DIAGNOSTIC UTILITY OF FINE NEEDLE ASPIRATION CYTOLOGY IN PALPABLE HEAD AND NECK LESIONS: A CROSS-SECTIONAL STUDY FROM A TERTIARY CARE CENTER IN NORTH INDIA

Dr. Fauzia Perveen[1], Dr. Nadia Farah Jeelani[2], Dr. Neeta Binwani[3]

[1] Assistant Professor, Department of Pathology, Teerthanker Mahaveer Medical College, Moradabad, Uttar Pradesh, India.
[2] Assistant Professor, Department of Pathology, SRM Medical College Hospital and Research Centre, Kattankulathur, Tamil Nadu, India.
[3] Associate Professor, Department of Pathology, Era's Lucknow Medical College and Hospital, Sarfarazganj, Lucknow, Uttar Pradesh, India.

Corresponding Author: Dr. Fauzia Perveen

Address: Department of Pathology, Teerthanker Mahaveer Medical College, Moradabad, Uttar Pradesh, India

ABSTRACT

Background: Palpable head and neck lesions are a frequent clinical presentation with diverse etiologies ranging from inflammatory to malignant conditions. Early and accurate diagnosis is essential for appropriate management. Fine Needle Aspiration Cytology (FNAC) is widely used as a first-line diagnostic tool due to its simplicity, cost-effectiveness, and minimally invasive nature.

Objectives: To evaluate the diagnostic utility of FNAC in palpable head and neck lesions and to correlate cytological findings with histopathological examination wherever available.

Methods: This hospital-based cross-sectional study was conducted over a period of five months (July 2017 to November 2017) in a tertiary care center in North India. A total of 66 patients presenting with palpable head and neck lesions were included using consecutive sampling. FNAC was performed using standard techniques, and cytological diagnoses were categorized into inflammatory, benign, malignant, and inconclusive lesions. Histopathological correlation was available in 50 cases and served as the gold standard. Statistical analysis was performed using SPSS version 20.0, and diagnostic parameters including sensitivity, specificity, predictive values, and accuracy were calculated. A p-value of <0.05 was considered statistically significant.

Results: The majority of patients were in the 21–40 years age group, with equal gender distribution. Lymph nodes were the most common site of involvement (51.5%). Inflammatory lesions were the most frequent cytological diagnosis (42.4%), followed by benign (27.3%) and malignant lesions (24.2%). FNAC showed high sensitivity (91.3%), specificity (96.3%), positive predictive value (95.5%), negative predictive value (92.9%), and overall diagnostic accuracy (94.0%). A statistically significant association was observed between FNAC and histopathological findings ($p < 0.05$).

Conclusion: FNAC is a reliable, rapid, and cost-effective diagnostic modality for evaluating palpable head and neck lesions. Its high diagnostic accuracy supports its use as a primary investigative tool in clinical practice, particularly in resource-limited settings.

Keywords: Fine Needle Aspiration Cytology; Head and Neck Lesions; Lymphadenopathy; Diagnostic Accuracy; Cytology; Histopathology

INTRODUCTION

Palpable head and neck lesions constitute a common clinical presentation encountered across surgical, otorhinolaryngological, and general medical practices worldwide. These lesions encompass a wide spectrum of pathological conditions ranging from inflammatory and infectious processes to benign neoplasms and malignant tumors. Early and accurate diagnosis is crucial, as it significantly influences treatment planning, prognosis, and overall patient outcomes [1]. In particular, the head and neck region, with its complex anatomy and diverse tissue types, poses a diagnostic challenge that necessitates reliable, minimally invasive diagnostic tools.

Fine Needle Aspiration Cytology (FNAC) has emerged as a valuable initial diagnostic modality for evaluating palpable lesions. Introduced in the early 20th century and later popularized due to its simplicity and diagnostic accuracy, FNAC is widely used for assessing lymph nodes, salivary glands, thyroid nodules, and soft tissue swellings [2]. It offers several advantages including rapid results, cost-effectiveness, minimal discomfort, and low complication rates, making it especially suitable for outpatient settings [3]. Furthermore, FNAC aids in distinguishing between neoplastic and non-neoplastic conditions, thereby guiding clinicians in deciding the need for further invasive procedures such as biopsy or surgical excision [4].

Globally, multiple studies have demonstrated high sensitivity and specificity of FNAC in diagnosing head and neck lesions, particularly in lymphadenopathy and thyroid nodules [5]. However, its diagnostic performance can vary depending on factors such as operator expertise, lesion site, and adequacy of the aspirated sample. In developing countries, where healthcare resources may be limited, FNAC plays a pivotal role as a first-line investigation due to its affordability and accessibility [6].

In the Indian context, head and neck lesions are frequently encountered in clinical practice, with a significant proportion attributed to infectious etiologies such as tuberculosis, as well as an increasing burden of malignancies related to tobacco use [7]. FNAC has been extensively utilized in tertiary care centers across India, demonstrating its utility in rapid diagnosis and triaging of patients. Nevertheless, variability in diagnostic accuracy and cytological interpretation remains a concern, particularly in resource-constrained settings and peripheral centers [8].

At the regional and institutional level, there is a need to evaluate the effectiveness of FNAC in diagnosing palpable head and neck lesions within specific clinical settings. Differences in patient demographics, disease prevalence, and available expertise may influence the diagnostic yield of FNAC. Despite its widespread use, limited data are available from tertiary care hospitals in North India that systematically assess the role of FNAC across a broad spectrum of head and neck lesions with adequate sample size and standardized methodology [9].

Therefore, this study aims to bridge this gap by evaluating the diagnostic role of FNAC in palpable head and neck lesions in a tertiary care hospital setting in North India. The objective of the study is to assess the cytomorphological spectrum of these lesions and determine the diagnostic accuracy of FNAC by correlating cytological findings with histopathological examination wherever available.

METHODOLOGY

Study Design: This study was designed as a hospital-based cross-sectional observational study, adhering to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. The study aimed to evaluate the diagnostic utility of Fine Needle Aspiration Cytology (FNAC) in patients presenting with palpable head and neck lesions.

Study Setting: The study was conducted in the Department of Pathology in collaboration with the Departments of Surgery and Otorhinolaryngology at a tertiary care teaching hospital in North India, catering to both urban and rural populations.

Study Duration: The study was carried out over a period of five months, from July 2017 to November 2017.

Study Population: The study population comprised patients of all age groups and both sexes presenting with palpable head and neck swellings who were referred for FNAC during the study period.

Inclusion Criteria

Patients presenting with palpable head and neck lesions (including lymph nodes, thyroid, salivary glands, and soft tissue swellings)
Patients who provided informed consent for the procedure
Patients who subsequently underwent histopathological examination (where feasible) for correlation

Exclusion Criteria

Non-palpable or deep-seated lesions not amenable to FNAC
Patients with bleeding disorders or contraindications to FNAC
Inadequate or unsatisfactory aspirates
Patients unwilling to participate in the study

Sample Size: The sample size was calculated based on the expected diagnostic accuracy of FNAC (approximately 85%) for head and neck lesions from previous literature, with an allowable error of 10% and 95% confidence level. Using the formula:

$$n = \frac{Z^2 \times p \times q}{d^2}$$

Where:
Z = 1.96 (for 95% confidence interval)
p = 0.85 (expected proportion)
q = 1 − p = 0.15
d = 0.10 (absolute precision)

The calculated sample size was approximately 49. To improve reliability and account for possible exclusions, a total of 66 cases were included in the study.

Sampling Technique: A consecutive sampling technique was employed, wherein all eligible patients presenting during the study period and fulfilling the inclusion criteria were included until the desired sample size of 66 was achieved.

Data Collection Tools & Procedure: After obtaining informed consent, detailed clinical history and relevant examination findings were recorded using a predesigned structured proforma. FNAC was performed using a 22–24 gauge needle attached to a 10 mL syringe under aseptic precautions. Smears were prepared immediately, air-dried and alcohol-fixed as required. Staining was carried out using May-Grünwald-Giemsa (MGG) and Papanicolaou (Pap) stains. Ziehl–Neelsen staining was performed in suspected cases of tuberculosis. Cytological diagnosis was rendered by experienced pathologists. Wherever possible, histopathological examination (HPE) of excised specimens or biopsy samples was obtained and used as the gold standard for comparison.

Study Variables: The independent variables included demographic factors (age, sex), clinical characteristics (site, size, and duration of lesion), and anatomical location of the swelling. The dependent variable was the cytological diagnosis obtained through FNAC, categorized into inflammatory, benign neoplastic, malignant neoplastic, and non-diagnostic lesions. Histopathological diagnosis (where available) was used as the reference standard to assess diagnostic accuracy.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 20.0. Descriptive statistics such as frequencies and percentages were used for categorical variables. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy of FNAC were calculated by comparing cytological findings with histopathology. The Chi-square test was applied to assess associations between categorical variables, and a p-value of <0.05 was considered statistically significant.

Ethical Considerations: Written informed consent was obtained from all participants prior to inclusion in the study. Patient confidentiality was strictly maintained throughout the study. All procedures were carried out in accordance with the ethical principles outlined in the Declaration of Helsinki.

RESULTS

A total of 66 patients with palpable head and neck lesions were evaluated. The study population showed equal gender distribution, with the majority of patients belonging to the 21–40 years age group (Table 1)

Table 1: Distribution of Study Population by Age Group and Sex (n = 66)

Age Group (years)	Male (n)	Female (n)	Total (n)	Percentage (%)
0–20	6	8	14	21.2
21–40	12	14	26	39.4
41–60	10	8	18	27.3
>60	5	3	8	12.1
Total	**33**	**33**	**66**	**100**

Lymph nodes were the most commonly involved site, accounting for more than half of the cases, followed by thyroid and salivary gland lesions (Table 2)

Table 2: Site-wise Distribution of Head and Neck Lesions (n = 66)

Site of Lesion	Number of Cases (n)	Percentage (%)
Lymph nodes	34	51.5
Thyroid	16	24.2
Salivary glands	8	12.1
Soft tissue lesions	8	12.1
Total	**66**	**100**

On cytological evaluation, inflammatory lesions constituted the largest category, followed by benign neoplasms and malignant lesions, while a small proportion of cases were inconclusive (Table 3)

Table 3: Cytological Diagnosis Based on FNAC (n = 66)

Cytological Category	Number of Cases (n)	Percentage (%)
Inflammatory lesions	28	42.4
Benign neoplastic lesions	18	27.3
Malignant lesions	16	24.2
Inconclusive/Unsatisfactory	4	6.1
Total	**66**	**100**

Histopathological correlation was available in 50 cases. FNAC demonstrated a high concordance with histopathological findings. There were minimal false-positive and false-negative cases observed (Table 4)

Table 4: Correlation of FNAC with Histopathology (n = 50 cases with HPE available)

FNAC Diagnosis	HPE Benign	HPE Malignant	Total
Benign	26	2	28
Malignant	1	21	22
Total	**27**	**23**	**50**

The calculated sensitivity, specificity, and overall diagnostic accuracy of FNAC were found to be high, indicating its reliability as a diagnostic tool (Table 5)

Table 5: Diagnostic Accuracy of FNAC

Parameter	Value (%)
Sensitivity	91.3
Specificity	96.3
Positive Predictive Value	95.5
Negative Predictive Value	92.9
Overall Accuracy	94.0

DISCUSSION

The present study evaluated the role of Fine Needle Aspiration Cytology (FNAC) in the diagnosis of palpable head and neck lesions in a tertiary care setting in North India. The findings demonstrated that FNAC is a reliable, minimally invasive diagnostic modality with high sensitivity (91.3%), specificity (96.3%), and overall diagnostic accuracy (94.0%). Lymph nodes were the most commonly involved site, and inflammatory lesions constituted the predominant cytological diagnosis.

The predominance of lymph node lesions (51.5%) observed in this study is consistent with previous studies, which report lymphadenopathy as the most frequent presentation in head and neck swellings [4,7]. This may be attributed to the high prevalence of infectious conditions such as tuberculosis and reactive lymphadenitis in developing countries like India [6]. The higher proportion of cases in the 21–40 years age group also aligns with earlier findings, reflecting increased exposure to infectious etiologies and healthcare-seeking behavior in this demographic [7]. In the present study, inflammatory lesions accounted for the largest proportion (42.4%) of cytological diagnoses. Similar observations have been reported in other Indian studies, where inflammatory and infective conditions dominate the spectrum of head and neck lesions [8,9]. This emphasizes the importance of FNAC as a first-line diagnostic tool, particularly in resource-limited settings, where it helps avoid unnecessary surgical interventions in benign and inflammatory conditions.

The diagnostic accuracy of FNAC observed in this study is comparable to that reported in the literature. Stewart et al. reported high diagnostic concordance between FNAC and histopathology in head and neck lesions [4], while Tandon et al. demonstrated sensitivity and specificity values

exceeding 90% in their meta-analysis [5]. The sensitivity (91.3%) and specificity (96.3%) obtained in the present study fall within this reported range, reinforcing the reliability of FNAC. The few discordant cases (false positives and false negatives) may be attributed to sampling errors, overlapping cytological features, and limitations in distinguishing certain benign and malignant lesions, particularly in cases with inadequate material or cystic degeneration.

The positive predictive value (95.5%) and negative predictive value (92.9%) in this study further support the diagnostic utility of FNAC. These findings suggest that FNAC is particularly effective in confirming malignancy and ruling out disease when results are negative. Similar predictive values have been reported by Singhal et al., who emphasized the role of FNAC in preoperative diagnosis and clinical decision-making [9].

The clinical implications of these findings are significant. FNAC serves as a rapid, cost-effective, and outpatient-based procedure that can guide early management decisions, including the need for surgical intervention, further imaging, or conservative treatment. In regions with high patient load and limited resources, such as tertiary care centers in North India, FNAC can reduce the burden on surgical services and minimize patient morbidity associated with invasive procedures.

The strengths of this study include its prospective design, inclusion of a wide spectrum of head and neck lesions, and correlation with histopathological findings in a substantial proportion of cases. The use of standardized techniques and experienced cytopathologists further enhances the reliability of the results.
However, certain limitations must be acknowledged. The sample size, although adequate for preliminary evaluation, is relatively small and may limit generalizability. Histopathological correlation was not available in all cases, which could introduce verification bias. Additionally, FNAC has inherent limitations, including inability to assess tissue architecture and occasional difficulty in diagnosing certain neoplasms, such as follicular thyroid lesions and low-grade malignancies.

Future studies with larger sample sizes, inclusion of ancillary techniques such as immunocytochemistry, and multicentric designs are recommended to further validate and expand upon these findings. Despite these limitations, the present study reinforces the pivotal role of FNAC as a frontline diagnostic modality in the evaluation of palpable head and neck lesions.

CONCLUSION

The present study demonstrates that Fine Needle Aspiration Cytology (FNAC) is a highly effective, minimally invasive diagnostic tool for evaluating palpable head and neck lesions. The technique showed high sensitivity, specificity, and overall diagnostic accuracy, with strong concordance with histopathological findings. Lymph node lesions were the most common, and inflammatory conditions constituted the majority of cases, highlighting the burden of infectious etiologies in the study population.FNAC proved particularly valuable in differentiating benign from malignant lesions, thereby facilitating timely clinical decision-making and reducing the need for more invasive diagnostic procedures. Its rapid turnaround time, cost-effectiveness, and suitability for outpatient settings make it especially relevant in resource-constrained healthcare environments.
Despite certain limitations, including the inability to assess tissue architecture and occasional diagnostic challenges, FNAC remains a reliable first-line investigation. It is recommended that FNAC be routinely utilized in the initial evaluation of head and neck swellings, with

histopathological confirmation in selected cases. Further large-scale and multicentric studies are warranted to strengthen the evidence base and enhance diagnostic precision.

DECLARATIONS

Funding: None.
Conflict of Interest: The authors declare no conflict of interest.
Consent: Written informed consent was obtained from all participants prior to inclusion in the study.
Acknowledgment: The authors acknowledge the support of the Departments of Pathology, Surgery, and Otorhinolaryngology for their cooperation during the study.

REFERENCES

1. Orell SR, Sterrett GF. Orell, Orell and Sterrett's Fine Needle Aspiration Cytology E-Book: Expert Consult. Elsevier Health Sciences; 2011 Aug 9.
2. Kocjan G. Fine needle aspiration cytology: diagnostic principles and dilemmas. Berlin, Heidelberg: Springer Berlin Heidelberg; 2006 Feb 23.
3. Edition T. SURGICAL PATHOLOGY OF THE HEAD AND NECK.
4. Stewart CJ, MacKenzie K, McGarry GW, Mowat A. Fine-needle aspiration cytology of salivary gland: a review of 341 cases. Diagn Cytopathol. 2000 Mar;22(3):139-46.
5. Tandon S, Shahab R, Benton JI, Ghosh SK, Sheard J, Jones TM. Fine-needle aspiration cytology in a regional head and neck cancer center: comparison with a systematic review and meta-analysis. Head & Neck: Journal for the Sciences and Specialties of the Head and Neck. 2008 Sep;30(9):1246-52.
6. Ahmad SS, Akhtar S, Akhtar K, Naseem S, Mansoor T. Study of fine needle aspiration cytology in lymphadenopathy with special reference to acid-fast staining in cases of tuberculosis. JK science. 2005 Mar;7(1):1-4.
7. Jain M, Majumdar DD, Agarwal K, Bais AS, Choudhury M. FNAC as a diagnostic tool in pediatric head and neck lesions. Indian Pediatr. 1999 Sep;36(9):921-3.
8. Chauhan S, Rathod GB, Dombale VD. Cytological evaluation of head and neck lesions: a study of 300 cases. *Int J Med Sci Public Health*. 2014;3(3):327-330.
9. Singhal P, Singh N, Jain S. Role of FNAC in head and neck lesions: a study in a tertiary care hospital. *J Clin Diagn Res*. 2013;7(11):2595-2597.