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Original Research Article

Comparison of fine needle aspiration cytology and histopathology in neck mass diagnosis

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ABSTRACT

Background: Neck masses are common clinical presentations with a wide range of etiologies, including benign, inflammatory and malignant conditions. Fine needle aspiration cytology (FNAC) is widely used as a first-line diagnostic tool, but histopathology remains the gold standard. This study aimed to evaluate the diagnostic performance of FNAC by comparing it with histopathological findings in patients with neck masses.
Methods: This descriptive study was conducted at Dhaka Medical College Hospital from July 2019 to June 2020. A total of 100 patients with clinically significant neck masses were enrolled through purposive sampling. FNAC was performed on all participants, followed by surgical excision and histopathological examination. Diagnostic metrics, including sensitivity, specificity, predictive values and accuracy, were calculated.
Results: Thyroid lesions were the most frequent diagnosis by FNAC (42%), followed by lymphadenopathy (35%) and salivary gland lesions (13%). FNAC identified 68% of cases as benign/inflammatory and 32% as malignant, while histopathology confirmed 73% as benign and 27% as malignant. The overall diagnostic accuracy of FNAC was 87.00%, with sensitivity of 94.12%, specificity of 71.88%, PPV of 87.67% and NPV of 85.19%. The correlation between FNAC and histopathology was statistically significant (p=0.001).
Conclusions: FNAC is a reliable, accessible and accurate screening tool for neck mass evaluation. However, histopathological confirmation remains essential, especially for definitive diagnosis and treatment planning.

Keywords: Bangladesh, Diagnostic accuracy, Fine needle aspiration cytology, Histopathology, Neck mass

INTRODUCTION

Neck masses are among the most frequent clinical presentations encountered in both otolaryngology and general surgical outpatient settings worldwide. Their significance lies not only in their prevalence but in their broad differential diagnosis, which includes a variety of benign, inflammatory, congenital and malignant conditions. In tertiary-level centers, particularly in South Asia, a substantial proportion of patients present with palpable neck swellings originating from cervical lymph nodes, thyroid gland, salivary glands or soft tissues. A recent study from India reported that thyroid swellings accounted for 42% of cases, while lymph node swellings represented 29% and notably, 62% of the neck masses in males were malignant highlighting a potential gender-linked malignancy risk that warrants early and precise evaluation.[1] The clinical approach to diagnosing neck masses remains complex. The overlap in presenting features between benign and malignant lesions often

confounds initial diagnosis. This is particularly evident in cases of tubercular lymphadenitis, metastatic lymphadenopathy or follicular thyroid neoplasms, which can mimic each other in clinical and imaging assessments. The need for an accurate, accessible and minimally invasive diagnostic method is especially acute in resource-limited countries like Bangladesh, where health facilities often face constraints in time, cost and infrastructure. Traditional clinical evaluations, although essential, are insufficient to reliably differentiate benign from malignant lesions, making cytological and histological evaluations indispensable.[2]

Fine needle aspiration cytology (FNAC) has emerged as a first-line diagnostic tool for evaluating palpable masses in the neck due to its simplicity, cost-effectiveness and patient compliance. FNAC requires minimal instrumentation, can be performed in outpatient settings and is associated with negligible complications. Several studies have validated FNAC's diagnostic utility. For instance, in a cohort of 179 patients, FNAC achieved a diagnostic accuracy of 92.1%, with a sensitivity of 81.8% and a specificity of 95%.[3] Another study reported an even higher sensitivity of 87.5% and specificity of 94.8% in head and neck lesions, particularly in thyroid malignancies, reinforcing FNAC's reliability as an initial diagnostic method.[4] These results are consistent across diverse age groups, including pediatric populations, where FNAC maintained an overall accuracy of 95.9%.[5]

Despite its high accuracy, FNAC has certain limitations. It provides a cytological smear but lacks architectural context, which is critical in distinguishing follicular adenomas from carcinomas, diagnosing lymphomas and subclassifying malignancies. Histopathological examination (HPE), through tissue biopsy, remains the gold standard in diagnostic confirmation. It allows for detailed tissue architecture analysis and immunohistochemical profiling, which are often decisive in challenging or ambiguous cases.[6,7] However, HPE is more invasive, requires surgical specimens and demands greater logistical support, often unavailable in many district-level or rural hospitals. In low- and middle-income countries (LMICs), including Bangladesh, the widespread reliance on FNAC stems from both its accessibility and clinical utility.

Nevertheless, practice patterns reveal a significant gap in systematic cross-validation of FNAC results with histopathological outcomes. A study in Dhaka observed that although FNAC provided correct diagnosis in 90% of neck masses, histopathology altered the diagnosis in a subset of ambiguous cases particularly follicular thyroid lesions and lymphoid pathologies.[8] Similarly, in a retrospective study in Assam, only 33.89% of FNAC cases were followed by HPE due to financial and systemic constraints, underscoring the critical need to improve diagnostic protocols and confirmatory practices.[9] The scarcity of region-specific data, particularly from Bangladesh, further complicates evidence-based standardization of diagnostic workflows. While many international studies validate FNAC and HPE independently, few have systematically compared the two methods using robust clinical correlation in Bangladeshi populations. This study, therefore, seeks to address that gap by evaluating the diagnostic accuracy, sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of FNAC and comparing it with HPE findings in patients presenting with neck masses at a tertiary care center in Bangladesh. By doing so, the study aims to offer evidence-based guidance for clinicians to optimize diagnostic strategies and reduce the burden of unnecessary invasive procedures.

METHODS

This descriptive study was conducted in the Department of Surgery at Dhaka Medical College Hospital (DMCH) over a one-year period from July 2019 to June 2020. The study population included patients of all ages and both genders admitted with clinically significant neck masses to the Department of Surgery and the Department of ENT and Head-Neck Surgery.

A total of 96 patients were selected using purposive sampling. Patients with severe preexisting comorbid conditions such as chronic renal failure, chronic liver disease or coagulopathy, those on recent antiplatelet therapy, steroids or chemotherapy, those who underwent surgery for unrelated causes and patients presenting with clinically insignificant neck masses were excluded from the study.

Only patients who met the inclusion criteria were enrolled for clinical, cytological and histopathological evaluation to compare the diagnostic utility of fine needle aspiration cytology (FNAC) and histopathological examination. Diagnostic metrics, including sensitivity, specificity, predictive values and accuracy, were calculated.

RESULTS

A total of 100 patients with neck masses were included in the study. The mean age of the participants was 32.67±8.42 years. The majority of patients (37%) were between 15 and 30 years of age, followed by 28% in the 31 to 45 years age group. Patients aged below 15 years accounted for 9%, while 19% were aged between 46 and 60 years and only 7% were above 60 years. In terms of gender distribution, 53% were male and 47% were female, indicating a slight male predominance.

Regarding the participants' place of residence, a significant proportion (66%) were from rural areas, while the remaining 34% were from urban settings. Fine needle aspiration cytology (FNAC) findings revealed that the most common category of neck mass was thyroid disorders, identified in 42% of cases. Among these, multinodular Goitre was the most frequent diagnosis

(20%), followed by Hashimoto's thyroiditis (12%), papillary carcinoma (6%) and medullary carcinoma (4%). Lymphadenopathy was observed in 35% of cases, which included reactive lymphoid hyperplasia (11%), tubercular lymphadenopathy (8%), metastatic lymphadenopathy (8%) and lymphoma (8%). Salivary gland lesions were present in 13% of patients, with pleomorphic adenoma and mucoepidermoid carcinoma accounting for 7% and 6%, respectively.

Additionally, 10% of the cases involved soft tissue lesions, which included lipoma (6%), benign cystic lesions (2%) and abscesses (2%). Based on cytological diagnosis, the majority of the neck masses were classified as benign or inflammatory lesions, comprising 68% of the cases. In contrast, malignant cytology was identified in 32% of the participants. Histopathological examination revealed that 73% of the neck masses were benign, while 27% were diagnosed as malignant.

Histopathological examination of the neck masses showed that 73% were benign or inflammatory in nature, while the remaining 27% were malignant. Among the benign and inflammatory lesions, Hashimoto's thyroiditis was the most frequently diagnosed condition (24.66%), followed closely by colloid goitre (21.92%). Other common benign findings included reactive lymphadenopathy (15.07%), tubercular lymphadenopathy (13.70%), pleomorphic adenoma (12.33%), lipoma (6.85%) and branchial cleft cysts identified after surgical excision (5.48%).

Among the malignant lesions, metastatic carcinoma was the most prevalent (25.93%), followed by mucoepidermoid carcinoma (18.52%) and non-Hodgkin lymphoma (18.52%). Other malignant conditions included papillary carcinoma (14.81%), Hodgkin lymphoma (11.11%), medullary carcinoma (7.41%) and follicular carcinoma (3.70%). These findings underscore the pathological diversity of neck masses and the critical role of histopathological diagnosis in identifying both benign and malignant etiologies.

A comparison between FNAC-based cytological findings and subsequent histopathological diagnoses revealed a statistically significant association (p=0.001). Among the 100 cases, 64 were identified as benign by both cytology and histology, indicating true positives, while 23 cases were correctly identified as malignant by both methods, representing true negatives.

However, 9 cases diagnosed as malignant on FNAC were later confirmed as benign on histopathology, representing false positives. Conversely, 4 cases initially classified as benign on cytology were confirmed to be malignant upon histological evaluation, indicating false negatives. The diagnostic validity of fine needle aspiration Cytology in comparison to histopathological examination was assessed. The sensitivity of FNAC was found to be 94.12%, indicating a high ability to correctly identify malignant cases. The specificity was 71.88%, reflecting a moderate capacity to accurately rule out malignancy in benign cases.

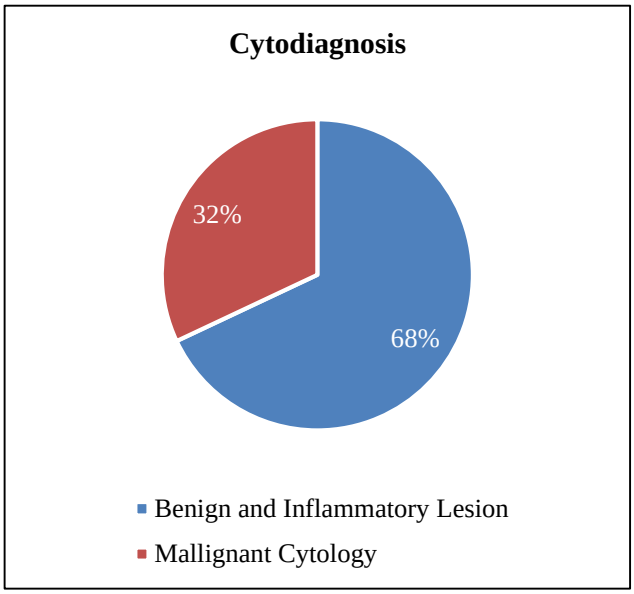

Figure 1: Distribution of participants by cytological diagnosis of cysts (n=100).

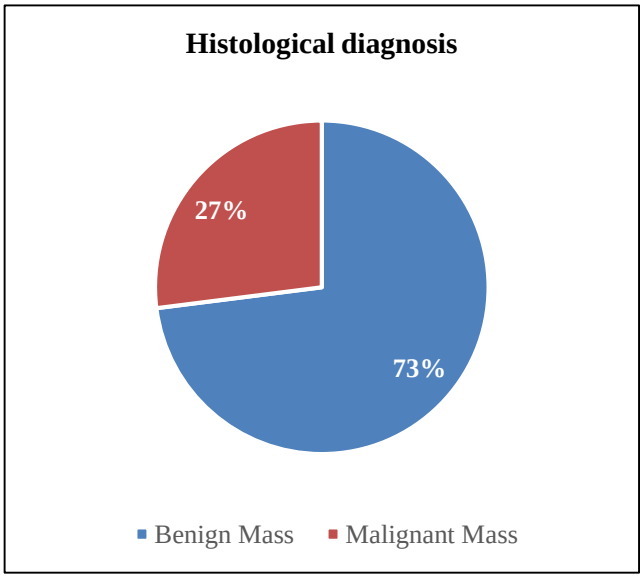

Figure 2: Distribution of participants by histological diagnosis of cysts (n=100).

The positive predictive value (PPV) was 87.67% and the negative predictive value (NPV) was 85.19%, suggesting strong predictive performance for both malignant and benign diagnoses. The positive likelihood ratio was calculated as 3.35 and the negative likelihood ratio was 0.08, further supporting FNAC's reliability in clinical screening. The overall diagnostic accuracy of FNAC was 87.00%, confirming its usefulness as a valuable preliminary diagnostic tool for evaluating neck masses.

Table 1: Distribution of baseline characteristics among the participants (n=100).

Baseline Characteristics	Frequency	%
Age (in years)		
<15	9	9.00
15-30	37	37.00
31-45	28	28.00
46-60	19	19.00
>60	7	7.00
Mean±SD	32.67±8.42	
Gender		
Male	53	53.00
Female	47	47.00
Residence		
Rural	66	66.00
Urban	34	34.00

Table 2: Evaluation of neck mass by FNAC findings (n=100).

FNAC	Frequency	%
Thyroid Disorder	42	42.00
Multinodular goitre	20	20.00
Hashimoto's thyroiditis	12	12.00
Papillary carcinoma	6	6.00
Medullary carcinoma	4	4.00
Lymphadenopathy	35	35.00
Reactive lymphoid hyperplasia	11	11.00
Tubercular lymphadenopathy	8	8.00
Metastatic lymphadenopathy	8	8.00
Lymphoma	8	8.00
Salivary gland	13	13.00
Pleomorphic adenoma	7	7.00
Mucoepidermoid carcinoma	6	6.00
Soft tissue	10	10.00
Lipoma	6	6.00
Benign cystic lesion	2	2.00
Abscess	2	2.00

Table 3: Histopathology findings of mass (n=100).

Findings	Frequency	%
Benign and inflammatory lesions (n=73)		
Hashimoto's thyroiditis	18	24.66
Colloid Goitre	16	21.92
Reactive lymphadenopathy	11	15.07
Tubercular lymphadenopathy	10	13.70
Pleomorphic adenoma	9	12.33
Lipoma	5	6.85
Branchial cleft cyst (after excision)	4	5.48
Malignant lesions (n=27)		
Papillary carcinoma	4	14.81
Follicular carcinoma	1	3.70
Medullary carcinoma	2	7.41
Hodgkins's lymphoma	3	11.11
Non-Hodgkin lymphoma	5	18.52
Metastatic carcinoma	7	25.93
Mucoepidermoid carcinoma	5	18.52

Table 4: Distribution of cases according to cytology and subsequent histology (n=100).

Types of neck mass	Benign cytology	Malignant cytology	P value
Benign histology	64 (true positive)	9 (false positive)	0.001
Malignant histology	4 (false negative)	23 (true negative)	

Table 5: Diagnostic validity test for cytodiagnosis and subsequent histopathology.

Statistic	Value
Sensitivity	94.12%
Specificity	71.88%
Positive likelihood ratio	3.35
Negative likelihood ratio	0.08
Positive predictive value (PPV)	87.67%
Negative predictive value (NPV)	85.19%
Accuracy	87.00%

DISCUSSION

The current study aimed to evaluate and compare the diagnostic utility of FNAC with histopathological examination in the assessment of neck masses. The findings revealed that the majority of patients belonged to the younger age group, with a mean age of 32.67±8.42 years and the highest prevalence among individuals aged 15–30 years. This observation aligns closely with studies conducted by Hasan and Banstola et al, both of which reported a similar age distribution, with the third decade of life being the most affected.[10,11]

While the gender distribution in the present study showed a slight male predominance (53% male vs. 47% female), other studies such as those by Sangavi et al, (2017) and Patel et al, (2018) reported a female predominance, highlighting regional and demographic variations in patient profiles.[12,13] In cytological evaluation, thyroid lesions emerged as the most frequent group diagnosed by FNAC (42%), with multinodular goitre being the most common subtype (20%). This finding is consistent with the work of Thakur et al, who also identified thyroid swellings as a dominant diagnostic group, particularly colloid goitre and Hashimoto's thyroiditis.[2]

Similarly, other studies reported comparable proportions of thyroid pathologies, reinforcing the trend of thyroid lesions being the most common neck mass presentation in cytological diagnosis.[14,15] Lymphadenopathy was observed in 35% of cases, which included reactive, tubercular, metastatic and lymphomatous etiologies similar to findings by Anam et al, who reported lymph node involvement as a major category with diverse causes.[9] Salivary gland and soft tissue lesions represented 13% and 10% of cases, respectively, comparable to proportions observed in earlier cytological reviews.[2,15] The distribution of benign and malignant lesions observed cytologically (68% benign/inflammatory and 32% malignant) was closely mirrored in histopathological findings (73% benign and 27% malignant), suggesting a high level of concordance. These proportions are consistent with the findings of Hota et al, Devkota et al and Mistry et al, all of which emphasized that benign thyroid and lymph node lesions are more common but should not overshadow the considerable burden of malignant pathology.[7,16,17]

Among benign histopathological diagnoses, Hashimoto's thyroiditis and colloid goitre were the most prevalent, while metastatic carcinoma and lymphomas were predominant among malignancies patterns that were similarly reported by Mohamed et al and Mantri et al, in their respective cohorts.[18,19] The comparative analysis of FNAC and histopathology in this study demonstrated strong diagnostic concordance. True positives (benign concordance) accounted for 64% and true negatives (malignant concordance) for 23%, with a statistically significant correlation (p=0.001). These values reflect the diagnostic reliability of FNAC and align closely with studies by Lokesh et al, Swamy et al and Patil, which reported over 85% agreement between cytological and histological findings.[20-22]

The occurrence of 9% false positives and 4% false negatives in the present study emphasizes the limitations of FNAC, particularly in differentiating low-grade malignancies or poorly cellular lesions, a challenge also noted in other literatures.[18] Regarding diagnostic validity, FNAC in this study achieved a sensitivity of 94.12% and an accuracy of 87%, reflecting its excellent ability to detect malignant cases. These results are comparable with those of Mohammad et al, who reported sensitivity of 87.5% and accuracy of 91.1% and Kambale et al, who found sensitivity of 97.4% and accuracy of 93.4%.[18,23]

Although the specificity in this study was moderately lower at 71.88%, it remains within the expected range, consistent with findings from Hafez et al and Tahoun et al, who reported specificity of 67.2% in similar settings.[24] The positive predictive value (87.67%) and negative

predictive value (85.19%) further support the diagnostic strength of FNAC, particularly in clinical screening contexts. The positive and negative likelihood ratios (3.35 and 0.08, respectively) confirm that FNAC is a reliable method for ruling in and ruling out malignancy, echoing the observations of Lokesh et al, in similar clinical environments.[20] Overall, the results of this study validate FNAC as a rapid, cost-effective and accurate preliminary diagnostic tool for evaluating neck masses, especially in resource-limited healthcare systems. However, the findings also reaffirm the necessity of histopathological confirmation for definitive diagnosis, particularly in cases where FNAC findings are ambiguous or inconsistent with clinical judgment. The high diagnostic accuracy and significant concordance observed in this study support the integration of FNAC into routine diagnostic workflows, with histopathology retained as the confirmatory standard.

Limitations of the study was that the study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

FNAC is a highly valuable, minimally invasive and cost-effective diagnostic tool for evaluating neck masses, particularly in resource-limited settings. In this study, FNAC demonstrated high sensitivity (94.12%) and strong diagnostic accuracy (87.00%) when compared with histopathological examination, which remains the gold standard. The concordance between FNAC and histopathology was statistically significant, reinforcing FNAC's reliability for initial diagnostic screening.

However, the occurrence of false positives and false negatives emphasizes the necessity of confirmatory histopathological evaluation, especially in cases with atypical or suspicious cytological features. The findings also reveal that thyroid lesions, lymphadenopathies and salivary gland pathologies remain the most common causes of neck masses, with a considerable proportion of malignancies, including metastatic carcinoma and lymphomas. Given its high diagnostic yield and practicality, FNAC should be routinely integrated into the diagnostic workflow for neck masses, while maintaining histopathology as the definitive tool for final diagnosis and treatment planning.

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