Original Article

Study Of Spectrum Of Head Neck And Face Swellings With Cyto-Histopathological Correlation

Dr. Vijay Ghule[1], Dr. Tushar Kambale[2], Dr. Padmakar Bardapurkar[3], Dr. Mayur Ambekar[4], Dr. Charusheela Gore[5], Dr. M B Iqbal[6]

1. Resident, Department of Pathology Dr. D.Y Patil Medical College, Hospital and Research centre, Dr. D.Y Patil Vidyapeeth, Pune, Maharashtra, India.
2. Professor, Department of Pathology Dr. D.Y Patil Medical College, Hospital and Research centre, Dr. D.Y Patil Vidyapeeth, Pune, Maharashtra, India.
3. Assistant Professor, Department of Pathology Dr. D.Y Patil Medical College, Hospital and Research centre, Dr. D.Y Patil Vidyapeeth, Pune, Maharashtra, India.
4. Senior Resident, Department of Pathology Dr. D.Y Patil Medical College, Hospital and Research centre, Dr. D.Y Patil Vidyapeeth, Pune, Maharashtra, India.
5. Professor and HOD, Department of Pathology Dr. D.Y Patil Medical College, Hospital and Research centre, Dr. D.Y Patil Vidyapeeth, Pune, Maharashtra, India.
6. Professor, Department of Pathology Dr. D.Y Patil Medical College, Hospital and Research centre, Dr. D.Y Patil Vidyapeeth, Pune, Maharashtra, India.

Corresponding author
Dr Tushar Kambale, Professor, Dept of Pathology, Dr D.Y Patil Medical College, Hospital and Research Center, Dr. D.Y Patil Vidyapeeth, Pimpri, Pune
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Abstract

Introduction: Head, neck and face swellings constitute a major proportion of palpable swellings. It occurs in individuals of all ages and includes various types of inflammatory, developmental, and neoplastic pathological lesions. Fine needle aspiration cytology (FNAC) is safe, reliable and has easy pre-operative access to these swellings and is utilized as an effective tool beforehand in surgical cases. The purpose of this study is to correlate FNAC diagnosis of head neck and face swellings with the histopathological examination (HPE) which is considered a gold standard.

Material and methods:

A prospective study is carried out in the cytology section of the pathology department of tertiary care hospital. A total of 1020 FNAC are performed, out of which 224 cases of Head neck and face swellings were included in the study. Cases with inadequate FNAC cellularity were excluded from the study. After assessing clinical and cytomorphological details, a diagnosis was made. Their correlation with the histopathological examination was done wherever possible.

Results:

Out of 224 FNAC lesions, the lymph node (50%) was the commonest site of aspiration followed by the thyroid (37%), salivary glands (7%) and others/miscellaneous sites (6%). 39 cases were neoplastic and 185 were non-neoplastic. Histopathological correlation was made in 93 (41.51%) cases. The diagnostic accuracy was 97.85%, sensitivity was 98.68%, specificity was 94.12%, positive predictive value was 98.68% and negative predictive value was 94.12%.

Conclusion:

Fine needle aspiration cytology provides minimally invasive, out-patient, and rapid cytological diagnosis in head neck and face swellings. It is time proven technique. It is extensively reliable for making a definitive diagnosis, with limitations. FNAC is clearly not substituted for histopathology but can be utilized as an adjunct.

Keywords: Fine needle aspiration cytology, Head neck and face lesions Histopathological examination, lymph node, thyroid.

INTRODUCTION

Head, neck and face swellings are more commonly encountered as superficial and deep swellings due to their complex developmental anatomy. These swellings arise from organs like the thyroid, lymph node, salivary glands, and other/miscellaneous sites. Fine needle aspiration cytology (FNAC) has well patient compliance as it is minimally invasive and accessible to the representative focus of the lesion. Once stated by Koss that 'FNAC is a technique whose time has come' is really true. [1]

FNAC serves as a pre-operative preliminary diagnostic method which is useful to narrow the differential diagnosis in the form of inflammation, cyst and neoplasms. [2] It is sensitive enough for initial investigation and diagnosis of head neck and face swellings.

The concept of gaining cellular and tissue material by a simple needle placed in palpable swelling is the basis of FNAC. It obviates the need for aggressive surgical treatment in relevant cases. [3]

Although FNAC continues to straddle clinical and tissue diagnosis, histopathological examination is the gold standard. It has therapeutic and prognostic significance. The aim is to establish an accurate diagnosis by a comparative study with respect to histopathological examination (HPE) wherever possible.

Material and methods:

The present study was done in the cytology section of the department of Pathology in tertiary care hospital from November 2020 to August 2022. The study included all cases referred to the cytopathology department with a clinical diagnosis of head, neck and face lesions and properly filled requisition form and clinical details.

Detailed clinical history including family and relevant history was documented from patients. Informed consent was taken. With all aseptic precautions, FNAC was done with a 22/23/24G needle and 10cc syringe. The aspirate was obtained by both aspiration and non-aspiration techniques. Direct smearing was followed on aspirate to prepare labelled and representative smears. [4]

Smears were either air-dried for Romanowsky-type (Leishman stain / AFB stain) or alcohol-fixed for haematoxylin and eosin (H & E) staining. By assessing detailed cytomorphological features diagnosis was made. Excisional biopsy specimens were formalin-fixed, paraffin-embedded and stained with H & E stain. The cyto-histopathological correlation was made in these cases. Cases with inadequate cellularity are excluded from the study.

This study is approved by Institutional ethical committee Certificate no. L.E.S.C./279/2021.

RESULTS

A total of 1020 FNA cytology was performed, the head, neck and face lesions constituting 236 cases out of which 12 cases were excluded due to inadequate cellularity on smears. Total 224 cases were included in the study. The age distribution was 2-70 years. A maximum number of patients were in the age group of 21 to 30 years (41%) followed by 31 to 40 years (31%) and 76 [33.9%] were male and 148 [66.07%] were female patients.

Out of 224 FNAC, the Lymph node 112 [50%] cases are the predominant site followed by the thyroid 83 [37%] cases, salivary glands 16 [7%] cases and others/ miscellaneous 13 [6%] cases. (Chart 1)

Out of 83 cases of thyroid lesions, the most common clinical symptom was of weakness in 41 cases followed by weight loss in 34 cases. Dysphagia was present in 33 cases, fever in 20 cases, and weight gain in 19 cases. Palpitations and hoarseness were present in 4 cases each. The most common nature of swelling was the diffuse

enlargement of the thyroid gland in 36 cases, second most were 30 cases of swelling involving the right lobe and 17 cases with left lobe involvement.

Out of 83cases, 14 were male and 69 were female patients. Male to female ratio was 1:4.9. Maximum cases were seen between 26-35 years. Out of 83 FNAC cases of thyroid swellings, Colloid goitre was reported in 60 cases. Lymphocytic thyroiditis was present in 1 case. Hashimoto's thyroiditis was reported in 6 cases. The follicular neoplasm was seen in 6 cases. Hurthle cell neoplasm was reported in 1 case. Papillary carcinoma constituted 9 cases. [Table 2]

Out of 83 FNAC cases of thyroid swellings, 33 cases were received for histopathological examinations. 31 [93.9%] cases were consistent and 2 [6.1%] cases where one case of a colloid goitre on FNAC turned out as Follicular adenoma and one case of Hurthle cell neoplasm on FNAC as Hurthle cell carcinoma. [Table 3]

Out of 112 lymph node lesions FNAC cases clinically presented with fever in 77 cases, weight loss in 54 cases, weakness in 53 cases, anorexia in 39 cases, cough in 13 cases and chills in 12 cases. Clinically lymph node swellings were mostly fixed in 57 cases and mobile in 47 cases. Matted nodes were present in 8 cases. Predominantly swellings were present in the upper cervical group 53 cases of lymph node followed by middle cervical 32 cases and lower cervical 12 cases. Submandibular and posterior triangle lymph node group lesions were seen in 6 cases each. The submental group was involved in 3 cases.

Maximum lymph node cases were from the 3rd decade followed by the 4th decade. Out of 112 lymph node lesions, FNAC cases 48 cases were male and 64 cases were female with male to female ratio was 1.33.

Out of 112 lymph node lesions, FNAC cases cytology diagnosis constitutes granulomatous lymphadenitis in 41 cases followed by reactive lymphadenitis in 32 cases. 10 cases of tuberculous lymphadenitis and 8 cases of lymph node abscess were reported. Neoplastic involvement of lymph nodes included 6 cases of lymphoma and metastasis of malignancy in 15 cases [Table 2].

A total of 31 cases of lymph node swelling was received for histopathological examinations. Which 28 [90.4%] cases were consistent and 3 [9.6%] cases where one case of reactive lymphadenitis on FNAC turned out as tubercular lymphadenitis, one case of granulomatous lymphadenitis as Kikuchi's lymphadenitis adenoma and one case of non-Hodgkin's lymphoma as reactive lymphadenitis [Table 3].

Out of 16 FNAC cases of salivary gland clinically dry mouth were the most common symptom in 13 cases, dysphagia in 12 cases, trismus in 10 cases and pain and fever in 6 cases each.

The parotid gland involvement was seen in 9 cases, a submandibular gland in 5 cases and in 2 cases was seen in the sublingual gland. Male and female cases were affected in equal proportions in salivary gland lesions. More cases were from the third and fourth decades.

Out of 16 salivary gland FNAC cases, cytology diagnosis constitutes predominantly pleomorphic adenoma in 8 cases, chronic sialadenitis in 4 cases, Warthin's tumour in 2 cases and adenoid cystic carcinoma in 2 cases [Table 2].

Total of 16 cases of salivary gland FNAC cases was received for histopathological examinations in which all cases 16 [100%] were consistent with cytology diagnosis. [Table 3]

In FNAC of 13 other swellings, 4 occurred on the scalp, 3 on the lateral neck, 2 on the nape of the neck, and 2 on the anterior neck. The single case occurred on the forehead and face. Maximum cases of other lesions occurred in the fourth decade followed by the fifth decade. 6 were male and 7 were female. Male to female ratio was 1:1.16. In these swellings, 6 were firm and 4 were soft in consistency, 2 swellings were fluctuant whereas 1 swelling was cystic in consistency. [Table 2]

In FNAC of these swellings, 6 cases were of an epidermal cyst, 3 were of lipoma, thyroglossal duct cyst and cystic hygroma each constituted 2 cases which were also confirmed on histopathology examination. (Table 3)

In the present study, out of 224 FNAC cases we received 93 specimens for cyto-histopathological correlation in which 88 [94.6%] cases were consistent with cytology diagnosis and 5[5.4%] cases were inconsistent. (Table 4)

In the present study, the overall accuracy rate of FNAC to diagnose malignancy was 97.85%, with a sensitivity of 98.68%, specificity of 94.12%, a positive predictive value of 98.68% and a negative predictive value of 94.12%. (Table 5 & Table 11)

Discussion:

In the present study out of a total 236 aspirates, 12 (5%) were not interpreted due to inadequate cellularity. So out of 224 FNA cases interpreted 207(92.4%) benign lesions and 17 (7.6%) were malignant. Out of 224 adequate smears, histopathological diagnosis was available in only 93(41.5%) cases. This was due to most of the non-neoplastic and inflammatory lesions being directly treated medically after cyto-diagnosis.

The present study comprises 224 FNAC of head neck and face lesions. The younger case was of 2 years and the older case was of 64 years. Maximum patients were from the third decade. This was in concordance with Rahman et al. [6] which studied cases of neck masses from the age group of 10 months to 85 years and found maximum cases from the third decade. A total of 105 (47%) cases was between the ages of 11 to 30 years. This is in keeping with the critical analysis of 392 [100%] cases of head and neck swellings done by Bhasker et al. [7] which included 134 (34.18%) cases from the age group of 11 to 30 years.

The present study included 76 male and 148 female patients. Male to female ratio (M: F) was 1: 1.94. This is comparable to another study by Tilak V et al. on head and neck masses which reported similarly increased female patients. [9]

The lymph node was the most aspirated site with 112 (50%) cases followed by the thyroid 83 (37%), salivary gland 16 (7%) and others 13 (5.8%). This distribution of cases was in accordance with another earlier study by Kapoor et al. [12] (Table 6)

Most of the thyroid lesions were non-neoplastic (80%). FNAC of thyroid lesions revealed colloid goitre as the predominant finding. It was reported in 60 (72%) cases. Papillary carcinoma was present in 9 (11%) cases and was the second most common lesion. Rathod et al and Rajbhandari et al observed similar findings with a maximum incidence of colloid goitre and then papillary carcinoma. [16, 18] Colloid goitre was the commonest lesion (26%) in our study. Inflammatory involvement of the thyroid (Thyroiditis) was present in 7 (8%) cases. 6 cases of Hashimoto's thyroiditis were diagnosed. A single case of lymphocytic thyroiditis was reported. The follicular neoplasm was present in 6 (7%) cases whereas a single case of Hurthle cell neoplasm was diagnosed. Histopathological correlation of FNAC thyroid cases in our study is 96.96%, which was very well compared with other studies (Table 7).

Lymph node lesions were the majority of 112 (50%) cases Granulomatous lymphadenitis (36.60%) was the most common diagnosis followed by reactive lymphadenitis (28%). This was in keeping with studies by Suryawanshi et al [13], Khetrapal et al [21], and Bhagat et al [22]. Lymph node abscesses were reported in 8 (7%) cases. In the remaining 21 cases of malignant lymph node involvement, 6 FNA cases reported neoplastic causes for lymphadenopathy. A total 15 (13%) cases were due to metastasis of malignant tumours. Out of 450 head and neck masses, Jasani et al. [14] reported metastasis in lymph node in 11.3% of cases. Tandon et al. [23] studies on FNAC of lymphadenopathy reported metastasis in 10.34% of cases which was comparable to our study. In 12 cases histopathological examination was available and established metastasis in lymph nodes from the primary site. In the majority of 10 cases, the primary was squamous cell carcinoma. Other 1 was of papillary carcinoma of the thyroid and 1 was of adenocarcinoma of the stomach. FNA has 100% diagnostic accuracy for identifying metastatic lesions which were as per the studies by Narang R et al. [8] and Keerthana R et al [24]. In 5 cases correlation with histopathological examination of affected lymph nodes establishes lymphoreticular malignancy of a particular type. Hodgkin lymphoma was diagnosed in 2 cases. Out of 3 cases of Non-Hodgkin Lymphoma, 1 was follicular lymphoma and 2 were diffuse large B cell lymphoma subtype. Histopathological correlation of FNAC lymph node cases in our study is 90.32% which was very well in concordance with other studies. (Table 8)

In salivary gland lesions, 14 (87.5%) cases were benign and 2 (12.5%) cases were malignant. This incidence was comparable to a study by Kambale T et al. [25] A maximum of 8 (50%) cases were of pleomorphic adenoma, 6

occurred in the parotid gland and 2 occurred in the submandibular gland. Chronic sialadenitis constituted 4 (25%) cases. Bhagat et al. [22] found benign pleomorphic adenoma as the predominant salivary gland lesion like our study. Sharma et al. [26] and Rathod et al. [16] found inflammatory lesions as the commonest finding followed by pleomorphic adenoma in their study which was discordant with our study. 2 cases (12.5%) each of Warthin's tumour and adenoid cystic carcinoma were present. There are many overlapping features in neoplasms involving salivary glands. Due to diverse differentiation and various growth patterns, histopathological correlation is often needed in malignant involvement of the salivary gland. All cases of neoplastic involvement of the salivary gland were confirmed by histopathological examination of excised lesions. The histopathology correlation of FNAC salivary gland cases in our study is 100%, which was in concordance with other studies. (Table 9)

In other lesions, 4 occurred on the scalp, 3 on the lateral neck and 2 on the anterior neck. The single case occurred on the forehead and face. In other swellings, 3 (23%) swellings of lateral neck and face region soft tissue were diagnosed as lipoma. Out of 6 (46%) cases of the epidermoid cyst, 4 presented as skin-covered swellings on the lateral scalp region. 1 case was presented as cervicofacial and 1 presented as forehead swelling. 2 (15%) cases were reported as a thyroglossal duct cyst. 2 (15%) cases with lateral neck swelling in younger children had reported as cystic hygroma on smears. Histopathological correlation of FNAC from other Head neck and face lesions in our study is 100%, which was in comparison with other studies. (Table 10)

Diagnostic Pitfalls-

False positive: False positive i.e., a cytological conclusion of malignancy in a lesion but the histopathologically benign character is found. In the present study cytologically one case was diagnosed as non-Hodgkin's lymphoma but on histology, it was proved to be reactive follicular hyperplasia. In this case, there was increased cellularity, and monomorphic appearance of lymphocytes due to blind aspiration of lymph node, and there are subtle distinction points of differentiation between these two lesions. On histopathology capsular infiltration and architecture are better evaluated.

False negative: False negative i.e., cases of histopathologically proven malignancy reported as benign nature on cytology are to be found. In the present study, a false negative diagnosis was encountered in one case. Cytologically diagnosed as Hurthle cell neoplasm and was histologically proven as Hurthle cell carcinoma. This happened because, on cytology of thyroid follicular neoplasms, there is a limitation of demonstration of capsular and vascular invasion.

The other three cases were found to be inconsistent, of which colloid goitre was diagnosed on cytology, which was confirmed as follicular adenoma on histopathology. Hypocellularity of aspirate and abundant colloid may lead to such discrepancy. To avoid such conflicts multiple passes and ultrasonography-guided aspiration with judgment should be required to target representative follicular focus.

Another aspirated lesion from lymph node was reported as reactive lymphadenitis on FNA cytology and turned out to be tuberculous lymphadenitis on histopathology. The tubercle or representative epithelioid granuloma was missed during aspiration. It leads to the discrepancy. Multiple passes from different areas of the lesion with different angles are necessary to avoid it.

One more case was reported on cytology, as granulomatous lymphadenitis was confirmed as Kikuchi's lymphadenitis on histopathology. Smears showing necrotic background along with epithelioid histiocytes were misinterpreted as tuberculous lymphadenitis on cytology. The histopathological examination highlighted morphological features of Kikuchi lymphadenitis such as immunoblasts, extensive necrosis, palisaded histiocytes at the periphery and plasmacytoid monocytes. So needs a careful cytomorphological approach and one should keep differentials in consideration along with proper clinical history.

Out of 93 histopathological confirmed cases, sensitivity between cytologic and histopathologic diagnosis was found in 98.68%, specificity in 94.12, positive predictive value in 98.68% and negative predictive value in 94.12% of cases (Table 5 & 11). In a total 93 histopathological confirmed cases, 88 cases were correctly diagnosed on FNAC giving overall diagnostic accuracy of 97.85 %. It is positively comparable with the findings of other studies. The correlation between FNAC and histopathology was considered statistically significant.

CONCLUSION

This study concludes that FNAC is a simple, rapid, safe diagnostic tool with good accuracy and concordance rate with the histopathologic diagnosis for palpable head and neck lesions. However, FNAC should be correlated with histopathology to arrive at an accurate diagnosis wherever possible, to differentiate malignant and benign lesions. The present study shows high sensitivity and specificity with high positive and negative predictive values.

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CHART 1. Pie diagram of the distribution of cases as per sites in present study:

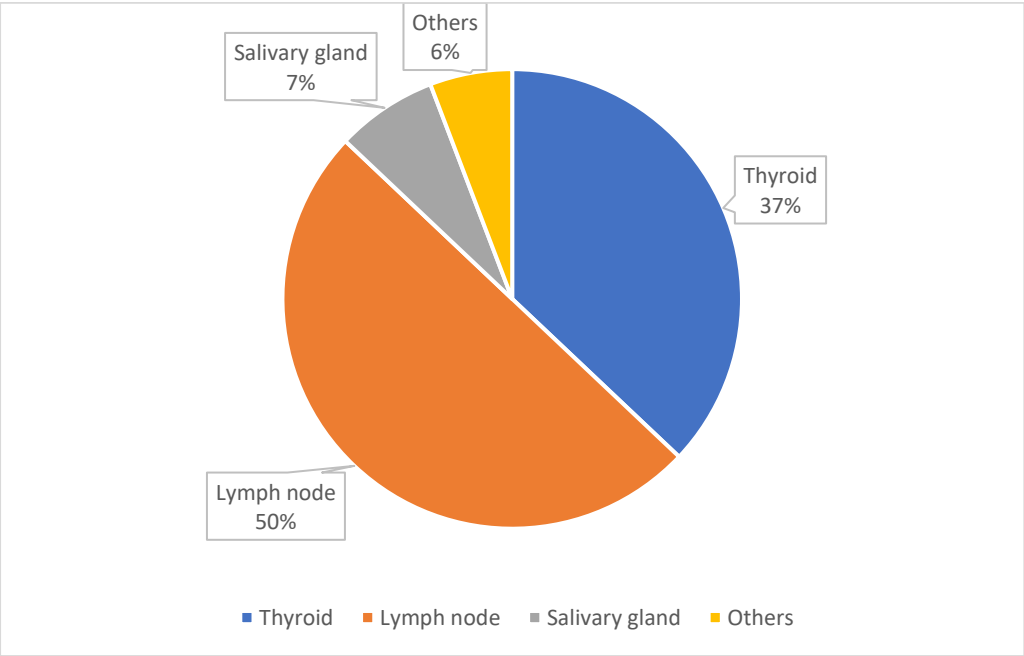

TABLE 1: The distribution of cases as per sites in present study

Site	No Of Cases	Percentage %
Thyroid	83	37
Lypmhnodes	112	50
Salivary Glands	16	7
Other/ Miscellaneous	13	6

TABLE 2. FNAC results of cases in present study:

FNAC results	Number of cases (N= 224)	Percentage %
Thyroid lesions		
• Colloid goitre	60	26.78
• Lymphocytic thyroiditis	1	0.44
• Hashimoto's thyroiditis	6	2.67
• Follicular neoplasm	6	2.67
• Hurthle cell neoplasm	1	0.44
• Papillary carcinoma	9	4
Lymph node lesions		
• Reactive lymphadenitis	32	14.28
• Granulomatous lymphadenitis	41	18.3
• TB lymphadenitis	10	4.46
• Lymph node abscess	8	3.57
• Hodgkin lymphoma	2	0.89
• Non-Hodgkin lymphoma	4	1.78
• Metastasis	15	6.69
Salivary gland lesions		
• Chronic sialadenitis	4	1.78
• Warthin's tumour	2	0.89
• Pleomorphic adenoma	8	3.57
• Adenoid cystic carcinoma	2	0.89
Others		
• Lipoma	3	1.33
• Epidermoid cyst	6	2.67
• Thyroglossal duct cyst	2	0.89
• Cystic hygroma	2	0.89

TABLE 3. Histopathological examination (HPE) results of cases in present study:

HPE results	Number of cases (N=93)	Percentage %
Thyroid lesions		
• Colloid goitre	9	9.67
• Lymphocytic thyroiditis	1	1.07
• Hashimoto's thyroiditis	6	6.45
• Follicular adenoma	7	7.52
• Hurthle cell carcinoma	1	1.07
• Papillary carcinoma	9	9.67
Lymph node lesions		
• Reactive lymphadenitis	5	5.37
• Granulomatous lymphadenitis	5	5.37
• Kikuchi's lymphadenitis	1	1.07
• Tuberculous lymphadenitis	3	3.22
• Hodgkin lymphoma	2	2.15

• Non-Hodgkin lymphoma	3	3.22
• Metastasis	12	12.90
Salivary gland lesions		
• Chronic sialadenitis	4	4.30
• Warthin's tumour	2	2.15
• Pleomorphic adenoma	8	8.60
• Adenoid cystic carcinoma	2	2.15
Others		
• Lipoma	3	3.22
• Epidermoid cyst	6	6.45
• Thyroglossal duct cyst	2	2.15
• Cystic hygroma	2	2.15

TABLE 4. Cytology and histopathological correlation in present study:

FNA report	**No. of cases**	**No. of surgical excision**	**Diagnosis matched with FNA**	**Diagnosis Not-matched with FNA**	**Histopathological diagnosis**
Colloid goiter	60	10	9	1	Colloid goiter=9 Follicular adenoma=1
Lymphocytic thyroiditis	1	1	1	-	Lymphocytic thyroiditis=1
Hashimoto's thyroiditis	6	6	6	-	Hashimoto's thyroiditis=6
Follicular neoplasm	6	6	6	-	Follicular adenoma=6
Hurthle cell neoplasm	1	1	-	1	Hurthle cell carcinoma=1
Papillary carcinoma	9	9	9	-	Papillary carcinoma=9
Reactive lymphadenitis	32	5	4	1	Reactive lymphadenitis=4 Tubercular lymphadenitis=1
Granulomatous lymphadenitis	41	6	5	1	Granulomatous lymphadenitis=5 Kikuchi's lymphadenitis=1
Tuberculous lymphadenitis	10	2	2		TB lymphadenitis=2
Lymph node abscess	8	-	-	-	-
Hodgkin lymphoma	2	2	2	-	Hodgkin lymphoma=2
Non-Hodgkin lymphoma	4	4	3	1	NHL-DLBCL=2 Follicular lymphoma=1 Reactive follicular hyperplasia=1

Metastasis	15	12	12	-	Metastasis =12
Chronic sialadenitis	4	4	4	-	Chronic sialadenitis=4
Warthin's tumor	2	2	2	-	Warthin's tumor=2
Pleomorphic adenoma	8	8	8	-	Pleomorphic adenoma=8
Adenoid cystic carcinoma	2	2	2	-	Adenoid cystic carcinoma=2
Lipoma	3	3	3	-	Lipoma=3
Epidermoid cyst	6	6	6	-	Epidermoid cyst=6
Thyroglossal duct cyst	2	2	2	-	Thyroglossal duct cyst=2
Cystic hygroma	2	2	2	-	Cystic hygroma=2

TABLE 5. Statistical association between FNAC and histopathology in present study:

Cytology Report	Histopathology correlation		Total
	Consistent	Inconsistent	
Benign	21	1	22
Malignant	16	1	17
Non-neoplastic	51	3	54
			93

TABLE 6. Comparison of site distribution in studies:

Study	Thyroid	Lymph node	Salivary gland	Others
Kapoor et al[12]	34%	43%	15%	8%
Suryawanshi K et al[13]	30.30%	39.66%	19%	7.71%
Jasani et al[14]	20%	69%	6%	6%
Present study	37%	50%	7%	5.8%

TABLE 7: Comparison of histopathology correlation of thyroid cases in studies:

Histopathology correlation / Study	Total cases FNAC[HPE]	Colloid goiter	Thyroiditis	Follicular neoplasm	Hurthle cell neoplasm	Papillary carcinoma	Consistency
Hota A et al[19]	403 [60]	27	5	3	1	24	88.33%

Suryawanshi K et al[13]	363 [63]	45	5	6	5	2	96.82%
Pathak R et al[20]	209 [9]	4	-	-	1	4	100%
Kapoor S et al[12]	100 [20]	12	3	2	-	3	85%
Present study	224 [33]	10	7	6	1	9	96.96%

TABLE 8: Comparison of histopathology correlation of lymph node cases in studies:

Histopathology Correlation	Total cases FNAC[HPE]	Reactive lymphadenitis	Granulomatous lymphadenitis	TB lymphadenitis	Lymphoma	Metastasis	Con-sistency
Hota A et al[19]	403 [26]	9	4	4	4	5	84.61 %
Suryawanshi K et al[13]	363 [74]	2	5	59	2	6	95.94 %
Pathak R et al[20]	209 [61]	16	13	-	17	15	67.21 %
Kapoor S et al[12]	100 [40]	9	2	17	5	7	100%
Present study	224 [31]	5	6	2	6	12	90.32 %

TABLE 9: Comparison of histopathology correlation of salivary gland cases in studies:

Histopathology correlation / Study	Total cases FNAC[HPE]	Chronic sialadenitis	Warthin's tumor	Pleomorphic adenoma	Adenoid cystic carcinoma	Consistency
Hota A et al[19]	409 [14]	2	2	9	1	100%
Suryawanshi K et al[13]	363 [29]	9	-	20	-	100%
Pathak R et al[20]	209 [1]	1	-	-	-	100%
Kapoor S et al[12]	100 [11]	1	-	9	1	100%
Present study	224 [16]	4	2	8	2	100%

TABLE 10: Comparison of histopathology correlation of others cases in studies:

Histopathology correlation / Study	Total cases FNAC[HPE]	Lipoma	Epidermoid cyst	Thyroglossal duct cyst	Cystic hygroma	Consistency
Hota A et al[19]	409 [9]	4	5	-	-	88.88%
Suryawanshi K et al[13]	363 [19]	7	12	-	-	100%
Pathak R et al[20]	209 [16]	4	12	-	-	100%
Kapoor S et al[12]	100 [5]	1	4	-	-	100%
Present study	224 [13]	3	6	2	2	100%

TABLE 11. Comparison of statistical correlation between FNAC and histopathology in studies:

Study	Accuracy	Sensitivity	Specificity	Positive predictive value	Negative predictive value
Fernandes H et al[27]	-	83.33%	100%	100%	97%
Bawankule et al[28]	96.66%	93.18%	98.66%	97.67%	95.94%
Rajbhandari M et al[18]	87.4%	86%	97%	-	-
Kapoor S et al[12]	-	90.47%	98.73%	95%	97.5%
Present study	97.85%	98.68%	94.12%	98.68%	94.12%

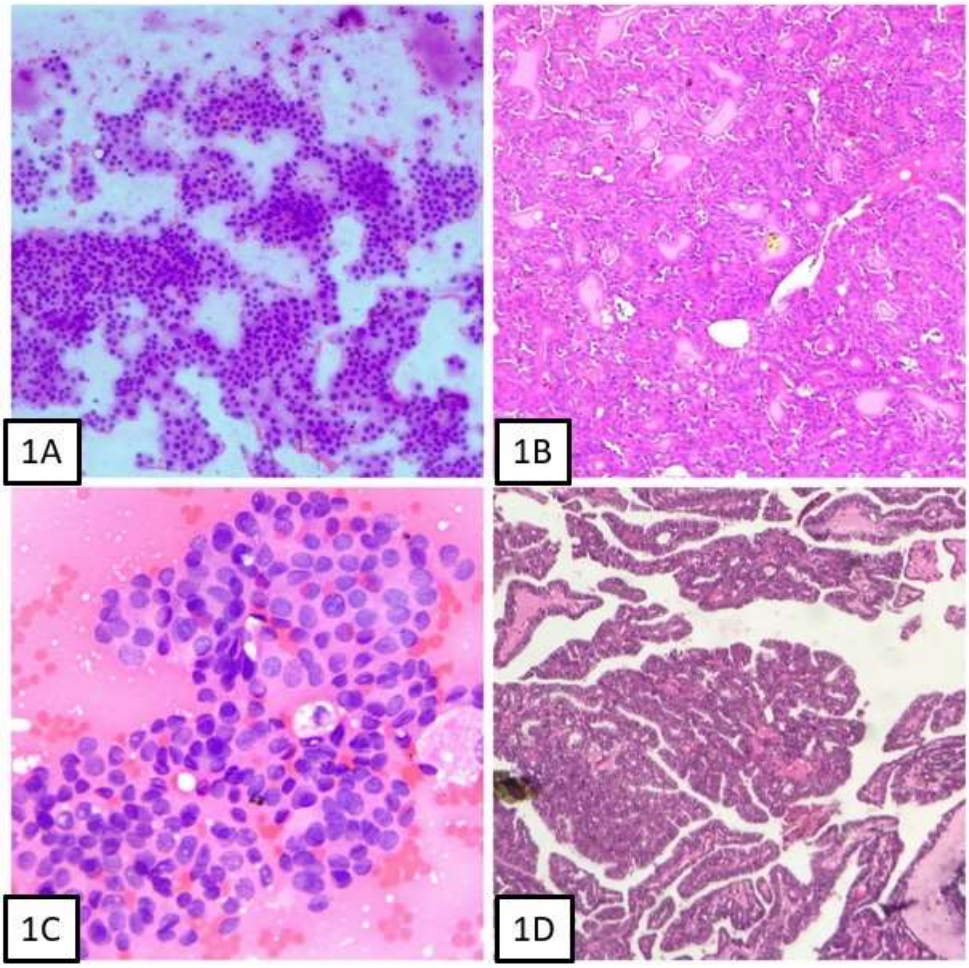

Figure 1: 1A - Hurthle cell neoplasm: FNAC smear shows follicular arrangement of Hurthle cells with prominent nucleoli and eosinophilic granular cytoplasm (H&E x100),

1B- Hurthle cell carcinoma: Histopathology section shows neoplastic follicles of thyorid lined by Hurthle cells (H&E x100),

1C & 1D- Papillary carcinoma of thyroid: FNAC smear shows thyroid follicular cells with pale nuclei, nuclear grooves and intranuclear pseudo-inclusions (H&E x400). Histopathology section shows many papillae with

fibrovascular core lined by cells with nuclear clearing, overlapping, inclusions and psammomatous calcification at one focus (H&E x100)

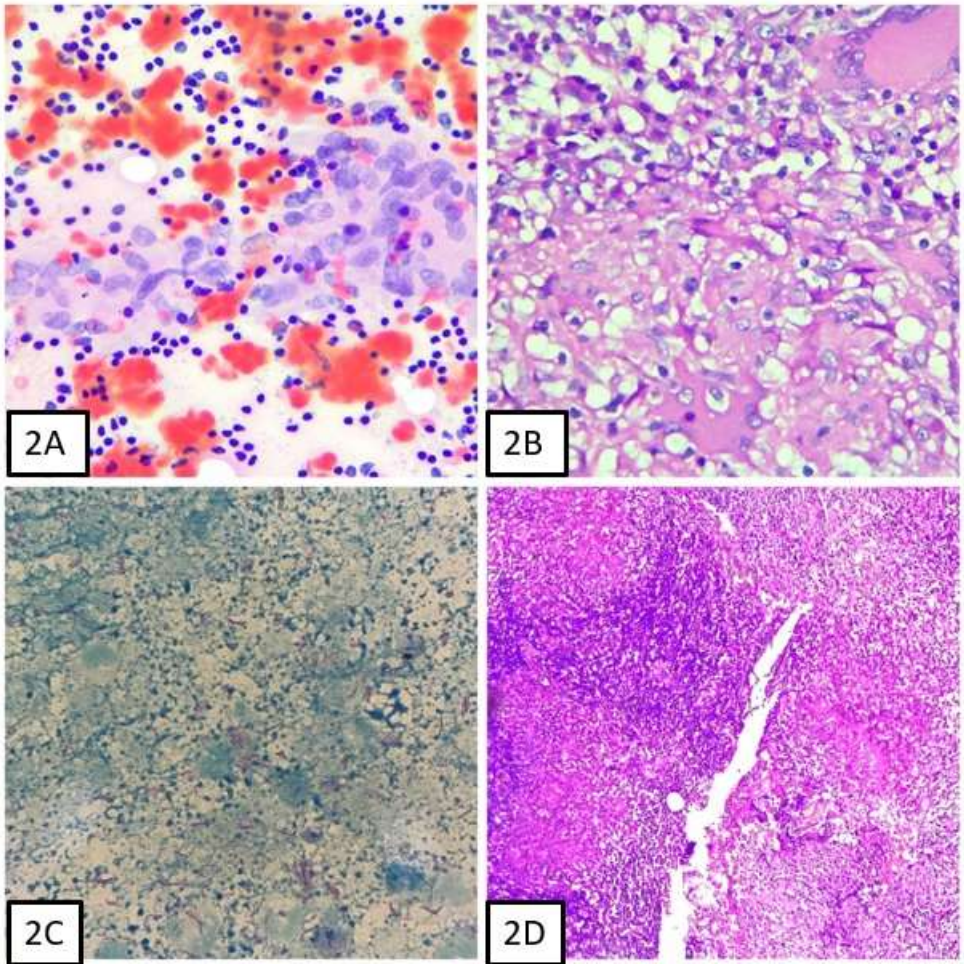

Figure 2: **2A & 2B**- Granulomatous lymphadenitis: Smear shows granuloma formed by clusters of epithelioid cells and peripheral lymphocytes (H&E x400). Histopathology section shows granuloma composed of epithelioid cells, lymphocytes and Langhan's type giant cell (H&E x400),

2C- AFB stain for TB: Smear shows distinct rod-shaped, red TB bacilli single or in groups. (Ziehl-Neelsen stain for AFB x400),

2D- Kikuchi's lymphadenitis: Section shows lymph node containing karyorrhectic debris, large foci of necrosis, and palisaded histiocytes (H&E x100)

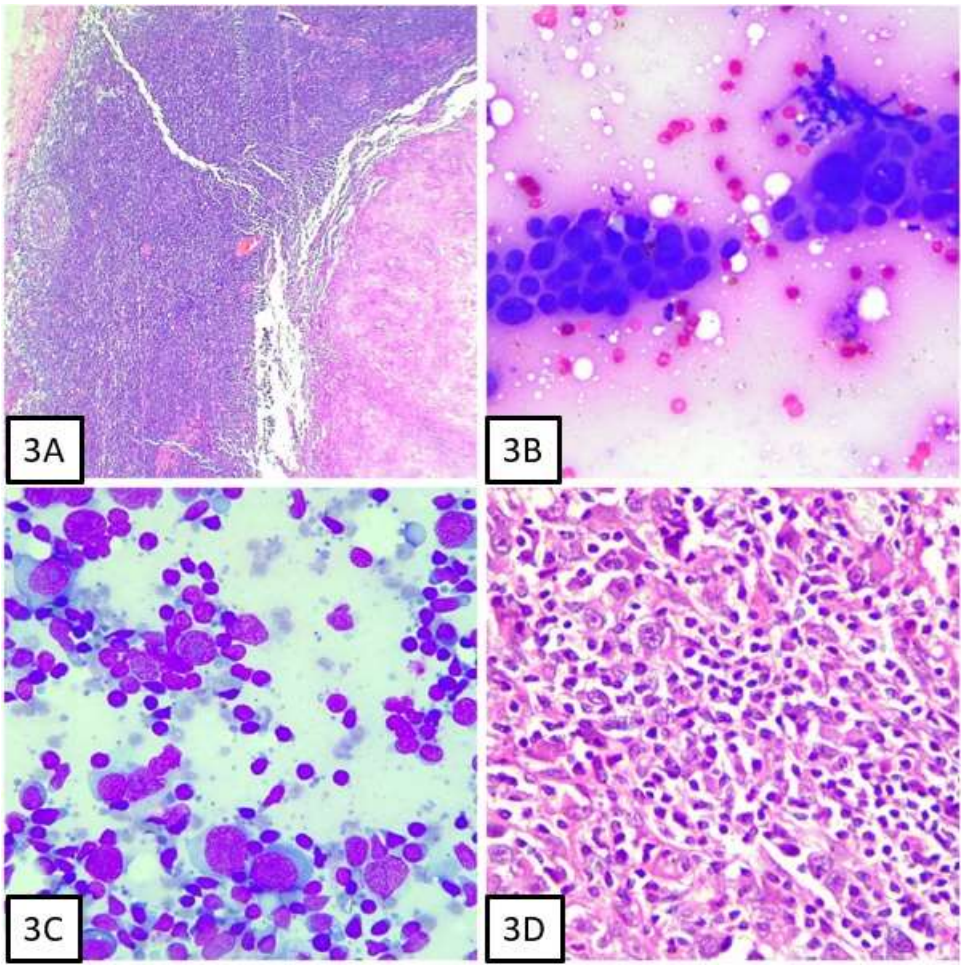

Figure 3: 3A & 3B- Squamous cell carcinoma metastasis to lymph node: Histopathology section shows nests of malignant squamous cells with keratinization in lymph node (H&E x100). FNAC smear shows nests and groups of malignant squamous cells (H&E x400),

3C & 3D- Hodgkin lymphoma: FNAC smear shows large cells with an enlarged oval nucleus, prominent macro-nucleolus, moderate cytoplasm and background lymphocytes (Leishman x400). Histopathology section shows few large cells with round to oval nucleus, prominent nucleolus, moderate cytoplasm and lymphocytes (H&E x400)

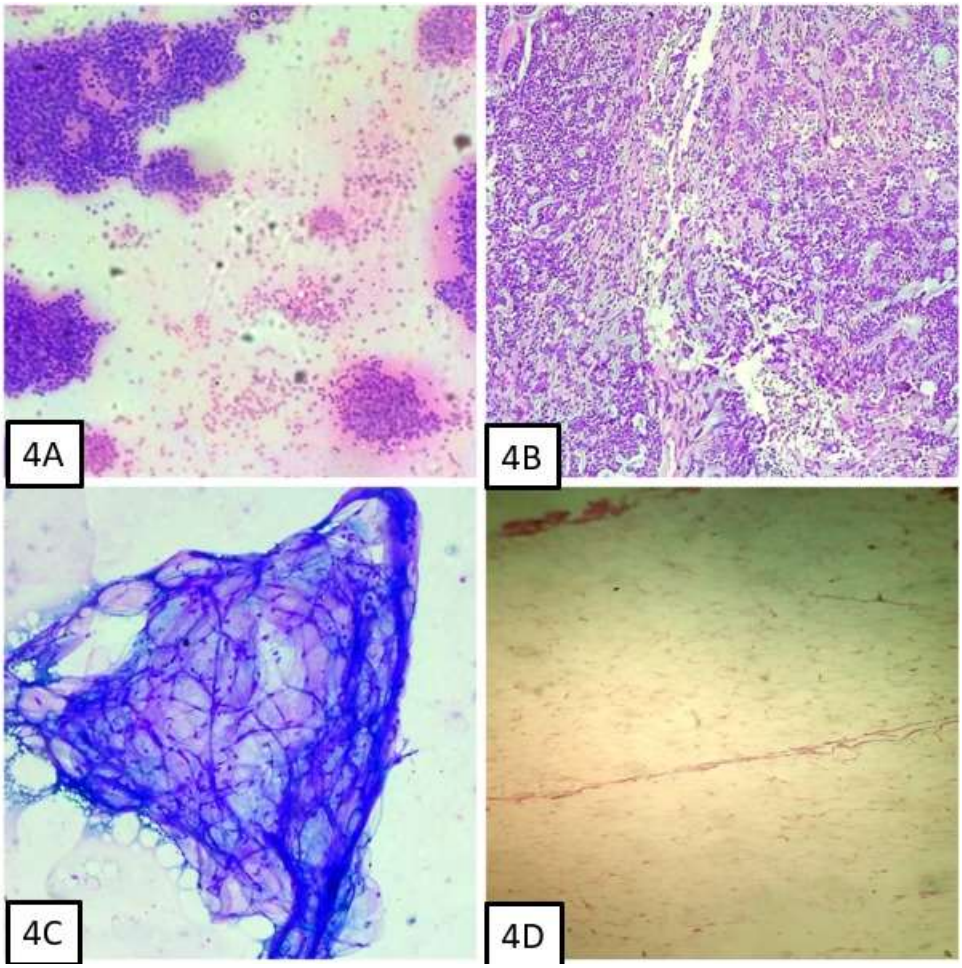

Figure 4: **4A & 4B**- Adenoid cystic carcinoma: FNAC Smear shows uniform tumor cells in aggregates and a sparse amount of matrix (H&E x100). Histopathology section shows myoepithelial cells arranged in cribriform pattern, myxoid globules and duct elements (H&E x100),

4C & 4D- Lipoma: FNAC smear shows clusters of mature adipocytes with clear cytoplasm and peripheral nuclei (Leishman x400) Histopathology section shows capsule and mature adipocytes with displaced nuclei separated by fibrovascular septa (H&E x100)