



ROLE OF FNAC IN THE DIAGNOSIS OF SALIVARY GLAND LESIONS

Pathology

Dr. Vidhi Shah*	Department of pathology, SBKS Medical Institute And Research Centre, Dhiraj Hospital, Waghodia, Vadodara*Corresponding Author
Dr. Chintan Inamdar	Department of pathology, SBKS Medical Institute And Research Centre, Dhiraj Hospital, Waghodia, Vadodara
Dr. Bindesh Jain	Department of pathology, SBKS Medical Institute And Research Centre, Dhiraj Hospital, Waghodia, Vadodara
Dr. Bhakti Patel	Department of pathology, SBKS Medical Institute And Research Centre, Dhiraj Hospital, Waghodia, Vadodara
Dr. Samiksha Daklia	Department of pathology, SBKS Medical Institute And Research Centre, Dhiraj Hospital, Waghodia, Vadodara
Dr. Kuntal Patel	Department of pathology, SBKS Medical Institute And Research Centre, Dhiraj Hospital, Waghodia, Vadodara

ABSTRACT

Aim: To evaluate the diagnostic utility of Fine Needle Aspiration Cytology (FNAC) in salivary gland lesions by comparing cytologic findings with histopathology, focusing on sensitivity, specificity, and diagnostic accuracy. **Materials and Methods:** A prospective study was conducted on 42 patients presenting with palpable salivary gland swellings. FNAC was performed using 22–25 gauge needles, and smears were stained with May-Grünwald-Giemsa and Hematoxylin & Eosin. Lesions were categorized as non-neoplastic, benign neoplastic, or malignant. Histopathology served as the gold standard for confirmation. FNAC findings were correlated with histopathological diagnosis to assess sensitivity, specificity, positive and negative predictive values, and overall diagnostic accuracy. **Results:** The parotid gland was most commonly affected (59.5%), followed by the submandibular (28.5%), minor salivary (7.2%), and sublingual glands (4.8%). FNAC identified 15 non-neoplastic (35.7%), 19 benign neoplastic (45.2%), and 8 malignant lesions (19.1%). Histopathology confirmed 15 non-neoplastic (35.7%), 18 benign (42.8%), and 9 malignant lesions (21.5%). FNAC demonstrated sensitivity of 87.5%, specificity of 95%, positive predictive value of 87.5%, negative predictive value of 95%, and overall accuracy of 92.8%. **Conclusion:** FNAC is a reliable, minimally invasive, and cost-effective diagnostic tool for salivary gland lesions, providing high accuracy for benign lesions and reasonable sensitivity for malignancies. While occasional diagnostic pitfalls exist, particularly with low-grade or morphologically heterogeneous tumors, FNAC remains valuable for preoperative evaluation and clinical decision-making, with histopathology serving as the definitive standard.

KEYWORDS

Aspiration, Cytology, Lesions,

INTRODUCTION

Fine Needle Aspiration Cytology (FNAC) has emerged as a widely accepted diagnostic tool for evaluating salivary gland lesions due to the superficial location and easy accessibility of these glands. Clinical assessment alone often fails to reliably differentiate benign from malignant lesions because most salivary gland tumors present with nonspecific features, and radiologic evaluation may not provide conclusive information. Although certain clinical signs such as rapid growth, pain, or facial nerve involvement may suggest malignancy, these features are not consistently present, making FNAC an invaluable preoperative diagnostic technique. Its minimally invasive nature and potential for outpatient application have led to its widespread adoption among clinicians, particularly for lesions involving the parotid and submandibular glands.¹⁻³

The cytologic characteristics of common salivary gland lesions are well described in the literature, providing a basis for FNAC interpretation. Typical cytologic features allow for the identification of non-neoplastic conditions such as sialadenitis, as well as benign tumors like pleomorphic adenoma and Warthin's tumor. However, FNAC interpretation is not without challenges. Cytologic pitfalls and overlapping features between different lesions can result in diagnostic errors. Variability in tumor cellularity, sampling limitations, and morphological heterogeneity—especially in malignant neoplasms—contribute to a wide reported range of sensitivity (62–97.6%) and specificity (94.3–100%). As a result, while FNAC is highly accurate for benign neoplasms, its reliability in type-specific diagnosis of malignant tumors is comparatively lower.^{4,5}

FNAC plays an important role in guiding clinical decision-making and management of salivary gland lesions. By providing early cytological assessment, FNAC can reduce unnecessary surgical interventions and facilitate appropriate planning for definitive treatment. Numerous studies have highlighted the cost-effectiveness of FNAC, as it prevents overtreatment in benign lesions and ensures timely surgical

intervention for malignancies. Additionally, FNAC can serve as a triaging tool in settings with limited resources, allowing for prioritization of patients who require urgent surgical management versus those who can be monitored conservatively.^{6,7}

Despite its advantages, FNAC has limitations that must be recognized. Malignant tumors often exhibit heterogeneous morphology, biphasic cellular populations, or subtle cytologic features, making accurate diagnosis challenging. Sampling errors, low cellular yield, and misinterpretation of reactive or inflammatory changes as neoplastic can further reduce diagnostic accuracy. Consequently, while FNAC demonstrates excellent sensitivity and specificity for identifying benign lesions, its performance in malignancy detection is variable, emphasizing the need for careful correlation with clinical and radiologic findings, and ultimately histopathological confirmation when malignancy is suspected.⁸⁻¹⁰

In the present study, we aimed to evaluate the diagnostic performance of FNAC in salivary gland lesions by comparing cytologic findings with histopathology, with special attention to discordant cases. By assessing sensitivity, specificity, and overall diagnostic accuracy, this study seeks to clarify the role of FNAC as a first-line, minimally invasive diagnostic tool, and to identify areas where diagnostic pitfalls may occur. Understanding the strengths and limitations of FNAC in this context is crucial for optimizing patient care, guiding surgical decision-making, and reducing the risk of unnecessary procedures in the management of salivary gland lesions.

MATERIALS AND METHODS

This study was conducted to evaluate the diagnostic utility of Fine Needle Aspiration Cytology (FNAC) in patients presenting with salivary gland swellings. A total of 42 patients with clinically suspected salivary gland lesions were included in the study. Patients of all age groups and both sexes presenting with palpable salivary gland masses were considered. Patients with bleeding disorders or those who

did not give informed consent were excluded. Ethical clearance was obtained from the institutional ethics committee prior to the commencement of the study.

All patients underwent a thorough clinical examination, including a detailed history and physical assessment of the swelling. FNAC was performed using a 22–25 gauge needle attached to a 10 mL syringe. The procedure was conducted under aseptic conditions, and care was taken to minimize patient discomfort. Multiple passes were made when necessary to obtain adequate material. Aspirated material was immediately smeared on clean glass slides, air-dried, and some slides were fixed in 95% ethanol for cytological evaluation.

The smears were stained using standard cytological techniques, including May-Grünwald-Giemsa (MGG) and Hematoxylin and Eosin (H&E). Special stains were applied when required to aid in the diagnosis. The cytological features were carefully evaluated, and lesions were categorized into non-neoplastic, benign neoplastic, and malignant lesions. Particular attention was given to cellularity, architectural arrangement, nuclear features, and the presence of background components such as mucin or inflammatory cells.

For diagnostic confirmation, surgical excision or core biopsy was performed in cases where clinical suspicion of neoplasia existed. Histopathological examination served as the gold standard for comparison. FNAC findings were then correlated with the histopathology to assess sensitivity, specificity, and overall diagnostic accuracy. Statistical analysis was performed using standard software, and results were expressed in percentages and proportions.

The study thus aimed to assess the reliability, safety, and efficacy of FNAC as a primary diagnostic tool for salivary gland lesions in the studied population. This method enabled early diagnosis and guided clinical management while being minimally invasive, cost-effective, and repeatable. Data analysis was done using SPSS software.

RESULTS

Table 1: Distribution of Salivary Gland Lesions by Site

Site of Lesion	Number of Cases	Percentage (%)
Parotid	25	59.5
Submandibular	12	28.5
Sublingual	2	4.8
Minor salivary glands	3	7.2
Total	42	100

Table 2: FNAC Diagnosis of Salivary Gland Lesions

FNAC Diagnosis	Number of Cases	Percentage (%)
Non-neoplastic	15	35.7
Benign neoplasm	19	45.2
Malignant	8	19.1
Total	42	100

Table 3: Histopathological Diagnosis of Salivary Gland Lesions

Histopathology Diagnosis	Number of Cases	Percentage (%)
Non-neoplastic	15	35.7
Benign neoplasm	18	42.8
Malignant	9	21.5
Total	42	100

Table 4: FNAC vs. Histopathology Correlation

FNAC Diagnosis	Histopathology Diagnosis	Number of Cases
Non-neoplastic	Non-neoplastic	15
Benign neoplasm	Benign neoplasm	18
Benign neoplasm	Malignant	1
Malignant	Malignant	7
Malignant	Benign neoplasm	1
Total		42

Table 5: Diagnostic Accuracy of FNAC

Parameter	Value (%)
Sensitivity (malignant lesions)	87.5
Specificity (malignant lesions)	95.0
Positive Predictive Value	87.5
Negative Predictive Value	95.0
Overall Accuracy	92.8

DISCUSSION

Salivary gland lesions present a wide spectrum of pathological conditions, ranging from inflammatory and non-neoplastic disorders to benign and malignant neoplasms. Accurate and timely diagnosis is essential for appropriate management, as the treatment and prognosis vary significantly depending on the nature of the lesion. Fine Needle Aspiration Cytology (FNAC) has emerged as a valuable diagnostic tool in the evaluation of salivary gland swellings due to its simplicity, minimally invasive nature, and rapid results. FNAC allows for cytological assessment of the lesion, aiding in distinguishing between non-neoplastic, benign, and malignant conditions, and often guides clinical decision-making prior to surgical intervention. Its high sensitivity, specificity, and overall diagnostic accuracy make FNAC a reliable first-line investigation in the assessment of salivary gland lesions.¹¹⁻¹⁴

Salivary gland lesions present a diverse spectrum of pathological conditions, ranging from inflammatory and non-neoplastic disorders to benign and malignant neoplasms. Accurate and timely diagnosis is crucial, as management strategies and prognosis differ significantly based on lesion type. Fine Needle Aspiration Cytology (FNAC) has emerged as a reliable diagnostic tool for salivary gland lesions due to its simplicity, minimal invasiveness, rapid results, and high diagnostic accuracy. FNAC allows cytological evaluation that often distinguishes non-neoplastic from neoplastic lesions, aiding in clinical decision-making prior to surgical intervention.^{13,14}

In our study of 42 patients, the parotid gland was most commonly involved (25 cases, 59.5%), followed by the submandibular gland (12 cases, 28.5%), minor salivary glands (3 cases, 7.2%), and the sublingual gland (2 cases, 4.8%). FNAC diagnosed 15 cases (35.7%) as non-neoplastic, 19 cases (45.2%) as benign neoplasms, and 8 cases (19.1%) as malignant lesions. Histopathology confirmed 15 non-neoplastic lesions (35.7%), 18 benign neoplasms (42.8%), and 9 malignant lesions (21.5%). Correlation between FNAC and histopathology showed excellent concordance: all non-neoplastic lesions were correctly identified, 18 of 19 benign neoplasms matched histology, and 7 of 8 malignant FNAC cases were confirmed malignant. FNAC demonstrated a sensitivity of 87.5%, specificity of 95%, positive predictive value of 87.5%, negative predictive value of 95%, and an overall accuracy of 92.8%, indicating its reliability as a minimally invasive diagnostic tool.

The findings of our study are supported by previous research. Fernandes et al. evaluated FNAC in 88 patients with suspected salivary gland swellings, predominantly involving the parotid gland (68 cases). Pleomorphic adenoma was the most common neoplasm, and mucoepidermoid carcinoma was the only malignant lesion observed. Discordant cases included one overdiagnosed Warthin's tumor and one underdiagnosed low-grade mucoepidermoid carcinoma, attributed to subtle malignant features and squamous metaplasia. The study highlighted that Warthin's tumor and mucoepidermoid carcinoma can pose diagnostic challenges on FNAC, with occasional sampling and interpretational errors.¹⁵

Jain et al. evaluated 80 patients who underwent preoperative FNAC followed by histopathology, with the parotid gland involved in 67.5% of cases. Non-neoplastic lesions constituted 10% of cases, while 72 cases were neoplasms (58 benign, 14 malignant). Cytologic-histologic concordance was 85.7% for benign lesions and 92.8% for malignant tumors. FNAC showed a sensitivity of 92.8%, specificity of 93.9%, positive predictive value of 81.2%, and negative predictive value of 98.4% for malignant tumors. The study concluded that FNAC is reliable for detecting malignancy, though tumor type-specific characterization may be limited, necessitating histopathological confirmation in challenging cases.¹⁶

In a prospective study, Kakoty et al. analyzed 50 patients, with histopathology available in 39 cases. The parotid gland was most frequently affected (62%), and pleomorphic adenoma was the most common neoplasm (44%). FNAC demonstrated a sensitivity of 90.91%, specificity of 96.42%, positive predictive value of 90.91%, and overall diagnostic accuracy of 94.87%, reaffirming its role as a rapid, safe, and accurate method for evaluating salivary gland lesions.¹⁷ Koirala et al. examined 67 patients with salivary gland lumps and correlated FNAC with histopathology. Pleomorphic adenoma was the most frequent lesion, with the parotid gland being the most commonly involved site. FNAC showed excellent sensitivity and accuracy for non-neoplastic (100%, 91.67%) and benign neoplastic lesions (100%, 91.67%), while for malignant lesions, sensitivity was lower (57.14%)

but specificity remained 100% with an accuracy of 83.33%. The study emphasized that accurate FNAC interpretation requires skill, highlighting potential pitfalls, particularly for malignant tumors with subtle cytological features.¹⁸

Overall, our study and the reviewed literature demonstrate that FNAC is a reliable, minimally invasive, and highly accurate diagnostic tool for salivary gland lesions. It provides valuable preoperative information, especially in distinguishing non-neoplastic from neoplastic lesions. While occasional false positives and negatives may occur—particularly in low-grade malignancies or tumors with overlapping cytological features—FNAC remains an effective first-line investigation. Histopathology continues to serve as the gold standard for definitive diagnosis, particularly when precise tumor typing is required.

CONCLUSION

FNAC is a reliable, minimally invasive, and cost-effective diagnostic tool for salivary gland lesions, providing high accuracy for benign lesions and reasonable sensitivity for malignancies. While occasional diagnostic pitfalls exist, particularly with low-grade or morphologically heterogeneous tumors, FNAC remains valuable for preoperative evaluation and clinical decision-making, with histopathology serving as the definitive standard.

REFERENCES

1. Layfield LJ, Glasgow BJ. Diagnosis of salivary gland tumors by fine-needle aspiration cytology: a review of clinical utility and pitfalls. *Diagn Cytopathol*. 1991;7:267–272.
2. Mairembam P, Jay A, Beale T, et al. Salivary gland FNA cytology: role as a triage tool and an approach to pitfalls in cytomorphology [published online ahead of print February 6, 2015]. *Cytopathology*. doi: 10.1111/cyt.12232.
3. Qizilbash AH, Sianos J, Young JE, Archibald SD. Fine needle aspiration biopsy cytology of major salivary glands. *Acta Cytol*. 1985;29:503–512.
4. Batsakis JG, Sneige N, El-Naggar AK. Fine needle aspiration of salivary glands: its utility and tissue effects. *Ann Otol Rhinol Laryngol*. 1992;101:185–188.
5. Kocjan G, Nayagam M, Harris M. Fine needle aspiration cytology of salivary gland lesions: advantages and pitfalls. *Cytopathology*. 1990;1:269–275. doi: 10.1111/j.1365-2303.1990.tb00360.x.
6. Daneshbod Y, Daneshbod K, Khademi B. Diagnostic difficulties in the interpretation of fine needle aspirate samples in salivary lesions: diagnostic pitfalls revisited. *Acta Cytol*. 2009;53:53–70. doi: 10.1159/000325085.
7. Mihashi H, Kawahara A, Kage M, Kojiro M, Nakashima T, Umeno H, et al. Comparison of preoperative fine-needle aspiration cytology diagnosis and histopathological diagnosis of salivary gland tumors. *Kurume Med J*. 2006;53:23–27. doi: 10.2739/kurumemedj.53.23.
8. Zurrida S, Alasio L, Tradati N, Bartoli C, Chiesa F, Pilotti S. Fine-needle aspiration of parotid masses. *Cancer*. 1993;72:2306–2311. doi: 10.1002/1097-0142(19931015)72:8<2306::aid-cnrcr2820720804>3.0.co;2-e.
9. Jayaram G, Verma AK, Sood N, Khurana N. Fine needle aspiration cytology of salivary gland lesions. *J Oral Pathol Med*. 1994;23:256–261. doi: 10.1111/j.1600-0714.1994.tb00055.x.
10. Chakrabarti S, Bera M, Bhattacharya PK, Chakrabarty D, Manna AK, Pathak S, et al. Study of salivary gland lesions with fine needle aspiration cytology and histopathology along with immunohistochemistry. *J Indian Med Assoc*. 2010;108:833–836.
11. Stewart CJ, MacKenzie K, McGarry GW, Mowat A. Fine-needle aspiration cytology of salivary gland: a review of 341 cases. *Diagn Cytopathol*. 2000;22: 139–146.
12. Ashraf A, Shaikh AS, Kamal F, Sarfraz R, Bukhari MH. Diagnostic reliability of FNAC for salivary gland swellings: a comparative study. *Diagn Cytopathol*. 2010; 38: 499–504.
13. Naz S, Hashmi AA, Khurshid A, et al. Diagnostic role of fine needle aspiration cytology (FNAC) in the evaluation of salivary gland swelling: an institutional experience [serial online]. *BMC Res Notes*. 2015; 8: 101.
14. Zbaren P, Guelat D, Loosli H, Stauffer E. Parotid tumors: fine needle aspiration and/or frozen section. *Otolaryngol Head Neck Surg*. 2008; 139: 811–815.
15. Fernandes H, D'souza CR, Khosla C, George L, Katte NH. Role of FNAC in the preoperative diagnosis of salivary gland lesions. *Journal of clinical and diagnostic research: JCDR*. 2014 Sep 20;8(9):FC01.
16. Jain R, Gupta R, Kudesia M, Singh S. Fine needle aspiration cytology in diagnosis of salivary gland lesions: A study with histologic comparison. *Cytojournal*. 2013 Jan 31;10:5. doi: 10.4103/1742-6413.109547. PMID: 23599724; PMCID: PMC3623452.
17. Kakoty S, Baruah TD, Babu CG. FNAC and histopathological correlation of salivary gland lesions: an observational study. *Int surg J*. 2017 Jul;4(7):2148-52.
18. Koirala S, Sayami G, Pant AD. Correlation of FNAC and histopathology in diagnosis of salivary gland lesions. *Journal of Pathology of Nepal*. 2014 Sep 23;4(8):654-7.