Section: ENT

Original Research Article

# ROLE OF FINE NEEDLE ASPIRATION CYTOLOGY IN EVALUATION AND MANAGEMENT OF NECK MASSES

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ABSTRACT

**Background:** Neck masses are a common clinical presentation with a broad differential diagnosis, ranging from benign to malignant etiologies. Fine Needle Aspiration Cytology (FNAC) serves as a minimally invasive, cost-effective, and reliable first-line diagnostic tool. This study evaluates the diagnostic utility of FNAC in the assessment of neck swellings and correlates it with histopathological examination (HPE).

**Materials and Methods:** A prospective, observational study was conducted on 100 patients with palpable, non-vascular neck masses in the Department of ENT at a tertiary care center over one year (June 1, 2017 – May 30, 2018). FNAC was performed using standard techniques and stained using PAP, H&E, MGG, and special stains as indicated. Cytological diagnoses were categorized and compared with subsequent HPE findings. The diagnostic capability was evaluated by calculating sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy.

**Results:** The mean age of patients was 42.89 ± 19 years, with a slight female predominance (53%). The most common lesions were benign (41%), followed by inflammatory (20%) and cystic (19%) swellings. The thyroid gland was the most frequently involved site (44%). FNAC showed 100% sensitivity, specificity, PPV, NPV, and accuracy for inflammatory and cystic lesions. For benign lesions, sensitivity was 85.1%, specificity 97.14%, and accuracy 90.24%. For malignant lesions, FNAC achieved 78.57% sensitivity, 100% specificity, and 96.34% accuracy. Additionally, correlation with HPE showed no statistically significant differences ($p>0.05$).

**Conclusion:** FNAC is a safe, simple, and highly effective diagnostic modality for evaluating neck masses. It demonstrates excellent diagnostic performance, particularly in detecting inflammatory, cystic, and benign lesions, and offers high specificity in identifying malignancies. FNAC should be considered a first-line investigation in the clinical workup of neck swellings.

**Keywords:** Neck mass, Fine Needle Aspiration Cytology (FNAC), Histopathology, Thyroid lesions, Diagnostic accuracy, Bethesda classification.

## INTRODUCTION

Neck masses represent a broad spectrum of pathological conditions and are a frequent clinical finding, particularly due to the anatomical complexity of the neck, which contains multiple organ systems in close proximity. Despite their superficial location making them readily accessible for evaluation, diagnosing the underlying cause of a neck mass can often be challenging due to the wide range of potential etiologies.[1]

These masses may arise from infectious, inflammatory, congenital, traumatic, benign, or malignant causes. Among the most common are reactive or suppurative lymphadenopathies, typically resulting from upper respiratory tract or pharyngeal infections. However, distinguishing between benign and malignant causes can be complex, especially when clinical presentation overlaps.[2-4] Research shows that the prevalence of neck masses increases with age, with a higher likelihood of neoplastic cervical adenopathy in older adults. While some

studies report the anterior triangle as the most commonly affected anatomical region, others identify the posterior triangle as the predominant site.[5] In children, acute neck swellings accompanied by signs of inflammation are a common cause of hospitalization.

In adults, especially middle-aged or elderly individuals with a history of smoking, the presence of a neck lump raises significant concern for metastatic disease, often from a primary malignancy of the upper aerodigestive tract.[6] The differential diagnosis of neck masses varies significantly with age and clinical context and necessitates a comprehensive approach, including detailed history-taking, physical examination, and relevant investigations.[7,8]

Among the diagnostic tools available, Fine Needle Aspiration Cytology (FNAC) has emerged as a cornerstone in the evaluation of neck masses. FNAC is considered the gold standard for assessing thyroid nodules and is widely used in evaluating salivary gland lesions.[9] It is a minimally invasive, safe, cost-effective, and rapid diagnostic technique that often serves as the first line of tissue-based investigation, guiding further management.

Advances in FNAC techniques, including the use of finer needles and improved staining methods, have enhanced its diagnostic accuracy. The procedure is simple, repeatable, and offers immediate cytological evaluation. In cases where a malignant diagnosis is established, FNAC enables prompt surgical planning and patient counseling. Conversely, a benign diagnosis provides reassurance and may eliminate the need for further invasive procedures. Additionally, FNAC can serve a therapeutic role in managing cystic lesions by aspirating the cyst contents.[10]

Given these advantages, the present study aims to evaluate the role and diagnostic utility of FNAC in the assessment and management of neck masses. It also seeks to correlate cytological findings with histopathological diagnoses wherever applicable, thereby highlighting FNAC's contribution in facilitating early diagnosis and appropriate treatment planning.

## MATERIALS AND METHODS

The Prospective, observational study was carried out in the Department of Otorhinolaryngology (ENT), at a tertiary care center DURING 1st June 2017 to 30th may 2018(1 year). A total of 73 patients were included in the study. Before initiation of the study, informed consent was obtained from all participants, and approval from the ethical committee was secured.

**Inclusion Criteria**

The present study included patients of all age groups and both genders who presented to the ENT department with complaints of palpable, non-vascular neck masses. Patients were included in the study only after receiving a thorough explanation of the research and providing written informed consent.

**Exclusion Criteria**

The study excluded patients who were unwilling to participate. Additionally, individuals with a prior history of neck surgeries were not included. Patients presenting with neck swellings following trauma, those with vascular neck swellings, or those with any medical condition in which fine-needle aspiration cytology (FNAC) was contraindicated were also excluded. Furthermore, patients who had been diagnosed with neck masses before the study period and were currently under follow-up during the study duration were not considered for inclusion in the study.

**Methodology:** All patients presenting with neck swellings were evaluated through a structured proforma, including detailed clinical history, physical examination, and relevant investigations to establish a provisional diagnosis.

**FNAC Procedure:** FNAC was performed by a pathologist using the conventional palpation method with a 22–25-gauge needle attached to a 10–20 ml disposable syringe. Depending on the site of the lesion, patients were positioned to optimize accessibility. For cervical lymph nodes and thyroid swellings, supine positioning was used; for supraclavicular and salivary gland lesions, sitting or lateral positions were adopted.

Smears were prepared immediately, some air-dried and stained with May-GrünwaldGiemsa (MGG), others fixed in 95% ethanol for Hematoxylin and Eosin (H&E) and Papanicolaou (PAP) staining. Special stains such as Ziehl-Neelsen (ZN) and Periodic Acid-Schiff (PAS) were applied when clinically indicated. Smear evaluation included cellularity, cytomorphological features, and background characteristics.

**Equipment Used:**

- 10–20 ml disposable syringes
- 22–25 gauge needles
- Clean glass slides and fixatives (95% alcohol)
- Stains: H&E, Giemsa, PAP, and special stains (e.g., ZN, PAS)

**Staining Techniques:** Standard protocols were followed for PAP, H&E, MGG, and ZN staining to facilitate accurate cytological interpretation.

**Histopathological Correlation:** FNAC findings were correlated with histopathology to assess diagnostic accuracy.

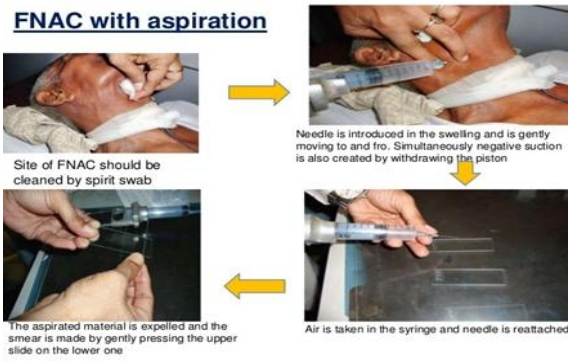


**Figure 1: FNAC with Aspiration**

**Statistical Analysis:** Data analysis was performed using SPSS software version 16.0. Findings were summarized as frequencies and percentages. The diagnostic efficacy of FNAC was determined by calculating sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy based on standard 2×2 contingency tables. The relationship between cytological and histopathological findings was examined using the Chi-square test, with a p-value of less than 0.05 considered statistically significant.

## RESULTS

In this prospective study of 100 patients with neck masses, the mean age was 42.89 ± 19.00 years, with most patients aged between 31–60 years. Females slightly outnumbered males (53% vs. 47%), with a female predominance seen particularly in thyroid lesions (72.72%). In contrast, lymph node, soft tissue, and miscellaneous lesions were more common in males. The most frequent site of neck swelling was the carotid triangle (25%), followed by the muscular (22%) and submandibular triangles (19%).

**Table 1: Demographic profile of the study participants**

| Characteristics | No. of patients | Percentage |
|---|---|---|
| Age (years) (Mean + SD) | 42.89 +19.00 | |
| Gender | | |
| Male | 47 | 47.00% |
| Female | 53 | 53.00% |

**Table 2: Diagnosis of different neck masses according to the FNAC impression**

| FNAC impression | Lymph node | Thyroid gland | Salivary Gland | Soft tissue | Neurogenic Tumour | Miscellaneous | Total | % |
|---|---|---|---|---|---|---|---|---|
| Inflammatory | 18 | - | 2 | - | - | - | 20 | 20 |
| Cystic | - | - | - | - | - | 19 | 19 | 19 |
| Benign | - | 29 | 4 | 6 | 2 | - | 41 | 41 |
| Malignant | 4 | 6 | - | - | - | - | 10 | 10 |
| Non diagnostic | 1 | 1 | - | - | - | - | 02 | 02 |
| Neoplastic | - | 08 | - | - | - | - | 08 | 08 |
| Total | 23 | 44 | 06 | 06 | 02 | 19 | 100 | 100 |

In this study, benign lesions were the most common FNAC finding (41%), mainly involving the thyroid gland. Inflammatory lesions accounted for 20%, primarily in lymph nodes, while cystic lesions made up 19%, mostly under miscellaneous causes. Malignancies were seen in 10% of cases, and 8% were classified as neoplastic. Non-diagnostic results were reported in 2% of cases. The thyroid gland was the most frequently involved site (44%), followed by lymph nodes (23%) and miscellaneous lesions (19%).

**Table 3: Diagnosis of thyroid lesions according to Bethesda system**

| Cytological diagnosis | No. of cases | % |
|---|---|---|
| Bethesda Category I (Non diagnostic/Unsatisfactory) | 1 | 2.27 |
| Bethesda Category II (Benign lesions) | 29 | 65.9 |
| Bethesda Category III (Atypia of undetermined significance/Follicular lesion of undetermined significance) | 1 | 2.27 |
| Bethesda Category IV (Follicular neoplasm) | 7 | 15.9 |
| Bethesda Category V (Suspicion for Malignancy) | 3 | 6.81 |
| Bethesda Category VI (Malignant) | 3 | 6.81 |
| Total | 44 | 100 |

In this study, the majority of thyroid lesions were benign (Bethesda Category II) seen in 65.9% of cases. Follicular neoplasms (Category IV) accounted for 15.9%, while malignant (Category VI) and suspicious for malignancy (Category V) lesions were each observed in 6.81%. Non-diagnostic (Category I) and indeterminate (Category III) cases were least common, each comprising 2.27%.

**Table 4: Comparison of FNAC with HPE in diagnosis of inflammatory neck mass**

| HPE | FNAC | | Total |
|---|---|---|---|
| | Yes | No | |
| FNAC with HPE in diagnosis of inflammatory neck mass | | | |
| Yes | 3(TP) | 0(FN) | 3 |
| No | 0(FP) | 79(TN) | 79 |
| Total | 3 | 79 | 82 |
| FNAC with HPE in diagnosis of cystic neck mass | | | |
| Yes | 19(TP) | 0(FN) | 19 |

| | | | |
|---|---|---|---|
| No | 0(FP) | 63(TN) | 63 |
| Total | 19 | 63 | 82 |
| FNAC with HPE in diagnosis of benign neck mass | | | |
| Yes | 40(TP) | 7(FN) | 47 |
| No | 1(FP) | 34(TN) | 35 |
| Total | 41 | 41 | 82 |
| FNAC with HPE in diagnosis of malignant neck mass | | | |
| Yes | 11(TP) | 3(FN) | 14 |
| No | 0(FP) | 68(TN) | 68 |

FNAC showed perfect agreement with HPE in diagnosing inflammatory and cystic neck masses, with 100% sensitivity and specificity. In benign lesions, FNAC identified most cases accurately, though 7 false negatives and 1 false positive were noted. For malignant lesions, it showed high specificity with 11 true positives and 3 false negatives. Overall, FNAC proved to be a reliable tool for evaluating neck masses.

**Table 5: Comparison of FNAC and HPE in diagnosis of different neck masses**

| Neck masses | Diagnosis by FNAC | | Diagnosis by HPE (Gold Standard) | | p value |
|---|---|---|---|---|---|
| | 1 | | 2 | | 1vs2 |
| | Number | % | Number | % | |
| Inflammatory neck mass | 3 | 3.66 | 3 | 3.66 | 1 |
| Cystic neck mass | 19 | 23.17 | 19 | 23.17 | 1 |
| Benign neck mass | 41 | 50 | 47 | 57.32 | 0.49 |
| Malignant Neck mass | 10 | 12.19 | 13 | 15.85 | 0.8 |
| Total | 82 | 100 | 82 | 100 | |

The comparison between FNAC and histopathology (HPE) in diagnosing different types of neck masses showed complete agreement in identifying inflammatory and cystic lesions (p=1). While FNAC diagnosed 41 benign cases, HPE confirmed 47, and for malignant masses, FNAC detected 10 cases compared to 13 by HPE. However, these differences were not statistically significant (p=0.49 for benign and p=0.8 for malignant), indicating that FNAC has good diagnostic concordance with HPE across various neck mass types.

**Table 6: Sensitivity, specificity, PPV, NPV and accuracy of FNAC diagnosis**

| Sensitivity Analysis | FNAC diagnosis (%) | | | |
|---|---|---|---|---|
| | inflammatory | cystic | benign | Malignant |
| Sensitivity | 100 | 100 | 85.1 | 78.57 |
| Specificity | 100 | 100 | 97.14 | 100 |
| PPV | 100 | 100 | 97.56 | 100 |
| NPV | 100 | 100 | 82.92 | 95.77 |
| Accuracy | 100 | 100 | 90.24 | 96.34 |

In our study, FNAC demonstrated excellent diagnostic performance for inflammatory and cystic neck masses, with 100% sensitivity, specificity, positive predictive value PPV, NPV, and overall accuracy. For benign swellings, FNAC showed a sensitivity of 85.10%, specificity of 97.14%, PPV of 97.56%, NPV of 82.92%, and an accuracy of 90.24%. In diagnosing malignant neck masses, FNAC achieved a sensitivity of 78.57%, specificity and PPV of 100%, NPV of 95.77%, and accuracy of 96.34%. These findings support FNAC as a reliable and accurate diagnostic tool, especially for ruling out malignancy and identifying inflammatory and cystic lesions.

## DISCUSSION

In this prospective study of 100 patients with palpable neck masses, FNAC demonstrated excellent diagnostic accuracy, 100% sensitivity and specificity for inflammatory and cystic lesions, and high specificity (100%) with good sensitivity (85.1% for benign and 78.57% for malignant lesions). The thyroid gland was the most commonly affected site (44%), with benign lesions comprising the majority of cases (41%). FNAC findings showed high concordance with histopathological examination (HPE), and statistical comparison revealed no significant differences between the two modalities reinforcing FNAC's reliability.

The mean age of the study population was 42.89 ± 19.00 years, with most patients falling within the 31–60 years age group. Female patients were reported more than males (53% vs. 47%), and a notable female predominance was observed in thyroid lesions (72.72%). In contrast, lymph node, soft tissue, and miscellaneous lesions were more frequently seen in males.

Similar demographic findings were reported by PradeepkumarKhokle et al,[11] who observed a higher number of females (60%) than males (40%) in a comparable study involving 100 patients, with the most common age group being 21–30 years. On the other hand, Mantri et al,[12] reported a male predominance with a male-to-female ratio of 1.5:1, and the majority of cases also belonged to the 31–60 years age group, consistent with our findings.

Among the thyroid lesions, FNAC reporting according to the Bethesda System showed that 65.9% of cases were benign (Category II). Follicular neoplasms (Category IV) accounted for 15.9%, while 6.81% each were categorized as suspicious for malignancy (Category V) and malignant (Category VI). Non-diagnostic (Category I) and atypia/FLUS) cases were least common (2.27% each). These findings are in accordance with Mantri et al,[12] who reported 51.42% benign lesions (Category II), 17.14% suspicious for malignancy (Category V), and 11.42% follicular neoplasms (Category IV), highlighting the similar distribution patterns. [Table 3]

Comparison of FNAC and HPE across different lesion types revealed no statistically significant differences in the diagnosis of benign or malignant neck masses, further supporting the diagnostic concordance between the two modalities. This finding aligns with the results from Shah et al,[13] who found 3 discordant cases among 100 patients, indicating high but not absolute agreement. [Table 5]

In the present study, FNAC demonstrated complete concordance with HPE in diagnosing inflammatory and cystic neck masses, achieving 100% sensitivity and specificity. Among benign lesions, FNAC accurately identified the majority of cases, though it yielded 7 false negatives and 1 false positive. For malignant lesions, FNAC maintained high specificity, correctly diagnosing 11 true positive cases, although 3 malignant cases were missed (false negatives). These results highlight FNAC as a reliable and effective diagnostic modality for the initial assessment of neck masses.

Chauhan S. et al,[14] reported 641 neck lesion cases in which FNAC findings were compared to histology in 71 cases. Their reported sensitivity, specificity, and accuracy were consistent with our study. For thyroid lesions, they reported 93.1% sensitivity, 100% specificity, and 98.4% accuracy. For salivary gland lesions, the sensitivity was 90% and specificity was 100%, while for lymph nodes and cystic lesions, sensitivity and specificity were also high, confirming FNAC's utility in routine practice.

Overall, our study reinforces the role of FNAC as a rapid, cost-effective, minimally invasive, and reliable first-line diagnostic tool in the evaluation of neck masses. FNAC shows excellent performance in diagnosing inflammatory and cystic lesions and performs reliably in detecting benign and malignant pathologies. Correlation with histopathology further validates its accuracy and importance in guiding clinical management and surgical decisions.

## CONCLUSION

The statistical analysis of various benign and malignant head and neck lesions in this study revealed a strong correlation between cytological (FNAC) and histological diagnoses. This confirms that FNAC is a highly effective tool for differentiating between benign and malignant neck masses. Its utility is especially significant in patients presenting with a neck mass as the only clinical finding, where a negative FNAC result for malignancy or metastasis can guide clinicians toward early medical management or a targeted biopsy, rather than initiating an extensive search for a primary tumor.

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