

Original Research Article

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Diagnostic concordance between FNAC and histopathology in salivary gland lesions: a retrospective analysis

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ABSTRACT

Background: Cytological diagnosis of salivary gland lesions is often difficult due to the wide morphological diversity of these tumors, the continual addition of new entities in WHO classifications, and the striking heterogeneity within individual tumors. Moreover, the significant overlap in cytological features between benign and malignant lesions makes accurate distinction and definitive diagnosis particularly challenging.

Methods: This was a retrospective observational study conducted in the Department of Pathology, Uttar Pradesh University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India. A total 136 Cytology cases and 66 Histopathology cases were retrieved from the Lab Information System and hospital record which were received between July 2022 to June 2026. FNAC and Histopathology slides were reviewed by two pathologists at different time and their diagnoses were correlated and final decision was made by their common consensus.

Result: The findings highlight that salivary gland lesions were most common among young and middle-aged adults, particularly between 20 and 40 years. Submandibular gland was the most frequently involved site and Pleomorphic Adenoma was the most common benign tumour. There were nine discrepant cases between FNAC and histopathology diagnoses highlights the diagnostic challenges in salivary gland lesions.

Conclusion: FNAC continues to serve as a reliable, minimally invasive diagnostic method for salivary gland lesions, showing strong concordance with histopathology in common benign and inflammatory conditions. Nonetheless, discrepancies highlight its limitations in identifying specific tumour subtypes and malignant lesions.

Keywords: FNAC, Histopathology, Salivary gland lesion, Pleomorphic adenoma

INTRODUCTION

Diagnosing salivary gland lesions using cytological methods remains a formidable challenge in modern pathology. This complexity arises from the broad morphological spectrum of salivary gland tumors, the ongoing inclusion of newly recognized entities in successive editions of the World Health Organization (WHO) tumor classification, and the marked intratumoral heterogeneity often observed.^{1,2} Additionally, the considerable cytological overlap between benign and

malignant lesions frequently hampers precise differentiation and definitive diagnosis.³

Fine-needle aspiration cytology (FNAC) has become a widely adopted initial diagnostic approach for evaluating salivary gland swellings, owing to its minimally invasive nature, safety, and cost-effectiveness. It plays a crucial role in the preoperative distinction between benign and malignant conditions and can offer an early indication of tumor subtype.^{4,5} This is particularly beneficial in preventing unwarranted surgical procedures for non-

neoplastic or benign lesions, especially in elderly patients or those with significant comorbidities.⁶ Numerous studies have demonstrated high diagnostic performance for FNAC, with reported sensitivity ranging from 87% to 100% and specificity between 92.8% and 93.9%.⁷⁻⁹ However, the reliability of FNAC is heavily dependent on the adequacy of the sampled material and the diagnostic expertise of the cytopathologist.¹⁰

Despite its advantages, FNAC is not without shortcomings. Sampling errors, particularly in cystic lesions like Warthin's tumor and low-grade mucoepidermoid carcinoma, can result in false-negative findings.¹¹ Moreover, interpretative difficulties such as mistaking reactive or metaplastic alterations for malignant features can lead to both false-positive and false-negative diagnoses.¹² These challenges highlight the pressing need for a more systematic and standardized reporting framework in salivary gland cytopathology.

METHODS

This was a retrospective observational study conducted in the Department of Pathology, Uttar Pradesh University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India. Our study was approved by the University Ethics committee with the decision dated 09/05/2026 and numbered IEC/14.22/2026. A total 136 salivary gland cytology cases were received during July 2022 to June 2026. Their histopathology diagnoses were retrieved retrospectively from the laboratory data. A total 66 histopathology cases were identified out of 136 cases. Demographic details of the patients like age, gender, and localization of the lesion were recorded from the Hospital Information System and patient case file. FNAC and histopathological diagnoses were compared. If available IHC details of the cases were also be recorded from the laboratory information system. FNAC and Histopathology slides were reviewed by two pathologists at different time and their diagnoses were correlated and final decision was made by their common consensus.

RESULTS

The gender distribution shows 81 male cases and 55 female cases, giving a male-to-female ratio of approximately 1.47:1. The pie chart illustrates this clearly, with males comprising 59.6% and females 40.4% of the total 136 cases (Figure 1).

The analysis of age-wise distribution across 136 cases shows that salivary gland lesions were most frequently encountered in the 30–40 years group, with 29 cases, followed closely by the 20–30 years group, which had 26 cases. Both the <20 years and 40–50 years categories recorded 22 cases each. The 50–60 years group accounted for 19 cases, while the lowest number was observed in patients above 60 years, with 18 cases. Overall, the findings highlight that salivary gland lesions were most

common among young and middle-aged adults, particularly between 20 and 40 years, whereas older age groups showed relatively fewer cases (Table 1),

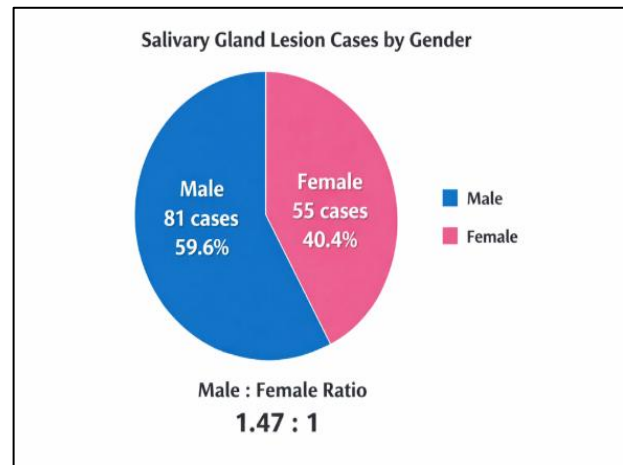


Figure 1: Gender distribution of cases.

Table 1: Distribution of cases according to age group.

Age group (years)	Number of cases
<20	22
20–30	26
30–40	29
40–50	22
50–60	19
> 60	18
Total	136

Table 2: Distribution of cases according to site.

Sites	Number of cases
Submandibular gland	53
Parotid gland	43
Infra-auricular region	15
Pre-auricular region	13
Angle of Mandible region	04
Cheek (Buccal mucosa)	03
Hard palate	02
Lip	02
Buccal Mucosa	01
Total	136

The submandibular gland was the most frequently involved site, accounting for 53 cases, followed by the parotid gland with 43 cases. Other regions included the infra-auricular region (15 cases), the preauricular region (13 cases), and the angle of mandible (4 cases). Less common sites were the cheek/buccal mucosa (3 cases), hard palate (2 cases), lip (2 cases), and a single case from the buccal mucosa. Overall, the findings highlight the predominance of submandibular and parotid gland involvement, which together accounted for the majority of cases, while lesions in intraoral sites such as the palate, lip, and buccal mucosa were relatively rare (Table 2).

The cytological diagnoses of salivary gland lesions in the dataset reveal a total of 136 cases, with pleomorphic adenoma being the most common diagnosis, accounting for 53 cases (Figure 2). Among the inflammatory conditions, chronic sialadenitis was predominant with 30 cases, followed by acute sialadenitis (6 cases) and a single case of lymphoepithelial sialadenitis. Non-neoplastic lesions such as sialadenosis (7 cases) and mucus retention cyst (12 cases) were also observed. Malignant neoplasms included mucoepidermoid carcinoma (13 cases, both low

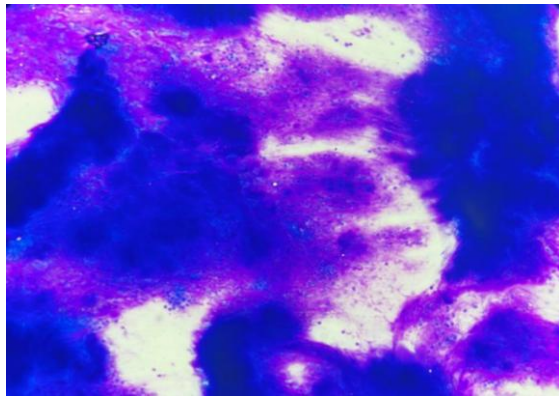


Figure 2: Pleomorphic adenoma shows abundant chondromyxoid stroma and fibrillary background (MGG 400X).

The analysis of histopathological findings across 66 salivary gland cases shows that pleomorphic adenoma was the most prevalent lesion, identified in 32 cases. Non-neoplastic conditions such as mucus retention cyst (11 cases) and chronic sialadenitis (10 cases) were also frequently observed. Less common benign entities included Warthin tumour (2 cases), along with single instances of intercalated duct adenoma, nodular oncocytic hyperplasia, and oncocytic sialolipoma. Malignant lesions

and high grade), acinic cell carcinoma (4 cases), adenoid cystic carcinoma (2 cases), adenocarcinoma (1 case), and salivary duct carcinoma (1 case) (Figure 3). Rare benign lesions such as lipoma, Kuttner tumour, and basal cell adenoma were each reported in a single case. Overall, the data highlights pleomorphic adenoma as the most frequent diagnosis, followed by chronic sialadenitis, underscoring the predominance of benign and inflammatory conditions in salivary gland cytology (Table 3).

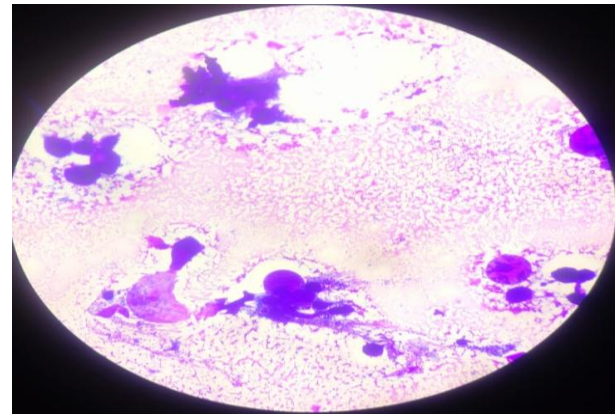


Figure 3: Adenoid cystic carcinoma shows hyaline globules (MGG 100X).

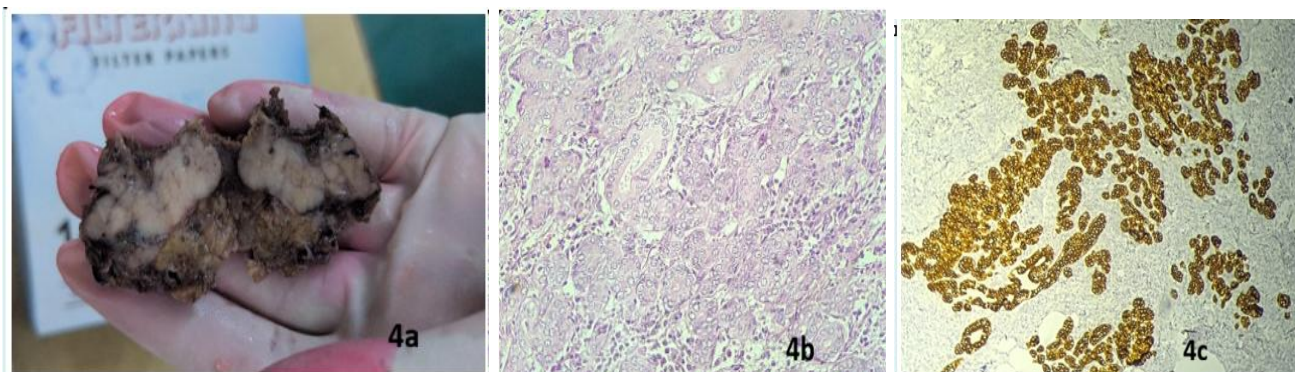
were comparatively fewer, with mucoepidermoid carcinoma reported in 5 cases, and single cases of adenoid cystic carcinoma, salivary duct carcinoma, and metastatic squamous cell carcinoma. Overall, pleomorphic adenoma dominated the histopathological spectrum, while malignant diagnoses, though less frequent, highlight the importance of careful evaluation in salivary gland pathology (Table 4).

Table 3: Distribution of cases according to cytology diagnoses.

Cytology diagnoses	Number of cases
Sialadenosis	07
Acute sialadenitis	06
Chronic sialadenitis	30
Lymphoepithelial sialadenitis	01
Mucus retention cyst	12
Lipoma	01
Pleomorphic adenoma (PA)	53
Kuttner tumour	01
Basal cell adenoma	01
Mucoepidermoid carcinoma (MEC) – low grade	05
Mucoepidermoid carcinoma (MEC) – high grade	08
Acinic cell carcinoma	04
Adenoid cystic carcinoma	02
Adenocarcinoma	01
Salivary gland neoplasm (unspecified)	03
Salivary duct carcinoma	01
Total	136

Table 4: Distribution of cases according to histopathology diagnoses.

Histopathology diagnosis	Number of cases
Mucus retention cyst	11
Chronic sialadenitis	10
Pleomorphic adenoma	32
Warthin tumour	02
Intercalated duct adenoma	01
Nodular oncocytic hyperplasia	01
Oncocytic sialolipoma	01
Mucoepidermoid carcinoma	05
Adenoid cystic carcinoma	01
Salivary duct carcinoma	01
Metastatic squamous cell carcinoma	01
Total	66


Figure 4: (a) Intercalated duct adenoma (Gross Picture); (b) Intercalated duct adenoma (IDA) shows proliferation of small back-to-back arranged ducts (H and E 200X); (c) IDA shows strong and diffuse CK7 positivity.

The analysis of the nine discrepant cases between FNAC and histopathology diagnoses highlights the diagnostic challenges in salivary gland lesions. In one case, FNAC suggested chronic sialadenitis, whereas histopathology confirmed intercalated duct adenoma (Figure 4a, 4b and 4c). Another discrepancy was seen where FNAC reported lipoma, but histopathology revealed oncocytic sialolipoma. Similarly, lymphoepithelial sialadenitis on cytology was later diagnosed as Warthin's tumour. A notable error occurred when mucoepidermoid carcinoma was misinterpreted, with histopathology identifying it as metastasis of squamous cell carcinoma. In another case, adenoid cystic carcinoma was suspected on FNAC, but the final diagnosis was pleomorphic adenoma. Three cases broadly labelled as salivary gland neoplasm on FNAC were later specified as Warthin's tumour, pleomorphic adenoma, and nodular oncocytic hyperplasia. Finally, one case diagnosed as Kuttner tumour on FNAC was confirmed as salivary duct carcinoma (Figure 5a and 5b) on histopathology and immunohistochemistry.

This pattern demonstrates that while FNAC is a valuable initial diagnostic tool, it has limitations in differentiating between benign and malignant lesions, as well as in identifying specific tumour subtypes. Histopathology

remains the gold standard for definitive diagnosis (Table 5).

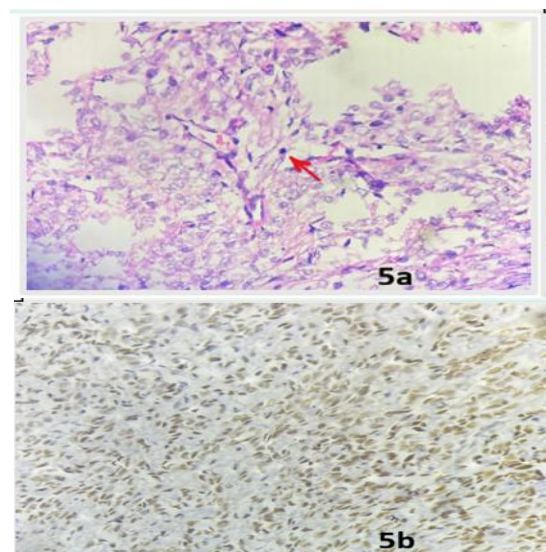

Figure 5: (a) Salivary duct carcinoma shows marked pleomorphic cells with mitosis (Red Arrow); (b) Salivary duct carcinoma shows Androgen Receptor (AR) positivity.

Table 5: Diagnostic discrepancies between FNAC and histopathology diagnoses.

No. of discrepant cases (n=09)	Diagnoses on FNAC	Diagnoses on histopathology
01	Chronic sialadenitis	Intercalated duct adenoma
01	Lipoma	Oncocytic sialolipoma
01	Lymphoepithelial sialadenitis	Warthins tumour
01	Mucoepidermoid carcinoma	Metastasis of squamous cell carcinoma
01	Adenoid cystic carcinoma	Pleomorphic adenoma
03	Salivary gland neoplasm	Warthins tumour: 1 case Pleomorphic adenoma: 1 case Nodular oncocytic hyperplasia: 1 case
01	Kuttner tumour	Salivary duct carcinoma

DISCUSSION

This retrospective study assessed the diagnostic concordance between FNAC and histopathology in salivary gland lesions. Our findings reaffirm FNAC as a practical frontline tool, while also highlighting its limitations in differentiating certain tumour subtypes.

It was observed that there was a male predominance (M:F ratio 1.47:1), which is comparable to the slight male bias reported by Subhashraj K (2008) in an Indian cohort.¹³ The clustering of cases in the 20–40 years age group mirrors the age distribution described by Ito et al (2005) who found salivary gland tumours to be more common among younger and middle-aged adults.¹⁴

The predominance of submandibular and parotid gland involvement in our series is consistent with the epidemiological data reported by Speight and Barrett (2002).¹⁵ Intraoral sites such as palate, lip, and buccal mucosa were rarely affected, which aligns with the relatively uncommon presentation noted in other studies.

Pleomorphic adenoma was the leading diagnosis on both FNAC and histopathology, reaffirming its position as the most common benign salivary gland tumour worldwide.¹⁶ Chronic sialadenitis was the predominant inflammatory condition, again mirroring earlier reports. Malignant lesions were less frequent, with mucoepidermoid carcinoma and adenoid cystic carcinoma being the most notable, similar to the spectrum described by Barnes et al (2005).¹⁶

Despite overall good concordance, nine cases showed discrepancies. For example, FNAC suggested chronic sialadenitis in one case, but histopathology revealed intercalated duct adenoma. Likewise, mucoepidermoid carcinoma was misinterpreted cytologically, later proven to be metastatic squamous cell carcinoma. Such diagnostic pitfalls have been highlighted by Zbären et al (2004) and Stewart et al. (2000) who cautioned that FNAC may struggle with morphologically overlapping entities.^{17,18} More recent work by Rohilla et al (2017) and Kala et al (2019) also emphasized the importance of standardized

reporting systems like the Milan System to reduce such discrepancies.^{11,12}

Clinically, FNAC remains invaluable for rapid triage and guiding initial management, especially in resource-constrained settings. It allows early differentiation between benign and malignant processes, which is critical for surgical planning. However, our data emphasize that FNAC should not be the sole determinant of treatment decisions; histopathology confirmation is essential before definitive therapy. Ancillary techniques such as immunohistochemistry and molecular profiling can further refine diagnosis in challenging cases.^{19,20}

The strength of this study lies in its relatively large sample size and direct comparison of cytological and histopathological diagnoses. Being retrospective, however, it was limited by incomplete clinical records and a smaller number of malignant cases, restricting conclusions about rarer tumour subtypes.

Future prospective studies with larger cohorts, standardized reporting through the Milan System, and integration of ancillary diagnostic tools could improve accuracy and reduce discrepancies. Advances in digital pathology and artificial intelligence may also enhance diagnostic precision and reproducibility in salivary gland cytology.

CONCLUSION

FNAC continues to serve as a reliable, minimally invasive diagnostic method for salivary gland lesions, showing strong concordance with histopathology in common benign and inflammatory conditions. Nonetheless, discrepancies highlight its limitations in identifying specific tumour subtypes and malignant lesions. Histopathology remains the gold standard, and the addition of ancillary techniques can further refine diagnostic precision. Clinicians should interpret FNAC results with caution and always seek histopathological confirmation before finalizing management.

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Conflict of Interest: Non declared

Ethical Approval: Ethical approval was taken from the university ethics committee (No. IEC/14.22/2026).

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