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# Fine Needle Aspiration Cytology in the Diagnosis of Neck Swelling

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ABSTRACT

**Background:** In otolaryngology practice, neck swellings are a common clinical presentation that can have a variety of causes, from benign inflammatory conditions to malignant neoplasms. For the preoperative assessment of neck masses, fine needle aspiration cytology (FNAC) has become a popular and reasonably priced diagnostic technique. This study sought to assess the diagnostic precision, sensitivity, and specificity of FNAC in identifying neck swellings. **Methods & Materials:** This descriptive cross-sectional study was conducted at the Department of Otolaryngology and Head and Neck Surgery, Dhaka Medical College Hospital from January 2024 to December 2024. Under aseptic conditions, FNAC was performed on 100 consecutive patients with neck swelling who satisfied the inclusion criteria using a 23-gauge needle. Histopathological analysis of surgically removed specimens was then used as the reference standard to correlate cytological diagnoses. Sensitivity, specificity, positive and negative predictive values, and overall accuracy were among the diagnostic performance metrics that were computed. **Results:** The mean age of the 53 male and 47 female participants in the study ranged primarily from 15 to 45 years. Thyroid lesions accounted for the largest proportion of neck masses (42%), followed by lymph node pathologies (35%), was made up of thyroid lesions. Malignant lesions made up 27% of cases, whereas benign and inflammatory lesions made up 73%. With an overall diagnostic accuracy of 87%, FNAC showed a sensitivity of 85.2%, specificity of 87.7%, positive predictive value of 71.9%, and negative predictive value of 94.1%. False-positive and false-negative results were found in 9% and 4% of cases, respectively. **Conclusion:** For assessing neck swellings, FNAC is a dependable, secure, and reasonably priced first-line diagnostic method with good specificity and tolerable sensitivity. Discordant cases require histopathological confirmation for a conclusive diagnosis and suitable therapeutic management, even though it greatly facilitates preoperative decision-making and minimizes needless surgical procedures.

***Keywords:*** *FNAC, Neck Swelling, Neoplasm.*

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## INTRODUCTION

Neck swellings are part of the clinical presentation of otolaryngology and head-neck surgery and they are considered to be one of the most common occurrence in both fields [1]. Among many disorders that may cause them, there are congenital defects, inflammatory lesions, benign neoplasma, and malignant tumor; all of them require a different approach to diagnosis and treatment [2]. The neck is anatomically a complex part of the body that is composed of lymphoid tissue, thyroid, salivary glands, and soft tissue structures and it is difficult to differentiate between the two entities [3]. Early and correct classification of benign and malignant pathology is important in order to treat with proper management; here unnecessary surgery in benign cases is prevented and immediate treatment with a malignancy is done. FNAC is an important diagnostic method used in the evaluation of palpable neck masses over the last four decades [4]. In this minimum invasive procedure, a fine-gauge needle is used to remove cellular material which is subject to cytological assessment. FNAC has several advantages over open biopsy, such as being simple to operate, fast, reproducible, cheap, and associated with minimal side effects such as nerve damage or tumor seeding [5]. It is possible to perform in outpatient conditions without general anesthesia, and this is particularly beneficial in high-risk and pediatric patients. Real-time evaluation of specimen sufficiency and possibility of repeat aspiration, also increases its clinical usefulness [6]. The diagnostic result of FNAC on the neck swellings has been widely reported with a sensitivity of 76 to 98 and a specificity of 89 to 100 at different locations and in different pathologies [7]. In most of the instances, specific cytomorphological features of soft tissue tumors, mass salivary glands, thyroid nodules and lesions of lymph nodes make possible accurate characterization of the preoperative settings. FNAC is especially applicable in high-burden situations where it can be applied to detect metastatic carcinoma in lymph nodes and diagnose tuberculous lymphadenitis [8]. In the case of thyroid nodules, it is the first-line test, which it is backed by the Bethesda System for Reporting Thyroid Cytopathology, standardizing the categories and management [9]. FNAC has been used to distinguish between pleomorphic adenoma and malignant neoplasma in the pathology of salivary glands, which is supplemented by Milan System of Reporting Salivary Gland Cytopathology. FNAC does have major limitations, however. It is operator-dependent and requires competent cytopathologists to interpret it and technical expertise in sampling [10]. Cystic or heterogeneous lesions have more of a likelihood of sampling errors and some, including follicular thyroid neoplasma and some types of lymphoma, are not definitively diagnosable by cytology. False negative can occur due to poor sampling, low grade malignancies or subtle cytological atypia, on the other hand, false positive can be due to reactive changes simulating malignancy or interpretation error [11]. To ensure quality control, the results of cytology have to be correlated with subsequent histopathology. Discordant cases help to enhance diagnostic criteria by pointing out errors in sampling or interpretation. FNAC performance validation on a local scale is particularly important to the efficient utilization of limited healthcare resources in resource-limited areas with a high TB rate such as Bangladesh. With this in mind, this study was aimed at evaluating the efficacy of FNAC as a method of diagnosing neck swellings. The study was conducted to evaluate the sensitivity, specificity, predictive values, overall accuracy, characterize the spectrum of pathologies, find common patterns of diagnostic discordance and evaluate the role of FNAC

as a first-line diagnostic method to reference to regarding this issue.

## METHODS & MATERIALS

The study was a descriptive, cross-sectional study that was done in the Department of Otolaryngology and Head and Neck Surgery, Dhaka Medical College Hospital within the period of January 2024 to December 2024. Swollen-neck patients who fulfilled the inclusion criteria and provided informed, written consent were enrolled and otherwise not. Sociodemographic data, history of clinical, and examination outcomes were collected with the help of a pretested structured questionnaire. Fine needle aspiration cytology was done by use of a 23-gauge needle and a 10-ml disposable syringe and was done as an outpatient procedure under aseptic conditions in all patients. The smears were prepared and analyzed by cytopathology. The removal of the tissue was considered the reference standard, which was examined histopathologically, and in case of the necessity, open biopsy of the neck mass was performed. Next, the histopathology and cytological diagnoses were compared; discordant cases were given special consideration. The cytological test was calculated in terms of diagnostic sensitivity, specificity, the overall accuracy, discordance rate, and the positive and negative predictive values. The SPSS version 26 was used to input and analyze the data.

## RESULTS

The demographic profile of the study population is shown in *Table I*. The majority of patients (37%) were in the 15-30 age range, followed by those in the 31-45 age range (28%). With 53% of the population being male and 47% being female, the gender distribution was comparatively balanced. Socioeconomic assessment showed that 44% of patients were from the poor economic strata, 38% were from the middle class, and only 18% were from the upper socioeconomic class. There was a wide range in educational attainment, with 30% having secondary education and 26% being illiterate. 66% of the study population lived in cities, which suggests that they seek healthcare more frequently than those who live in rural areas (34%). According to the occupational distribution, housewives made up 12% of the study population, while workers (30%) and businessmen (22%), respectively, were the largest groups.

**Table I**
Socio-demographic characteristics of the study population ($n$ = 100)

| Characteristic | Category | (n) | (%) |
|---|---|---|---|
| Age group (years) | <15 | 9 | 9% |
| | 15-30 | 37 | 37% |
| | 31-45 | 28 | 28% |
| | 46-60 | 19 | 19% |
| | >60 | 7 | 7% |
| Sex | Male | 53 | 53% |
| | Female | 47 | 47% |
| Socioeconomic status | Poor | 44 | 44% |
| | Middle | 38 | 38% |
| | Upper | 18 | 18% |
| Education level | Illiterate | 26 | 26% |
| | Can sign only | 6 | 6% |
| | Primary | 14 | 14% |
| | Secondary | 30 | 30% |
| | Higher secondary | 24 | 24% |
| Place of residence | Urban | 66 | 66% |
| | Rural | 34 | 34% |
| Occupation | Business | 22 | 22% |
| | Service holder | 16 | 16% |
| | Worker | 30 | 30% |
| | Farmer | 14 | 14% |
| | Housewife | 12 | 12% |
| | Retired | 6 | 6% |

The clinical symptomatology of the patients is represented in *Table II*. Neck swelling was the main complaint for all patients (100%) when they first arrived. 84% of patients reported pain and tenderness. With 78% reporting an elevated temperature and 76% reporting anorexia and nausea. In 60% of patients, lymphadenopathy was clinically identified, suggesting either metastatic disease or reactive enlargement. Swallowing difficulties (54%) and respiratory discomfort (12%) were examples of local compressive symptoms. 44% of patients reported having a headache, which may have been caused by a systemic illness or referred pain from neck lesions.

**Table II**
Clinical presentation of the study population ($n$ = 100).

| Symptom/sign | (n) | (%) |
|---|---|---|
| Swelling in the neck | 100 | 100% |
| Pain and tenderness | 84 | 84% |
| Elevated temperature | 78 | 78% |
| Anorexia, nausea | 76 | 76% |
| Lymphadenopathy | 60 | 60% |
| Difficulty swallowing | 54 | 54% |
| Headache | 44 | 44% |
| Respiratory discomfort | 12 | 12% |

*There were multiple responses*

Neck masses are categorized in *Table III* according to their anatomical site. Thyroid gland lesions were the most common site of involvement (42%). The second most prevalent category (35%), which included both inflammatory and malignant disorders, was lymph node pathologies. 13% of cases involved salivary gland lesions, primarily affecting the parotid gland. Lipomas, cysts, and abscesses were among the 10% of soft tissue masses that made up the study population.

**Table III**
Distribution of neck masses by anatomical site ($n$ = 100).

| Site of neck mass | (n) | (%) |
|---|---|---|
| Thyroid | 42 | 42% |
| Lymph node | 35 | 35% |
| Salivary gland | 13 | 13% |
| Soft tissue | 10 | 10% |
| Others | 0 | 0% |

The cytological diagnoses are listed in *Table IV* according to anatomical site. Hashimoto's thyroiditis (35.7%) and nodular goiter (52.4%) were the most prevalent thyroid lesions. Papillary carcinoma (9.5%) and medullary carcinoma (2.4%) were examples of malignant thyroid neoplasms. The most common diagnosis in lymph node pathology was reactive lymphoid hyperplasia (40%). 22.8% of cases of lymph nodes were granulomatous lymphadenitis. Malignant conditions included lymphoma (17.1%) and metastatic lymphadenitis (20%). 30.7% of the salivary gland lesions had mucoepidermoid carcinoma, while the majority (69.2%) had pleomorphic adenoma. The majority of the soft tissue lesions were benign, consisting of abscesses (20%), benign cystic lesions (20%), and lipomas 60%.

**Table IV**
Fine-needle aspiration cytology (FNAC) diagnosis of neck masses by site ($n$ = 100).

| Sites of Neck masses | Cytological diagnosis | (n) | (%) |
|---|---|---|---|
| Thyroid (n = 42) | Nodular goiter | 22 | 52.4% |
| | Hashimoto's thyroiditis | 15 | 35.7% |
| | Papillary carcinoma | 4 | 9.5% |
| | Medullary carcinoma | 1 | 2.4% |
| Lymph node (n = 35) | Reactive lymphoid hyperplasia | 14 | 40% |
| | Granulomatous lymphadenitis | 8 | 22.8% |
| | Metastatic lymphadenitis | 7 | 20% |
| | Lymphoma | 6 | 17.1% |
| Salivary gland (n = 13) | Pleomorphic adenoma | 9 | 69.2% |
| | Mucoepidermoid carcinoma | 4 | 30.7% |
| Soft tissue (n = 10) | Lipoma | 6 | 60% |
| | Benign cystic lesion | 2 | 20% |
| | Abscess | 2 | 20% |

The final histopathological diagnoses that serve as the benchmark are shown in *Table V*. Hashimoto's thyroiditis (23.3%) and colloid goiter (20.5%) were the most common benign and inflammatory lesions. Reactive lymphadenitis (13.7%), granulomatous lymphadenitis (12.32%), pleomorphic adenoma (10.9%), lipoma (6.8%), thyroglossal cyst (4.1%), fungal lymphadenitis (4.1%), branchial cleft cyst (2.7%), and dermoid cyst (1.4%) were among the other benign conditions. Among the malignant lesions, metastatic carcinoma (25.9%), non-Hodgkin lymphoma (18.5%), mucoepidermoid carcinoma (18.5%), papillary carcinoma (14.8%), Hodgkin lymphoma (11.1%), medullary carcinoma (7.4%), and follicular adenoma (3.7%).

**Table V**
Histopathological diagnosis of neck masses ($n$ = 100).

| Groups | Histopathological diagnosis | (n) | (%) |
|---|---|---|---|
| Benign and inflammatory lesions (n = 73) | Hashimoto's thyroiditis | 17 | 23.30% |
| | Thyroglossal cyst | 3 | 4.10% |
| | Colloid goiter | 15 | 20.50% |
| | Reactive lymphadenitis | 10 | 13.70% |
| | Fungal lymphadenitis | 3 | 4.10% |
| | Granulomatous lymphadenitis | 9 | 12.32% |
| | Pleomorphic adenoma | 8 | 10.90% |
| | Branchial cleft cyst | 2 | 2.70% |
| | Lipoma | 5 | 6.80% |
| | Dermoid cyst | 1 | 1.40% |
| Malignant lesions (n = 27) | Papillary carcinoma | 4 | 14.80% |
| | Follicular adenoma | 1 | 3.70% |
| | Medullary carcinoma | 2 | 7.40% |
| | Hodgkin lymphoma | 3 | 11.10% |
| | Non-Hodgkin lymphoma | 5 | 18.50% |
| | Metastatic carcinoma | 7 | 25.90% |
| | Mucoepidermoid carcinoma | 5 | 18.50% |

*Table VI* demonstrates the correlation between Cytodiagnosis and subsequent histology. There were 64% of true positive cases, which denotes those benign lesions were correctly identified. There were 23% of true negative cases, demonstrating accurate malignancy identification. The most clinically significant error category, false-negative results, which can postpone cancer treatment, happened in 4% of cases. 9% had false-positive results, meaning that histology revealed benign conditions but cytology indicated malignancy, which could have resulted in needless aggressive interventions.

**Table VI**
Correlation between Cytodiagnosis and Subsequent histology (*n*=100).

| Category | Benign cytology (n) (%) | Malignant cytology (n) (%) |
|---|---|---|
| Benign histology | 64 (64%) (true positive) | 4 (4%) (false negative) |
| Malignant histology | 9 (9%) (false positive) | 23 (23%) (true negative) |

*Table VII* depicts the Diagnostic performance of FNAC for detecting malignant neck lesions. FNAC demonstrated a sensitivity of 85.2%, specificity of 87.7%, positive predictive value of 71.9%, negative predictive value of 94.1%, and overall diagnostic accuracy of 87% when using histopathology as the gold standard and classifying malignancy as the positive condition.

**Table VII**
Diagnostic performance of FNAC for detecting malignant neck lesions (positive = malignant).

| Parameter | Value (%) |
|---|---|
| Sensitivity | 85.2 |
| Specificity | 87.7 |
| Positive predictive value | 71.9 |
| Negative predictive value | 94.1 |
| Overall diagnostic accuracy | 87.0 |

## DISCUSSION

This research tested the diagnostic importance of the fine needle aspiration cytology. The international reports also indicate that neck masses accuracy is between 82% and 96% and FNAC had an overall accuracy of 87% with a sensitivity of 85.2% and a specificity of 87.7% [12,13]. FNAC positive result is particularly reliable in proving malignancy as demonstrated by high specificity. This in most cases can aid in the early treatment decision without having to wait and confirm the situation through histopathology. Thyroid lesions (42%), then soft tissue lesions (10%), salivary gland masses (13%), and lymph node enlargements (35%), were the most frequent pathology of the neck. This trend aligns with that of Kohale et al., who also report autoimmune conditions and endemic deficiency of iodine to be the leading causes of thyroid conditions [14]. High percentage of lymph node pathology (especially granulomatous lymphadenitis possible pathologic sign of tuberculosis, 22.8% of lymph node cases) is also a clear indication of high prevalence of extrapulmonary tuberculosis in Bangladesh, which is also observed in other developing countries [15,16]. Rajbhandari et al., who demonstrated that 27-45% of lymph node FNAC samples reacted, indicated that reactive lymphoid hyperplasia was the most frequent diagnosis of lymph nodes (40) [17]. Most patients were younger adults (15-45 years old) and most of them were males with a slight prevalence (53%). Conversely, the older age groups have higher chances of having a neck mass particularly thyroid nodules and metastatic nodes as demonstrated by Iacob et al. [18]. Although it is probable that many were inflammatory or infectious, not indolent neoplasma by virtue of high rates of pain, tenderness, and fever, the fact that the proportion of the patients of lower socioeconomic status and urban dwellers was larger is more likely to be indicative of health service usage patterns. In relation to thyroid pathology FNAC has proven to be very concordant when it comes to benign diseases of the thyroid gland like the Hashimoto thyroiditis and the nodular goiter. The familiar limitation that cytology can not distinguish between follicular adenoma and carcinoma without assessing the presence of capsular or vascular invasion was also proved by a false-negative case in which a cytological diagnosis of follicular neoplasm proved to be follicular carcinoma [19,20]. We achieve a specificity of 87.7% which is equivalent to reported thyroid FNAC sensitivity and specificity (70-92% and 88-100%, respectively) particularly with the Bethesda system, which confirms FNAC as a viable technique in the assessment of thyroid nodules [21,22]. FNAC was particularly effective in the metastatic lymph node disease case, with an overall diagnostic accuracy rate of 87% and comparable sensitivity of 91% to 98% reported [23]. Errors in reactive background interpretation or sampling issues in necrotic lesions were the major reasons of missing cases of metastatic squamous cell carcinoma [24]. Conversely, caseous necrosis and classic granulomatous cytology were generally readily diagnostic of tuberculous lymphadenitis, and Ziehl-Neelsen staining was performed when there was need to do so. This lymphoma diagnosis was still a challenging one as half of the cases were initially diagnosed as reactive hyperplasia, which echoes the known shortcoming of FNAC in lymphoblastic disorders [25]. The findings are in line with existing recommendations that support core or excisional biopsy as a preferred method of diagnosing suspected lymphoma. Salivary gland FNAC, following a system of work with the risks that is provided within the Milan system, did incredibly well as it correctly identified mucoepidermoid carcinoma in most of the cases and pleomorphic adenoma in all [26]. False negatives (4%) were due to sampling error, interpretive issues and inherent cytological limitations whereas false positives (9) were due to reactive atypia in Hashimoto thyroiditis, granulomatous inflammation or cystic degeneration. In order to minimize these errors, standardized reporting systems, high frequency cytology-histology correlation, and quality assurance processes are important.

## LIMITATIONS

Among limitations in the study are the single center, relatively small sample size, the absence of a routine ultrasound guidance that may have enhanced the sampling error, and partial histological validation of benign cytology. However, the findings confirm the use of FNAC as a rapidly and least invasive and cost-effective initial test of neck masses, especially where resources are scarce.

## CONCLUSION

Our investigation confirmed that the fine needle aspiration cytology is an extremely convenient, cost effective and less invasive method of diagnosing neck swellings and that its overall accuracy is 87%, specificity (87.7%) is high and sensitivity (85.2%) is high. It is effective in most instances to distinguish benign and malignant lesions to be able to plan the surgery more appropriately and avoid unnecessary surgeries in most cases. But, in cases where the cytological findings prove ambiguous or inconsistent with clinical suspicion, histopathological verification is needed because FNAC is limited in nature, particularly in the diagnosis of lymphomas and follicular thyroid neoplasms. FNAC is used when the clinical assessment and radiological imaging are done to the maximum in order to maximize diagnostic accuracy.

## RECOMMENDATION

In order to reduce sampling errors and obtain better diagnostic accuracy, future researches must incorporate ultrasound-guided FNAC and larger and multicenter cohorts. More rigid reporting systems and regular cytology-histology correlation would be introduced to minimize conflict of interpretations.

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## CONFLICT OF INTEREST

None declared

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