

# Role of fine-needle aspiration cytology in the diagnosis of major salivary gland tumors: A study with histological and clinical correlation

Archana Shetty, V Geethamani<sup>1</sup>

Department of Pathology, Sapthagiri Institute of Medical Sciences and Research Center, <sup>1</sup>Department of Pathology, BGS Institute of Medical Sciences and Research Center, Bengaluru, Karnataka, India

## Abstract

**Introduction:** Neoplastic lesions of salivary glands present an interesting subject because of their histologic diversification. Complex features exhibited by them have aroused considerable speculations concerning their histogenesis and continues to hold the interest of clinicians and pathologists. Major salivary glands are superficial and have easy accessibility for fine-needle aspiration cytology (FNAC). These glands are generally not subjected to incisional or core needle biopsy, because of the possible risks of fistula formation and tumor seedling. FNAC diagnosis of major salivary gland neoplasms aids in proper planning of required surgery and avoidance of the same in cases of non-neoplastic lesions.

**Materials and Methods:** Cytological features of major salivary gland tumors diagnosed on FNAC were studied over a period of one and a half years. Cytological and architectural patterns in smears were compared with histopathological features in cases where the specimens were available with a note on the age, sex and presenting complaints. Statistical Analysis: Analysis of variance (ANOVA) was used to find the significance of study parameters. Chi-square/Fisher Exact was used to find the significance of study parameters on categorical scale between two or more groups. *P* value of <0.05 was considered to be significant.

**Results:** A total of 114 salivary gland FNACs were done, 75 patients were clinically suspected to be neoplasms. The peak incidence was in the third to fourth decade of life with a female preponderance. Parotid was the most commonly affected gland (80%) with pleomorphic adenoma and mucoepidermoid carcinoma (10.7%) being the most common benign and malignant tumors respectively. The diagnostic accuracy of FNAC was 97.6%. Warthins tumor was misdiagnosed and was associated with a strong smoking history.

**Conclusion:** Salivary gland neoplasms constitute a small but significant percentage of head and neck tumors. FNAC is inexpensive, quick, and aids in the preoperative diagnosis and planning of surgery.

**Key Words:** Fine-needle aspiration cytology, histopathology, major salivary gland tumors, Warthin's tumor

### Address for correspondence:

Dr. Archana Shetty, Department of Pathology, Sapthagiri Institute of Medical Sciences and Research Center, Street No. 15, Hesaraghatta Main Road, Bengaluru - 560 090, Karnataka, India. E-mail: archanashetty2924@gmail.com

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## INTRODUCTION

Salivary gland tumors, because of their diversity, till date continue to hold the interest of the surgeons and the pathologists. Although fine needle aspiration cytology (FNAC) is now part of routine clinical practice for the evaluation of thyroid tumors<sup>[1]</sup> and cervical lymph nodes, no consensus has been reached concerning the role of this procedure in the management of salivary glands lesions, as some authors consider that it has a low sensitivity for diagnosis of malignant salivary tumors.<sup>[2,3]</sup>

The purpose of this study was to determine the diagnostic value of FNAC to define its place and its advantages in the diagnostic strategy. The study also adds a note on the clino-pathological details of the same.

## MATERIALS AND METHODS

All patients presenting to the surgical and ENT outpatient departments, as cases of salivary gland swellings, were subjected to FNAC after obtaining consent. Nonneoplastic lesions were not included in the study. FNA was performed under aseptic precautions, after obtaining the patient details. Aspirates were stained with May-Grunwald-Giemsa (MGG), Papanicolaou (PAP) and haematoxylin and eosin (H and E) stains. Histopathological correlation was made in cases where the surgically resected specimens were available. The sensitivity, specificity and accuracy of FNA were calculated using appropriate statistical methods Analysis of variance (ANOVA) was used to find the significance of study parameters between three or more groups of patients. Post-Hoc Tukey test was used to find the pair wise significance. Chi-square/Fisher Exact was used to find the significance of study parameters on categorical scale between two or more groups. *P* value of <0.05 was considered to be significant.

## RESULTS

During the study, a total of 2051 FNAC's were performed out of which salivary gland FNAC's constituted 114 in number (5.5%), of which 39 were nonneoplastic lesions.

The peak incidence of tumors was in the third to fourth decade, with the oldest patient being 68-year-old, with a slight female preponderance. The parotid was the most commonly affected gland as shown in Table 1.

Swelling was the most common complaint (100%), followed by associated pain (21.3%). FNAC diagnosis of the tumors was as presented in Table 2.

**Table 1: Site distribution of salivary gland tumours**

Site	n (%)	95% CI
Parotid gland	60 (80.0)	69.59-87.49
Submandibular gland	14 (18.7)	11.46-28.93
Sublingual gland	1 (1.3)	0.02-7.17
Total	75 (100.0)	-

CI: Confidence interval

**Table 2: Analysis of fine needle aspiration cytology of major salivary gland tumours**

FNAC findings	n (%)	95% CI
Benign	60 (80.0)	69.59-87.49
Pleomorphic adenoma	51 (68.0)	56.79-77.46
Warthin's tumour	8 (10.7)	5.50-19.66
Oncocytoma	1 (1.3)	0.2-7.17
Malignant	13 (16.3)	10.42-27.43
Adenoid cystic carcinoma	5 (6.7)	2.88-14.68
Mucoepidermoid carcinoma	8 (10.7)	5.50-19.66
Nondiagnostic aspirate	2 (2.7)	0.7-9.21
Total	75 (100.0)	-

FNAC: Fine needle aspiration cytology, CI: Confidence interval

Cytological features of tumors on cytology correlated with histopathology in relation to pleomorphic adenoma [Figure 1a and b], oncocytoma [Figure 2a and b], adenoid cystic carcinoma (ACC) [Figure 3a and b] and Mucoepidermoid carcinoma [Figure 4a and b].

The two non-diagnostic aspirates were from large swellings in the parotid region that yielded only necrotic material, posing a diagnostic dilemma. The histopathological correlation later proved both the cases to be Warthin's tumors with extensive cystic change [Figure 5a-c].

## Postoperative correlation with histopathology

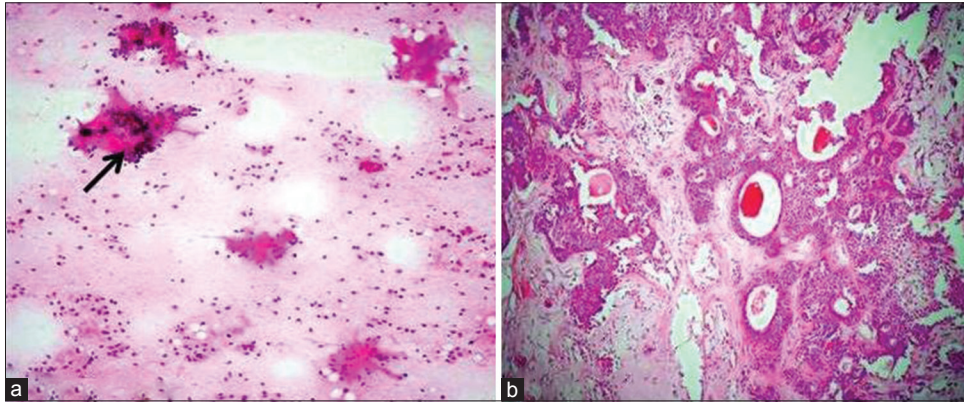
The histopathological correlation was available for 56 cases and was correlated with the FNAC diagnosis. The sensitivity and specificity along with *P* value for the various tumors is presented in Table 3.

Two cases of Warthin's tumors could not be diagnosed on FNAC, thus reducing the sensitivity.

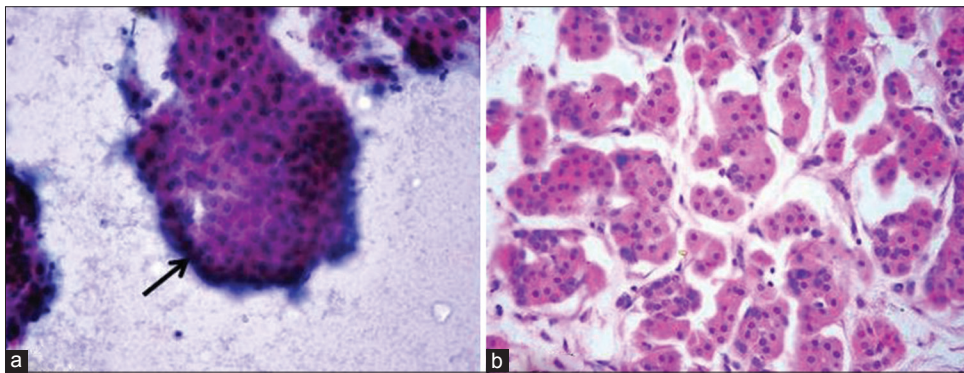
## DISCUSSION

The incidence of major salivary gland tumors is found to be 18.8 cases/year. This correlates with the study conducted by Fernandes and Pandit.<sup>[4]</sup> Majority of the major salivary gland neoplasms arise in the parotid gland. In this study, also the majority of the tumors were arising in the parotid gland (80%), which co-relates well with the studies till date.

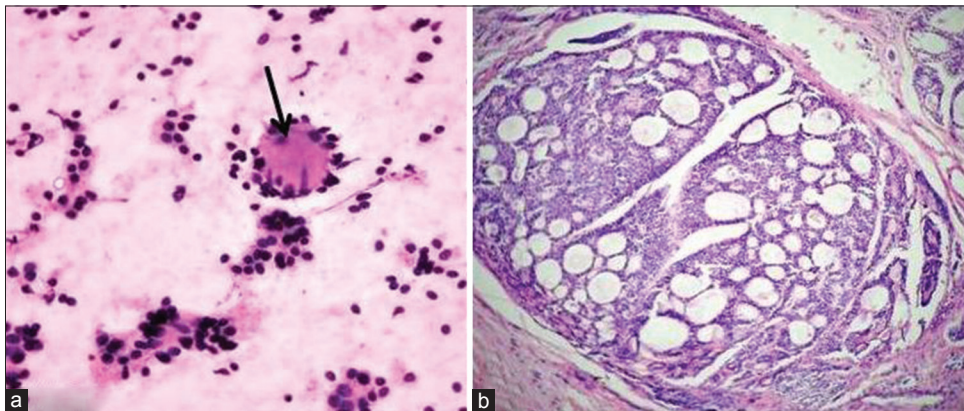
Salivary gland neoplasms, present as asymptomatic slowly growing masses, with associated pain being the next most



**Figure 1:** Pleomorphic adenoma (a) cytology showing a mixture of myoepithelial and plasmacytoid cells against a chondromyxoid background black arrow (H&E stain, ×100). (b) Histopathology of pleomorphic adenoma (H&E stain, ×100)



**Figure 2:** Oncocytoma (a) cytology showing monolayered sheets of oncocytes (arrow) in a clean background (H&E stain, ×400). (b) Histopathology of oncocytoma showing Groups of benign oncocytes (H&E stain, ×100)

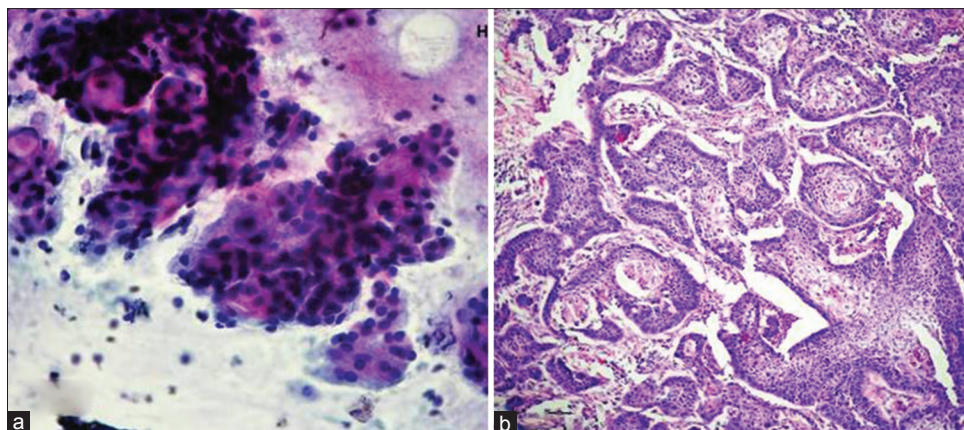


**Figure 3:** Adenoid cystic carcinoma (a) cytology showing scattered hyaline globules (arrow) with adherent hyperchromatic, small monotonous tumour cells (Pap stain, ×400) (b) histopathology of adenoid cystic carcinoma (H&E stain, ×40)

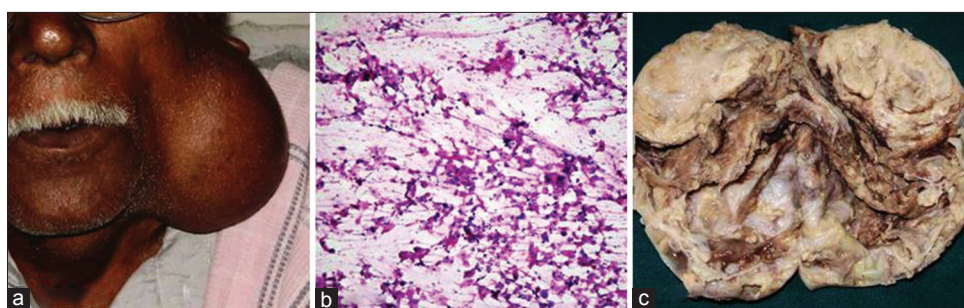
**Table 3: Correlation of fine needle aspiration cytology with histopathological diagnosis - an evaluation**

FNAC versus histopathological	Sensitivity	Specificity	PPV	NPV	Accuracy	P
Adenoid cystic carcinoma	100.0	100.0	100.0	100.0	100.0	<0.001**
Mucoepidermoid carcinoma	100.0	100.0	100.0	100.0	100.0	<0.001**
Pleomorphic adenoma	100.0	100.0	100.0	100.0	100.0	<0.001**
Warthin's tumour	77.8	100.0	87.5	95.8	94.6	<0.001**

PPV: Positive predictive value, NPV: Negative predictive values, FNAC: Fine needle aspiration cytology, \*\*P<0.05



**Figure 4:** Mucoepidermoid carcinoma (a) cytology showing a mixture of epithelial, intermediate and mucin secreting cells with relatively bland nuclei (Pap stain, x400) (b) histopathology of mucoepidermoid carcinoma (H&E stain, x200)



**Figure 5:** (a) Huge swelling in the left parotid region. (b) Fine needle aspiration cytology smear showing only hemorrhage and necrotic debris on repeated aspirates (H&E stain, x100). (c) Surgically resected specimen showing a solid tumor with large areas of cystic change, confirmed as Warthin's tumor on histopathology

common symptom; pain and fixity to the overlying skin are ominous signs.<sup>[5,6]</sup>

Pleomorphic adenoma was the most common benign tumour, with slight female preponderance occurring mainly in the third decade of life.<sup>[7,8]</sup> It most commonly affects the parotid gland,<sup>[7,9,10]</sup> cytology of the tumour shows a combination of bland epithelial cell in aggregates and sheets and fragments of the fibrillary chondromyxoid stroma.<sup>[7]</sup> This tumor posed no cytological difficulties in our study.

Warthin's tumor, the second most common benign tumor occurs mainly in the fifth to sixth decade, with a male preponderance.<sup>[11,12]</sup> Warthin's tumor is known to occur predominantly in smokers. The risk of developing Warthin's tumor is 8 times high in smokers as compared to nonsmokers.<sup>[13,14]</sup> In this study also, all the patients who were diagnosed as cases of Warthin's tumor gave a smoking history. The present study reported 2 cases of nondiagnostic aspirates on FNAC. The smears from repeated aspirates showed only nonspecific findings such as scattered squamous cells, lymphocytes and inflammatory infiltrate in a hemorrhagic background. On histopathology, the tumors were diagnosed as Warthin's. Oncocytic tumors

like the Warthin's tumors are known to undergo cystic change, misleading the diagnoses as in the present study, even after repeated aspirates.<sup>[15-17]</sup>

Cytological features of oncocytoma are described classically as sheets of monotonous looking epithelial cells with abundant granular eosinophilic cytoplasm and round to oval nuclei with minimal lymphoid infiltration in the background.<sup>[18]</sup> The smears of aspirated oncocytoma in the present study also showed similar features and the diagnosis on histopathology was also oncocytoma involving the parotid gland.

Shafkat *et al.*<sup>[5]</sup> and Paik *et al.*<sup>[19]</sup> reported mucoepidermoid carcinoma to be the commonest malignant tumor occurring in the major salivary glands, with parotid being the favoured site.<sup>[10]</sup> Cytological features suggestive of mucoepidermoid carcinoma which include intermediate cells, squamous cells and overlapping epithelial groups<sup>[20]</sup> were all seen in varying proportions in our study.

ACC was the 2<sup>nd</sup> most common malignant tumor in our study similar to other studies.<sup>[5,21,22]</sup> However, few studies also<sup>[10,23]</sup> document it to be the most common salivary gland

tumor. The hyaline globules are described as the most striking features of ACC's. Hyaline globules are also seen in cases of epithelial-myoepithelial carcinomas, basal cell adenomas and occasionally in cases of pleomorphic adenomas also. These globules are homogenous structures occurring either singly or surrounded by epithelial cells.<sup>[24]</sup> However, basal cell adenoma can be differentiated by the peripheral palisading of the tumor cells and presence of squamous morules on smears. Truly chondromyxoid matrix on FNA smears with spindle cells is a feature specific to pleomorphic adenoma. Epithelial myoepithelial carcinoma, a rare entity has cells with pale and indistinct cytoplasm which is so fragile, that it disperses in the background and most of the cells appear as naked nuclei. The chromatin in these cells is pale with a discrete central nucleoli.<sup>[9,16]</sup>

Cytological features of salivary gland tumours can often overlap, hence the final diagnosis must always take into account cellular, stromal and clinical features into account.

#### Fine needle aspiration cytology as a diagnostic procedure

The accuracy of FNAC as correlated with the histopathological diagnosis was 94.6% in our case and correlates with other studies. FNAC is a reliable procedure for preoperative examination that provides valuable information for the preoperative diagnostic work-up. It alerts the surgeon to the possible presence of malignancy, helps in definition of a surgical plan regarding resection margins, assess the need for lymph node dissection and the degree of urgency of treatment.

The sensitivity and specificity of the FNA were calculated using appropriate methods, and the results of the present study were compared with the other studies as shown in Table 4.

FNAC is a reliable examination procedure that provides valuable information for the preoperative diagnostic work-up and alerts the surgeon to the possible presence of malignancy. As the complication rate logically increases with the degree of invasiveness of the surgical procedure, it is important to be able to characterize the tumor preoperatively to correctly inform the patient about the type of surgery that will be performed, the need for lymph node dissection and the possibility of nerve sacrifice.<sup>[25,26]</sup>

**Table 4: Comparative analysis of comparison of sensitivity and specificity of fine needle aspiration cytology with other studies**

Study group	Sensitivity of FNAC (%)	Specificity of FNAC (%)
Paik <i>et al.</i> <sup>[19]</sup>	89.7	96.3
Lurie <i>et al.</i> <sup>[17]</sup>	66	100
Canan <i>et al.</i> <sup>[16]</sup>	94.3	100
Das <i>et al.</i> <sup>[21]</sup>	94.6	75
Present study	94.4	100

FNAC: Fine-needle aspiration cytology

## CONCLUSION

Major salivary gland neoplasms present with nonspecific clinical symptoms, needing a high degree of suspicion. This study reaffirms that FNAC of the major salivary gland neoplasms is a safe, quick and affordable investigative procedure. It also offers an invaluable and highly accurate initial diagnostic tool for the management of patients even in the era of the brown stain, immunohistochemistry. However, occasionally tumors like Warthin's have a tendency to undergo severe cystic degeneration leading to nondiagnostic aspirates, making histopathological diagnosis confirmatory in such cases.

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## Conflicts of interest

There are no conflicts of interest.

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