Pivotal Role of Fine Needle Aspiration Cytology in the Diagnosis of Head and Neck Lesions: Our Hospital Experience

Geethamala K[1], Aruna S[2], Shreekant K Kittur[3], Rekha M Haravi[4], Meena N Jadhav[5], Rashmi K Patil[6]

Abstract

Background: Head and neck swellings are the commonest clinical findings affecting all the age groups. FNAC is of great value in early diagnosis and differentiation of wide plethora of infective, benign and malignant lesions, in head and neck region. Prior cytodiagnosis by FNAC helps in delineating the heterogenous lesions occurring in head and neck region which serves as an aid in the evaluation and planning of necessary management.

Objectives of the study: To study the cytomorphological features and classify various head & neck lesions. To evaluate the role of FNAC in head and neck lesions. To study diagnostic accuracy of FNAC by histopathological correlation wherever available.

Materials and Methods: A prospective study was conducted from January 2016 to December 2018. FNA was performed on 1568 cases of head and neck lesions and cytomorphological features were studied. These cytomorphological features were correlated with concomitted histopathologic diagnosis, wherever available. Data analysis was done by Statistical Package for the Social Sciences software version 22.0 and presented in terms of proportions or percentage. Chi-square test was used to see the association between the different variables. A *p*-value of < 0.05 was considered as significant.

Results: There were 1568 FNAC cases enrolled, out of which lymph node lesions (*n* = 703) were the most commonest lesions followed by thyroid gland, miscellaneous group and salivary gland. Reactive hyperplasia of lymph nodes, nodular goiter, epidermal cyst and pleomorphic adenoma were the predominant diagnoses of lymphnodes, thyroid gland, miscellaneous group and salivary gland respectively. Histopathological correlation was available in 348 cases and showed sensitivity of 80.76%, specificity of 100%, positive predictive value of 100% and negative predictive value of 98.4%. The diagnostic accuracy of FNAC was 98.55%. The association between FNAC diagnoses and histopathological diagnoses were considered to be statistically significant.

Conclusion: FNAC is a valuable preliminary diagnostic tool for assessing head and neck lesions and serves as a guide for diagnosis, therapeutic and better management of various cases.

Keywords: Fine needle aspiration cytology; Histopathology; Lymph node; Thyroid; Salivary gland.

Authors Affiliation: [1]Assistant Professor, [2,4,5,6]Associate Professor, [3]Professor & Head, Department of Pathology, Belgaum Institute of Medical Sciences, Belagavi, Karnataka 590001, India.

Corresponding Author: Geethamala K, Assistant Professor, Department of Pathology, Belgaum Institute of Medical Sciences, Belagavi, Karnataka 590001, India.

E-mail: drgeethamala@gmail.com

Received on 24.02.2020, **Accepted on** 20.05.2020

Introduction

Head and neck swellings are the commonest clinical findings affecting all the age groups.[1] These swellings are extremely worrying for both physician and patient, due to myriad of pathological conditions.[1,2] Fine needle aspiration cytology (FNAC) is a simple outpatient procedure which is easy, accurate, reliable, repeatable and minimally invasive. FNAC

is of great value in early diagnosis and differentiation of wide plethora of infective, benign and malignant lesions in head and neck region. The most common sites which are encountered for FNAC in head and neck region are lesions from lymphnodes, thyroid gland, salivary gland, skin and soft tissue. Other lesions include congenital developmental cysts, carotid body tumors and skin adnexal tumors. Prior cytodiagnosis by FNAC helps in delineating the heterogenous lesions occurring in head and neck region which serves as an aid in the evaluation and planning of necessary management.[1-5] Consecutively in many non-neoplastic and cystic lesions, FNAC serves as both diagnostic and therapeutic tool. Hence the present study was undertaken to evaluate the role of FNAC in diagnosing various head and neck region swellings, to review the diversity of lesions in the patients attending our hospital and to correlate cytodiagnosis with histopathology.

Objectives of the study:

1. To study the cytomorphological features and classify various head & neck lesions.

2. To evaluate the role of FNAC in head and neck lesions.

3. To study diagnostic accuracy of FNAC by histopathological correlation wherever available.

Materials and Methods

This present prospective study was conducted in the department of pathology, Belgaum Institute of Medical Science, Belagavi from January 2016 to December 2018. All the patients with head and neck swellings irrespective of age and sex were included in the study. The study was started after getting the approval from ethical committee of the institution and also with the consent of the patients. In all the patients with head and neck lesions, clinical history, physical findings, imaging findings and probable clinical diagnoses were noted. FNA was performed by a pathologist by conventional palpation method using a 22 gauge needle or by image guided (ultrasonography or computerized tomography) for deep seated lesions. Direct smears were prepared, two of them were air dried and stained with Giemsa stain and other two slides were fixed in alcohol and stained with Papanicolaou stain. Also Ziehl Neelson staining for demonstration of acid fast bacilli was carried out. Cytomorphological features of various head and neck lesions were studied. Subsequent surgical specimens received were fixed in 10% formalin and subjected to gross examination, processing, paraffin embedding, cutting and stained by hematoxylin and eosin. The cytomorphological features were correlated with concomitted histopathologic diagnoses, wherever available.

Statistical analysis

Statistical analysis was done using Statistical Package for the Social Sciences software version 22.0 (SPSS Inc, Chicago) and data was presented in terms of proportions or percentage. Chi-square test was used to see the association between the different variables. A p-value of < 0.05 was considered as significant.

Results

The present study included 1568 cases of head and neck lesions. Age of the patients ranged from 1.5 months to 88 years, in which 51.3% were males and 48.6% were females. Third and fourth decade accounting to 40% were the frequently affected age group followed by second and fifth decade (Table 1).

Table 1: Age wise distribution of head and neck lesions

Age group	Number	Percentage
<10	179	11.4
11–20	241	15.3
21–30	335	21.3
31–40	289	18.4
41–50	221	14.1
51–60	152	9.6
>61	152	9.6
Total	1568	100.0

The commonest head and neck lesions in the present study were from lymphnodes accounting to 703 (44.83%) of cases followed by thyroid gland 395 (25.19%), miscellaneous group 357 (22.76%) and salivary gland lesions 54 (3.4%) of cases (Table 2 & Fig 1 & 2).

Table 2: Site wise distribution of head and neck lesions

Site	Number	Percentage
Lymphnodes	703	44.83
Thyroid gland	395	25.19
Salivary gland	54	3.4
Miscellaneous	357	22.76
Inadequate	59	3.76
Total	1568	100

Fig. 1A: Clinical photograph of post auricular swelling-Tubercular lymphadenopathy, **1B:** Enlarged thyroid gland- Multinodular goitre, **1C:** Central midline swelling-Thyroglossal cyst, **1D:** Bilateral supraclavicular swellings-Metastatic deposits of germ cell tumor from testicular origin

Fig 2A: Clinical photograph of Right cervical swelling- Benign spindle cell lesion- Schwannoma, **2B:** Scalp swelling- Benign skin adnexal tumor, **2C:** Bilateral parotid gland swelling- Sialadenosis, **2D:** Left parotid gland swelling- Pleomorphic adenoma.

In 59 cases (3.7%) out of 1568 cases, the aspirates were unsatisfactory and in all of them definitive diagnosis could not be given. Eleven cases from thyroid gland needed ultrasound guided FNAC.

The largest category of head and neck lesions were from lymphnodes. The highest number of cases were of reactive hyperplasia 17.7% (278 cases) followed by tubercular lesions 13.7% (215 cases).

Malignant lesions included 0.8% (13 cases) of Non-Hodgkin lymphoma (NHL) and 0.12% (2 cases) of Hodgkin lymphoma (HL). Metastatic deposits of squamous cell carcinoma was commonest followed by adenocarcinoma and poorly differentiated carcinoma. One case each of papillary carcinoma thyroid gland and germ cell tumor of testicular origin were reported (Table 3 & Fig. 3).

Table 3: Distribution of various head and neck lesions according to cytological diagnosis

|	Cytological diagnosis	Number	Percentage
Lymphnode			
Inflammatory/Benign	Reactive lymphadenitis	278	17.7
	Tubercular lymphadenitis	215	13.7
	Suppurative lymphadenitis	72	4.6
	Granulomatous lymphadenitis	24	1.5
	Rosai dorfman disease	1	0.06
Malignant	Non-Hodgkin's lymphoma	13	0.8
	Hodgkin's lymphoma	2	0.12
Metastatic deposits	Squamous cell carcinoma	87	5.5
	Adenocarcinoma	5	0.3
	Poorly differentiated carcinoma	4	0.2
	Germ cell tumor-Testis	1	0.06
	Papillary carcinoma thyroid	1	0.06
Thyroid gland			
Inflammatory/Benign	Nodular goitre	185	11.8
	Hashimotos thyroiditis	96	6.1
	Colloid goitre	57	3.6
	Adenomatoid goitre	16	1.02
	Toxic goitre	12	0.76
	Thyroglossal cyst	11	0.5
	Follicular neoplasm	8	0.19
	Granulomatous thyroiditis	3	0.12
	Graves disease	2	0.12
	Ectopic thyroid	2	0.7
Malignant	Papillary carcinoma	7	0.45
	Medullary carcinoma	1	0.06
	Anaplastic carcinoma	3	0.19
Salivary gland			
Inflammatory/Benign	Sialadenitis	21	1.34
	Sialadenosis	6	0.38
	Parotid cyst	1	0.06
	Pleomorphic adenoma	22	1.4
Malignant	Mucoepidermoid carcinoma	4	0.25
Miscellaneous			
Inflammatory/Benign	Epidermal cyst	187	11.92
	Lipoma	80	5.1
	Benign cystic lesion	25	1.6
	Branchial cyst	5	0.32
	Lymphoepithelial cyst	4	0.25
	Cystic hygroma	3	0.19
	Hemangioma	15	0.96
	Skin adnexal tumor	11	0.7
	Schwannoma	9	0.57
	Benign spindle cell tumor	5	0.31
	Paraganglioma	2	0.12
	Calcinosis cutis	1	0.06
Malignant	Basal cell carcinoma	1	0.06
	Malignant melanoma	1	0.06
Inadequate		59	3.76
Total		1568	100
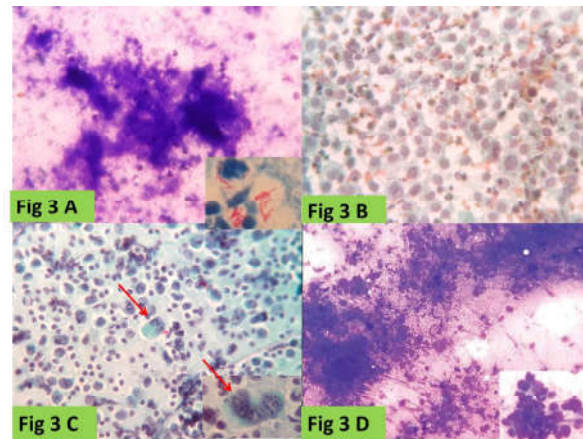
Fig 3A: Microphotograph from FNAC of cervical lymphnode showing caseous necrosis (Giemsa stain 40x). Inset showing Ziehl Neelson stain –Acid fast bacilli (100x)- Tubercular lymphadenitis. **3B:** Cervical lymphnode showing monotonous population of lymphoid cells- Non Hodgkin's lymphoma (Papanicolaou stain 40x). **3C:** Cervical lymphnode showing monotonous population of lymphoid cells and various types of Reed Sternberg cells- Hodgkin's lymphoma (Papanicolaou stain 40x). **3D:** Bilateral supraclavicular swellings showing poorly cohesive pleomorphic cells scattered singly, lymphocytes and tigroid background- Metastatic deposits of germ cell tumor from testicular origin (Giemsa stain 40x).

Thyroid gland lesions composed of 395 cases, second largest group in head and neck lesions. Nodular goitre was the highest number of cases accounting to 11.8% (185 cases) followed by other lesions. Among the malignant lesions papillary carcinomas were the commonest accounting to 0.45% (7 cases) followed by anaplastic and medullary carcinoma (Table 3 & Fig 4).
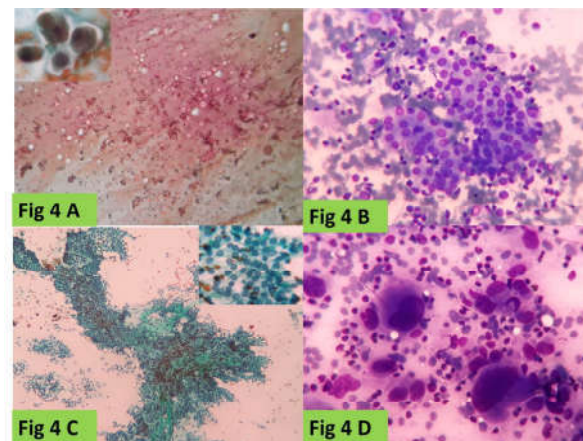

Fig 4A: Microphotograph from FNAC of thyroid gland showing thyroid follicular cells and thin colloid. (Papanicolaou stain 40x). Inset showing cyst macrophages- Colloid goitre (Papanicolaou stain 40x). **4B:** Sheets and clusters thyroid follicular cells with lymphocytes infiltrating.- Suggestive of Hashimotos thyroiditis (Giemsa stain 40x). **4C:** Papillary fragment of thyroid follicular cells. (Papanicolaou stain 40x)Inset showing cells with nuclear grooves and inclusions - Papillary carcinoma (Papanicolaou stain 100x). **4D:** Large malignant cells of varying sizes - Anaplastic carcinoma (Papanicolaou stain 40x).

The miscellaneous category which included the lesions arising from blood vessels, skin, soft tissue, cysts, neural lesions, congenital lesions and others. In the present study, these were the third largest category in head and neck lesions. The commonest lesions in them were epidermal cysts accounting to 11.92% (187 cases) and 5.1% (80 cases) of lipoma cases (Table 3).

Salivary gland lesions composed of 54(3.4%) cases. Among which pleomorphic adenomas were the majority accounting to 1.4% (22 cases). The malignant lesions were mucoepidermoid carcinoma accounting to 0.25% (4 cases) (Table 3 & Fig. 5).
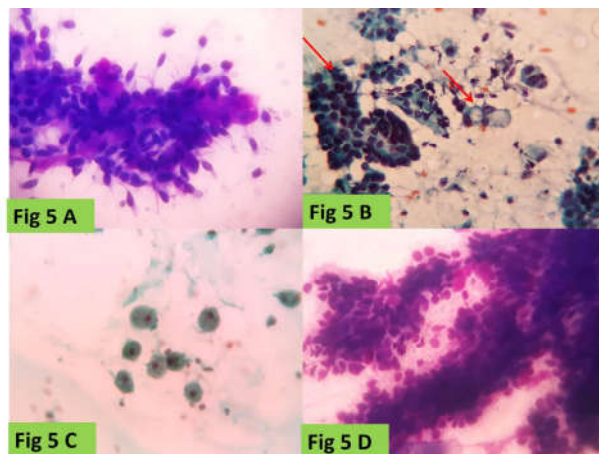
Fig 5A: Microphotograph from FNAC of parotid gland showing cohesive epithelial cells, myoepithelial cells and fibrillar fibromyxoid stroma -Pleomorphic adenoma. (Giemsa stain 40x). **5B:** Clusters of epithelial cells, intermediate cells, mucin secreting cells and dirty background- Mucoepidermoid carcinoma- (Papanicolaou stain 40x). **5C:** Scattered cyst macrophages and proteinaceous material- Benign cystic lesion. (Papanicolaou stain 40x). **5D:** Cluster of small basaloid cells with uniform nuclei and hyaline stroma- Benign adnexal tumor. (Giemsa stain 40x).

Histopathological correlation was available in 348 cases. Of these, histological findings were concordant with cytological diagnoses in 93.6% (326 cases) and discordant findings were seen in 6.32% (22 cases) (Table 4).

Statistical analysis revealed overall sensitivity, specificity, positive predictive value, negative predictive value were found out to be 80.76%, 100%, 100% and 98.4% respectively. The diagnostic accuracy of FNAC was 98.55%. The association between FNAC diagnoses and histopathological diagnoses showed *p*-value <0.05 and was considered to be statistically significant.

Table 4: Cyto -histological correlation of various head and neck lesions

Lymphnode		Total Cytological cases	Corresponding histological cases	Concordance	Discordance
Inflammatory/Benign	Reactive lymphadenitis	278	10	7	3 (2-TB LN 1-NHL)
	Tubercular lymphadenitis	215	2	2	-
	Suppurative lymphadenitis	72	8	6	2 (2-TB LN)
	Granulomatous lymphadenitis	24	7	4	3 (2-TB LN 1-HL)
Malignant	Non-Hodgkin's lymphoma	13	4	4	–
	Hodgkin's lymphoma	2	1	1	–
Metastatic deposits	Squamous cell carcinoma	87	8	8	–
Thyroid gland					
Inflammatory/Benign	Nodular goitre	185	58	53	5 (5-Follicular adenoma)
	Colloid goitre	57	7	6	1 (Hashimotos thyroiditis)
	Adenomatoid goitre	16	4	4	–

Lymphnode		Total Cytological cases	Corresponding histological cases	Concordance	Discordance
	Thyroglossal cyst	11	10	10	–
	Follicular neoplasm	8	4	3	1 Encapsulated follicular papillary carcinoma
Malignant	Papillary carcinoma	7	4	4	–
Salivary gland					
Benign	Pleomorphic adenoma	22	8	7	1 (Mucoepidermoid carcinoma)
Malignant	Mucoepidermoid carcinoma	4	3	3	–
Miscellaneous					
Inflammatory/Benign	Epidermal cyst	187	123	123	–
	Lipoma	80	46	40	1 (Pilomatricoma)
	Benign cystic lesion	25	7	3	4 (1-Epidermal cyst 2-Thyroglossal cyst 1-Basaloid SCC)
	Branchial cyst	5	2	2	–
	Lymphoepithelial cyst	4			
	Cystic hygroma	3			
	Hemangioma	15	12	12	–
	Skin adnexal tumor	11	8	8	–
	Schwannoma	9	8	8	–
	Benign spindle cell tumor	5			
	Paraganglioma	2			
	Calcinosis cutis	1			
Malignant	Basal cell carcinoma	1	1	1	–
	Malignant melanoma	1			
Inadequate		59	12	–	12 (4-TB LN 2-Hemangioma 2-Schwanoma 2-Epidermal cyst 2-Calcinosis cutis
Total			348	326 (93.6)	22 (6.32)

Discussion

FNAC was first introduced by Martin and Ellis in 1930.[1,6] Since then FNAC has become a popular procedure in the evaluation of various palpable swellings. FNAC is the first line of investigation tool for head and neck lesions which inturn helps in differentiating the myriad of etiologies and further in their management.[1-6] In the present study, 1568 cases of head and neck lesions were studied. The male to female ratio in our study was 1.1: 1 which is in concordance with other studies.[2-7] The age group presented with head and neck lesions were 3rd and 4th decade which is similar to other studies.[2-7] Maximum numbers of malignant lesions were seen in elderly age group comparable to the various studies conducted.[2-7]

Out of 1568 cases, 96.2% (1509 cases) yielded satisfactory conclusive cytological diagnoses. However 3.7% (59 cases) showed unsatisfactory inadequate diagnoses. Several other studies revealed higher range of unsatisfactory results

from 9.3–15% and quoted the probable reasons for these being smaller sized swellings, cystic lesions, less cellularity, fibrosis, necrotic degeneration and haemorrhagic aspirates. In the present study also, unsatisfactory results were mostly due to smaller swellings and haemorrhagic aspirates.

The commonest head and neck lesions in the present study were from lymphnode swellings accounting to 44.83% (703 cases) followed by thyroid gland, miscellaneous category and salivary glands. Which was in concordance with studies done by Nanik J,[7] Kishore SH,[8] Sreedevi P[9] and Meenai FJ.[10] In contrast Muddegowda PH[11] found thyroid gland swellings as the predominant lesion (Table 5).

Table 5: Comparison of commonest sites of head and neck lesions in various studies

Study	Lymphnode	Thyroid	Miscellaneous	Salivary Gland
Nanik J 2015[7]	64.3	17.5	13.5	4.8
Kishore SH 2015[8]	39.58	31.25	–	18.75
Jadhav 2018[20]	33.00	30.31	22.80	13.88
Meenai F.J 2018[10]	63.98	18.25	9.7	3.5
Present study 2019	44.83	25.19	22.76	3.4

In the lymphnode swellings the reactive lymphadenitis was the predominant cytodiagnosis accounting to 17.7%. The metastatic deposits of squamous cell carcinoma was the commonest malignant entity accounting to 5.5%. These results were in concordance with studies like Kishore SH,[8] Sreedevi P[9] Valiya LG.[12] In contrast, a study done by Meenai FJ[10] showed metastatic squamous cell carcinoma lymphadenopathy as the commonest cause of cervical swellings. The authors explained the reason, as the study been done in tertiary care centre with well-established oncology unit and higher rates of referral of cancer patients.

Histopathological correlation was available in 40 cases and only eight cases showed discordant results. 3 cases of cytodiagnosed reactive lymphnode turned out on histology as tubercular etiology in 2 cases and one case of NHL. 2 cases of suppurative lymphnode on cytodiagnosis turned out to be tubercular origin in histology. Of the 3 cases of granulomatous lymphnode, 2 cases turned out to be tubercular lesions and one case as HL. Possible reason for these eight discordant results may be due to the needle being not hitting the exact site of the pathological lesion. Similar explanations of missing the exact site of lesion by the needle, less cellularity and haemorrhagic aspirates were given by the other authors attributing to the failure to obtain consistent results.[8-10,12,13]

Amongst the thyroid gland swellings, FNAC diagnosis revealed maximum cases of nodular goitre accounting to 11.8% followed by Hashimoto's thyroiditis, colloid goitre and others. The papillary carcinoma was commonest malignant tumor. Analogous to the studies done by Kishore SH,[8] Sreedevi P[9] Meenai FJ[10] Rathod GB[14] wherein benign lesions of thyroid gland were frequent and among malignant lesions, papillary carcinomas were the commonest. A study done by Valiya LG[12] quoted that FNAC serves the purpose of both diagnostic and therapeutic in cystic thyroid lesions and cytodiagnosis helps to know the necessity of the surgical intervention. In the present study 87 cases of thyroid gland lesions had histopathological correlation and showed discordance only in 6 cases. 5 cases of nodular goitre turned out to be follicular adenomas. 1 case of follicular neoplasm was diagnosed as encapsulated variant of follicular papillary carcinoma on histopathology. Similar results were seen in a study done by Gagneten[15] who concluded saying cell poor aspirates lead to diagnostic dilemmas and hence should do multiple aspirations from different areas of thyroid gland swellings in order to obtain representative material.

In our study among the miscellaneous category, epidermal cyst (11.9%) and lipoma (5.1%) were the commonest lesions. Comparable results were seen in studied done by Sreedevi P[9] Meenai F.J[10] Bhagat VM.[16] In contrast, a study done by Singal[13] found lipomas followed by epidermal cysts and hemangiomas as the commonest entities. Histopathological correlation was obtained in 210 cases. Of which, only 6 cases showed discordance, 1 case of lipoma on FNAC turned out to be pilomatricoma on histopathology. 3 cases of benign cystic lesions on cytology, 1 case was epidermal cyst and 2 cases were Thyroglossal cysts. Other one case of benign cystic lesion turned out to be basaloid squamous cell carcinoma on histopathology. Similar diagnostic dilemma was also encountered by Sahni

S et al.[17] and concluded saying that, major drawback of FNAC in head and neck lesions is the presence of cysts and cystic change. This cystic change can be seen both in benign and malignant lesions which at times poses difficulty hence, authors suggested to do re-aspirations from residual solid area after draining the cyst under ultrasound guidance.

In the present study, maximum cases in salivary gland lesions were pleomorphic adenoma followed by sailadenitis. Malignant lesions were least accounting to 4 cases of mucoepidermoid carcinoma. These results were in concordance with other studies wherein pleomorphic adenoma was the frequent benign and mucoepidermoid carcinoma being the commonest malignant entity.[7,9-11] However studies done by Kishore SH[8] Valiya LG[12] and Rathod GB[13] had discordance

having inflammatory and reactive lesions as the majority cases. 11 cases had histopathological correlation where in 10 cases showed consistent results only one case of pleomorphic adenoma on FNAC turned out to be mucoepidermoid carcinoma on histopathology. Studies reveal that cellular pleomorphic adenoma with squamous metaplasia and cellular atypia always posed diagnostic dilemma and should be cautious in the cytodiagnosis.[7-12]

In the present study, histopathological correlation for head and neck lesions were available in 348 cases. Of which, 93.6% showed concordant results with cytological diagnosis whereas 6.32% showed discordant results. Similar ranges of concordant and discordant results were seen in various other studies conducted[10,18,19] (Table 6).

Table 6: Concordance and discordance of cytohistologic results in various head and neck lesions studies

Study	Concordance %	Discordance %
Maniyar AU 2013[18]	85.87	14.13
Khetrapal S et al. 2015[19]	91.8	8.2
Meenai FJ 2018[10]	94.7	5.6
Present study 2019	93.6	6.32

Overall sensitivity, specificity, positive predictive value, negative predictive value were found out to be 80.76%, 100%, 100% and 98.4% respectively. The diagnostic accuracy of FNAC was 98.55% in the present study which was comparable to values obtained in other similar studies conducted on head and neck lesions[8,20-22] (Table 7).

The major limitation of the present study was less number of cases with cyto-histopathological correlation. However this less number is acceptable as FNAC is first line of investigative tool which can obviate the need of surgery if the lesion is non-neoplastic.

Table 7: Diagnostic reliability of FNAC on head and neck lesions in various studies

Study	Sensitivity	Specificity	PPV	NPV	Accuracy
Kishore H 2015[8]	81.8	96.8	85	90	93.02
Sharma N 2016[21]	95.45	100	100	97.29	98
Dallari 2017[22]	80.36	95.65	91.84	88.89	89.86
Jadhav 2018[20]	78.57	100	–	–	95.7
Present study	80.76	100	100	98.46	98.55

Conclusion

FNAC is a simple valuable, reliable, repeatable and cost effective outpatient procedure. The sensitivity, specificity, positive predictive, negative predictive value, accuracy and good agreement between

cytological and histological correlation findings exemplifies the fact that FNAC is a valuable preliminary diagnostic tool for assessing head and neck lesions. Hence, FNAC of head and neck lesions serves as a guide for diagnosis, therapeutic and better management of various cases.

References

1. Orell SR, Klijanienko J. Head and neck; salivary gland. In: Orell SR, Sterrett GF (eds). Fine Needle Aspiration Cytology. 5th ed. New Delhi: Elsevier Ltd 2012;38–150.

2. Schwarz R, Chan NH, MacFarlane JK. Fine Needle Aspiration Cytology in the evaluation of head and neck masses. Am J Surg 1990;159:482–85.

3. Howlett DC, Harper B, Quante M, et al. Diagnostic adequacy and accuracy of Fine Needle Aspiration Cytology in neck lump assessment: Results from a regional cancer network over a one year period. J Laryngol Otol 2007;121:571–79.

4. Fernandes H, D'souza CRS, Thejaswini BN. Role of FNAC in palpable head and neck masses. J Clin Diagn Res 2009;3(5):1719–25.

5. Swamy GG, Singh A, Ahuja JM, Satyanarayana N. Accuracy of fine needle aspiration cytology in the diagnosis of palpable head and neck masses in a tertiary health care center. Journal of College of Medical Sciences 2010;6(4):19–25.

6. Martin HE, Ellis EB. Biopsy of needle puncture and aspiration. Ann Surg 1930;92:169–81.

7. Nanik J, Rathore H, Pachori G, et al. Cytomorphology of head and neck lesions: A study in tertiary care hospital. PJMS 2015;5(3):145–49.

8. Kishore SH, Rajshri DP, Nandkumar DV, et al. Spectrum of FNAC in palpable head and neck lesions in a tertiary care hospital in India: A 3 years study. Ind J Pathol Oncol 2015;2(1):7–13.

9. Sreedevi P, Kishore Ch, Pararkusa NC. Diagnostic Role of FNAC in evaluation of Head and Neck Lesions. IOSR Journal of Dental and Medical Sciences 2016;15(9):11–15.

10. Meenai F.J, Jain R, Ojha S, et al. Study of spectrum of head and neck lesions diagnosed on fine needle aspiration cytology (FNAC). Trop J Path Micro 2018;4(1):93–100.

11. Muddegowda PH, Srinivasan S, Lingegowda JB, et al. Spectrum of Cytology of Neck Lesions: Comparative Study from Two Centers. J Clin Diag Res 2014;8(3):44–45.

12. Valiya LG, Padhariya BB, Baxi SN. Spectrum of FNAC in Palpable Head and Neck Lesions In a tertiary care hospital in Western India: A 2 years study. Journal of Dental and Medical Sciences 2016;15(6):14–19.

13. Singal P, Bal MS, Kharbanda J, et al. Efficacy of fine needle aspiration cytology in head and neck lesions. Int J Med Dent Sci 2014;3:421–30.

14. Rathod GB, Parmar P. Fine needle aspiration cytology of swellings of head and neck region. Indian J Med Sci 2012;66(3):49–54.

15. Gagneten CB, Lowenstein A. The role of fine needle aspiration biopsy cytology in the evaluation of the clinically solitary thyroid nodule. Acta Cytol 1987;31:595–98.

16. Bhagat VM, Tailor HJ, Saini PK et al. Fine needle aspiration cytology in non-thyroid head and neck masses-a descriptive study in teritary care hospital. Natl J Med Sci Res 2013;3(3):273–76.

17. Sahni S, Shankar VS, Krishnappa A. Diagnostic Efficacy of Fine Needle Aspiration Cytology in Cystic Lesions of Head and Neck Region: A single Experience at Tertiary Health Care Centre. Natl J Lab Med 2017;6(2):1–7.

18. Maniyar AU, Patel H, Parmar. Study of Cytodiagnosis of Head and Neck Neoplastic Lesions and Comparision with Histopathology-Research and Reviews: J Med Health Scien 2013;2:54–59.

19. Khetrapal S, Jetley S, Jairajpuri Z, et al. Fnac of head & neck lesions and its utility in clinical diagnosis: A study of 290 cases. Natl J Med Res 2015;5(1):33–8.

20. Jadhav DS, Barge AK, Valand AG. Study of fine needle aspiration cytology of palpable head and neck lesions in tertiary care centre. Ind J Pathol Oncol 2018;5(3):375–81.

21. Sharma N, Sharma S, Sarkar M, et al. Study of Pathological Spectrum of Neck Lesions with Cytohistopathological Correlation. Natl J Lab Med 2016;5(3):58–63.

22. Dallari S, Gusella PM, Campanella P, Ciommi, Mariateresa, Pantanetti P et al. Current usefulness of aspiration cytology (FNAC) in the head and neck diagnosis. Pathologica 2017; 109:355–62.