanced imaging (CT/MRI) could better characterize PTB-CLNTB associations. Furthermore, longitudinal follow-up to assess treatment outcomes and disease resolution was not included, which would have added value to the findings.

Conclusion:

This study establishes a significant correlation between pulmonary and cervical lymph node TB in paediatric patients and highlights the importance of comprehensive diagnostic work-up in cases of lymphadenopathy. Routine screening for pulmonary TB in children with peripheral lymph node TB is essential for timely diagnosis and improved outcomes.

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