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Study of fine needle aspiration cytology of salivary gland lesions

Dr. Anjali S Kulkarni[1], Dr. Arjun Namdeo Narote[2], Dr. Anil R Joshi[3]

[1] Assistant Professor, Department of Pathology Government Medical College Aurangabad, Maharashtra, India
[2] Resident (Medical Officer), Department of Pathology, Government Medical College Aurangabad, Maharashtra, India
[3] Professor and Head, Department of Pathology Government Medical College Aurangabad, Maharashtra, India

Abstract
Introduction: Fine Needle Aspiration Cytology (FNAC) is a reliable diagnostic method for evaluation of the lesions salivary glands. The main goal of FNAC of salivary gland lesions is to assist clinicians in the management of patients who present with mass lesions. The present study designed to compare the cytological findings of salivary gland lesions with their histologic diagnoses, in order to assess the sensitivity, specificity, predictive values and diagnostic accuracy of FNAC, with an emphasis on discordant cases in relation with FNAC pitfalls.
Method: Present study is prospective study, carried out over 130 case of salivary gland swelling who had undergone FNAC were enrolled.
Results: Most common age group was 21 to 60 years. Mean age for non-neoplastic lesion, benign tumours & malignant tumours was 40.16 years, 45.17 years & 53.58 years respectively. 46.15% patients were male and 53.85% patients were female with M:F ratio of 1:1.14. Parotid gland was the most common site of involvement (65.38%) followed by submandibular gland (31.54%). 46.15% lesions were non-neoplastic and 53. 85% were neoplastic. Among neoplastic lesions, 65.72% tumours were benign and 34. 28% were malignant. The overall accuracy of cytologic diagnosis in identifying correct lesion was 85.7%. Diagnostic Accuracy for malignant lesions was 68.75%, 100%, 100%, 92.42% & 93.50%. Sensitivity and specificity for benign lesions was 96.77% and 95.65% Sensitivity and specificity for malignant lesion was 68.75% and 100%.
Conclusion: We recommend FNAC study as a preliminary investigation to reliably differentiate neoplastic and non-neoplastic lesions of salivary gland. However, specific histopathologic typing is a must in any doubtful case, more so in malignant lesions.

Keywords: FNAC, salivary lesions, sensitivity, accuracy

Introduction
Salivary gland lesions constitute one of the most interesting lesions in head and neck region, as they provide a vast range of morphologic patterns at a single site [1].
Bland Sutton aptly said "Tumours of the salivary gland are a pathological puzzle and a source of unsatisfactory speculation. The nature of the lesion cannot be determined on clinical examination and therefore pathological examination is required for definite diagnosis in suspected cases of neoplastic disease [2].
Fine Needle Aspiration Cytology (FNAC) is a reliable diagnostic method for evaluation of these lesions because of rather the superficial location and easy accessibility of the salivary glands. The main goal of FNAC of salivary gland lesions is to assist clinicians in the management of patients who present with mass lesions [3].
However, recent years have witnessed emergence of FNAC as a useful, reliable method and fast diagnostic technique which serves as a useful adjuvant to histopathology and provides a reasonable diagnosis to guide further course of management [4]. It is widely used for the diagnosis of the salivary gland lesions for a fast clarification of the nature of the lesion whether it is benign or malignant [5].
FNAC is useful to avoid unnecessary surgery in non-neoplastic benign lesions such as sialadenitis and provide a preoperative diagnosis, staging and determine the surgical modality and the follow-up of the neoplastic salivary gland lesions [5].
The present study designed to compare the cytological findings of salivary gland lesions with their histologic diagnoses, in order to assess the sensitivity, specificity, predictive values and diagnostic accuracy of FNAC, with an emphasis on discordant cases in relation with FNAC pitfalls.

Material and Methods
The present study was carried out in the prospective study of FNAC salivary gland lesions was carried out in the Department of Pathology over a period of three years from June 2015 to June 2018 at Government Medical College Aurangabad.

Study Population
Present study included patients attending Out-Patient Department (OPD) in our institute without any consideration of age and sex, with a clinical or radiological diagnosis of salivary gland involvement. In every case, a detailed clinical and thorough physical examination done.

Study Design: Prospective Study

Case Selection

Inclusion Criteria

All patients presenting with salivary gland swelling and patients referred for FNAC in Department of Pathology.

Exclusion Criteria

1) Patients presenting with non-palpable salivary gland swelling.
2) Patients with bleeding tendencies.

A detailed clinical history was obtained and thorough clinical examination with special reference to symptoms and signs of salivary gland disease was recorded on the specific proforma, prior to procuring sample for cytology study. Written informed consent of the patient was obtained and proper information regarding the procedure was given to the patient.

After FNAC the Smears prepared were dried and fixed on 95% alcohol and stained by H & E stain or/and Papanicolaou stain. Stained smear was examined under the microscope and results were studied. Then Cytological diagnosis was made. The sensitivity, specificity, positive predictive value and negative predictive value of cytological diagnosis were evaluated.

These values were calculated by the following formulae. Patients with non-diagnostic FNACs were excluded from the calculations.

Statistical Analysis Formulae

Sensitivity =

True Positive / (True Positive + False Negative) X 100

Specificity =

True Negative / (True Negative +False Positive) X 100

Positive Predictive Value =

True Positive / (True Positive + False Positive) X 100

Negative Predictive Value =

True Negative / (True Negative + False Negative) X 100 Accuracy = True Positive + True Negative / (True Positive + False Positive + True Negative + False Negative) X 100

Observations

In present study 130 case of salivary gland swelling that had undergone FNAC were enrolled and cytological diagnosis was done.

In the present study, age range was 7 to 78 years; the youngest patient was a 7 years old female child with chronic inflammatory lesion suggestive of Sialoadenitis and the oldest was of 78 years diagnosed as suspicious of malignancy suggestive of epithelial-myoepithelial carcinoma. Overall maximum number of patients 31(23.84%) were in the age group of 31-40 years. In the non-neoplastic lesion 12(20%) cases out of 60 cases were found in 41-50years. In the benign lesion 16(34.78%) cases out of 46 cases were found in 31-40 years age group. In the malignant lesion, maximum no of patients 6(25%) cases out of 24 cases were found in 61-70 years age group.

Table 1: Diagnostic category-wise distribution of salivary gland lesions

Sr. No.	Diagnostic Category	Total	Percentage
1	Non –Neoplastic Lesions	60	46.15%
2	Neoplastic Lesions - Benign - Malignant	 46 24	 35.38% 18.47%
	Total	130	100%

In this study, non-neoplastic lesions were 60(46.15%), benign lesions 46(35.38%) and malignant lesions 24(18.46%) out of 130 cases.

In the present study out of 130 cases, 60 were males (46.15%) and 70 were females (53. 84%) with M: F ratio was 1:1.14. Benign tumours were more common in Female patients 24(52.17%) and malignant tumours in male patients15 (62. 5%).

Present study showed parotid gland as the most frequent site of involvement in all categories of salivary gland lesions 85 (65.38%) followed by submandibular gland 41(31.53%). While sublingual gland 01(0.77%) and minor salivary gland 03(2.31%) contribute less.

Table 2: Results of Cytology

Lesions	No. of Cases	Percentage
A) Non-neoplastic lesions (n=60) I. Chronic Sialoadenitis II. Chronic Granulomatous Sialadenitis III. Cystic Lesions	 36 10 14	 46.15%
B) Neoplastic Lesions: 1) Benign tumours (n=46) I. Pleomorphic Adenoma II. Monomorphic Adenoma III. Warthin Tumour IV. Myoepithelioma V. Oncocytoma	 35 04 04 01 02	 35.38%
2) Malignant tumour(n=24) I. Mucoepidermoid Carcinoma II. Adenoid Cystic Carcinoma III. Myoepithelial Carcinoma IV. Duct Carcinoma V. Epithelial-Myoepithelial Carcinoma VI. Poorly Differentiated Carcinoma VII. Suspicious of Malignancy	 06 01 01 02 02 01 11	 18.46%

Table 2. Shows distribution of various lesions encountered on cytological examination. Out of 130 cases, 60(46.15%) were of non-neoplastic lesions. Total neoplastic lesions were 70(53.84%). Among neoplastic lesions, benign neoplastic were 46(35.38%) and malignant were 24 (18.46%) on cytology in non-neoplastic lesions, Chronic Sialadenitis is the most common non-neoplastic lesion in the present study, followed by chronic granulomatous sialadenitis and non-neoplastic cyst Among neoplastic lesions, pleomorphic adenoma to be the most common tumour 22 cases (46.81%) followed by Mucoepidermoid Carcinoma 11cases (23.40%), Warthin tumour 04 Cases (8.51%), Monomorphic Adenoma 03 cases (6.38%)

Table 3: Sensitivity, Specificity, PPV, NPV & Accuracy for Non-Neoplastic Lesions, Benign, Malignant Lesions and Overall Salivary Gland Lesions

Sr. No.	Type of Lesion	Sensitivity	Specificity	PPV	NPV	Accuracy
1.	Non- Neoplastic Lesions	96.67%	89.36%	85.29%	97.67%	92.20%
2	Benign Lesions	96.77%	95.65%	93.75%	97.78%	96.10%
3.	Malignant Lesions	68.75%	100%	100%	92.42%	93.50%
4.	Overall Salivary Gland Lesions	89.36%	96.67%	97.67%	85.29%	92.21%

Discussion

Total 130 cases of FNAC were studied. Salivary gland tumours develop in a wide range of age. In present study, range of age for benign tumours was 31-40 years and it correlates with the studies of Huq AHMZ *et al.* (2013) [8], Ritu Jain *et al.* (2013) [9], Anita Omhare *et al.* (2014) [13], Vidyadhara Rani *et al.* (2014) [14], Panchal *et al.* (2015) [16]. Range of age for malignant tumours was 61-70 years and it correlates with the studies of Vaidya S *et al.* (2011) [7], Anita Omhare *et al.* (2014) [13] and Kacharu *et al.* (2016) [19].

In present study 46.15% male and 53.85% female patients were seen. There was slight female preponderance with male to female ratio (M: F ratio) of 1:1.14 in present study. Our finding is comparable to the studies of N. Sangeetha *et al.* (2013) [11] and Vidyadhara Rani *et al.* (2014) [14]. The higher number of cases in female patients had been reported by our study.

Present study showed 65. 38% cases with parotid involvement which correlates with other studies of Ritu Jain *et al.* (2013) [9], Shilpa H Gandhi *et al.* (2013) [11], Kacharu *et al.* (2016) [19]. Submandibular gland was involved in 31.53% cases and this finding is comparable with that of Ritu Jain *et al.* (2013) [9], Sonal Verma *et al.* (2016) [18], Kacharu *et al.* (2016) [19]. There was only one case (0.77%), 26 years old female with diagnosis of Chronic Sialadenitis which showed involvement of sublingual gland. Also there were three cases (2.32%) showed involvement of minor salivary glands; one case was 36 years old male with diagnosis of Low Grade Mucoepidermoid Carcinoma which showed involvement of minor salivary glands of palate; second case was 35 years old male with diagnosis of Pleomorphic Adenoma showed involvement of minor salivary gland left cheek; and third case was 60 years old female patient with diagnosis of Low Grade Mucoepidermoid Carcinoma which showed involvement of minor salivary glands of right cheek.

In present study, the patients presented with a swelling in parotid gland, submandibular or minor salivary glands. Present study showed, overall salivary gland swellings presented with unilateral and there was no single case with bilaterality.

Table 4: Relative Frequency of Different Lesions

Author (Year)	Non-neoplastic Lesions	Neoplastic Lesions
Shilpa H. Gandhi *et al.* (2013) [10]	40%	60%
Koirala S *et al.* (2014) [12]	52.20%	47.80%
Anita Omhare *et al.* (2014) [13]	53.22%	46.78%
Hilda Fernandes *et al.* (2014) [15]	42.05%	57.95%
Samreen Naz *et al.* (2015) [17]	39.5%	60.5%
Kacharu *et al.* (2016) [19]	34.8%	65.20%
Present Study (2017)	46.15%	53.85%

Present study showed non-neoplastic lesions to represent 46.15% of total cases and rest 53.85% were neoplastic lesions. These findings were comparable with study of Hilda Fernandes *et al.* (2014) [15]. Our Study showed 66.40% of salivary gland lesion located in parotid gland as comparable in the study by Kacharu *et al.* (2016) [19].

Present study showed 65.71% lesions to be benign tumour and 34.29% lesions to be malignant tumours, which correlated with previous studies Koirala S *et al.* (2014) [12], Anita Omhare *et al.* (2014) [13]. Among benign tumours, pleomorphic adenoma was the most common tumor (76.09%). There were 3 cases diagnosed as suggestive of Monomorphic Adenoma. Out of these three, one case was diagnosed as Monomorphic Adenoma on Cytopathology.

Among malignant tumors, 6 cases were suggestive of mucoepidermoid carcinoma, two were suggestive of adenoid cystic carcinoma, two were suggestive of Duct Carcinoma, two were suggestive of Epithelial-Myoepithelial Carcinoma, one was suggestive of Poorly Differentiated Carcinoma and eleven cases were with diagnosis of suspicious of malignancy.

In present study pleomorphic adenoma was the single most common tumor (46.80%) which was seen in most of the studies in the Literature. The present study showed uncommon benign tumours like Myoepithelioma (one case), Oncocytoma (one case).

Mucoepidermoid carcinoma was the most common malignant tumour in the present study (23.40%). This finding showed agreement with studies of Huq AHMZ *et al.* (2013) [8], N. Sangeetha *et al.* (2013) [11], Koirala S *et al.* (2014) [12], Panchal *et al.* (2015) [16].

The present study showed uncommon malignant tumours like Duct Carcinoma (one case), Myoepithelial Carcinoma (one case) and Epithelial-Myoepithelial Carcinoma (one case).

In the present study sensitivity, Specificity, PPV, NPV and Diagnostic Accuracy of FNAC technique for diagnosing Non-neoplastic Lesion was 96.67%, 89.36%, 85.29%, 97.67% and 92.20% respectively. These present study findings were correlating with the study by Koirala S *et al.* (2014) [12].

Table 5: Overall FNAC Sensitivity, Specificity, PPV, NPV And Diagnostic Accuracy

Author (Year)	Sensitivity	Specificity	PPV	NPV	Accuracy
N. Sangeetha *et al.* (2013) [11]	90.22	95.92	-	-	95.32
Koirala S *et al.* (2014) [12]	100	87.73	-	-	88.89
Anita Omhare *et al.* (2014) [13]	88.2	97.1	88.2	97.1	95.3
Present Study (2017)	89.36	96.67	97.67	85.29	92.21

In the present study Sensitivity, Specificity, PPV, NPV and Diagnostic Accuracy of FNAC technique for diagnosing overall salivary gland Lesions was 89.36%, 96.67%, 97.67%, 85.29% and 92.21% respectively. These present study findings were correlating with the studies by N. Sangeetha *et al.* (2013) [11] and Anita Omhare *et al.* (2014) [13].

Table 6: FNAC Sensitivity, Specificity, PPV, NPV And Diagnostic Accuracy for Benign Lesions In Various Studies

Author (Year)	Sensitivity	Specificity	PPV	NPV	Accuracy
Vaidya S *et al.* (2011) [7]	100	81.80	95.9	100	96.6
N. Sangeetha *et al* (2013) [11]	93.75	92.31	-	-	94.74
Koirala S *et al.* (2014) [12]	100	86.95	-	-	91.67
Present Study (2017)	96.77	95.65	93.75	97.78	96.10

In the present study Sensitivity, Specificity, PPV, NPV and Diagnostic Accuracy of FNAC technique for diagnosing Neoplastic Benign salivary gland Lesions was 96.77%, 95.65%, 93.75%, 97.78% and 96.10% respectively. These present study findings were correlating with the study by N. Sangeetha *et al.* (2013) [11].

Table 7: FNAC Sensitivity, Specificity, PPV, NPV And Diagnostic Accuracy For Malignant Lesions In Various Studies

Author (Year)	Sensitivity	Specificity	PPV	NPV	Accuracy
N. Sangeetha *et al.* (2013) [11]	76.92	100	-	-	94.74
Sevinc Sahin *et al.* (2015) [5]	62.5	92	55.6	93.9	87.9
Present Study (2017)	68.75	100	100	92.42	93.50

In the present study Sensitivity, Specificity, PPV, NPV and Diagnostic Accuracy of FNAC technique for diagnosing Neoplastic benign salivary gland lesions was 68.75%, 100%, 100%, 92.42% and 93.50% respectively. These present study findings were comparable with the studies by Sevinc Sahin *et al.* (2015) [5] and N. Sangeetha *et al.* (2013) [11].

Aarthi R. Rau *et al.* (2006) [6] published their study on effects of FNAC related tissue changes on subsequent histological evaluation. They concluded that the changes do not interfere with subsequent histological evaluation of tumours.

To summarize it all, use of FNAC can provide helpful preoperative diagnostic information for deciding the line of management.

Summary and Conclusions

Present Study was conducted in Department of Pathology for three years, to study the cytological diagnostic profile of salivary gland lesions and evaluate the efficacy of FNAC as a fast and reliable method to give a preoperative reasonable assessment of underlying lesion.

Summary

- Total 130 patients undergone FNAC for salivary gland swellings, 92.20% aspirates were diagnostic.
- 14% of total smears were of inflammatory aetiology, which responded to conservative management. Hence, FNAC avoided unnecessary surgery in 14% of patients.
- Most common age group was 21 to 60 years. Mean age for non-neoplastic lesion, benign tumours & malignant tumours was 40.16 years, 45.17 years & 53.58 years respectively.
- 46.15% patients were male and 53.85% patients were female with M: F ratio of 1:1.14.
- Salivary gland tumours comprised 1.5 % of all malignant tumours diagnosed in the study period.
- Parotid gland was the most common site of involvement 65.38% followed by submandibular gland 31.54%.
- 46.15% lesions were non-neoplastic and 53.85% were neoplastic. Among neoplastic lesions, 65.72% tumours were benign and 34.28% were malignant.
- The overall accuracy of cytologic diagnosis in identifying correct lesion was 85.7%
- Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value, Diagnostic Accuracy for non-neoplastic lesions was 96.67%, 89.36%, 85.29%, 97.67% & 92.20%.
- Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value, Diagnostic Accuracy for benign lesions was 96.77%, 95.65%, 93.75%, 97.78% & 96.10%.
- Sensitivity, Specificity, Positive Predictive Value, Negative Predictive Value, Diagnostic accuracy for malignant lesions was 68.75%, 100%, 100%, 92.42% & 93.50%.
- Sensitivity and specificity for benign lesions was 96.77% and 95.65% Sensitivity and specificity for malignant lesion was 68.75% and 100%.

Conclusion

To conclude it all, we recommend FNAC study as a preliminary investigation to reliably differentiate neoplastic and non-neoplastic lesions of salivary gland to plan further management accordingly. It provides a fairly accurate idea of a benign or malignant tumour. However, specific histopathologic typing is a must in any doubtful case, more so in malignant lesions.

The accuracy of FNAC can be further improved, if the diagnostic pitfalls are given due attention. In spite of few limitations, FNAC is valuable in saving the time for diagnosis, cost involved in surgical procedures and the patient counselling preoperatively based on cytologic diagnosis.

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