



Fine Needle Aspiration Cytology in the Evaluation of Head and Neck Lesions: A Cross Sectional Study

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ABSTRACT

Background

Fine needle aspiration cytology (FNAC) is a minimally invasive technique that provides early differentiation of benign from malignant pathology. This study aimed to explore the cytological spectrum of head and neck swellings and also analyze the diagnostic accuracy, sensitivity and specificity of FNAC, taking biopsy as the gold standard.

Methods

This was an analytical cross-sectional study conducted in the Department of Pathology, College of Medical Sciences-Teaching Hospital from 1st January 2024 to 31st December 2024. FNAC samples from 340 patients presenting with head and neck swellings were included in the study. Data was collected using a well structured proforma and entered and analyzed by using Microsoft Excel.

Results

Among 340 study samples, 295 cases were categorized as benign and non-neoplastic lesions and the remaining 45 cases were diagnosed as malignant lesions by FNAC. The most common site of FNAC was from thyroid gland (59.42%) followed by lymph node (27.35%). Biopsy samples from the same lesions were available in 88 cases and the sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of FNAC were calculated to be 53.33%, 86.20%, 66.66%, 78.12% and 75% respectively.

Conclusions

FNAC helps us in differentiating benign, malignant and non neoplastic lesions. Benign lesions can be more reliably detected by FNAC than malignant lesions. Intermediate categories need to be interpreted in the background of clinical and radiological parameters and confirmed by biopsy wherever necessary.

Keywords: Biopsy; Fine needle aspiration cytology; Lymph nodes; Salivary glands; Thyroid gland.

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INTRODUCTION

Head and neck swellings include various lesions of lymph node, soft tissue, salivary glands, thyroid, blood vessels, and neural tissue.¹ Fine needle aspiration cytology (FNAC) is a minimally invasive technique used in the initial diagnosis of head and neck swellings.² Existing literatures report variation in the diagnostic utility of FNAC. The sensitivity, specificity and diagnostic accuracy, reported was 96.8%, 30.4% and 79.1% respectively in the study by *Akinmoladun VI et al.*, and 95.45%, 100% and 98% respectively by *Sharma et al.*,^{3,4} Also, there are limited studies available in our country regarding the cytological spectrum of head and neck lesions. Thus, the main objective of this study is to explore the cytological spectrum of head and neck lesions by FNAC. This study will also provide additional insights into the sensitivity, specificity and diagnostic accuracy of FNAC taking biopsy as the gold standard.

METHODS

Study Area

The study was conducted in the Department of Pathology, College of Medical Sciences-Teaching Hospital, Bharatpur, Nepal.

Study Design

This was an analytical cross sectional study.

Population Size

Census method was used for the data collection in this study. The total number of FNAC from head and neck swellings performed in the department of Pathology during the study period were 340. So, this study was conducted among FNAC samples from patients presenting with head and neck lesions from both in patients and out patients departments. Biopsy samples from the same lesions (wherever available) were included in the study. Samples with missing data were excluded from the study.

Fine-needle aspiration was performed by a pathologist, using a 23-G needle and a 10 ml syringe. The aspirated material was spread on the glass slides and some were air dried and others were immediately fixed by immersion in 95% ethyl alcohol. Air-dried

slides were stained with Giemsa stain. Wet slides were stained with Papanicolaou (PAP) stain. The slides were evaluated and cytological diagnosis was made.

Biopsy samples from the same lesions were available in 88 cases. Biopsy samples were received at the Pathology department fixed with formalin and then processed and stained with Hematoxylin and Eosin stain. Histopathological diagnosis was given after microscopic evaluation by the pathologist.

Data Collection

Study was conducted from 1st January 2024 to 31st December 2024. Both demographic and clinical data were collected from the hospital records through a well-structured case proforma.

Data Analysis

The data was entered and analyzed by using Microsoft Excel. Descriptive statistics: Mean, standard deviation for continuous data and frequencies and percentage for categorical data were calculated. Sensitivity, specificity, diagnostic accuracy, positive and negative predictive values of FNAC, taking biopsy as the gold standard were also calculated.

RESULTS

The present study included FNAC samples from 340 patients presenting with head and neck swellings. The age of the patients ranged from 3 to 89 years. Mean (standard deviation) age of the patients was 45.66 (18.64) years in the study. Maximum number of patients (24.11%) were seen in the age group of 50-59 years. Female constituted 76.48% of the cases and the remaining (23.52%) were males.

Benign and non neoplastic lesions contributed to (86.77%) of the cases and the remaining (13.23%) were diagnosed as malignant lesions by FNAC. Malignant lesions were most common in the age group of 70-79 followed by 40 to 49 and 50 to 59 years. Biopsy samples from the same lesions were available in 88 cases and the sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy of FNAC were calculated to be 53.33%, 86.20%, 66.66%, 78.12% and 75%

respectively (Table 1).

Table 1: Frequency distribution of the patients with head and neck lesions by age groups (n=340).

Age group (years)	Frequency (%)	Non neoplastic/ Benign	Malignant
1-9	11 (3.24)	11	0
10-19	28 (8.24)	27	1
20-29	37 (10.88)	32	5
30-39	41 (12.06)	36	5
40-49	58 (17.06)	49	9
50-59	82 (24.12)	73	9
60-69	56 (16.47)	53	3
70-79	23 (6.76)	13	10
>=80	4 (1.17)	1	3

The most common site of FNAC was from thyroid gland in 202 cases (59.42%) followed by lymph node in 93 cases (27.35%) and salivary gland in 22 cases (6.47%) (Table 2).

Table 2: Distribution of site of head and neck lesions among the patients (n=340).

Site	Frequency n (%)
Salivary gland	22 (6.47)
Soft tissue	6 (1.76)
Lymph node	93 (27.35)
Thyroid gland	202 (59.42)
Others	17 (5)

Among the FNAC samples from head and neck region, 59.42% of the samples was from the thyroid gland. The age of the patients undergoing thyroid gland FNAC ranged from 16 to 80 years with maximum number of cases seen in the age group of 50 to 59 years. Majority of the patients (177 cases) were female with female to male ratio calculated to be 7.08:1. FNAC impression was given according to The Bethesda System of Reporting Thyroid Cytopathology (TBSRTC). Maximum number of cases (84) belonged to category II- Benign and included cases diagnosed as Follicular Nodular Disease, Lymphocytic thyroiditis, Hashimoto's thyroiditis and Granulomatous thyroiditis. The impression of category III- Atypia of Undetermined Significance (AUS) was assigned to 59 cases. Category IV- Follicular neoplasm was assigned to 13 cases and 17 cases were labelled as category

V- Suspicious for malignancy with majority being suspicious for papillary thyroid carcinoma. Category VI-Malignant was assigned to 4 cases, 3 of which were diagnosed as Papillary thyroid carcinoma and 1 case as Anaplastic thyroid carcinoma. The impression of Category I- Nondiagnostic was given in 25 cases. For correlating FNAC diagnosis with histopathology, FNAC categories I and III were considered as Benign and IV and V were considered as Malignant.⁶ Following this, 168 cases were considered benign and 34 cases were considered malignant from FNAC evaluation. Histopathological diagnosis was available in 64 cases where 36 cases were diagnosed as benign and 28 cases were diagnosed as malignant. Correlation between FNAC and histopathology revealed concordance in 45 cases and discordance in the remaining 19 cases (Table 3).

Table 3: Distribution of benign and malignant cases of thyroid gland diagnosed by FNAC and histopathology (n=64).

	Benign (Histopathology) (%)	Malignant (Histopathology) (%)
Benign (FNAC)	30 (46.87)	13 (20.31)
Malignant (FNAC)	6 (9.37)	15 (23.43)

Table 4 The sensitivity, specificity, positive predictive value and negative predictive value and diagnostic accuracy of thyroid gland FNAC were calculated to be 53.57%, 83.33%, 71.42%, 69.76% and 70.30% respectively.

FNAC from lymph nodes constituted 27.35% of the head and neck lesions. The age of the patients ranged from 3 to 89 years. Non neoplastic lesions comprised 93.54% of the cases and 5.37% were malignant lesions. An impression of atypical lymphoid hyperplasia was made in one of the FNAC cases. Among 87 non neoplastic cases, the most common impression was reactive lymphadenitis (59 cases), followed by granulomatous lymphadenitis (17 cases), and necrotizing granulomatous lymphadenitis (5 cases). Tubercular lymphadenitis was diagnosed in 3 cases after demonstration of AFB

in Ziehl Neelsen stain following FNAC. Necrotizing lymphadenitis was diagnosed in 1 case while acute suppurative lymphadenitis was diagnosed in 2 cases by FNAC. Among the 5 malignant cases, 3 were diagnosed as positive for malignancy and 2 were diagnosed as metastatic carcinoma.

For correlating FNAC results with histopathology, atypical lymphoid hyperplasia, which was the only indeterminate diagnosis, was reclassified as malignant lesion in FNAC.⁷ Histopathological diagnosis was available in only 10 cases. Non neoplastic cases were concordant with the biopsy findings in 8 cases whereas 1 case of granulomatous lymphadenitis was diagnosed as Kikuchi necrotizing lymphadenitis on biopsy. Atypical lymphoid hyperplasia was diagnosed as Classical Hodgkin Lymphoma on subsequent histopathology.

Salivary glands accounted for 6.47% of the head and neck lesions and parotid gland was the most common site. The age of the patients ranged from 5 to 86 years. Among them 15 were female and the remaining 7 cases were male. FNAC impression of salivary gland lesions was given according to Milan's system of reporting salivary gland cytopathology as shown in table 4. Maximum number of cases were seen in Milan IV-A with the most common diagnosis of pleomorphic adenoma followed by Warthin tumor.

Table 4: FNAC diagnosis of salivary gland lesions by The Milan System for Reporting Salivary Gland Cytopathology (n=22).

Category	Frequency n (%)
Milan I	1 (4.55)
Milan II	6 (27.27)
Milan III	2 (9.09)
Milan IV-A	9 (40.91)
Milan IV-B	2 (9.09)
Milan V	2 (9.09)
Milan VI	0 (0)

Follow up with histopathological reports were available in only 6 cases. Histopathological diagnosis was available in 4 out of 6 cases of category IV-A lesions. All these 4 lesions were diagnosed

as pleomorphic adenoma on histopathology. One case of granulomatous sialadenitis on FNAC was diagnosed as Mucoepidermoid carcinoma, low grade on histopathology in one case. Another case of Milan IV-B (Neoplasm of uncertain malignant potential) was diagnosed as chronic sialadenitis on histopathology. Both specificity and negative predictive value of FNAC were calculated to be (80%) (Table 5).

Table 5: Distribution of benign and malignant cases of salivary gland diagnosed by FNAC and histopathology (n=6).

	Benign (Histopathology)	Malignant (Histopathology)
Benign (FNAC)	4 (66.66%)	1 (16.66%)
Malignant (FNAC)	1 (16.66%)	-

A total of 5% of FNAC from head and neck region were grouped as "Others" among which the most common lesions diagnosed were benign lipomatous lesion (6 cases) and acute suppurative lesion (6 cases) followed by benign cystic lesion (5 cases). The impression of keratinous cyst was made in 2 cases, branchial cyst in 1 case and benign spindle cell lesion was made in 2 cases. An impression of malignant spindle cell lesion was also given in 1 case. Histopathological diagnosis was available in 8 cases. All 6 cases of lipomatous lesion in FNAC were concordant with the histopathological diagnosis. However, one case of benign cystic lesion was diagnosed as lymphangioma in histopathology. Only 1 case diagnosed as suspicious for malignant spindle cell lesion in FNAC was discordant with the histopathological diagnosis which was diagnosed as capillary hemangioma on biopsy.

DISCUSSION

FNAC is a primary investigation used to evaluate head and neck lesions. Various parameters like age and sex distribution, site of FNAC, FNAC impression and histopathological diagnosis wherever available were evaluated in this study.

This study reveals that the head and neck lesions

were commonly seen in the age group of 50-59 years followed by 40-49 years which is similar to the findings by *Dhamsaniya et al.*, where maximum number of cases are seen in 41 to 60 years.⁸ However, the findings differ from the studies by *Anam et al.*, and *Quader et al.*, where the prevalence was more common in 21-30 years and 21-40 years respectively.^{9, 7} This difference could be due to the difference in demographic structure and health seeking behavior of the population. In this study, female constituted 76.48% of the cases similar to the study by *Thapa et al.*,⁵

This study also reveals that non neoplastic and benign pathology are more common in the head and neck region with the prevalence of 86.77%. This finding is supported by the studies by *Thapa et al.*, (88.1%) and *Kaur et al.*, (84.7%).^{5, 10} However, higher proportion of malignant lesions (64.7%) were reported in a study by *Kaushal et al.*,¹¹ This difference could be due to their small sample size and also most of the swellings are of lymph node origin where metastasis is common. In this study, malignant lesions are common in the older and middle age group of 70-79 years followed by 40-59 years similar to the observations by *Thapa et al.*, (61-70 years).⁵ In the present study, FNAC demonstrated the sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy to be 53.33%, 86.20%, 66.66%, 78.12% and 75% respectively. Various studies have reported variable sensitivity and specificity. *Thapa et al.*, *Rajbhandari et al.* and *Yenkure et al.*, reported sensitivity of 80%, 86% and 82.92% respectively.^{5, 12, 1} The low sensitivity reported in the present study could be due to maximum number of cases (approx 60%) of thyroid swellings attributing to head and neck lesions with often low sensitivity of FNAC in the diagnosis of thyroid lesions (53.57% in this study; 57.89% in the study by *Erkinuresin T* and *Demirci H* ; 61.5% in the study by *Shrestha et al.*,^{14, 15} Similarly low sensitivity has been reported by *Asha CS* and *Roy BRS* where thyroid lesions attribute to maximum number of cases of head and neck swellings.¹³ The low sensitivity could also be

due to more cases in borderline categories that have been reclassified as benign for analytical purposes. The specificity of FNAC in the present study is also slightly lower than that reported by *Thapa et al.*, (94.4%), *Rajbhandari et al.*, (97%), *Yenkure et al.*, (98.66%) and *Asha CS* and *Roy BRS* (97.4%)^{5, 12, 1, 13} The low specificity could be due to interpretation errors and diagnostic challenges.

This study revealed that 59.42% of the total head and neck swellings was due to thyroid lesions. Thyroid swellings were seen most commonly in the age group of 50-59 years similar to that by *Ranabhat et al.*,¹⁶ However, *Jain D* and *Jain N* and *Patel et al.*, reported thyroid disorders to be more common in 4th and 3rd decades of life respectively.^{17, 18} Thyroid disorders were more common in females in the present study in accordance to the findings by *Ranabhat et al.*, and *Patel et al.*,^{16, 18} Commonest diagnosis made by FNAC was Bethesda II (Benign, 41.58%) which is comparable to the findings by *Chakraborty et al.*, (48%) but lower than that by *Kafle et al.*, (81.7%).^{19, 20} The prevalence of AUS (Bethesda III) was found to be quite higher (29.2%) than that recommended by the Bethesda system (<7%). However wide variation has been reported in the literature ranging from 1% to >25% with the two most common causes for this indeterminate diagnosis being nodule type and poor aspiration technique.²¹ Biopsy findings were available in 64 cases and in 19 cases, FNAC diagnosis were discordant with the biopsy findings. Discordance was most commonly seen in Bethesda Cat III lesions (10 cases) as this is an inherently ambiguous diagnostic category that includes both benign and malignant lesions. Histopathological diagnosis was discordant also in Bethesda Category IV (4 cases) and these cases were reported as follicular adenoma and follicular nodular disease in resection specimens. This can be explained by the fact that capsular and vascular invasion can not be evaluated in FNAC.²² This can be also due to overlap in cytological features with presence of benign follicular cells in microfollicular pattern in both lesions and inability to access architectural features in FNAC. Two cases of Bethesda category V were

reported as benign in subsequent resection in this study. False positive results could be due to papillary hyperplasia in benign nodules that mimic papillary thyroid carcinoma and atypia in thyroiditis or focal nuclear atypia in hyperplastic nodules mimicking malignancies.²³ Only 1 case of Bethesda Category II was diagnosed as malignant lesion (NIFTP). This disparity could be due to heterogeneity within the targeted nodule or among diverse nodules.²³ Two cases of category I lesions were diagnosed as NIFTP which was missed by FNAC most likely due to sampling errors. The sensitivity and specificity of FNAC in the diagnosis of thyroid lesions is 53.77% and 83.33% respectively. The sensitivity is comparable to the findings by *Asha CS et al.*, (57.1%) but lower than that by Joshi and Hedge (95.77%) and *Rajbhandari et al.*, (96%).^{13, 6, 12} Some studies have reported sensitivity as low as 57% which could be due to combination of operator variation, limited number of samples and diagnostic challenges.⁶ The specificity is comparable to that by *Erkinure et al.*, (88.8%) and lower than that reported by *Dhungana et al.*, (98.075%).^{14, 24} Low specificity could be due to interpretation errors.²³ The low positive and negative predictive values are associated with low sensitivity and specificity observed in this study.

Evaluation of 93 cases of FNAC of the cervical lymph nodes revealed 93.54% of the cases to be non neoplastic with reactive lymphadenitis being the most common diagnosis (63.44%) by FNAC. This observation is in agreement with the study by Thapa et al where reactive lymphadenitis was seen in 52.7% of the cases.⁵ Among the remaining non neoplastic cases of lymphadenitis, granulomatous lymphadenitis was the most common contributor. ZN staining was done in all the 26 cases of granulomatous and necrotizing lymphadenitis. However, AFB were detected in only 3 (12.5%) cases which is less than that reported by *Raina et al.*, (35%) and *Thapa et al.*, (65%).^{25, 5} This difference could be due to multiple factors like variation in cytomorphological patterns, sampling and technical limitations along with the variation in time dedicated to the screening of the slides.²⁶ Only

9 of these non neoplastic lesions were available for histopathological evaluation. FNAC diagnosis were concordant with the biopsy findings except 1 case where granulomatous lymphadenitis was diagnosed as Kikuchi necrotizing lymphadenitis. This could be due to misinterpretation of clustered histiocytes as epithelioid granulomas. Histopathological follow ups were not available in malignant lesions.

The only case of atypical lymphoid hyperplasia was diagnosed as classical Hodgkin lymphoma on subsequent biopsy which could be due to paucity of classical Reed Sternberg cells that mimicked atypical cells in FNAC.

Among twenty-two cases of salivary gland FNAC evaluated in this study, the commonest pathology detected was benign neoplasm (Milan IV “A”) in 40.90% of the cases which is in agreement to the findings by *Dhungana I et al.*,²⁴ Biopsy findings were concordant with FNAC in the diagnosis of pleomorphic adenoma in all the cases. However, one case of granulomatous sialadenitis on FNAC was diagnosed as Mucoepidermoid carcinoma, low grade on histopathology. This can be explained by the fact that low grade mucoepidermoid carcinoma have significant cystic components and these cysts occasionally rupture releasing mucus which can evoke a florid inflammatory reaction and sometimes granulomatous response.²⁷ Detection of only granulomas could be due to sampling of only the area of granulomatous inflammation and missing the epithelial components. Another case of Milan IV-B (Neoplasm of uncertain malignant potential) was diagnosed as chronic sialadenitis on histopathology. This could be due to misinterpretation of atypical cells associated with reactive atypia in chronic sialadenitis. The specificity of FNAC in detection of malignant salivary gland neoplasms was calculated to be 80%. This is less than that reported by Hota et al (94.7%).²⁸ However, the results from this study are confounded by the limited histopathology cases available for cytohistological correlation.

Among the remaining lesions, benign lipomatous lesion was the most common diagnosis made by FNAC which is comparable to that by *Thapa et*

al., where lipomatous lesion was the commonest soft tissue neoplasm.⁵ Cytological diagnosis was consistent with histopathological diagnosis in all the lipomatous lesions. The case of suspicious for malignant spindle cell lesion was discordant with the histopathological diagnosis of capillary hemangioma on biopsy. The reactive endothelial cells might have aroused the suspicion of malignancy in this case.

Conclusions

FNAC is a rapid and efficient tool in the evaluation of head and neck lesions. It helps in early distinction between inflammatory, benign and malignant lesions and thus reduces the need for unnecessary surgical interventions. The sensitivity (53.33%) and specificity (86.20%) calculated in the present study was less in comparison to most of the available studies. However, the specificity was found to be higher than sensitivity which implies benign lesions can be more reliably detected by FNAC than malignant lesions and intermediate categories need to be interpreted in the background of clinical and radiological parameters and confirmed by biopsy wherever necessary.

Ethics approval

Ethical clearance was obtained from College of Medical Sciences-Teaching Hospital-Institutional Review Committee (COMSTH-IRC) (Ref No.2025-072).

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Conflict of interest

The author declares no conflict of interest.

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Availability of data and materials

All the relevant data collected and analyzed during this study are available upon reasonable request from the principal investigator.

Author contributions

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