



Original Article

Diagnostic Utility of FNAC in Salivary Gland Lesions: A Cytohistopathological Correlation Study

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ABSTRACT

Background: Salivary gland lesions comprise a heterogeneous group of inflammatory, cystic, benign, and malignant conditions that often present as palpable glandular swellings. Accurate preoperative diagnosis is essential for appropriate clinical management. Fine Needle Aspiration Cytology (FNAC) is a minimally invasive and cost-effective diagnostic technique widely used for the evaluation of salivary gland lesions. The present study was undertaken to assess the diagnostic utility of FNAC through cytohistopathological correlation.

Materials and Methods: This hospital-based observational study was conducted in the Department of Pathology of a tertiary care teaching hospital over a period of six months. A total of 80 patients with salivary gland lesions who underwent both FNAC and subsequent surgical excision were included in the study. Cytological diagnoses were compared with histopathological findings, which served as the gold standard. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy of FNAC were calculated.

Results: The study included 80 cases with a mean age of 43.2 ± 15.4 years. Females constituted 57.5% of the study population. The parotid gland was the most commonly involved site (72.5%). Histopathological examination revealed 52 (65.0%) benign neoplasms, 12 (15.0%) malignant neoplasms, and 16 (20.0%) non-neoplastic lesions. Pleomorphic adenoma was the most common benign lesion (43.8%), while mucoepidermoid carcinoma was the most frequent malignant tumor (6.3%). Cytohistopathological concordance was observed in 75 of 80 cases, yielding a concordance rate of 93.8%. FNAC demonstrated a sensitivity of 91.7%, specificity of 97.1%, positive predictive value of 84.6%, negative predictive value of 98.5%, and overall diagnostic accuracy of 96.3%.

Conclusion: FNAC is a reliable, safe, and highly accurate diagnostic tool for the preoperative evaluation of salivary gland lesions. The high sensitivity, specificity, and diagnostic accuracy observed in the present study support its continued use as a first-line investigation in patients presenting with salivary gland swellings.

Keywords: Salivary gland lesions; Fine Needle Aspiration Cytology;; Cytohistopathological correlation; Pleomorphic adenoma; Mucoepidermoid carcinoma.

INTRODUCTION

Salivary gland lesions constitute a heterogeneous group of disorders that include inflammatory, reactive, cystic, benign neoplastic, and malignant neoplastic conditions. Although salivary gland tumors account for only 3–6% of all head and neck neoplasms, they exhibit considerable morphological diversity and often present diagnostic challenges. These lesions may arise in the major salivary glands (parotid, submandibular, and sublingual glands) or in the minor salivary glands distributed throughout the oral cavity and upper aerodigestive tract. Accurate preoperative diagnosis is essential because treatment and prognosis vary significantly among different salivary gland pathologies.^{1,2}

The parotid gland is the most common site of salivary gland tumors, accounting for nearly 70–80% of cases. Most parotid tumors are benign, whereas lesions arising in the submandibular, sublingual, and minor salivary glands have a relatively higher risk of malignancy. Pleomorphic adenoma is the most frequently encountered benign tumor, while mucoepidermoid carcinoma and adenoid cystic carcinoma are among the common malignant neoplasms. Owing to the wide histological spectrum of salivary gland lesions, reliable preoperative diagnostic methods are required for appropriate clinical management.^{3,4}

Clinical examination and imaging techniques help in assessing the location and extent of salivary gland lesions; however, they often cannot reliably distinguish benign from malignant conditions. Histopathological examination remains the gold standard for definitive diagnosis, but it is available only after surgical excision or biopsy. Therefore, minimally invasive diagnostic procedures that provide accurate preoperative information are of great clinical value.⁵

Fine Needle Aspiration Cytology (FNAC) is a simple, rapid, safe, and cost-effective diagnostic technique widely used in the evaluation of salivary gland swellings. It can be performed on an outpatient basis with minimal discomfort to the patient and provides valuable information regarding the nature of the lesion. FNAC assists in differentiating non-neoplastic from neoplastic lesions and helps identify malignant tumors before surgery, thereby facilitating appropriate treatment planning.^{6,7}

Despite its advantages, FNAC has certain limitations due to overlapping cytological features, sampling errors, cystic changes, and the diverse morphology of salivary gland tumors. Consequently, correlation of cytological findings with histopathological examination is necessary to evaluate its diagnostic performance. Several studies have reported high sensitivity, specificity, and overall diagnostic accuracy of FNAC in salivary gland lesions, supporting its role as an effective preoperative diagnostic tool.^{8–10}

The present study was undertaken to assess the diagnostic utility of FNAC in salivary gland lesions by correlating cytological findings with histopathological diagnoses and determining its sensitivity, specificity, predictive values, and overall diagnostic accuracy.

MATERIALS AND METHODS:

Study Design and Setting

This hospital-based observational study was conducted in the Department of Pathology at Fatima Institute of Medical Sciences, Kadapa, Andhra Pradesh over a period of six months after obtaining approval from the Institutional Ethics Committee.

Study Population

The study included patients presenting with clinically or radiologically diagnosed salivary gland swellings who underwent FNAC followed by surgical excision and histopathological examination. Consecutive eligible patients fulfilling the inclusion criteria during the study period were enrolled.

Sample Size

A total of 80 cases of salivary gland lesions with both cytological and histopathological diagnoses were included in the study.

Inclusion Criteria

- Patients of all age groups and both sexes presenting with salivary gland swellings.
- Patients who underwent FNAC followed by surgical excision.
- Cases with adequate cytological material and available histopathological specimens.
- Patients willing to participate in the study.

Exclusion Criteria

- Inadequate or unsatisfactory FNAC smears.
- Patients who did not undergo surgical excision or histopathological examination.
- Recurrent lesions without histopathological confirmation.
- Poorly preserved cytological or histopathological specimens.

Data Collection

Demographic and clinical details including age, sex, duration of swelling, site of involvement, clinical diagnosis, and radiological findings were obtained from medical records and requisition forms. The anatomical site of the lesion and relevant clinical history were documented for each case.

Fine Needle Aspiration Cytology Procedure

FNAC was performed under strict aseptic precautions using a 22–23 gauge disposable needle attached to a 10 mL syringe. The lesion was immobilized and aspirated using negative pressure. In cystic lesions, fluid contents were aspirated completely and residual solid areas were sampled whenever feasible.

The aspirated material was expelled onto clean glass slides. Smears were prepared immediately and fixed in 95% ethanol. The smears were stained using the Papanicolaou (Pap) staining method and examined microscopically by experienced pathologists for cytomorphological evaluation.

The smears were examined microscopically by experienced pathologists. Cytological diagnoses were categorized into:

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

Whenever applicable, lesions were also classified according to the Milan System for Reporting Salivary Gland Cytopathology.

Histopathological Examination

Following surgical excision, specimens were received in 10% neutral buffered formalin and subjected to routine gross examination. Representative tissue sections were processed by standard paraffin embedding techniques. Sections of 4–5 μm thickness were prepared and stained with Hematoxylin and Eosin (H&E) for histopathological evaluation. Histopathological diagnosis was established based on morphological criteria and was considered the gold standard for final diagnosis.

Cytohistopathological Correlation

The cytological diagnosis obtained by FNAC was compared with the corresponding histopathological diagnosis. Cases were categorized as:

- Concordant cases: Cytological diagnosis matched histopathological diagnosis.
- Discordant cases: Cytological diagnosis differed from histopathological diagnosis.

The degree of agreement between FNAC and histopathology was assessed.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software version 23.0.

Categorical variables were expressed as frequencies and percentages, whereas continuous variables were expressed as mean \pm standard deviation. Cytohistopathological agreement was evaluated using the Chi-square test. Diagnostic indices including sensitivity, specificity, PPV, NPV, and accuracy were calculated using standard formulas with histopathological diagnosis as the reference standard.

A p-value of less than 0.05 was considered statistically significant.

RESULTS:

A total of **80 cases** of salivary gland lesions with available cytological and histopathological diagnoses were included in the study. The patients ranged in age from 12 to 78 years, with a mean age of 43.2 ± 15.4 years. The highest number of cases was observed in the 21–40 years age group (40.0%), followed by the 41–60 years age group (35.0%). (Table 1)

Table 1. Age Distribution of Study Participants

Age Group (Years)	Number (n=80)	Percentage (%)
≤ 20	6	7.5
21–40	32	40.0
41–60	28	35.0
>60	14	17.5

There were 46 females (57.5%) and 34 males (42.5%), with a male-to-female ratio of 1:1.35. (Table 2)

Table 2. Gender Distribution

Gender	Number	Percentage (%)
Male	34	42.5
Female	46	57.5

The parotid gland was the most commonly affected site, accounting for 72.5% of cases, followed by the submandibular gland (22.5%) and minor salivary glands (5.0%). (Table 3)

Table 3. Site Distribution of Salivary Gland Lesions

Site	Number	Percentage (%)
Parotid gland	58	72.5
Submandibular gland	18	22.5
Minor salivary glands	4	5.0

Among the 80 cases evaluated by FNAC, benign neoplasms constituted the largest category (63.8%), followed by non-neoplastic lesions (21.2%) and malignant neoplasms (15.0%). (Table 4)

Table 4. Cytological Spectrum of Salivary Gland Lesions

Cytological Diagnosis	Number	Percentage (%)
Chronic sialadenitis	10	12.5
Benign cystic lesion	7	8.7
Pleomorphic adenoma	34	42.5
Warthin tumor	17	21.3
Mucoepidermoid carcinoma	5	6.3
Adenoid cystic carcinoma	4	5.0
Acinic cell carcinoma	3	3.7
Total	80	100

Histopathological examination revealed that 52 cases (65.0%) were benign neoplasms, 12 cases (15.0%) were malignant neoplasms, and 16 cases (20.0%) were non-neoplastic lesions. Pleomorphic adenoma was the most common lesion, accounting for 43.8% of all cases, followed by Warthin tumor (21.2%). (Table 5)

Table 5. Histopathological Spectrum of Salivary Gland Lesions

Histopathological Diagnosis	Number	Percentage (%)
Chronic sialadenitis	10	12.5
Benign cystic lesion	6	7.5
Pleomorphic adenoma	35	43.8
Warthin tumor	17	21.2
Mucoepidermoid carcinoma	5	6.3
Adenoid cystic carcinoma	4	5.0
Acinic cell carcinoma	3	3.7
Total	80	100

Of the 80 cases studied, cytological findings were concordant with histopathological diagnosis in 75 cases (93.8%), while discordance was observed in 5 cases (6.2%). (Table 6)

Table 6. Cytohistopathological Correlation

Correlation Status	Number	Percentage (%)
Concordant	75	93.8
Discordant	5	6.2
Total	80	100

For statistical evaluation, histopathology was considered the gold standard. FNAC correctly identified 11 of the 12 malignant lesions and accurately categorized 66 of the 68 non-malignant lesions. (Table 7)

Table 7. Diagnostic Validity of FNAC for Detection of Malignancy

FNAC Diagnosis	Histopathological Malignant	Histopathological Benign/Non-neoplastic	Total
Malignant	11	2	13
Benign/Non-neoplastic	1	66	67
Total	12	68	80

Based on the above findings:

- **Sensitivity:** 91.7%
- **Specificity:** 97.1%
- **Positive Predictive Value (PPV):** 84.6%
- **Negative Predictive Value (NPV):** 98.5%
- **Overall Diagnostic Accuracy:** 96.3%

Table 8. Diagnostic Indices of FNAC

Parameter	Value (%)
Sensitivity	91.7
Specificity	97.1
Positive Predictive Value	84.6
Negative Predictive Value	98.5
Diagnostic Accuracy	96.3

A statistically significant agreement was observed between FNAC and histopathological diagnosis (Chi-square = 58.42, $p < 0.001$), indicating excellent diagnostic concordance. (Table 9)

Table 9. Agreement Between FNAC and Histopathology

Variable	Value
Chi-square (χ^2)	58.42
Degrees of freedom	1
p-value	<0.001

DISCUSSION:

The present study was undertaken to evaluate the diagnostic utility of Fine Needle Aspiration Cytology (FNAC) in salivary gland lesions by correlating cytological findings with histopathological examination. FNAC is widely accepted as a reliable preoperative diagnostic tool because it is minimally invasive, rapid, economical, and associated with minimal patient discomfort. The findings of the present study demonstrated excellent cytohistopathological correlation and high diagnostic accuracy, reaffirming the usefulness of FNAC in routine clinical practice.

In the present study, the majority of patients belonged to the 21–40 years age group, with a mean age of 43.2 ± 15.4 years. Similar age distributions have been reported by Rohilla et al.¹¹ and Jain et al.¹², who observed that salivary gland lesions commonly occur during the third to fifth decades of life. The predominance of lesions in middle-aged individuals may be attributed to the higher incidence of benign salivary gland tumors in this age group.

A slight female predominance was observed in the present study, with females accounting for 57.5% of cases. Comparable observations have been reported by Kumar et al.¹³ and Gupta et al.¹⁴, who found a higher frequency of salivary gland lesions among female patients. However, gender distribution varies among studies depending on the geographic region and lesion subtype.

The parotid gland was the most frequently involved site, accounting for 72.5% of all lesions. This finding is in accordance with studies by Rohilla et al.¹¹ and Song et al.¹⁵, which reported that the parotid gland is the predominant site of salivary gland pathology. The larger size of the parotid gland and the greater amount of glandular tissue may contribute to its higher susceptibility to both benign and malignant lesions.

Histopathological evaluation revealed that benign neoplasms constituted the majority of cases. Pleomorphic adenoma was the most common lesion, representing 43.8% of all cases. Similar findings have been reported in numerous studies where pleomorphic adenoma accounted for approximately 40–60% of salivary gland tumors.^{11,16} The high prevalence of pleomorphic adenoma can be attributed to its origin from both epithelial and myoepithelial components, making it the most common salivary gland neoplasm worldwide.

Warthin tumor was the second most common benign lesion encountered in the present study. This observation is comparable with findings reported by Griffith et al.¹⁷ and Rossi et al.¹⁸. The characteristic cytological features of Warthin tumor, including oncocytic epithelial cells, abundant lymphoid background, and cystic degeneration, usually permit accurate cytological diagnosis.

Among malignant lesions, mucoepidermoid carcinoma was the most common malignancy identified, followed by adenoid cystic carcinoma and acinic cell carcinoma. Similar patterns have been described in previous studies and are consistent with the current WHO classification of salivary gland tumors.^{19,20} The recognition of malignant salivary gland tumors on FNAC is particularly important because it influences the extent of surgery and postoperative management.

A concordance rate of 93.8% between cytological and histopathological diagnoses was observed in the present study. This high level of agreement is comparable to that reported by Rohilla et al.¹¹ and Layfield et al.²¹, who documented concordance rates ranging from 85% to 96%. The high concordance observed emphasizes the reliability of FNAC as a preoperative diagnostic modality.

The sensitivity and specificity of FNAC for detecting malignancy were 91.7% and 97.1%, respectively. These findings are comparable to those reported in a meta-analysis by Schmidt et al.²², which demonstrated sensitivity values ranging from 80% to 95% and specificity values exceeding 90% in most studies. The high specificity observed in the present study indicates that FNAC is particularly effective in excluding malignancy and preventing overtreatment of benign lesions.

The positive predictive value (84.6%) and negative predictive value (98.5%) obtained in the present study further support the diagnostic reliability of FNAC. The high negative predictive value suggests that lesions diagnosed as benign on cytology are highly unlikely to be malignant on histopathological examination. Similar findings have been reported by Song et al.¹⁵ and Griffith et al.¹⁷.

The introduction of the Milan System for Reporting Salivary Gland Cytopathology has significantly improved the standardization of reporting and communication between pathologists and clinicians. Studies by Rossi et al.¹⁸ and Faquin et al.²³ have demonstrated that the Milan System improves risk stratification and facilitates more accurate prediction of malignancy risk within individual diagnostic categories. The application of this system can further enhance the clinical utility of FNAC.

CONCLUSION:

The present study demonstrates that Fine Needle Aspiration Cytology (FNAC) is a reliable and effective diagnostic tool for the evaluation of salivary gland lesions. FNAC showed high sensitivity, specificity, and diagnostic accuracy, with excellent agreement between cytological and histopathological diagnoses. Pleomorphic adenoma was the most common benign lesion, while mucoepidermoid carcinoma was the most frequent malignant tumor. Despite occasional diagnostic limitations, FNAC remains a simple, rapid, minimally invasive, and cost-effective procedure that plays an important role in the preoperative assessment and management of salivary gland swellings.

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