Section: Pathology

Original Research Article

DIAGNOSTIC UTILITY OF FINE NEEDLE ASPIRATION CYTOLOGY IN EVALUATING LYMPHADENOPATHIES: A TERTIARY CARE HOSPITAL EXPERIENCE

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ABSTRACT

Background: Lymphadenopathy is a common clinical condition with diverse etiologies ranging from benign reactive processes to malignancies. Early and accurate diagnosis is essential for appropriate management. Fine Needle Aspiration Cytology (FNAC) is a minimally invasive, cost-effective, and rapid diagnostic modality widely used for evaluating lymph node lesions. This study aimed to assess the diagnostic utility of FNAC in lymphadenopathies and analyze the spectrum of cytological findings in a tertiary care setting.

Materials and Methods: This retrospective study was conducted over 21 months (January 2022–October 2023) in the Cytology OPD of a tertiary care hospital. A total of 380 cases of peripheral lymphadenopathy were included. FNAC was performed using standard techniques, and smears were stained with Giemsa and Papanicolaou stains. Cytological diagnoses were categorized, and histopathological correlation was performed where available. Data were analyzed using descriptive statistics, and diagnostic accuracy parameters were calculated.

Results: Among 380 cases, males constituted 55.3% and females 44.7%, with the most affected age group being 21–30 years (21.6%). Reactive lymphadenopathy (35.5%) was the most common diagnosis, followed by granulomatous (28.4%) and tuberculous lymphadenitis (21.8%). Malignancies accounted for 13.6%, predominantly metastatic lesions (11.3%). Cervical lymph nodes were the most frequently involved site (56.3%). FNAC demonstrated high diagnostic accuracy, with sensitivity of 92.3% and specificity of 99.7% for malignancies.

Conclusion: FNAC is a reliable, rapid, and minimally invasive diagnostic tool with high sensitivity and specificity in evaluating lymphadenopathy, making it an effective first-line investigation, particularly in resource-limited settings.

Keywords: Lymphadenopathy, FNAC, Cytology, Tuberculous lymphadenitis, Metastasis, Diagnostic accuracy.

INTRODUCTION

Lymphadenopathy, characterized by the enlargement of lymph nodes, is a common clinical presentation with a broad spectrum of etiologies, ranging from reactive inflammatory processes to malignancies.[1] The evaluation of lymphadenopathy is critical in distinguishing benign from malignant causes, facilitating early diagnosis and appropriate management.[2] Fine Needle Aspiration Cytology (FNAC) is a widely used, minimally invasive, cost-effective diagnostic tool that plays a crucial role in assessing lymphadenopathies. FNAC is preferred over more invasive procedures like excisional biopsy due to its rapid results, no specific need of prior hematological workup, advantage of performing

repeat FNAC's and minimal complications.[1-4] The utility of diagnostic cytopathology is rapidly increasing in laboratory diagnostics.[5] Apart from rapid turnover time, the obtained material can also be used for molecular studies.

Lymphadenopathy may result from infectious diseases such as tuberculosis, reactive lymphoid hyperplasia, metastatic malignancies, or primary lymphoproliferative disorders. In resource-limited settings, FNAC serves as an effective first-line diagnostic modality, reducing the need for more invasive procedures.[5] Its utility is particularly significant in tertiary care centers, where patients present with diverse clinical conditions requiring timely and precise diagnosis.[6]

The knowledge of the spectrum of lymphadenopathy in a given geographical region is also important for making a definitive diagnosis.

This study aims to evaluate the diagnostic utility of FNAC in lymphadenopathies, assess its accuracy in differentiating benign from malignant lesions, and analyze the spectrum of cytological diagnoses encountered in a tertiary care hospital. By analyzing the effectiveness of FNAC in routine clinical practice, this study contributes to the growing evidence supporting its role as a primary diagnostic tool in lymph node pathology.

MATERIALS AND METHODS

This retrospective study was conducted in the Cytology Outpatient Department (OPD) of a tertiary care hospital over a period of 21 months, from January 2022 to October 2023. The study included all cases of peripheral lymphadenopathy that underwent FNAC for diagnostic evaluation. A total of 380 cases were analyzed using a universal sampling method, ensuring comprehensive inclusion of all eligible cases within the study period.

Data collection involved reviewing patient records, including demographic details, clinical presentation, FNAC findings, and final diagnoses. FNAC was performed using a 22–24 gauge needle without anesthesia, and aspirated material was smeared onto glass slides. The smears were air-dried and stained with Giemsa stain, while alcohol-fixed smears were subjected to Papanicolaou staining. The cytological findings were categorized into reactive lymphoid hyperplasia, granulomatous lymphadenitis, tuberculous lymphadenitis, metastatic malignancies, lymphoproliferative disorders, and other miscellaneous conditions.

The diagnostic accuracy of FNAC was assessed based on cytomorphological patterns, and histopathological correlation was performed where available. Cases with inconclusive or inadequate samples were noted, and repeat aspirations were performed when necessary. The results were analyzed to determine the distribution of different causes of lymphadenopathy. Data were entered into Microsoft Excel and analyzed using SPSS software (version 26) for statistical analysis. Descriptive statistics such as frequencies and percentages were used to categorize the distribution of various cytological diagnoses. The sensitivity and specificity of FNAC in detecting malignancies were calculated wherever histopathological correlation was available.

RESULTS

A total of 380 cases of peripheral lymphadenopathy were included in the study, with a male predominance (n=210, 55.3%) compared to females (n=170, 44.7%). The most common age group affected was 21-30 years (n=82, 21.6%), followed by 11-20 years (n=64, 16.8%) and 31-40 years (n=62, 16.3%). The lowest prevalence was observed in patients above 71 years (n=14, 3.7%) (Table 1).

Table 1: Age and Gender Distribution of Study Subjects

Age Group (Years)	Male (n=210)	Female (n=170)	Total (n=380)	Percentage (%)
<10	30	22	52	13.7%
11-20	36	28	64	16.8%
21-30	45	37	82	21.6%
31-40	33	29	62	16.3%
41-50	25	18	43	11.3%
51-60	22	17	39	10.3%
61-70	12	12	24	6.3%
>71	7	7	14	3.7%
Total	**210**	**170**	**380**	**100%**

FNAC results demonstrated that reactive lymphadenopathy (35.5%) was the most frequently diagnosed condition, followed by granulomatous lymphadenitis (28.4%) and tuberculous lymphadenitis (21.8%). Malignant cases accounted for 13.6% of total cases, with metastatic malignancies (11.3%) being the predominant malignant finding, while lymphoproliferative disorders (2.3%) were relatively rare (Figure 1).

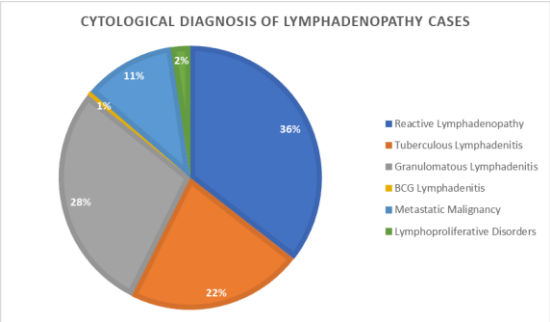

Figure 1. Cytological diagnosis of lymphadenopathy cases

Histopathological correlation of FNAC results in malignant cases showed a sensitivity of 92.3% and specificity of 99.7%. Among metastatic malignancies, 40 cases were confirmed on histopathology, with three false negatives and one false positive resulting in a sensitivity of 93.0% and specificity of 99.5%. Lymphoproliferative disorders had one false negative case but no false positives, yielding a sensitivity of 88.9% and specificity of 100% (Table 2).

Table 2: FNAC Results and Histopathological Correlation in Malignant Cases

FNAC Diagnosis	Confirmed on Histopathology	False Negatives	False Positives	Sensitivity (%)	Specificity (%)
Metastatic Malignancy	40	3	1	93.0%	99.5%
Lymphoproliferative Disorders	8	1	0	88.9%	100%
Total Malignancies	**48**	**4**	1	**92.3%**	**99.7%**

The most frequently involved anatomical site was the cervical region (56.3%), followed by the submandibular (10.0%) and supraclavicular (9.0%) regions. Axillary (6.6%), inguinal (3.2%), and postauricular (2.1%) lymphadenopathy were less commonly observed. Multiple-site lymphadenopathy was present in 8.7% of cases, while intra-abdominal lymphadenopathy was the least frequent (0.3%) (Table 3).

Table 3: Distribution of Lymphadenopathy Based on Anatomical Location

Site of Lymphadenopathy	Number of Cases (n=380)	Percentage (%)
Cervical	214	56.3%
Supraclavicular	34	9.0%
Posterior Triangle	9	2.4%
Submandibular	38	10.0%
Submental	6	1.6%
Axillary	25	6.6%
Inguinal	12	3.2%
Postauricular	8	2.1%
Intra-abdominal	1	0.3%
Multiple Sites	33	8.7%
Total	**380**	**100%**

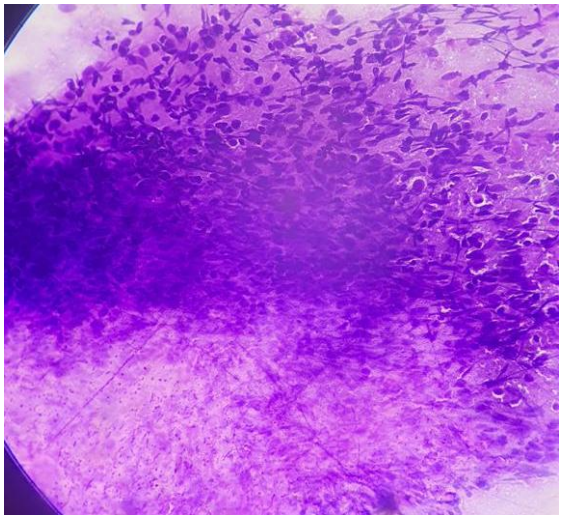

Figure 2. Caseating necrotising granuloma seen in tuberculosis

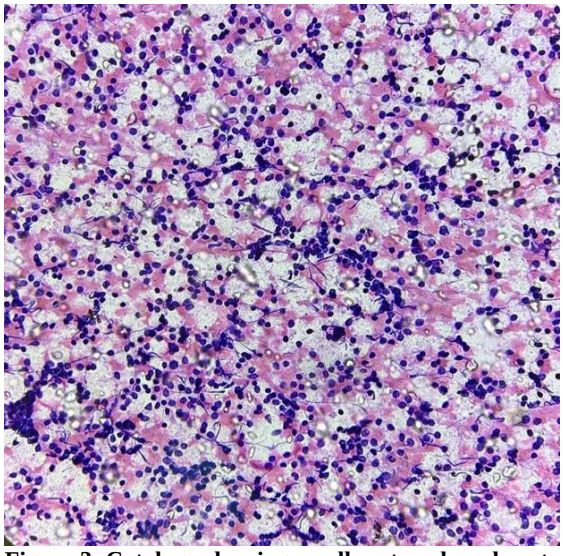

Figure 3. Cytology showing small mature lymphocytes with round nucleus, clumped chromatin, and small round nucleoli suggestive of Small lymphocytic lymphoma (lymphoproliferative disorder)

DISCUSSION

Fine Needle Aspiration Cytology (FNAC) has established itself as a crucial diagnostic instrument in the assessment of lymphadenopathies, owing to its minimally invasive approach, cost-effectiveness, prompt results, and high accuracy. This study elucidates the efficacy of FNAC in the diagnosis of various lymph node pathologies, corroborating findings from existing literature in this domain.

The current study identified a male predominance of 55.3%, a finding that is consistent with results observed in studies conducted by Sharma et al.[10], Ronchi A et al.[11], and Hashmi et al.[1] The most frequently affected age group was 21 to 30 years, comprising 21.6% of the subjects, followed by the 11 to 20 years age group at 16.8%. This age distribution aligns with the findings reported by Sharma et al.[10] and Hashmi et al.[1]

In the present study, the predominant cytological diagnosis was reactive lymphadenopathy, accounting for 35.5% of cases, followed by granulomatous lymphadenitis at 28.4% and tuberculous lymphadenitis at 21.8%. This distribution is comparable to the studies conducted by Sharma et al.[10], Hashmi et al.[1] and Attaullah M. et al.[9], who identified granulomatous lymphadenitis as the most frequent diagnosis, succeeded by reactive lymphadenopathy. The observed variation in proportions may be ascribed to geographical influences. Among the neoplastic cases, 43 cases were metastatic of epithelial malignancy while 9 were lymphoreticular malignancy.

In our study, the diagnostic accuracy of FNAC was found to be impressive, demonstrating a sensitivity of 92.3% and a specificity of 99.7% for malignant cases. These findings align with those reported by Ha HJ et al.[3], who documented a sensitivity of 97.8% and a specificity of 97.5% in their evaluation of lymphadenopathies utilizing FNAC. Furthermore, Ronchi A et al.[11] provided sensitivity and specificity rates of 93% and 100%, respectively. Notably, our study identified one false positive case, which displayed keratin pearls alongside atypical squamous cells; however, the corresponding biopsy resulted in a negative diagnosis. This inconsistency may be attributable to an inadequate biopsy specimen.

The anatomical distribution of lymphadenopathy in the present study revealed a predominance of cervical lymph node involvement (56.3%), which is in line with observations by Sharma et al.[10], Hashmi et al.[1], who reported that the cervical group was the most commonly affected, accounting for 79% of cases. This consistency across studies highlights the cervical region as a common site for lymphadenopathy, necessitating careful evaluation in clinical practice.

While FNAC demonstrates high accuracy, certain limitations persist. For instance, differentiating between reactive hyperplasia and low-grade lymphomas can be challenging due to overlapping cytological features. In such scenarios, supplementary techniques like immunocytochemistry or molecular studies may enhance diagnostic precision. Additionally, the expertise of the cytopathologist plays a crucial role in interpreting FNAC results, and variability in experience can influence diagnostic outcomes.

CONCLUSION

In conclusion, our study reinforces the diagnostic utility of FNAC in evaluating lymphadenopathies, offering a reliable, rapid, and minimally invasive method with high sensitivity and specificity. Its application is particularly valuable in resource-limited settings, facilitating prompt and accurate diagnosis, which is essential for guiding appropriate therapeutic interventions.

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