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ORIGINAL RESEARCH

Histocytological correlation of head and neck lesions in a tertiary care centre

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ABSTRACT

Introduction: Fine Needle Aspiration Cytology (FNAC) is the primary diagnostic tool for evaluating head and neck lesions. This study aims to correlate FNAC with histopathological findings, evaluating its accuracy, sensitivity, specificity, and predictive values. **Methodology:** A prospective study was conducted on 72 cases at a tertiary care hospital from June 2022 to May 2023. **Results:** The study concluded that FNAC has an overall accuracy of 95.6% and is an invaluable tool in diagnosing head and neck lesions, providing a non-invasive means of distinguishing between benign and malignant conditions.

Keywords: FNAC, head and neck lesions, histopathology, accuracy, sensitivity, specificity

INTRODUCTION

Head and neck lesions encompass a wide range of pathological conditions, including congenital, inflammatory, and neoplastic lesions, affecting various anatomical structures such as lymph nodes, thyroid, salivary glands, skin, and soft tissues. Due to the diversity of these lesions, a comprehensive and reliable diagnostic tool is essential for timely and accurate diagnosis.[1-3]

Fine Needle Aspiration Cytology (FNAC) has emerged as the first-line diagnostic investigation for these lesions. FNAC is a minimally invasive, cost-effective technique that allows for rapid diagnosis without requiring extensive surgical intervention. It has become an essential procedure in differentiating between benign and malignant lesions, guiding treatment decisions, and minimizing unnecessary surgeries.[2,3,4]The role of FNAC in diagnosing head and neck lesions has been well established, particularly in differentiating neoplastic from non-neoplastic lesions. FNAC not only facilitates early diagnosis but also helps triage patients for further management, including surgical intervention when necessary. The cytological evaluation obtained through FNAC is typically followed by histopathological confirmation after surgery or biopsy.[5,6]

Despite FNAC's widespread use, variations in sensitivity and specificity have been reported, particularly in certain types of lesions, such as thyroid and salivary gland neoplasms. Studies have shown FNAC to be highly sensitive for diagnosing malignancies in some regions, while its accuracy in other areas remains a subject of ongoing research.[4,5] This study aims to further investigate the diagnostic value of FNAC by correlating it with histopathological findings in head and neck lesions. The aim of current study is to correlate Fine Needle Aspiration Cytology (FNAC) findings with histopathological results in head and neck lesions.[7]

SPECIFIC OBJECTIVES

1. To evaluate the diagnostic accuracy of FNAC in distinguishing neoplastic and non-neoplastic head and neck lesions.
2. To determine the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of FNAC in various head and neck sites.
3. To categorize head and neck lesions by site (e.g., thyroid, salivary glands, lymph nodes) and assess the role of FNAC in guiding clinical management.

MATERIALS AND METHODS

Study Design

This prospective, hospital-based study was conducted at PDU Medical Hospital, Rajkot, from June 2022 to May 2023. The study included 72 cases of head and

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neck lesions that were evaluated using FNAC and histopathology.

Sample Size
A total of 72 cases of palpable head and neck masses were studied. The cases were selected based on the inclusion and exclusion criteria mentioned below.

Inclusion Criteria
1. Patients of all ages and sexes presenting with head and neck lesions, either clinically palpable or detected via radiological findings.
2. Lesions where FNAC was feasible and histopathological follow-up was available.

Exclusion Criteria
1. Patients with clinical evidence of hyperthyroidism were excluded as these cases are best diagnosed using biochemical tests.
2. Unwilling or uncooperative patients.

FNAC Procedure
After obtaining informed consent, a 22G hypodermic needle attached to a 10cc disposable syringe was used to perform FNAC under aseptic conditions. Smears were prepared, fixed, and stained using Haematoxylin and Eosin (H&E), Papanicolaou, and May-Grunwald-Giemsa (MGG) stains for cytological evaluation.

Histopathological Procedure
For histopathology, biopsy specimens or surgically excised tissues were fixed in 10% formalin, processed, and stained using H&E stain. Histopathological diagnoses were then correlated with FNAC findings.

Statistical Analysis
The diagnostic accuracy of FNAC was calculated based on sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). True positive, false positive, true negative, and false negative results were used to calculate these metrics.

RESULTS
A total of 72 cases were included in the study, with a slight female predominance (54.16% females vs. 45.83% males). The most common age group was 31-40 years, accounting for 16 cases (22.5%), followed by the age groups 21-30 years and 41-50 years, each contributing 14 cases (19.4%). The youngest patient in the study was 3 years old, while the oldest was 78 years old. The age and sex distribution are presented in Table 1.

Table 1: Age and Sex Distribution of Patients

Age Group	Number of Patients (%)	Male	Female
1-10	3 (4.1%)	0	3
11-20	6 (8.3%)	3	3
21-30	14 (19.4%)	8	6
31-40	16 (22.5%)	3	13
41-50	14 (19.4%)	6	8
51-60	10 (13.8%)	5	5
61+	9 (12.5%)	8	1
Total	72 (100%)	33	39

The most affected age group was 31-40 years, predominantly females (13 out of 16 cases in this age group), suggesting a possible sex-based predisposition for certain lesions in this age group, particularly thyroid lesions, which were more common in females.

FNAC Findings
The FNAC findings were categorized into non-malignant, malignant, and suspicious cases. The most commonly biopsied site was the thyroid gland (22 non-malignant cases, 3 suspicious cases), followed by the salivary glands and lymph nodes. The overall breakdown of FNAC results by anatomical site is summarized in Table 2.

Table 2: FNAC Results by Site

Site	Non-malignant	Malignant	Suspicious
Thyroid	22	0	3
Salivary Gland	15	0	0
Lymph Node	5	1	0
Skin & Adnexa	12	1	1
Soft Tissue	11	0	1
Total	65	2	5

Out of 72 cases, 65 (90.2%) were found to be non-malignant, 2 (2.8%) were malignant, and 5 (6.9%) were suspicious on FNAC. The majority of non-malignant cases involved thyroid and salivary gland lesions. Two malignant cases were found in the skin and lymph node regions, with one case of metastatic squamous cell carcinoma in a lymph node and one case of keratinizing squamous cell carcinoma in the skin and adnexa.

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Histopathological Findings

After performing FNAC, the resected or biopsy specimens were examined histopathologically. The results were then compared to the cytological findings. The histopathological results are presented in Table 3.

Table 3: Histopathological Findings by Site

Site	Non-malignant	Malignant	Suspicious
Thyroid	22	2	1
Salivary Gland	15	0	0
Lymph Node	5	1	0
Skin & Adnexa	13	1	0
Soft Tissue	11	1	0
Total	66	5	1

Of the 72 cases, 66 (91.7%) were non-malignant, 5 (6.9%) were malignant, and 1 (1.4%) was suspicious. Histopathologically confirmed malignancies included two cases of thyroid carcinoma (both papillary), one case of metastatic squamous cell carcinoma in a lymph node, one case of keratinizing squamous cell carcinoma in the skin, and one soft tissue malignancy.

FNAC-Histopathological Correlation

The correlation between FNAC and histopathological findings is summarized in Table 4. Out of 72 cases, FNAC correctly identified 66 cases as non-malignant, 3 cases as malignant, and 1 case as suspicious, with 2 inconsistent findings where FNAC results were non-malignant, but histopathology confirmed malignancy.

Table 4: Histocytological Correlation

Site	Non-malignant	Malignant	Suspicious	Inconsistent	Total
Thyroid	22	0	1	2	25
Salivary Gland	15	0	0	0	15
Lymph Node	5	1	0	0	6
Skin & Adnexa	13	1	0	0	14
Soft Tissue	11	1	0	0	12
Total	66	3	1	2	72

Diagnostic Accuracy

The overall diagnostic accuracy of FNAC in this study was found to be 95.6%, with a sensitivity of 60% and specificity of 100%. The positive predictive value (PPV) was 100%, while the negative predictive value (NPV) was 95.6%. These values reflect FNAC's high specificity in ruling out malignancy in non-malignant cases but indicate a moderate sensitivity, likely due to the small number of malignant cases.

Table 5: Diagnostic Accuracy of FNAC

Test Result	No Disorder	Disorder
Positive Test	0 (False Positive)	3 (True Positive)
Negative Test	67 (True Negative)	2 (False Negative)

- Sensitivity = (True Positives) / (True Positives + False Negatives) = 3 / (3 + 2) = 60%
- Specificity = (True Negatives) / (True Negatives + False Positives) = 67 / (67 + 0) = 100%
- Positive Predictive Value (PPV) = (True Positives) / (True Positives + False Positives) = 3 / (3 + 0) = 100%
- Negative Predictive Value (NPV) = (True Negatives) / (False Negatives + True Negatives) = 67 / (67 + 2) = 95.6%
- Overall Accuracy = (True Positives + True Negatives) / Total Cases = (3 + 67) / 72 = 95.6%

DISCUSSION

The present study aimed to evaluate the diagnostic accuracy of Fine Needle Aspiration Cytology (FNAC) in head and neck lesions by correlating FNAC findings with histopathological diagnoses. FNAC plays a pivotal role as a first-line diagnostic tool, providing rapid, cost-effective, and minimally invasive evaluation of palpable lesions in the head and neck region. The study results showed an overall accuracy of 95.6%, highlighting FNAC's significant diagnostic value.

Comparison with Other Studies

Several studies have investigated the accuracy, sensitivity, and specificity of FNAC in diagnosing head and neck lesions. In this study, FNAC showed a sensitivity of 60% and a specificity of 100%, with a positive predictive value of 100% and a negative predictive value of 95.6%. These findings are consistent with previous research, though some variation in sensitivity is noted.

In comparison, a study by Kumar et al. reported a higher sensitivity of 77%, specificity of 100%, and accuracy of 97.7%, indicating a strong correlation between FNAC and histopathological findings .[8]Similarly, Rajbhandari et al. found FNAC to have a sensitivity of 86%, specificity of 97%, and accuracy

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of 87.4% in their analysis of head and neck lesions.[9] The slightly lower sensitivity in our study may be attributed to the relatively small number of malignant cases, which can lead to an underestimation of FNAC's diagnostic performance for malignancies. However, the high specificity seen in our study is in line with previous research, underscoring FNAC's reliability in identifying non-malignant conditions.

Tilak et al. also observed similar findings, with sensitivity rates of 90.91% and specificity of 93.18%, resulting in an overall accuracy of 92.73%.[10] This supports FNAC's robust diagnostic utility in head and neck lesions. The variation in sensitivity across studies may be attributed to differences in study population, lesion types, operator expertise, and cytological criteria used for diagnosis.

Accuracy of FNAC in Different Lesions

Thyroid Lesions

The thyroid was one of the most common sites evaluated in this study. Out of the 24 thyroid cases, FNAC accurately diagnosed 22 as benign, while histopathology confirmed these results. Two cases were classified as malignant on histopathology, one of which was missed on FNAC and diagnosed as suspicious, leading to a lower sensitivity in detecting thyroid malignancies.

Thyroid lesions are often benign, with FNAC being highly accurate in identifying non-neoplastic conditions such as colloid goiter and thyroiditis. However, some challenges remain in diagnosing malignancies such as follicular carcinoma, as distinguishing between follicular adenomas and carcinomas based solely on cytology is difficult. This is because FNAC cannot assess capsular or vascular invasion, which are critical for diagnosing follicular carcinoma. Despite this, FNAC remains a valuable tool for triaging patients and determining the need for further surgical intervention.

In this study, FNAC demonstrated an accuracy of 95.6% for thyroid lesions, comparable to findings from Baloch et al. and Faquin et al., where FNAC had an accuracy of 96% for diagnosing benign thyroid lesions.[11,12] The high accuracy of FNAC in thyroid lesions reaffirms its role as an essential diagnostic tool in thyroid nodule evaluation, reducing unnecessary surgeries for benign conditions.

Salivary Gland Lesions

FNAC is also highly effective for diagnosing salivary gland lesions, which accounted for 15 cases in this study. All 15 cases were correctly diagnosed as benign on FNAC and histopathology. Pleomorphic adenoma was the most common lesion, followed by Warthin's tumor. These results align with other studies, such as those by Kocjan et al., which showed that FNAC is highly reliable in identifying benign salivary gland tumors.[13]

However, the challenge in salivary gland FNAC lies in diagnosing low-grade malignancies such as mucoepidermoid carcinoma or adenoid cystic carcinoma, which may show cytological features overlapping with benign lesions. Fortunately, none of the cases in this study presented such diagnostic challenges. The diagnostic accuracy of FNAC for salivary gland lesions in our study was 100%, which is comparable to results from Seethala et al. and Layfield et al., who reported accuracy rates of over 90%.[14,15]

Lymph Node Lesions

Lymph nodes are a frequent site of FNAC in the head and neck region, especially for patients presenting with lymphadenopathy. In this study, FNAC was performed on six lymph node lesions, with five cases correctly diagnosed as benign (tubercular and chronic inflammatory lymphadenitis) and one as malignant (metastatic squamous cell carcinoma). The sensitivity of FNAC in detecting malignant lymph node lesions was lower in this study, as one case of lymphoma was classified as benign on FNAC, likely due to sampling error or inadequate cellularity.

Previous studies have demonstrated FNAC's high diagnostic accuracy in detecting metastatic carcinomas in lymph nodes, particularly from squamous cell carcinoma. The findings of Hirachand et al. and Singh et al. support this, with FNAC showing high sensitivity (85-90%) in identifying metastatic malignancies in lymph nodes. However, FNAC may be less sensitive for diagnosing lymphoma, as a full immunohistochemical and molecular workup is often required for definitive diagnosis.[16,17]

Despite these limitations, FNAC remains a useful tool for triaging patients with lymphadenopathy, especially in resource-limited settings where access to advanced diagnostic tools may be limited.

Skin and Adnexal Lesions

In our study, skin and adnexal lesions were represented by 14 cases, of which 13 were benign and one was malignant. The benign lesions included keratinous cysts and keloids, while the malignant case was diagnosed as keratinizing squamous cell carcinoma on histopathology. FNAC's accuracy in diagnosing skin and adnexal lesions was high, with only one false negative result.

Other studies, such as those by Bajaj et al., have also reported high diagnostic accuracy for FNAC in skin and adnexal lesions, particularly in differentiating benign from malignant conditions. FNAC provides a rapid and reliable diagnosis for cutaneous lesions, often reducing the need for excisional biopsy in benign cases.[16,18]

Soft Tissue Lesions

Soft tissue lesions, including lipomas and sarcomas, are commonly encountered in head and neck FNAC. In this study, 12 cases were evaluated, with 11 diagnosed as benign and one as malignant on

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histopathology. The benign cases included lipomas, while the malignant case was a soft tissue sarcoma.

FNAC is known to have limitations in diagnosing soft tissue tumors, particularly in distinguishing between benign and malignant mesenchymal tumors. The cytological features of sarcomas can be subtle, and a core biopsy or excisional biopsy is often required for definitive diagnosis. Nonetheless, FNAC serves as a useful screening tool in identifying benign lesions, such as lipomas, which do not require surgical intervention. Layfield et al. reported similar findings, with FNAC being highly effective in diagnosing benign soft tissue tumors but less reliable in detecting sarcomas.

Diagnostic Pitfalls and Limitations of FNAC

While FNAC is a valuable diagnostic tool, it is not without limitations. One of the key challenges is obtaining adequate and representative samples, particularly in deep-seated lesions. Inadequate cellularity or poor sampling technique can lead to false negative or non-diagnostic results. In our study, two cases were classified as suspicious on FNAC, which were later confirmed as malignant on histopathology.

Another limitation of FNAC is its inability to provide architectural details, which are often crucial for diagnosing certain malignancies. For example, in follicular thyroid lesions, distinguishing between adenoma and carcinoma requires evidence of capsular or vascular invasion, which cannot be assessed on cytology alone. Similarly, for lymphomas, a definitive diagnosis often requires a combination of immunophenotyping and molecular studies, which are beyond the scope of FNAC.

Despite these limitations, FNAC remains a widely used and reliable diagnostic tool, particularly in settings where resources are limited. Its high specificity ensures that patients with benign lesions can avoid unnecessary surgical procedures, while those with suspicious or malignant findings can be referred for further diagnostic workup.

CONCLUSION

The results of this study demonstrate that FNAC is a highly accurate diagnostic tool for head and neck lesions, with an overall accuracy of 95.6%. It is particularly effective in diagnosing benign conditions, with a specificity of 100%. However, its sensitivity is lower for malignancies, highlighting the need for caution in interpreting FNAC results, especially in suspicious or indeterminate cases. Despite its limitations, FNAC remains an essential first-line investigation for head and neck lesions, providing rapid, cost-effective, and minimally invasive diagnosis that guides clinical management and reduces unnecessary surgeries.

The findings of this study are consistent with other studies in the literature, further supporting the role of FNAC in diagnosing head and neck lesions. Future studies with larger sample sizes and the inclusion of advanced diagnostic techniques such as immunocytochemistry and molecular analysis may help improve the sensitivity of FNAC, particularly for challenging cases such as lymphomas and follicular thyroid neoplasms.

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