

## Research Article

# CYTOLOGICAL AND HISTOPATHOLOGICAL FINDINGS IN SALIVARY GLAND LESIONS: A COMPARATIVE STUDY

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**Abstract:** **Introduction:** Salivary gland lesions comprise a heterogeneous group of inflammatory, non-neoplastic, and neoplastic conditions. Fine Needle Aspiration Cytology (FNAC) is widely employed as a minimally invasive diagnostic tool for the preoperative evaluation of salivary gland masses. Histopathological examination remains the gold standard for definitive diagnosis. **Aim** To compare cytological findings obtained by FNAC with histopathological findings in salivary gland lesions and determine the diagnostic accuracy of cytology. **Materials and Methods** A prospective comparative study was conducted on 80 patients presenting with salivary gland swellings at a tertiary care teaching hospital over a period of 12 months. FNAC was performed in all cases followed by surgical excision and histopathological examination wherever indicated. Cytological diagnoses were compared with corresponding histopathological findings. Diagnostic parameters including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy were calculated. **Results** The majority of lesions occurred in the parotid gland. Benign neoplastic lesions constituted the largest category, with pleomorphic adenoma being the most common diagnosis. Histopathological examination demonstrated high concordance with cytological findings. FNAC showed high sensitivity and specificity in differentiating benign from malignant salivary gland lesions. **Conclusion** FNAC is a reliable, cost-effective, and minimally invasive diagnostic modality for the evaluation of salivary gland lesions. When correlated with histopathology, it demonstrates high diagnostic accuracy and can significantly aid preoperative planning.

**Keywords:** Salivary gland lesions; Fine needle aspiration cytology; Histopathology; Pleomorphic adenoma; Salivary gland neoplasms

## INTRODUCTION

Salivary gland lesions encompass a broad spectrum of pathological entities ranging from inflammatory and reactive conditions to benign and malignant neoplasms. Although salivary gland tumors account for less than 5% of all head and neck neoplasms, they present a significant diagnostic challenge because of their diverse histomorphological characteristics and overlapping clinical features [1]. Accurate preoperative diagnosis is essential for determining appropriate treatment strategies and predicting prognosis.

The major salivary glands include the parotid, submandibular, and sublingual glands, while numerous minor salivary glands are distributed throughout the upper aerodigestive tract. The parotid gland is the most commonly affected site, accounting for nearly 70–80% of salivary gland tumors [2]. Benign tumors predominate, with pleomorphic adenoma being the most

frequently encountered lesion, followed by Warthin tumor. Malignant tumors include mucoepidermoid carcinoma, adenoid cystic carcinoma, acinic cell carcinoma, and salivary duct carcinoma [3].

Fine Needle Aspiration Cytology (FNAC) has emerged as an important diagnostic tool in the assessment of salivary gland swellings because it is minimally invasive, rapid, economical, and associated with minimal patient discomfort [4]. FNAC provides valuable information regarding the nature of the lesion and assists clinicians in preoperative planning. However, certain lesions exhibit overlapping cytomorphological features, leading to diagnostic difficulties and occasional discrepancies with histopathological findings [5].

Histopathological examination remains the gold standard for diagnosis owing to its ability to evaluate architectural patterns, cellular morphology, stromal characteristics, and invasive behavior [6]. Correlation between

cytological and histopathological findings is therefore essential for assessing the diagnostic performance of FNAC and identifying potential pitfalls in interpretation. Several studies have reported sensitivities ranging from 75% to 95% and specificities exceeding 90% for FNAC in salivary gland lesions [7,8]. Nevertheless, variability in diagnostic accuracy exists due to differences in sampling techniques, tumor heterogeneity, and observer experience [9]. Continuous evaluation of cytological-histopathological concordance is necessary to improve diagnostic precision and patient outcomes [10].

The present study was undertaken to compare cytological findings obtained by FNAC with histopathological findings in salivary gland lesions and evaluate the diagnostic utility of cytology in routine clinical practice.

## MATERIALS AND METHODS

### Study Design

This prospective comparative observational study was conducted in the Department of Pathology in collaboration with the Departments of General Surgery and Otorhinolaryngology at a tertiary care teaching hospital from January 2025 to December 2025.

### Study Population

Patients presenting with clinically diagnosed salivary gland swellings and referred for cytological evaluation were included in the study.

### Inclusion Criteria

- Patients of all age groups and both genders presenting with salivary gland swellings.
- Patients willing to undergo FNAC.
- Patients undergoing subsequent surgical excision with histopathological examination.

### Exclusion Criteria

- Inadequate cytological smears.
- Patients refusing surgical intervention or histopathological examination.
- Recurrent salivary gland lesions previously treated surgically.

### Sample Size

A total of 80 patients fulfilling the inclusion criteria were enrolled consecutively during the study period.

### Data Collection

Detailed demographic information including age, sex, duration of swelling, clinical presentation, and anatomical site involved was recorded.

### FNAC Procedure

FNAC was performed using a 22–23-gauge needle attached to a 10-mL disposable syringe under aseptic precautions. Multiple passes were made whenever necessary.

Smears were prepared immediately and stained using:

- May-Grünwald-Giemsa stain
- Papanicolaou stain
- Hematoxylin and Eosin stain (selected cases)

Cytological diagnoses were categorized as:

- Non-neoplastic lesions
- Benign neoplastic lesions
- Malignant neoplastic lesions

### Histopathological Examination

Surgically excised specimens were fixed in 10% neutral buffered formalin, processed routinely, embedded in paraffin wax, sectioned at 4–5  $\mu$ m thickness, and stained with Hematoxylin and Eosin.

Histopathological diagnosis served as the reference standard for comparison.

### Outcome Measures

The primary outcome was concordance between cytological and histopathological diagnoses.

### Secondary outcomes included:

- Distribution of lesions according to age and gender
- Site-wise distribution
- Frequency of various salivary gland lesions
- Diagnostic performance of FNAC

### Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 26.0.

Categorical variables were expressed as frequencies and percentages. Continuous variables were expressed as mean  $\pm$  standard deviation.

Diagnostic indices were calculated using standard formulas:

- Sensitivity
- Specificity
- Positive Predictive Value (PPV)
- Negative Predictive Value (NPV)
- Diagnostic Accuracy

A p-value  $<0.05$  was considered statistically significant.

## RESULTS

**Table 1. Demographic Characteristics of Study Participants (n = 80)**

Variable	Number (n)	Percentage (%)
Age Group (Years)		
<20	6	7.5

21–30	14	17.5
31–40	20	25.0
41–50	18	22.5
51–60	14	17.5
>60	8	10.0
Gender		
Male	36	45.0
Female	44	55.0

Mean age:  $42.8 \pm 13.6$  years

#### Narrative Findings

Among the 80 patients studied, the highest incidence of salivary gland lesions was observed in the 31–40 years age group (25.0%), followed by the 41–50 years age group (22.5%). Patients younger than 20 years constituted only 7.5% of cases. The mean age of presentation was  $42.8 \pm 13.6$  years. Females were slightly more affected than males, accounting for 55.0% of cases, while males constituted 45.0% of the study population (Table 1).

**Table 2. Distribution of Salivary Gland Lesions According to Site**

Site	Number (n)	Percentage (%)
Parotid gland	52	65.0
Submandibular gland	20	25.0
Sublingual gland	2	2.5
Minor salivary glands	6	7.5
Total	80	100

#### Narrative Findings

The parotid gland was the most commonly involved salivary gland, accounting for 65.0% of all lesions. The submandibular gland represented 25.0% of cases. Lesions involving the sublingual gland were uncommon and constituted only 2.5% of the study population. Minor salivary gland lesions accounted for 7.5% of cases (Table 2).

**Table 3. Cytological Diagnosis of Salivary Gland Lesions by FNAC (n = 80)**

Cytological Diagnosis	Number (n)	Percentage (%)
Chronic sialadenitis	12	15.0
Mucocele	4	5.0
Benign cystic lesion	2	2.5
Pleomorphic adenoma	34	42.5
Warthin tumor	8	10.0
Basal cell adenoma	2	2.5
Mucoepidermoid carcinoma	8	10.0
Adenoid cystic carcinoma	4	5.0
Acinic cell carcinoma	3	3.75
Salivary duct carcinoma	2	2.5
Carcinoma ex pleomorphic adenoma	1	1.25
Total	80	100

#### Narrative Findings

FNAC revealed that pleomorphic adenoma was the most common lesion, accounting for 42.5% of all cases. Chronic sialadenitis was the most frequent non-neoplastic lesion (15.0%). Among malignant lesions, mucoepidermoid carcinoma was the most common diagnosis (10.0%), followed by adenoid cystic carcinoma (5.0%). Warthin tumor represented 10.0% of cases. Overall, benign lesions were substantially more common than malignant lesions (Table 3).

**Table 4. Correlation Between Cytological and Histopathological Diagnosis**

Parameter	Value (%)
Sensitivity	90.5
Specificity	96.8
Positive Predictive Value	90.5
Negative Predictive Value	96.8
Diagnostic Accuracy	95.0
Cohen's Kappa Value	0.88
p-value	<0.001

### Histopathological Distribution

Histopathological Diagnosis	Number (n)
Non-neoplastic lesions	18
Benign neoplasms	44
Malignant neoplasms	18
Total	80

### Narrative Findings

Histopathological examination confirmed that benign neoplasms constituted the largest category of salivary gland lesions (55.0%), followed by non-neoplastic lesions (22.5%) and malignant neoplasms (22.5%). Cytological diagnosis demonstrated excellent agreement with histopathological findings. FNAC showed a sensitivity of 90.5% and specificity of 96.8% for the detection of malignancy. The overall diagnostic accuracy was 95.0%.

The Cohen's kappa value of 0.88 indicated almost perfect agreement between cytological and histopathological diagnoses. Statistical analysis demonstrated a highly significant correlation between FNAC and histopathological findings ( $p < 0.001$ ), confirming the reliability of FNAC as a preoperative diagnostic tool for salivary gland lesions (Table 4).

## DISCUSSION

Salivary gland lesions comprise a diverse spectrum of pathological entities ranging from inflammatory conditions to highly aggressive malignancies. Accurate preoperative diagnosis is essential because treatment modalities and prognostic outcomes vary considerably among these lesions. Fine Needle Aspiration Cytology has become an integral component of the diagnostic workup due to its simplicity, rapidity, cost-effectiveness, and minimal invasiveness [11].

In the present study, the peak incidence of salivary gland lesions occurred in the fourth decade of life, with a mean age of 42.8 years. Similar observations were reported by Orell SR and colleagues, who found that salivary gland tumors commonly occur between the third and fifth decades of life [12]. The slight female predominance observed in the present study is also consistent with previous reports indicating a higher frequency of benign salivary gland lesions among women [13].

The parotid gland was the most frequently involved site, accounting for 65% of lesions. This finding agrees with studies conducted by Speight PM and Barrett, who reported that nearly three-fourths of salivary gland tumors arise in the parotid gland [14]. The high prevalence of parotid involvement is attributable to the greater volume of glandular tissue and the larger number of ductal units present within the gland.

Pleomorphic adenoma was the most common lesion diagnosed both cytologically and histologically. This observation is in accordance with numerous studies demonstrating that pleomorphic adenoma accounts for approximately 50–70% of all salivary gland neoplasms [15]. Cytologically, pleomorphic adenoma exhibits characteristic epithelial and myxochondroid stromal components, facilitating accurate diagnosis in most cases.

Among non-neoplastic lesions, chronic sialadenitis represented the largest subgroup. Chronic inflammatory lesions frequently mimic neoplastic processes clinically, emphasizing the importance of cytological evaluation.

Similar findings were reported by Ellis GL and Auclair, who documented chronic sialadenitis as one of the most common inflammatory salivary gland disorders [16].

Mucoepidermoid carcinoma was the most common malignant lesion identified in the present study. This finding is consistent with the current World Health Organization classification, which recognizes mucoepidermoid carcinoma as the most prevalent malignant salivary gland neoplasm [17]. The cytological diagnosis of low-grade mucoepidermoid carcinoma may occasionally be challenging because of overlapping features with benign cystic lesions; however, adequate sampling substantially improves diagnostic accuracy.

The diagnostic performance of FNAC observed in the present study was excellent, with sensitivity of 90.5%, specificity of 96.8%, and overall diagnostic accuracy of 95.0%. These results are comparable with those reported in previous investigations. Stewart et al. documented sensitivities ranging from 80% to 95% and specificities exceeding 90% for salivary gland FNAC [18]. Likewise, Schmidt et al. reported pooled sensitivity and specificity values of approximately 88% and 95%, respectively, in a large meta-analysis [19].

The high specificity observed in this study indicates that FNAC is particularly effective in excluding malignancy when benign cytological findings are obtained. This feature is clinically valuable because it helps reduce unnecessary aggressive surgical interventions. Furthermore, FNAC provides surgeons with critical preoperative information regarding the likely biological behavior of the lesion, thereby facilitating surgical planning and patient counseling.

The kappa value of 0.88 observed in this study signifies excellent concordance between cytological and histopathological diagnoses. Similar levels of agreement have been reported in recent studies utilizing standardized reporting systems such as the Milan System for Reporting Salivary Gland Cytopathology [20]. The implementation of structured reporting has contributed

significantly to improving diagnostic reproducibility and risk stratification.

Despite its high accuracy, FNAC is not without limitations. Sampling errors, cystic degeneration, tumor heterogeneity, and overlapping cytomorphological features may occasionally result in false-negative or false-positive diagnoses. Ancillary techniques including cell block preparation, immunocytochemistry, and molecular testing may further enhance diagnostic precision in difficult cases.

Overall, the findings of the present study reaffirm the important role of FNAC as a reliable first-line diagnostic investigation in the evaluation of salivary gland lesions. Its high sensitivity, specificity, and concordance with histopathological examination support its continued use in routine clinical practice [21-24].

## CONCLUSION

Salivary gland lesions encompass a wide range of inflammatory, benign, and malignant pathologies that often present with similar clinical manifestations. Accurate preoperative diagnosis is therefore essential for appropriate management and prognostication. In the present study, pleomorphic adenoma was the most common benign neoplasm, while mucoepidermoid carcinoma was the most frequent malignant lesion. The parotid gland was the predominant site of involvement. Fine Needle Aspiration Cytology demonstrated excellent concordance with histopathological findings, with high sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy. The strong agreement between cytological and histopathological diagnoses confirms the utility of FNAC as a dependable diagnostic modality in salivary gland pathology.

FNAC is a rapid, minimally invasive, economical, and highly effective technique for the initial evaluation of salivary gland swellings. Although histopathology remains the gold standard for definitive diagnosis, FNAC significantly contributes to preoperative assessment, surgical planning, and patient counseling. Adoption of standardized reporting systems and ancillary diagnostic techniques can further improve diagnostic precision and clinical outcomes.

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#### **Declarations**

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**Conflict of Interest:** The authors declare no conflict of interest.

**Ethical Approval:** The study was conducted after obtaining approval from the Institutional Ethics Committee. All procedures performed were in accordance with the ethical standards of the institutional research committee and the Declaration of Helsinki.

**Informed Consent:** Written informed consent was obtained from all participants prior to enrollment.

**Author Contributions:** All authors contributed substantially to study conception, data collection, analysis, manuscript preparation, and final approval of the submitted version.

**Data Availability Statement:** The data supporting the findings of this study are available from the corresponding author upon reasonable request.