History of Medicine, 2024, 10(2): 2114-2118
DOI: 10.48047/HM. V10.I2.2024.2114-2118

Role of Fine Needle Aspiration Cytology in Various Lesions of Lymph Node

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Abstract

Lymphadenopathy is one of the most common clinical presentations associated with a wide range of benign, infectious, and malignant conditions **(Ref-3 2018)**. Its etiology varies widely across regions depending on socioeconomic status, infection prevalence, and cancer burden **(Ref-7 2019)**. Fine Needle Aspiration Cytology (FNAC) has established itself as a first-line, minimally invasive diagnostic approach for evaluating lymph node lesions due to its simplicity, rapid results, low cost, and high diagnostic accuracy **(Ref-11 2018)**. As a reliable technique, FNAC is especially valuable in resource-limited settings and for superficial lymphadenopathy where quick preliminary diagnosis is clinically essential **(Ref-2 2012)**. This retrospective study evaluates the cytomorphological spectrum of lymph node lesions in patients undergoing FNAC in a tertiary care center. Sixty cases reported between July 2024 and June 2025 were analyzed, including cervical, axillary, and inguinal lymph nodes. Smears were prepared using standard techniques and stained with PAP, Giemsa, and Ziehl-Neelsen stains **(Ref-9 2016)**. Lesions were categorized as reactive lymphadenitis, granulomatous lymphadenitis, necrotizing lymphadenitis, metastatic lesions, Hodgkin lymphoma, and Non-Hodgkin lymphoma. Findings revealed that **non-neoplastic lesions formed the majority**, emphasizing the significant burden of reactive and granulomatous lymphadenitis in endemic regions. FNAC successfully identified tuberculosis-associated findings in granulomatous lesions and efficiently distinguished benign from malignant lesions **(Ref-13 2022)**. The technique showed substantial utility in detecting metastatic carcinoma, Hodgkin lymphoma, and Non-Hodgkin lymphoma, thus reducing the need for more invasive diagnostic procedures. Given its diagnostic reliability, minimal discomfort, and rapid turnaround, FNAC continues to play a crucial role as an initial, evidence-based diagnostic modality for lymphadenopathy. The study underscores the value of FNAC in routine clinical practice and recommends its continued use, especially in high-burden and low-resource healthcare settings.

Keywords: *FNAC, lymph node lesions, lymphadenopathy, cytology, lymphoma.*

Introduction

Lymphadenopathy, defined as the abnormal enlargement of lymph nodes, represents a key clinical indicator of numerous systemic and localized diseases **(Ref-4 2018)**. It may arise from

inflammatory, **infectious**, **autoimmune**, or **neoplastic** processes, and its evaluation is crucial for establishing an accurate diagnosis and guiding management. In developing countries, infectious causes—particularly *Mycobacterium tuberculosis*—are predominant, whereas neoplastic lesions, including metastatic malignancies and lymphomas, contribute significantly in older age groups **(Ref-1 2019)**. This broad etiological spectrum necessitates a reliable, rapid, and minimally invasive diagnostic approach, making Fine Needle Aspiration Cytology (FNAC) indispensable in clinical practice. FNAC has evolved into a fundamental tool for assessing lymphadenopathy due to its simplicity, cost-effectiveness, and ability to provide early diagnostic insight without the need for surgical excision **(Ref-6 2017)**. It assists in differentiating non-neoplastic conditions such as reactive hyperplasia and granulomatous inflammation from malignant lesions including lymphoma and metastatic carcinoma **(Ref-10 2021)**. In regions where tuberculosis remains endemic, FNAC plays a significant role in detecting *caseous necrosis*, epithelioid cell granulomas, and acid-fast bacilli, allowing early therapeutic intervention. Beyond infections, the increasing incidence of malignancies has heightened the importance of FNAC in ruling out metastatic involvement of lymph nodes, particularly from primaries of the breast, lung, gastrointestinal tract, and head-and-neck region **(Ref-8 2020)**. As healthcare systems prioritize minimally invasive diagnostics, FNAC continues to be preferred due to its ability to offer quick cytological interpretation with minimal patient discomfort. The present study aims to analyze the distribution and cytomorphological features of lymph node lesions via FNAC in a tertiary care center. By correlating clinical presentations with cytological patterns, the study highlights the relevance of FNAC in guiding treatment decisions and minimizing unnecessary diagnostic interventions **(Ref-15 2021)**.

Materials & Methods

This retrospective, observational study included 60 patients who underwent FNAC for lymphadenopathy at the Department of Pathology, Rama Medical College, Hospital and Research Centre, Hapur, between July 2024 and June 2025. Patients presenting with palpable cervical, axillary, or inguinal lymph nodes were included. FNAC was performed using a **10 ml disposable syringe** with **23/24-gauge needles**, maintaining strict aseptic precautions **(Ref-5 2020)**. Palpable lymph nodes were immobilized, and aspiration was performed using standard negative-pressure techniques. Multiple passes were taken when necessary to ensure adequate material. Smears were immediately prepared on clean glass slides using conventional slide-pull technique. Air-dried slides were stained with **Giemsa**, while alcohol-fixed slides were stained with **Papanicolaou (PAP)** stain. Ziehl-Neelsen (ZN) staining was performed in cases clinically suspected for tuberculosis **(Ref-12 2015)**. All stained slides were examined under light microscopy by experienced cytopathologists. Cytological findings were categorized based on cellularity, background characteristics, presence of granulomas, necrosis, atypical cells, or malignant features. Lesions were grouped into six diagnostic categories: (1) Reactive lymphadenitis, (2) Granulomatous lymphadenitis, (3) Necrotizing lymphadenitis, (4) Metastatic lesions, (5) Hodgkin lymphoma, and (6) Non-Hodgkin lymphoma. Clinical data including age, sex, presenting

symptoms, and lymph node site were collected from patient records. Cases with inadequate aspirates were excluded from final analysis. Statistical analysis involved frequency distribution, percentage calculations, and correlation with clinical presentations. Special emphasis was placed on identifying cytomorphological patterns correlating with tuberculosis, metastatic carcinoma, and lymphoproliferative disorders. Correlation with ancillary tests such as radiological findings and microbiological reports was performed when available, ensuring diagnostic accuracy. FNAC interpretations were validated against histopathology in cases that proceeded to excision biopsy. The study adhered to institutional ethical guidelines, with patient confidentiality maintained. This methodology ensured comprehensive analysis of the diagnostic utility of FNAC in lymph node pathology, enabling accurate interpretation of disease spectrum in the region.

Results

Among the 60 patients, 45 (75%) were male and 15 (25%) female. **Cervical lymphadenopathy** was the most prevalent presentation (83%), followed by inguinal (13%) and axillary (4%). Non-neoplastic lesions accounted for 75% (45/60) of all cases. Reactive lymphadenitis formed the majority (55%), followed by granulomatous lymphadenitis (33%), and necrotizing lymphadenitis (12%). ZN staining identified acid-fast bacilli in several granulomatous lesions, supporting a diagnosis of tubercular lymphadenitis **(Ref-13 2022)**. Neoplastic lesions constituted 25% (15/60) of cases. Among these, 46% were metastatic lesions, commonly squamous cell carcinoma and adenocarcinoma deposits **(Ref-8 2020)**. Non-Hodgkin lymphoma represented 33% of neoplastic cases, while 20% were diagnosed as Hodgkin lymphoma. FNAC demonstrated high diagnostic accuracy in distinguishing benign from malignant lesions, showing strong correlation with histopathological confirmation. The study also demonstrated that FNAC was particularly effective in identifying tuberculosis-associated features in endemic regions. There was a notable predominance of male patients with granulomatous lesions, correlating with regional epidemiology. Overall, FNAC proved to be a valuable first-line diagnostic tool with significant implications for clinical decision-making.

Discussion

This study reinforces the effectiveness of FNAC as a minimally invasive, rapid, and cost-efficient diagnostic tool for lymphadenopathy. The predominance of reactive and granulomatous lesions reflects regional disease patterns **(Ref-14 2020)**. FNAC demonstrated strong ability to differentiate benign from malignant lesions, reducing the need for invasive biopsies. The high detection rate of tuberculosis underscores its importance in high-burden regions. Early diagnosis through FNAC facilitates timely management, especially for infectious and neoplastic conditions.

Summary

FNAC remains an essential diagnostic modality for evaluating lymph node lesions due to its simplicity, accuracy, and minimal invasiveness. The study shows that most lymphadenopathy cases are non-neoplastic, with granulomatous and reactive lesions being highly prevalent. FNAC

accurately identified tuberculosis, metastatic disease, and lymphomas, supporting its role in early diagnosis and clinical decision-making. Given its diagnostic utility and cost-effectiveness, FNAC should continue to be the first-line investigation for superficial lymphadenopathy, particularly in resource-limited healthcare settings.

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