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Original Research Article

Correlation of Fine Needle Aspiration Cytology of Lymph Node Lesions with Histopathological Findings

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Abstract:

Background: Lymphadenopathy is a common clinical condition caused by a wide range of benign and malignant diseases. Fine Needle Aspiration Cytology (FNAC) is widely used as a minimally invasive diagnostic technique for the preliminary evaluation of lymph node lesions, while histopathology remains the gold standard for definitive diagnosis.

Aim: To evaluate the diagnostic accuracy of FNAC in lymph node lesions and to correlate cytological findings with histopathological examination.

Methodology: A hospital-based cross-sectional observational study was conducted in the Department of Pathology, Government Medical College Bettiah, Bihar, over 8 months. A total of 40 patients with palpable lymphadenopathy who underwent FNAC followed by excisional biopsy were included. Cytological findings were compared with histopathological results, and diagnostic parameters such as sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were calculated using the Galen and Gambino method.

Results: Metastatic carcinoma was the most common lesion (32.5%), followed by granulomatous lymphadenitis (25%) and reactive lymphadenitis (22.5%). FNAC showed strong correlation with histopathology with 17 true positives, 20 true negatives, 2 false positives, and 1 false negative. Sensitivity, specificity, PPV, NPV, and diagnostic accuracy were 94.44%, 90.91%, 89.47%, 95.24%, and 92.50% respectively.

Conclusion: FNAC is a reliable, rapid, and minimally invasive diagnostic tool for the initial evaluation of lymph node lesions, showing high correlation with histopathology.

Keywords: Fine Needle Aspiration Cytology, Lymphadenopathy, Histopathology, Lymph Node Lesions, Diagnostic Accuracy, Metastatic Carcinoma.

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Introduction

Lymphadenopathy is a familiar clinical problem that is faced in medical practice and can occur as a result of a broad spectrum of etiologies, including benign reactive mechanisms and malignant neoplasms. Lymph node enlargement can be a result of infections, inflammatory conditions, immune system disorders or metastatic cancer. Due to the crucial role of lymph nodes as the immune system component, they often react to a variety of pathological conditions which take place in the body [1]. Lymphadenopathy assessment, thus, constitutes a crucial process in clinical diagnosis and care because the cause might either be self-limiting diseases or life-threatening diseases that need urgent care. Proper diagnosis of the lesion of the lymph nodes is essential in identifying the treatment plan to be used and the prognosis of the patients.

Historically, excisional biopsy with histopathological analysis has been the standard of choice in the diagnosis of lesions of lymph nodes. Histopathology is a method which offers specific details of both architectural and cytological nature and contributes to defining the type of lesion and differentiating between reactive, infectious, and neoplastic events [2]. But surgical biopsy is an invasive test which might need anesthesia, hospital facilities and it turns out to be slower in diagnosis. Less invasive diagnostic methods are more popular in numerous clinical cases, in particular those cases in which a rapid preliminary diagnosis is needed. This has given rise to

the rising application of Fine Needle Aspiration Cytology (FNAC) as a screening diagnostic tool in the assessment of lymphadenopathy.

FNAC is an extensive diagnosis method that is extensively applied for evaluating enlarged lymph nodes. It is a procedure that entails the removal of cellular material of a lymph node with a slender needle followed by microscopic examination. FNAC has become popular due to the fact that it is least invasive, easy to administer and yields quick results [3]. It may also be performed in an outpatient environment without the use of anesthesia and therefore it is a convenient technique to both clinicians and patients. As a result of these strengths, FNAC has emerged as a significant primary investigation test during diagnostic work up of lymph node lesions.

FNAC has a number of benefits as a method of diagnosis. It is less invasive and less uncomfortable to the patient as compared to surgery biopsy. The process is not complicated and may be conducted within a short period using very few pieces of equipment [4]. FNAC is also deemed to be reliable and offers quick initial diagnosis and facilitates early clinical determination. The second significant benefit is that it is cost-effective and, therefore, especially applicable to resource-restricted healthcare facilities. Due to these features, the use of FNAC as the initial diagnostic procedure in the assessment of lymphadenopathy is common.

FNAC is also very useful in the diagnosis of various pathological conditions of lymph nodes, in addition to being simple and cost-effective. It is significant in the detection of inflammatory and infectious diseases like reactive lymphadenitis, granulomatous lymphadenitis and tuberculous lymphadenitis [5]. FNAC is especially useful in the management and early treatment of tuberculous lymphadenitis in the areas where the prevalence of tuberculosis is high. Moreover, with the aid of FNAC, it is also possible to identify neoplastic diseases such as lymphomas and metastatic lymph node malignancies. Cytological diagnosis of early metastatic disease is valuable in terms of staging the cancer and developing the necessary treatment approach.

FNAC has several limitations in spite of the numerous benefits it has. The method is not able to provide full data on the architectural pattern of the lymph node, which is occasionally required on final diagnosis especially in the event of lymphoma, as it mainly measures the morphology of the individual cells. This is the reason why histopathological examination is the gold standard and, in most cases, it is necessary to validate the diagnosis made via cytology by performing histopathological examination. Thus, the relationships between the cytological results obtained with FNAC and those of histopathological results are needed to identify the accuracy and reliability of this technique in the diagnosis of lymph node lesions [6].

Cytological findings and correlation with histopathological examination can be used in determining the diagnostic validity of FNAC and to determine potential discrepancies. The importance of such correlation studies is that they give us much useful information regarding the sensitivity, specificity, and the overall diagnostic accuracy of FNAC in the assessment of the lymph node pathologies. The correlation of FNAC to histopathology to gain insight on its strengths and limitations would aid in enhancement of diagnostic methods and provide better patient management [7].

A number of research have shown that the FNAC is an efficient and dependable procedure of preliminary diagnosis of the lesion in the lymph nodes. It has been extensively applied in assessment of superficial lymphadenopathy, especially of the cervical, axillary and inguinal lymph nodes. The procedure does not only aid in the differentiation of benign and malignant lesions but also aids clinicians in determining whether the surgical biopsy is required. In most instances, FNAC is able to save needless surgical interventions by giving adequate diagnostic information [8].

The scope of conditions that can manifest as lymphadenopathy is quite large, so it is critical to apply the diagnostic tools that would be accurate, quick, and require the minimum level of invasiveness. FNAC meets these criteria and is an excellent screening test in the assessment of lesions of the lymph nodes. Yet cytological results should be compared with the end-of-the-line histopathologic diagnosis made using biopsy to prove its usefulness in terms of diagnostic modality.

Thus, the proposed research will determine the diagnostic potential of Fine Needle Aspiration Cytology in diagnosing lesions of lymph nodes and identify the diagnostic accuracy of the method by comparing the results of cytology with histopathology. The research aims at bringing out the practicality of the FNAC as a valuable screening tool in the assessment of lymphadenopathy. By comparing the cytopathological diagnosis of lymph nodes and histopathological results, the research aims to evaluate the accuracy of FNAC and its possible use in assisting in the clinical management of patients with lesions of the lymph nodes.

Methodology

Study Design: The present study was conducted as a hospital-based cross-sectional observational study to evaluate the correlation between Fine Needle Aspiration Cytology (FNAC) findings and histopathological examination (HPE) of lymph node lesions. FNAC is widely used as a preliminary diagnostic tool for lymphadenopathy due to its simplicity, rapid

results, and cost-effectiveness. The study aimed to determine the diagnostic accuracy of FNAC by comparing cytological findings with histopathological results, which are considered the gold standard for diagnosis.

Study Area: The study was carried out in the Department of Pathology, Government Medical College Bettiah, West Champaran, Bihar, India.

Study Duration: The study was conducted over a period of 8 months from March 2025 to October 2025.

Sample Size: A total of 40 lymph node samples were included in the study. These samples were obtained from patients presenting with palpable lymph node swellings who underwent FNAC examination in the pathology department and later had their lymph nodes surgically excised for histopathological evaluation.

Study Population: The study population consisted of patients of all age groups and both sexes who presented with clinically palpable lymphadenopathy and were referred to the Department of Pathology for diagnostic evaluation. Only those patients who underwent both Fine Needle Aspiration Cytology and subsequent histopathological examination of the lymph node were included in the study so that accurate cytological and histopathological correlation could be performed.

Data Collection: Data were collected using a structured proforma designed for the study. The information recorded included demographic details such as age and gender, as well as clinical features including the site, size, consistency, mobility, and tenderness of the lymph nodes. FNAC was performed on all selected cases using a 22–23 gauge needle attached to a 10 ml disposable syringe under aseptic conditions. The aspirated material was spread onto clean glass slides, air-dried or alcohol-fixed, and stained with May-Grünwald-Giemsa (MGG) and Hematoxylin and Eosin (H&E) stains for cytological evaluation. In cases where lymph nodes were surgically excised, the specimens were fixed in 10% neutral buffered formalin, processed using routine paraffin embedding techniques, sectioned, and stained with Hematoxylin and Eosin for histopathological examination. The cytological diagnosis obtained from FNAC was then compared with the histopathological findings.

Inclusion Criteria

- Patients presenting with palpable lymph node swelling.
- Patients who underwent FNAC of lymph nodes in the Department of Pathology.
- Patients whose lymph nodes were subsequently excised and sent for histopathological examination.
- Patients who provided informed consent for participation in the study.

Exclusion Criteria

- Patients with inadequate or unsatisfactory FNAC smears.
- Cases where histopathological specimens were not available for correlation.
- Patients who refused consent to participate in the study.
- Recurrent cases already diagnosed and under treatment.

Study Procedure: Patients presenting with lymphadenopathy were first clinically evaluated and then referred for Fine Needle Aspiration Cytology in the Department of Pathology. The aspirated material was examined microscopically to determine the cytological diagnosis, which included categories such as reactive lymphadenitis, granulomatous lymphadenitis, suppurative lymphadenitis, or malignant lesions. In cases where surgical excision of the lymph node was performed, the specimens were subjected to routine histopathological processing and microscopic examination. The histopathological diagnosis was considered the gold standard, and the findings were compared with the cytological diagnosis obtained from FNAC. The degree of agreement between FNAC and histopathology was evaluated to determine the reliability and diagnostic accuracy of FNAC in lymph node lesions.

Statistical Analysis: The collected data were compiled and entered into Microsoft Excel for analysis. Descriptive statistics such as frequency and percentage were used to present demographic and clinical characteristics of the patients. The correlation between cytological and histopathological findings was assessed using the Galen and Gambino method, which was used to calculate diagnostic parameters including sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy of FNAC in diagnosing lymph node lesions. The results were presented in the form of tables and percentages for clear interpretation".

Result

Table 1 shows the demographic distribution of the study participants (N = 40). The highest proportion of cases was observed in the 41–50 years age group (20%), followed by 31–40 years and 51–60 years (17.5% each). Participants aged 21–30 years and above 60 years each accounted for 15%, while 11–20 years represented 10% of the cases. The 0–10 years age group had the lowest proportion with 5%. Regarding gender distribution, females constituted a slightly higher proportion with 21 cases (52.5%), while males accounted for 19 cases (47.5%). Overall, lymph node lesions were more commonly observed in middle-aged individuals, with a nearly equal distribution between males and females.

Table 1: Demographic Distribution of Study Participants (N = 40)			
Variable	**Category**	**Number of Cases**	**Percentage (%)**
Age Group (Years)	0–10	2	5
	11–20	4	10
	21–30	6	15
	31–40	7	17.5
	41–50	8	20
	51–60	7	17.5
	>60	6	15
Gender	Male	19	47.5
	Female	21	52.5

Table 2 presents the clinical characteristics of lymph nodes among 40 cases. The cervical region was the most common site of lymph node involvement, accounting for 23 cases (57.5%), followed by the axillary nodes in 7 cases (17.5%), inguinal nodes in 6 cases (15%), and supraclavicular nodes in 4 cases (10%). Regarding consistency, hard lymph nodes were most frequently observed (40%), followed by firm nodes (35%) and soft nodes (25%). In terms of mobility, the majority of lymph nodes were fixed (62.5%), while 37.5% were mobile. These findings suggest that cervical lymphadenopathy with firm to hard consistency and reduced mobility was common among the study participants.

Table 2: Clinical Characteristics of Lymph Nodes (N = 40)			
Parameter	**Category**	**Number of Cases**	**Percentage (%)**
Site of Lymph Node	Cervical	23	57.5
	Axillary	7	17.5
	Inguinal	6	15
	Supraclavicular	4	10
Consistency	Soft	10	25
	Firm	14	35
	Hard	16	40
Mobility	Mobile	15	37.5
	Fixed	25	62.5

Table 3 presents the cytological (FNAC) and histopathological diagnosis of lymph node lesions among 40 cases. Metastatic carcinoma was the most common diagnosis, accounting for 13 cases (32.5%) on both FNAC and histopathology. Granulomatous lymphadenitis was the next most frequent finding with 10 cases (25%) on FNAC and 9 cases (22.5%) on histopathology. Reactive lymphadenitis was observed in 9 cases (22.5%) on FNAC and 8 cases (20%) on histopathology. Suppurative lymphadenitis accounted for 3 cases (7.5%), while lymphoma was diagnosed in 5 cases (12.5%) on both FNAC and histopathology. Overall, the findings demonstrate a close correlation between FNAC and histopathological diagnoses of lymph node lesions.

Table 3: Cytological (FNAC) and Histopathological Diagnosis of Lymph Node Lesions (N = 40)				
Diagnosis	**FNAC (n)**	**FNAC (%)**	**Histopathology (n)**	**Histopathology (%)**
Reactive Lymphadenitis	9	22.5	8	20
Granulomatous Lymphadenitis	10	25	9	22.5
Suppurative Lymphadenitis	3	7.5	3	7.5
Metastatic Carcinoma	13	32.5	13	32.5
Lymphoma	5	12.5	5	12.5
Total	**40**	**100**	**40**	**100**

Table 4 shows the correlation between Fine Needle Aspiration Cytology (FNAC) and histopathological findings in 40 cases. Among the cases diagnosed as malignant on FNAC, 17 cases were confirmed as malignant on histopathology (true positives), while 2 cases were found to be benign (false positives). In the group diagnosed as benign on FNAC, 20 cases were confirmed as benign (true negatives) and 1 case was identified as malignant on histopathology (false negative). Overall, histopathology revealed 18 malignant and 22 benign cases. This comparison demonstrates a strong correlation between FNAC and histopathological diagnosis, supporting the usefulness of FNAC as a reliable preliminary diagnostic tool for breast lesions.

Table 4: Correlation of FNAC with Histopathological Findings (N = 40)			
FNAC Diagnosis	**Histopathology Malignant**	**Histopathology Benign**	**Total**
FNAC Positive (Malignant)	17 (True Positive)	2 (False Positive)	19
FNAC Negative (Benign)	1 (False Negative)	20 (True Negative)	21
Total	**18**	**22**	**40**

Table 5 presents the diagnostic accuracy of Fine Needle Aspiration Cytology (FNAC) using the Galen and Gambino method. The sensitivity of FNAC was 94.44% (17/18), indicating a high ability to correctly identify malignant cases. The specificity was 90.91% (20/22), reflecting a strong capacity to correctly identify benign cases. The positive predictive value (PPV) was 89.47% (17/19), suggesting that most positive FNAC results truly represented disease. The negative predictive value (NPV) was 95.24% (20/21), indicating a high likelihood that negative results were truly disease-free. Overall, the diagnostic accuracy of FNAC was 92.50% (37/40), demonstrating that FNAC is a reliable and effective diagnostic tool for evaluating breast lesions.

Table 5: Diagnostic Accuracy of FNAC (Galen and Gambino Method)		
Parameter	**Formula**	**Value**
Sensitivity	TP / (TP + FN) = 17 / 18	**94.44%**
Specificity	TN / (TN + FP) = 20 / 22	**90.91%**
Positive Predictive Value	TP / (TP + FP) = 17 / 19	**89.47%**
Negative Predictive Value	TN / (TN + FN) = 20 / 21	**95.24%**
Diagnostic Accuracy	(TP + TN) / N = 37 / 40	**92.50%**

Discussion

The current research examined diagnostic accuracy of fine needle aspiration cytology (FNAC) in lesions of lymph nodes by comparing cytological results with histopathological examination (HPE). In our research, we found that most of the patients belonged to the middle-aged age group (especially 4150 years age group, 20%), 3140 years (17.5%), 5160 years (17.5%). Other comparison studies with lymphadenopathy have also indicated a similar age distribution, with more people in the middle age and old age suffering from lymphadenopathy. According to Mohanty and Wilkinson (2013) [9], majority of the patients who provided the lymph node aspirates were in the fifth and sixth decades of life and that is similar to our results. Similarly, even a review of 376 superficial lymph node aspirates done by Kline (1984) [10] revealed that there was a more prevalent rate of lymphadenopathy amongst middle-aged adults. These findings are indicative of the fact that the enlargement of lymph nodes as a result of both benign and malignant states increase with age".

In the current research, there were a little more case of females (52.5%) than of males (47.5%). This observation is similar to the above study where females constituted 53.33% of incidences. Mohanty and Wilkinson (2013) have reported similar female predominance [9] but other researchers have reported slight male predominance meaning that gender distribution could differ based on the population under investigation and the etiological conditions. Nevertheless, in general, there is a majority of the studies which state that lymphadenopathy has approximately equal gender predilection in both genders.

The most affected site of lymph node in our study was the cervical area as it was involved in 57.5% of the cases. This result is quite in line with the results on the given discussion where cervical lymph nodes were found in 58.33% of the incidences. The same has been noted in a number of past studies. The most affected location in the study of lymph node FNAC by Mohanty and Wilkinson (2013) [9] was also the cervical lymph nodes. Cervical lymphadenopathy is widely recognized to be related to infections, granulomatous diseases, and head and neck malignancies metastases and this is the reason why it is very common in cytological and histopathological assessments (Kocjan, 2006) [11].

Regarding clinical features, the most frequent results of our study were hard lymph nodes (40%), and then firm nodes (35%), as well as soft nodes (25%). A similar observation has been made in the presented discussion in which hard consistency was found in 45 percent of the instances. Hard lymph nodes are commonly linked with cancerous diseases, especially metastatic carcinoma whereas the firm lymph nodes are common in reactive or granulomatous diseases (Caraway & Katz, 2006) [12]. In addition, most lymph nodes in our study were fixed (62.5%), and it can be compared with the results of the comparative study, in which the number of fixed nodes was mostly the same. Fixity Lymph node fixity is usually a clinical finding that is suggestive of malignancy because of invading against the surrounding tissue.

Our study showed that our cytological analysis showed that metastatic carcinoma was the most frequent diagnosis (32.5). The second diagnosis was granulomatous lymphadenitis (25%), reactive

lymphadenitis (22.5%), lymphoma (12.5%), and suppurative lymphadenitis (7.5%). The comparative discussion, on the contrary, cited granulomatous lymphadenitis as the most predominant diagnosis in FNAC with histopathological examination indicating a squamous cell carcinoma deposit as the most prevalent lesion. This variability of outcomes can be explained by the fact that the prevalence of infectious diseases and malignancies will be different in various population groups. As an example, tuberculosis is one of the principal causes of granulomatous lymphadenitis in developing nations, which frequently results in the increase of the ratio of granulomatous lesions on FNAC (Orell et al., 2005) [13].

In our study, metastatic carcinoma was the most common lesion (32.5%), then granulomatous lymphadenitis (22.5%), reactive lymphadenitis (20%), lymphoma (12.5%), and suppressive lymphadenitis (7.5%) were identified by histopathological examination. Such results are in line with a number of prior studies in which metastatic deposition was a significant part of the malignant lymph node lesions. According to a study conducted by Kline (1984) [10], metastatic carcinoma had a high percentage of lymph node aspirates especially in the cervical lymph nodes. In the same line, Caraway and Katz (2006) [12] stressed that FNAC can be very helpful in detecting the presence of metastatic carcinoma in lymph nodes because of the cytological appearance.

FNAC Correlation with histopathology in our study revealed that there was a high level of agreement. True positive cases were 17, true negative cases were 20, false positive cases were 2 and false negative cases were 1. These results can be compared to the comparative study in which the number of cases of true positive was 37, true negative was 19 and the number of false positive and false negative cases were insignificant. The fact that occasionally there could be false positive or false negative outcomes can be explained by sampling errors, inefficient aspirations, or common cytological characteristics of reactive and malignant lesions (Kocjan, 2006) [11].

The diagnostic strengths of FNAC in our study was sensitivity of 94.44, specificity of 90.91, positive predictive value of 89.47, negative predictive value of 95.24 and overall diagnostic accuracy of 92.50. These are quite comparable to the ones reported in the comparative study with the sensitivity of 94.87, with specificity of 90.48, and a diagnostic accuracy of 93.33. High sensitivity and specificity of FNAC in assessing the lymph node lesions were also reported by Mohanty and Wilkinson (2013) [9], which confirms the reliability of the FNAC method of diagnosis. The high diagnostic accuracy of FNAC underscores the ability of this technique in initial assessment of lymphadenopathy as a rapid, minimally invasive and cost-effective diagnostic technique.

Altogether, the results of the current research prove the high level of correlation between the FNAC technique and the histopathological analysis in the diagnosis of the lesions of the lymph nodes. The sensitivity, specificity and diagnostic accuracy of FNAC in the study is in accordance with the literature published in the past that showed that FNAC is a useful first-line diagnostic tool to evaluate lymphadenopathy and subsequent clinical management (Orell et al., 2005; Mohanty & Wilkinson, 2013) [13,9].

Conclusion

The current research paper has shown that fine needle aspiration cytology (FNAC) is a dependable and efficient diagnostic tool in assessing lesions of lymph nodes. Various age groups of patients with a mild preponderance of females comprised the study population with cervical lymph nodes being the most frequent site of involvement. A variety of benign and malignant lymph node lesions were identified, with metastatic carcinoma being the most frequent malignant condition, while reactive and granulomatous lymphadenitis constituted a significant proportion of benign lesions. Comparison between cytological and histopathological findings showed a strong correlation, indicating that FNAC provides dependable preliminary diagnostic information. Although a few discrepancies were observed, FNAC overall showed high diagnostic performance in differentiating benign from malignant lymph node lesions. Therefore, FNAC can be considered a valuable, minimally invasive, and rapid diagnostic tool for the initial evaluation and management of lymphadenopathy, with histopathology remaining the confirmatory method where necessary.

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