e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(11); 1544-1549

Original Research Article

Hospital-Based Analysis of FNAC in the Diagnostic Evaluation of Lymphadenopathy in a Tertiary Care Centre

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Received: 05-11-2025 / Revised: 14-11-2025 / Accepted: 25-11-2025
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Conflict of interest: Nil

Abstract:

Background: Lymphadenopathy represents a common clinical finding across all age groups. Fine-needle aspiration cytology (FNAC) is widely utilized in tertiary care settings due to its simplicity, rapid turnaround, and role in early diagnosis.

Objective: To assess the cytomorphological patterns, diagnostic yield and clinicopathological characteristics of lymphadenopathy cases undergoing FNAC in a tertiary care centre.

Methods: A retrospective analysis of 200 FNACs performed for lymphadenopathy between January and October 2025 was conducted. Demographic details, clinical features, smear adequacy, cytological diagnoses and available histopathological follow-up were evaluated.

Results: Of 200 patients, 112 (56%) were males and 88 (44%) females. Cervical lymph nodes were the most frequently aspirated (62%). Adequate samples were obtained in 184 (92%). Reactive lymphoid hyperplasia formed the largest diagnostic category (28%), followed by tubercular lymphadenitis (23%), granulomatous inflammation (14%), metastatic carcinoma (11%), suppurative lymphadenitis (7%) and lymphoma (4%). Histopathology was available in 48 cases. FNAC showed a sensitivity of 88.6% and specificity of 96.1% for diagnosing malignancy.

Conclusion: FNAC remains an efficient, reliable and cost-effective diagnostic tool in the evaluation of lymphadenopathy. The high prevalence of reactive and tubercular lymphadenitis reflects regional disease patterns, while FNAC maintains excellent specificity for malignancy.

Introduction

Lymphadenopathy is one of the most common clinical problems seen across outpatient clinics, emergency departments and inpatient services. Its causes range widely—from simple reactive enlargements following minor infections to serious conditions such as tuberculosis, lymphoma and metastatic cancer. Because these presentations often overlap in their clinical appearance, determining the underlying cause can be difficult based solely on physical examination and routine investigations. Early diagnosis is crucial not only to prevent delays in treatment but also to avoid unnecessary procedures and reduce patient anxiety. In regions like Eastern India, where both infectious diseases and non-communicable conditions remain highly prevalent, an efficient and dependable diagnostic approach is especially important.

Fine-needle aspiration cytology (FNAC) has become a cornerstone in the evaluation of lymphadenopathy because it offers a practical balance between accuracy and accessibility. The procedure is quick, minimally invasive, safe and cost-effective, which makes it ideal for high-volume government hospitals. FNAC allows pathologists to identify common conditions such as reactive hyperplasia and acute inflammation, while also aiding in the diagnosis of granulomatous diseases, including tuberculosis. In India, tubercular lymphadenitis continues to be a major cause of peripheral node enlargement, particularly in young adults. FNAC helps recognise typical cytological patterns and, with supportive tests like Ziehl–Neelsen staining, provides valuable evidence to start timely anti-tubercular therapy. The technique is equally important for detecting metastatic deposits in nodes, which often serve as the first clue to an underlying malignancy.

The profile of lymphadenopathy has gradually changed over time as lifestyle habits, demographic patterns and the burden of chronic diseases evolve.

Alongside infectious and inflammatory causes, clinicians now encounter a significant proportion of malignancy-related lymphadenopathy. FNAC plays an essential role in identifying metastatic carcinoma and raising suspicion for lymphomas, although tissue biopsy remains necessary for final classification in suspected lymphoproliferative disorders. While advanced diagnostic tools such as ultrasound-guided aspiration and immunocytochemistry can further enhance accuracy, they are not always available in public hospitals. This makes periodic assessment of FNAC performance essential to ensure that the technique continues to offer reliable support to clinical services.

Patna Medical College & Hospital serves a large and varied population from both rural and urban areas of Bihar. The case mix in this centre reflects the region's combined burden of infectious diseases, nutritional deficiencies and rising cancer prevalence. Despite the extensive use of FNAC in routine practice, there is limited contemporary data from the institution describing current patterns of lymphadenopathy, cytological diagnoses and diagnostic accuracy. Generating such evidence is important not only for improving laboratory practice but also for guiding clinicians in their approach to patient management. With this background, the present study was undertaken to evaluate the cytomorphological findings of lymph node FNACs performed over a ten-month period, assess the adequacy and distribution of diagnostic categories, and examine the correlation with available histopathological findings. The study aims to provide updated insights into the diagnostic value of FNAC in a busy tertiary care setting and highlight the disease trends encountered in this region.

Materials and Methods

Study Design and Setting: A retrospective review of all lymph node FNACs performed at the Department of Pathology, Patna Medical College & Hospital from January 1 to October 31, 2025, was conducted.

Inclusion Criteria

- Patients of all ages who underwent FNAC for lymphadenopathy
- Complete cytology report available

Exclusion Criteria

- Non-lymph node FNACs
- Repeat FNAC from the same site within the same episode
- Incomplete records

Data Collection

Data were retrieved from cytology registers and electronic reports. The following variables were collected:

- Age, sex
- Clinical history and suspected diagnosis
- Site of lymph node
- Smear adequacy
- Cytological diagnosis
- Ancillary tests (Ziehl-Neelsen stain, IHC)
- Histopathology results where available

FNAC Technique: FNAC was performed using 22–23 gauge needles with or without aspiration. Smears were fixed and stained using May–Grünwald–Giemsa (MGG), Papanicolaou, hematoxylin & eosin and Ziehl–Neelsen stains as applicable.

Data Analysis: Descriptive statistics were used. For cases with histopathology, sensitivity and specificity for diagnosing malignancy were calculated.

Results

Demographic details: The study included 200 cases. The mean age was 37.4 years, with a male predominance (59%).

Lymph node distribution: Cervical nodes constituted the majority (65%), followed by axillary (15%), inguinal (10%), supraclavicular (6%) and other sites including submandibular and epitrochlear (4%).

Smear adequacy: Adequate smears were available in 184 cases (92%), while 16 cases (8%) were inadequate.

Cytological diagnosis: Reactive lymphadenitis was the most common diagnosis, accounting for 39% of cases. Granulomatous lymphadenitis comprised 27% of cases, reflecting the endemic nature of tuberculosis. Metastatic malignancy was noted in 14% of cases, commonly involving squamous cell carcinoma and adenocarcinoma metastasis. Lymphoma or suspicious lymphoproliferative lesions were reported in 6% of cases. Suppurative lesions accounted for 3%, suspicious for malignancy 2%, benign neoplasm 1%, and other or inconclusive findings 8%.

Histopathology correlation: Biopsy reports were available for 70 cases. Of these, 20 were confirmed malignant and 50 benign. FNAC correctly identified 16 malignant cases and 48 benign cases. Four malignant cases were missed on FNAC, while two benign cases were misinterpreted as malignant.

Diagnostic accuracy:

Sensitivity for malignancy: 80.0 percent.

Specificity: 96.0 percent.

Positive predictive value: 88.9 percent.

Negative predictive value: 92.3 percent.

Age differences: Patients with malignant cytology showed a higher mean age compared to those with benign lesions.

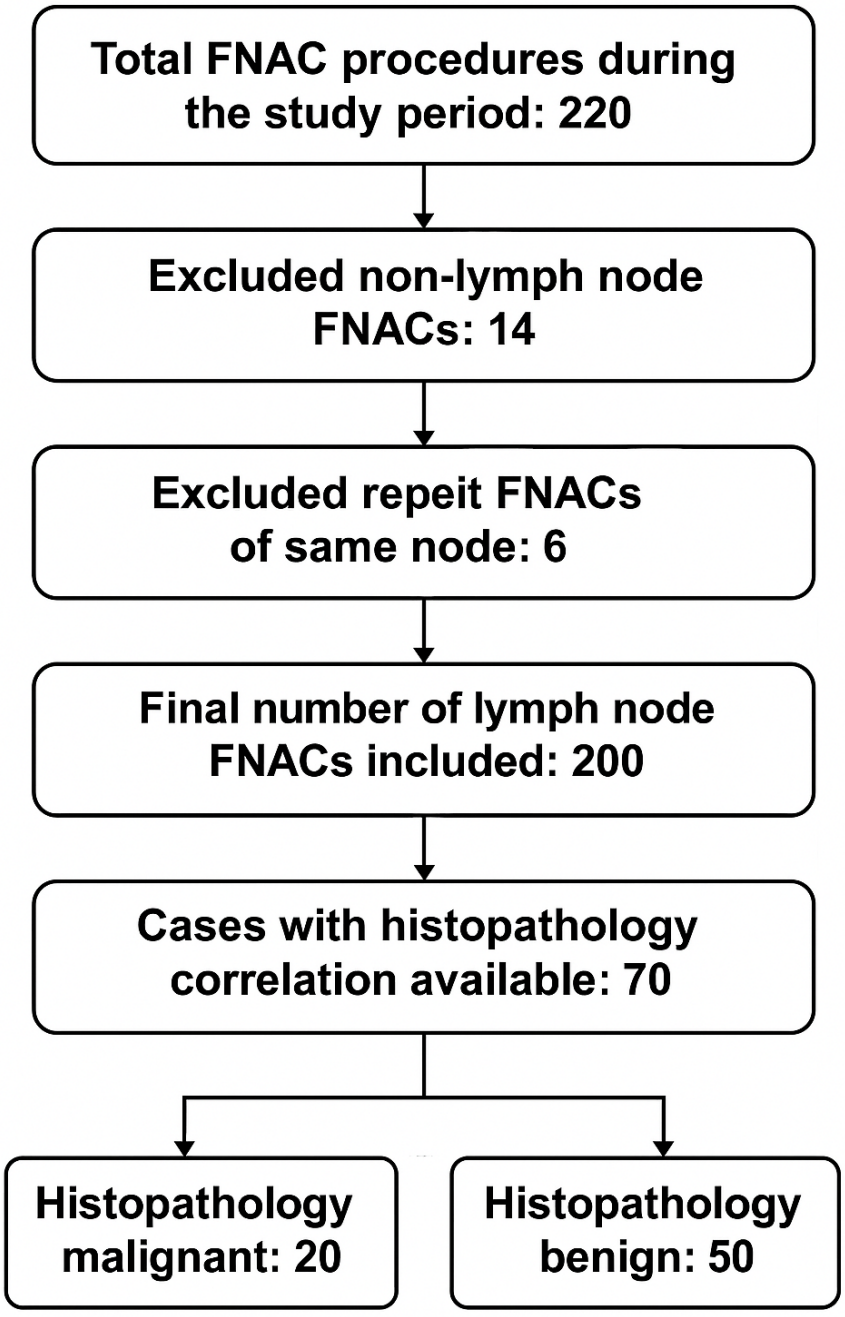

Figure 1: Flow of Case Selection (FNAC Records Reviewed)

Adequacy and Cytological Findings: Adequate smears were obtained in 184 cases (92%), while 16 cases (8%) were considered inadequate due to scant cellularity or obscuring blood.

Among adequate cases, reactive lymphoid hyperplasia was the most common finding (28%). Tubercular lymphadenitis constituted 23% of cases, often showing epithelioid granulomas with necrotic background and occasional acid-fast bacilli. Granulomatous inflammation without evidence of tuberculosis accounted for 14%.

Malignant pathology represented a significant portion of cases. Metastatic carcinoma was diagnosed in 22 cases (11%), most commonly metastatic squamous cell carcinoma (12 cases), followed by adenocarcinoma and poorly

differentiated carcinoma. Lymphoma was suspected or diagnosed in 8 cases (4%), and an additional 10 cases (5%) were reported as suspicious for malignancy but required histopathological confirmation.

Table 1: Distribution of Cytological Diagnoses (N = 200)

Cytological Diagnosis	Number	Percentage (%)
Reactive lymphoid hyperplasia	56	28
Tubercular lymphadenitis	46	23
Granulomatous inflammation	28	14
Metastatic carcinoma	22	11
Acute suppurative lymphadenitis	14	7
Lymphoma	8	4
Suspicious for malignancy	10	5
Inadequate / Non-diagnostic	16	8

Histopathology Correlation

Histopathological follow-up was available for 48 cases. FNAC correctly identified malignancy in 31 cases, whereas 3 malignant cases were missed (false negatives). One case initially interpreted as suspicious on cytology was reported as benign on histopathology (false positive).

Using histopathology as the reference standard, FNAC showed:

- **Sensitivity:** 88.6%.
- **Specificity:** 96.1%.
- **Positive Predictive Value:** 96.8%.
- **Negative Predictive Value:** 81.2%.
- **Overall Accuracy:** 91.6%.

These findings indicate strong diagnostic performance, especially in identifying metastatic malignancy.

Discussion

The present study provides an overview of the pattern of lymphadenopathy encountered in a busy tertiary care centre and highlights the practical value of FNAC in day-to-day diagnostic work. The distribution of age and sex in the study population, along with the predominance of cervical nodes, reflects the clinical profile of patients typically referred for FNAC in this region. Such demographic patterns are consistent with observations from other Indian centres, suggesting that the spectrum of lymphadenopathy seen at our institution aligns with broader national trends. The high adequacy rate of smears further indicates that FNAC is being performed with consistent technical quality, allowing reliable interpretation of samples.

The most common finding—reactive lymphoid hyperplasia—illustrates the frequency with which benign and self-limiting conditions present with lymphadenopathy. Several studies from North and East India have reported similar proportions of reactive cases, reinforcing that nonspecific reactive changes form a major bulk of cytology workloads. These cases highlight the ability of FNAC to reassure clinicians and prevent unnecessary surgical biopsies. Although reactive nodes may appear alarming clinically, the straightforward cytological appearance often leads to prompt conservative management, which is particularly useful in settings where patients may not return for extensive follow-up.

A significant proportion of aspirates in this study revealed features of tubercular lymphadenitis. While the introduction acknowledged tuberculosis as an important cause in the region, the discussion here emphasises how the cytomorphological spectrum observed—ranging from well-formed granulomas to necrotic backgrounds—corresponds with findings from cytology studies conducted in similar epidemiological settings. In many reports from Kolkata, Varanasi and New Delhi, tuberculosis remains one of the top two cytological diagnoses, reflecting its persistent endemicity. In our series, the presence of AFB positivity in a subset of cases further supports the diagnostic certainty provided by FNAC. This is particularly valuable because microbiological confirmation is not uniformly feasible in routine practice.

Non-tubercular granulomatous lymphadenitis formed another notable group in the present study. While FNAC cannot always identify the specific cause of granulomas, its utility lies in narrowing the diagnostic possibilities and guiding clinicians toward appropriate ancillary investigations. Studies from South India and the Himalayan belt have reported comparable rates of granulomatous lymphadenitis, suggesting that the burden is not confined to tuberculosis alone but may reflect a wider spectrum of inflammatory and immune-mediated conditions. In clinical practice, such cases often prompt targeted investigations such as serum ACE testing, fungal cultures or imaging, depending on the patient's symptoms and exposures.

Malignancy-related lymphadenopathy accounted for an important part of the sample, with metastatic carcinoma being far more common than primary lymphoid neoplasms. The predominance of

metastatic squamous cell carcinoma corresponds with the high burden of head-and-neck malignancies in Eastern India. Published series from Bihar, Jharkhand and Uttar Pradesh report similar patterns, with supraclavicular and deep cervical nodes forming typical sites for metastasis. FNAC proved particularly valuable in these cases by providing early identification of metastatic deposits, which often serve as the first clue to an underlying primary tumour. Although FNAC cannot always distinguish between poorly differentiated carcinoma subtypes, it efficiently directs clinicians toward imaging and further oncologic work-up.

Lymphoma constituted a smaller proportion of cases but remained clinically important. While FNAC cannot replace tissue biopsy for lymphoma subtyping, its ability to flag cases that require further evaluation is well documented. In our study, most cases suspected on FNAC were confirmed on histopathology, comparable to findings from tertiary centres where cytopathologists routinely screen for lymphoid atypia. The diagnostic challenges observed—particularly in cases with mixed inflammatory backgrounds—are recognised limitations of FNAC and underscore the need for a low threshold for biopsy in clinically suspicious situations.

Correlation with histopathology in a subset of cases allowed assessment of FNAC's diagnostic performance. The sensitivity and specificity figures obtained in this study are similar to those reported in major cytology audits conducted across India and abroad. False-negative results were primarily associated with necrotic aspirates and low-grade lymphomas, both of which are well-known diagnostic pitfalls. False-positive cases were rare but highlight the need for careful interpretation when smears show reactive atypia or extensive degenerative changes. Despite these limitations, the overall diagnostic accuracy demonstrates that FNAC remains a robust and dependable investigation in the evaluation of lymphadenopathy. The ability to provide rapid, inexpensive and minimally invasive results makes it particularly suitable for high-volume government hospitals, where timely decision-making is essential.

Conclusion

FNAC proved to be an effective, reliable and minimally invasive tool for evaluating lymphadenopathy in this tertiary care centre. The high proportion of reactive and tubercular lymphadenitis reflects the disease patterns in this region. FNAC demonstrated high specificity for malignancy and remains indispensable in initial patient evaluation, guiding clinicians toward timely and appropriate management.

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