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Original Research Article

INCIDENCE AND CLINICAL PROFILE OF TUBERCULOUS CERVICAL LYMPHADENITIS IN A TERTIARY CARE HOSPITAL: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Cervical lymphadenopathy is a common clinical presentation in surgical practice, with tuberculosis being a major cause in endemic regions. Early identification and accurate diagnosis are essential to reduce morbidity associated with extrapulmonary tuberculosis. **Aim:** To determine the incidence and analyze the clinical profile of tuberculous cervical lymphadenitis in patients presenting with cervical lymphadenopathy in a tertiary care hospital.

Materials and Methods: This prospective observational study included 235 patients presenting with cervical lymphadenopathy over 18 months in a tertiary care hospital. Detailed clinical evaluation, ultrasonography, fine needle aspiration cytology (FNAC), chest radiography, and laboratory investigations were performed. Suspected cases underwent histopathological examination and CBNAAT testing. Statistical analysis was conducted using descriptive statistics and chi-square tests, with $p < 0.05$ considered significant.

Results: The incidence of tuberculosis among cervical lymphadenopathy cases was 51.1% (95% CI: 44.7–57.5). The mean age of patients was 35.4 ± 17.3 years, with a significant proportion below 30 years (41.7%). Females constituted 56.6% of the study population. Solitary lymph node presentation (69.4%) and Level V nodal involvement (53.2%) were most common. CBNAAT demonstrated higher sensitivity (69.2%) compared to FNAC (30.8%) and ultrasonography (30.8%), with 100% sensitivity and 100% negative predictive value when compared with histopathology ($p < 0.001$).

Conclusion: Tuberculosis remains a predominant cause of cervical lymphadenopathy in tertiary care settings, especially among younger individuals. Posterior cervical nodes and solitary presentation are common clinical features. CBNAAT significantly enhances diagnostic accuracy and should be incorporated into routine evaluation protocols for cervical lymphadenopathy in tuberculosis-endemic regions.

Keywords: Tuberculous cervical lymphadenitis. Extrapulmonary tuberculosis. CBNAAT.

INTRODUCTION

Tuberculosis (TB) remains one of the leading infectious causes of morbidity and mortality worldwide. According to the World Health Organization, India continues to bear a significant proportion of the global TB burden, with millions of new cases reported annually.[1] Although pulmonary tuberculosis is the most common presentation, extrapulmonary tuberculosis (EPTB) constitutes nearly 15–20% of all TB cases in immunocompetent individuals and more than 50% in HIV-positive patients.[2] Among the various forms of EPTB, tuberculous lymphadenitis is the most frequent manifestation, particularly involving the cervical lymph nodes.

Cervical tuberculous lymphadenitis represents a significant diagnostic challenge because it often mimics other pathological conditions such as reactive lymphadenitis, lymphoma, metastatic malignancy, and other granulomatous disorders. Clinically, patients may present with painless neck swelling, constitutional symptoms such as fever and weight loss, or abscess formation with sinus discharge. Traditionally, matted lymph nodes have been considered classical for tuberculosis; however, recent studies suggest varied clinical presentations including solitary and discrete nodes.[3]

The pathogenesis of tuberculous lymphadenitis involves either primary infection of lymph nodes or secondary spread from a pulmonary focus via lymphatic or hematogenous routes. The disease is typically paucibacillary, which reduces the sensitivity of conventional smear microscopy. Fine Needle Aspiration Cytology (FNAC) has emerged as a first-line diagnostic modality due to its simplicity, cost-effectiveness, and high diagnostic yield in endemic regions.[4] Cytological features such as epithelioid granulomas with caseous necrosis and Langhans giant cells strongly suggest tuberculosis. However, FNAC may be inconclusive in a subset of cases.

Recent advances in molecular diagnostics, particularly Cartridge-Based Nucleic Acid Amplification Test (CBNAAT/GeneXpert), have significantly improved diagnostic accuracy and facilitated early detection of rifampicin resistance [5]. Histopathological examination (HPE) remains the gold standard in doubtful cases, especially when malignancy is suspected.

Aim

To determine the incidence and analyze the clinical profile of tuberculous cervical lymphadenitis in patients presenting with cervical lymphadenopathy in a tertiary care hospital.

Objectives

1. To estimate the incidence of tuberculosis among patients presenting with cervical lymphadenopathy.
2. To analyze the demographic and clinical characteristics of patients diagnosed with tuberculous cervical lymphadenitis.
3. To evaluate the diagnostic utility of FNAC, ultrasonography, CBNAAT, and histopathological examination in diagnosing cervical tuberculosis.

MATERIALS AND METHODS

Source of Data

The data were collected from patients presenting with cervical lymphadenopathy to the Outpatient and Inpatient Departments of General Surgery at the tertiary care hospital. All eligible patients who fulfilled the inclusion criteria during the study period were enrolled consecutively.

Study Design

The study was designed as a prospective observational hospital-based study.

Study Location

The study was conducted in the Department of General Surgery at a tertiary care teaching hospital equipped with pathology, radiology, and molecular diagnostic facilities.

Study Duration

The study was carried out over a period of 18 months.

Sample Size

The sample size was calculated using OpenEpi software (Version 3.01), based on a previously reported prevalence of tuberculous lymphadenitis of 54%, with 20% relative precision, 95% confidence interval, 5% alpha error, and 20% non-response rate. The final calculated sample size was 235 patients.

Inclusion Criteria

- Patients aged ≥13 years presenting with cervical lymphadenopathy.
- Patients willing to provide informed consent.
- Recurrent or persistent cervical lymphadenitis.

Exclusion Criteria

- Children below 13 years of age.
- Diagnosed cases of malignancy presenting with cervical metastasis.
- Patients whose lymphadenopathy resolved completely after a short course (5 days) of antibiotics.
- Patients unwilling to participate.

Procedure and Methodology

After obtaining informed consent, detailed history and clinical examination were performed. Initial conservative management with oral antibiotics (Amoxicillin 500 mg thrice daily for 5 days) was given. Patients were reviewed after two weeks.

If the lymph node resolved, the case was excluded. Persistent cases underwent further investigations including:

- Ultrasonography (USG) of the neck
- Fine Needle Aspiration Cytology (FNAC)
- Chest X-ray
- Erythrocyte Sedimentation Rate (ESR)

- Sputum examination for AFB (if indicated)

Cases with inconclusive FNAC underwent excision biopsy for Histopathological Examination (HPE). CBNAAT testing was performed on aspirated material or biopsy specimens for confirmation and detection of rifampicin resistance.

Diagnosis of tuberculous lymphadenitis was confirmed if:

- Ziehl-Neelsen stain demonstrated Acid-Fast Bacilli (AFB), and/or
- Granulomatous inflammation with caseous necrosis was identified on cytology or histopathology, and/or
- CBNAAT was positive for Mycobacterium tuberculosis.

Patients diagnosed with tuberculosis were referred to the chest clinic and initiated on anti-tubercular therapy as per national guidelines.

Sample Processing

FNAC samples were processed using standard cytological techniques and stained with Hematoxylin & Eosin and Ziehl-Neelsen stains. Biopsy specimens were fixed in 10% formalin, processed, paraffin embedded, sectioned, and stained for histopathological evaluation. CBNAAT testing was performed as per manufacturer protocol under sterile conditions.

Statistical Methods

Data were entered into Microsoft Excel and analyzed using SPSS software (Version XX). Descriptive statistics such as mean, standard deviation, frequencies, and percentages were calculated. Chi-square test was used to assess associations between categorical variables. A p-value <0.05 was considered statistically significant.

Data Collection

A structured proforma was used to collect demographic data, clinical findings, investigation results, and final diagnosis. All data were anonymized and confidentiality was maintained throughout the study.

RESULTS

Table 1: To determine the incidence and analyze the clinical profile of tuberculous cervical lymphadenitis (N = 235)

Variable	Category / Mean ± SD	n (%)	95% CI	Test of Significance	p-value
Age (years)	35.4 ± 17.3	—	33.2 – 37.6	One-sample t-test	0.018*
Age Group	<30 years	98 (41.7%)	35.4 – 48.1	χ^2 test	0.012*
	30–50 years	90 (38.3%)	32.1 – 44.5		
	>50 years	47 (20.0%)	15.1 – 25.8		
Sex	Male	102 (43.4%)	37.1 – 49.8	χ^2 test	0.041*
	Female	133 (56.6%)	50.2 – 62.9		
Clinical Presentation	Single Node	163 (69.4%)	63.3 – 75.0	χ^2 test	<0.001*
	Multiple	43 (18.3%)	13.7 – 23.8		
	Matted	29 (12.3%)	8.6 – 17.1		
Lymph Node Station	Level 5	125 (53.2%)	46.8 – 59.4	χ^2 test	<0.001*
	Level 3	56 (23.8%)	18.6 – 29.8		
	Level 4	36 (15.3%)	11.1 – 20.4		
	Level 2	18 (7.7%)	4.8 – 11.8		

Statistically significant

Table 1 summarizes the demographic and clinical profile of 235 patients presenting with cervical lymphadenopathy. The mean age of the study population was 35.4 ± 17.3 years (95% CI: 33.2–37.6), which was statistically significant on one-sample t-test ($p = 0.018$), indicating that the study cohort predominantly comprised younger individuals. Age-wise distribution showed that 41.7% of patients were below 30 years, followed by 38.3% between 30–50 years and 20% above 50 years; this distribution was statistically significant (χ^2 test, $p = 0.012$).

There was a mild female predominance, with 56.6% females and 43.4% males ($p = 0.041$), suggesting a significant gender difference in presentation. Regarding clinical examination, the majority of patients presented with a single lymph node (69.4%), whereas 18.3% had multiple nodes and 12.3% had matted nodes. This distribution was highly significant ($p < 0.001$), indicating that solitary node presentation was the commonest clinical pattern.

Analysis of lymph node stations revealed that Level V nodes were most frequently involved (53.2%), followed by Level III (23.8%), Level IV (15.3%), and Level II (7.7%), with strong statistical significance ($p < 0.001$). These findings highlight a predominance of posterior cervical group involvement in the overall cohort.

Table 2: To estimate the incidence of tuberculosis among patients with cervical lymphadenopathy (N = 235)

Diagnosis	n (%)	95% CI	Test of Significance	p-value
Tuberculosis	120 (51.1%)	44.7 – 57.5	One-sample proportion Z-test	0.001*
Non-TB causes	115 (48.9%)	42.5 – 55.3		

Incidence of TB = 51.1%

Table 2 depicts the incidence of tuberculosis among patients with cervical lymphadenopathy. Out of 235 patients, 120 were diagnosed with tuberculosis, giving an incidence of 51.1% (95% CI: 44.7–57.5), whereas 48.9% had non-tuberculous etiologies. The one-sample proportion Z-test demonstrated

statistical significance (p = 0.001), indicating that tuberculosis constituted a major etiological factor in cervical lymphadenopathy within this tertiary care setting.

Table 3: Demographic and Clinical Characteristics of Patients with Tuberculous Cervical Lymphadenitis (n = 120)

Variable	Category / Mean ± SD	n (%)	95% CI	Test of Significance	p-value
Age (years)	30.9 ± 14.9	—	28.2 – 33.6	Independent t-test	<0.001*
Age Group	<30 years	65 (54.2%)	45.2 – 63.0	χ^2 test	0.003*
	30–50 years	41 (34.2%)	26.1 – 43.1		
	>50 years	14 (11.7%)	6.9 – 18.9		
Sex	Male	52 (43.3%)	34.5 – 52.6	χ^2 test	0.048*
	Female	68 (56.7%)	47.4 – 65.5		
Clinical Type	Single	75 (62.5%)	53.4 – 70.9	χ^2 test	0.009*
	Multiple	23 (19.2%)	13.0 – 27.3		
	Matted	22 (18.3%)	12.3 – 26.4		
Lymph Node Station	Level 5	69 (57.5%)	48.4 – 66.2	χ^2 test	0.002*
	Level 3	23 (19.2%)	13.0 – 27.3		
	Level 4	16 (13.3%)	8.2 – 20.8		
	Level 2	12 (10.0%)	5.7 – 16.8		

Table 3 analyzes the demographic and clinical characteristics of the 120 patients diagnosed with tuberculous cervical lymphadenitis. The mean age among TB patients was 30.9 ± 14.9 years (95% CI: 28.2–33.6), which was significantly lower than the overall cohort (p < 0.001), suggesting that tuberculosis predominantly affected younger individuals. More than half (54.2%) of TB patients were below 30 years of age, followed by 34.2% in the 30–50 years group and only 11.7% above 50 years (p = 0.003).

Female patients constituted 56.7% of TB cases, while males accounted for 43.3%, with borderline statistical significance (p = 0.048). Clinically, most TB patients presented with a single lymph node (62.5%), whereas 19.2% had multiple nodes and 18.3% had matted nodes (p = 0.009).

Lymph node station analysis revealed that Level V nodes were most commonly involved (57.5%), followed by Level III (19.2%), Level IV (13.3%), and Level II (10%). This distribution was statistically significant (p = 0.002).

Table 4: Diagnostic Utility of FNAC, Ultrasonography, CBNAAT and HPE in Diagnosing Cervical Tuberculosis

Investigation	TB Detected (n=120)	Sensitivity %	95% CI	Test of Significance	p-value
Ultrasound	37	30.8%	22.7 – 39.9	McNemar χ^2	<0.001*
FNAC	37	30.8%	22.7 – 39.9	McNemar χ^2	<0.001*
CBNAAT	83	69.2%	60.2 – 77.1	χ^2 vs FNAC	<0.001*
HPE (Biopsy)	73	60.8%	51.7 – 69.3	χ^2 vs FNAC	<0.001*

Diagnostic Accuracy of CBNAAT (Compared with HPE Gold Standard; n=187)

Parameter	Value	95% CI
Sensitivity	100%	95.0 – 100
Specificity	73.6%	65.1 – 80.9
PPV	88.0%	79.2 – 93.5
NPV	100%	95.6 – 100
Chi-square	150.88	p <0.001*

Table 4 evaluates the diagnostic utility of various investigations in diagnosing cervical tuberculosis. Ultrasonography and FNAC detected tuberculosis in 30.8% of confirmed cases each, with identical sensitivity (95% CI: 22.7–39.9), and both were statistically inferior when compared with advanced modalities (p < 0.001).

CBNAAT demonstrated the highest sensitivity among non-invasive tests, detecting 69.2% of TB cases (95% CI: 60.2–77.1), which was significantly superior to FNAC (p < 0.001). Histopathological examination (HPE) identified 60.8% of cases (95% CI: 51.7–69.3), also significantly better than FNAC (p < 0.001).

When CBNAAT was compared against HPE as the gold standard (n = 187), it showed 100% sensitivity and 100% negative predictive value, indicating excellent ability to rule out disease. Specificity was 73.6%, and positive predictive value was 88.0%. The association between CBNAAT and HPE findings was highly significant (χ^2 = 150.88, p < 0.001), confirming strong diagnostic concordance.

DISCUSSION

Cervical lymphadenopathy continues to represent one of the most frequent clinical presentations of extrapulmonary tuberculosis in surgical practice. In the present study of 235 patients, the mean age was 35.4 ± 17.3 years, with a statistically significant predominance of younger individuals (p = 0.018). A majority (41.7%) were below 30 years of age. This age trend is consistent with findings by Nayak et al. (2025) [1], who reported a mean age of 27.08 years with nearly 80% of cases occurring in the second to fourth decades of life. Similarly, Saber et al. (2022) [2] observed that the highest incidence of cervical tuberculous lymphadenitis occurred in the 10–39 year age group, reinforcing the observation that

extrapulmonary tuberculosis predominantly affects the younger, economically productive population.

The current study demonstrated a mild female preponderance (56.6%), which was statistically significant ($p = 0.041$). Comparable findings were reported by Naik et al. (2024),[3] who noted a slight female predominance in extrapulmonary tuberculosis cases. In contrast, Rana et al. (2022),[4] documented a male predominance in cervical tubercular lymphadenitis in a hilly region of Uttarakhand. The difference may reflect regional sociocultural factors, health-seeking behavior, or gender-related immune response variations.

Clinically, solitary lymph node presentation was the most common pattern (69.4%), while only 12.3% presented with classical matted nodes. This finding challenges the traditional teaching that matted nodes are pathognomonic of tuberculous lymphadenitis. Mamoon et al. (2024),[5] similarly observed that single discrete nodes were common, although matted nodes were traditionally emphasized. Our results suggest evolving clinical presentations, possibly due to earlier detection and prompt medical intervention.

Lymph node station analysis revealed that Level V nodes were most frequently involved (53.2%), followed by Level III and Level IV nodes. These findings are in concordance with Kaur et al. (2024),[6] who also reported a predominance of posterior cervical group involvement. However, Kumar Sharma et al. (2020) [7] reported upper deep jugular nodes as most frequently involved in their clinicopathological study. Such variations may be attributable to demographic differences or referral patterns across tertiary centers.

The incidence of tuberculosis among patients presenting with cervical lymphadenopathy in our study was 51.1%, which was statistically significant ($p = 0.001$). This high incidence parallels the findings of Algarni et al. (2023),[8] who reported a tuberculous etiology in 52.7% of cervical lymphadenopathy cases, and Ashrafozzaman et al. (2025),[9] who reported a 54% incidence in enlarged neck nodes. These comparable figures reaffirm the persistent high burden of extrapulmonary tuberculosis in developing countries.

Among confirmed TB cases (n=120), the mean age was significantly lower (30.9 ± 14.9 years), with 54.2% below 30 years ($p < 0.001$). This age shift toward younger individuals has also been documented by Alam et al. (2023) [10], suggesting that cervical tuberculous lymphadenitis disproportionately affects younger populations. Female predominance persisted in TB patients (56.7%), again aligning with findings from Dhua et al. (2022),[11] who observed similar demographic trends in rural India.

Diagnostic evaluation revealed that conventional ultrasonography and FNAC detected only 30.8% of cases each, whereas CBNAAT demonstrated a significantly higher sensitivity of 69.2% ($p < 0.001$). Histopathology identified 60.8% of cases. These findings strongly correlate with Preethi et al. (2024),[12] who reported superior diagnostic yield of molecular methods compared to conventional cytology in cervical lymphadenopathy. Furthermore, Patel et al. (2025),[13] demonstrated enhanced detection rates of lymph node tuberculosis using CBNAAT compared to traditional methods.

The diagnostic accuracy analysis of CBNAAT in our study showed 100% sensitivity and 100% negative predictive value, with strong statistical association with histopathology ($\chi^2 = 150.88$, $p < 0.001$). Similar high sensitivity rates were reported by Sondhi et al. (2022),[14] who highlighted the effectiveness of CBNAAT in diagnosing tubercular lymphadenitis, particularly in younger populations. These findings reinforce the reliability and clinical utility of molecular diagnostics in lymph node tuberculosis.

CONCLUSION

The present prospective observational study demonstrated that tuberculosis remains a leading cause of cervical lymphadenopathy in tertiary care settings, with an incidence of 51.1% among patients presenting with enlarged cervical lymph nodes. The disease predominantly affected younger individuals, particularly those below 30 years of age, and showed a mild female preponderance. Clinically, solitary lymph node presentation was more common than classical matted nodes, and the posterior cervical (Level V) group was the most frequently involved nodal station.

Among diagnostic modalities, conventional ultrasonography and FNAC showed limited sensitivity, whereas CBNAAT significantly improved diagnostic yield and demonstrated excellent sensitivity and negative predictive value when compared with histopathology. The findings underscore the importance of incorporating molecular diagnostic techniques in the routine evaluation of cervical lymphadenopathy in tuberculosis-endemic regions. Early and accurate diagnosis facilitates prompt initiation of anti-tubercular therapy and helps reduce disease-related morbidity.

Overall, cervical tuberculous lymphadenitis continues to represent a substantial public health concern, particularly among young adults, necessitating heightened clinical suspicion and standardized diagnostic protocols in tertiary care hospitals.

Limitations of the study

1. The study was conducted in a single tertiary care center, which may limit generalizability to primary or rural healthcare settings.
2. Being hospital-based, referral bias may have influenced the observed incidence rates.
3. HIV status and other immunocompromised conditions were not analyzed in detail, which could affect the epidemiological profile.

4. Long-term treatment outcomes and recurrence rates were not evaluated.
5. Although CBNAAT showed high sensitivity, culture confirmation was not performed for all cases due to resource constraints.
6. The observational design limits causal inference regarding risk factors associated with tuberculous lymphadenitis.

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