Original Research Article

A study of fine needle aspiration cytology and histopathology correlation of salivary gland neoplasms in a tertiary care hospital: an observational study

Asima Malik[1], Ahlam Mushtaq[2], Salma Bhat[1], Suhail Naik[3]*

[1]Department of Pathology, Government Medical College, Srinagar, Kashmir, India
[2]Department of Pediatric Biochemistry, Government Medical College, Srinagar, Kashmir, India
[3]Department of Pediatrics, Government Medical College, Srinagar, Kashmir, India

*Correspondence:
Dr. Suhail Naik,
E-mail: suhailpediatrics@gmail.com

ABSTRACT

Background: Salivary gland lesions contribute to 3 to 6.5% of all neck and head neoplasms in adults. The objective of the current study was to determine the frequency and distribution of various salivary gland neoplasms using fine needle aspiration cytology (FNAC), and their histopathological correlation to ascertain the predictive value of FNAC in diagnosing these lesions.
Methods: A prospective hospital-based observational study conducted in the department of Pathology, Government Medical College Srinagar from March 2024 to April 2025. All the patients with salivary gland lesions in the age group of 0 to 70 years were enrolled in this study. The FNAC and histopathological examination (HPE) were done in all the swellings of the salivary glands.
Results: In our study, salivary gland lesions were more commonly observed in males (53.7%) and predominantly occurred in the 21–60 years age group (30 cases). The parotid gland was the most frequently involved site (60.9%). Benign tumors constituted 56% of cases, followed by non-neoplastic lesions and malignant tumours', each accounting for 21.95% of cases. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of FNAC with respect to HPE were 83.3%, 94.3%, 71.4%, and 97.1%, respectively.
Conclusion: FNAC is a reliable, minimally invasive, and cost-effective diagnostic tool for evaluating salivary gland lesions. It demonstrates high sensitivity and specificity in distinguishing benign from malignant lesions, making it a valuable preliminary diagnostic method. However, histopathological examination remains the gold standard for definitive diagnosis.

Keywords: FNAC, HPE, Salivary gland, Benign, Malignant

INTRODUCTION

Fine needle aspiration cytology (FNAC) has transformed the diagnostic approach to salivary gland pathology by providing a rapid, reliable, and minimally invasive alternative to conventional biopsy. Its simplicity, cost-effectiveness, and high diagnostic accuracy have established FNAC as an indispensable first-line investigation in contemporary clinical practice. In contrast to incisional biopsy, which carries potential risks such as facial nerve injury, fistula formation, and surgical site infection, FNAC offers a safe and efficient method for distinguishing between neoplastic and non-neoplastic lesions.

Owing to its high sensitivity and specificity, FNAC plays a pivotal role in the prompt and accurate diagnosis of salivary gland swellings.

The salivary glands are exocrine organs responsible for the production and secretion of saliva. They include the paired parotid, submandibular, and sublingual glands, as well as numerous minor glands distributed throughout the oral cavity and oropharynx. Salivary gland neoplasms constitute approximately 6% of all head and neck tumours'.[1] The cytological diagnosis of salivary gland lesions remains a challenging aspect of modern pathology. This complexity arises from the remarkable morphological diversity of salivary gland neoplasms, the continual inclusion of newly recognized entities in successive editions of the World Health Organization (WHO) tumour classification, and the pronounced intratumoral heterogeneity characteristic of these lesions.[2] Fine-needle aspiration cytology (FNAC) has emerged as a widely employed first-line diagnostic modality for evaluating salivary gland swellings, owing to its safety, minimally invasive nature, and cost-effectiveness. It plays a crucial role in the preoperative differentiation of benign and malignant lesions and frequently offers a preliminary indication of the tumour subtype.[3] The evaluation of salivary gland lesions can be challenging due to the heterogeneous nature of both benign and malignant tumours, overlapping cytomorphological features, and occasional inadequacy of sampling.[4]

This diagnostic advantage is particularly valuable in the evaluation of inflammatory and cystic disorders, such as acute and chronic sialadenitis, retention cysts, and granulomatous lesions, where conservative management can often be guided without the need for surgical intervention.

Although imaging modalities such as ultrasonography, sialography, and computed tomography serve as useful adjuncts, they often fall short in delineating the biological behaviour or precise histological nature of salivary gland tumours. In contrast, FNAC demonstrates high sensitivity and specificity, enabling clinicians to differentiate benign from malignant entities with substantial confidence.

Pleomorphic adenoma remains the most common benign tumour, particularly involving the parotid gland in patients aged 30–70 years. Among malignant neoplasms, adenoid cystic carcinoma, mucoepidermoid carcinoma, acinic cell carcinoma, adenocarcinoma, and squamous cell carcinoma shows a relatively higher predilection in female patients. Benign lesions and high-grade malignancies together constitute the neoplastic group, with myoepithelioma, basal cell adenoma, and pleomorphic adenoma being the most frequently encountered benign variants.

In the present investigation, the majority of cases were categorized as either neoplastic or non-neoplastic based on FNAC findings. Wherever feasible, histopathological examination (HPE) was performed to assess the diagnostic precision and efficacy of FNAC by correlating cytological and histopathological results.

The objective of this study is to classify salivary gland lesions into neoplastic and non-neoplastic categories using FNAC and to validate these findings against histopathological examination. Through this cytohistological correlation, the study aims to critically evaluate the diagnostic accuracy and clinical utility of FNAC in the assessment of salivary gland swellings.

METHODS

This prospective, hospital-based observational study was conducted from March 2024 to April 2025 in the Department of Pathology, Government Medical College, Srinagar. The primary objective was to evaluate the cytological and histopathological spectrum of salivary gland lesions and to determine the diagnostic accuracy of FNAC.

Study population

The study comprised 41 consecutive patients presenting with clinically palpable salivary gland swellings, irrespective of age or gender. Informed written consent was obtained from all participants, and relevant clinical, radiological, and laboratory details were systematically documented using electronic data capture tools.

Inclusion criteria

All patients who presented with clinically palpable salivary gland swelling. All the age groups and both genders were included.

Exclusion criteria

Patients with acute infection, who had already undergone surgery, swelling not arising from salivary glands and who did not give consent.

FNAC procedure

FNAC was performed on all 41 patients using 21–25-gauge disposable needles attached to a 10 ml syringe. Multiple passes were made when necessary to obtain adequate cellular material. The aspirates were smeared onto clean glass slides, air-dried, and stained with Giemsa stain according to standard laboratory protocols.

Histopathological examination

All 41 patients underwent surgical excision of the affected salivary gland lesions. The excised specimens were fixed in 10% neutral buffered formalin, processed, and embedded in paraffin. Sections were stained with haematoxylin and eosin (H and E) for routine histopathological evaluation. Special stains and immunohistochemistry (IHC) were employed selectively to aid in definitive diagnosis, particularly in cases with ambiguous cytomorphological features.

Diagnostic categorization

Based on FNAC findings, lesions were initially classified into non-neoplastic lesions, further sub-classified into-benign and malignant

Subsequent histopathological evaluation served as the gold standard for diagnostic confirmation and correlation.

Data analysis

Data were compiled and analysed using appropriate descriptive and inferential statistical methods. Diagnostic parameters, such as sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy of FNAC, were calculated using histopathology as the reference standard. Statistical analysis was performed using statistical package for the social sciences (SPSS) software, and a p value of <0.05 was considered statistically significant.

RESULTS

In the 41 instances that were examined, there were 19 females and 22 males (a male-to-female ratio of 1.15:1). A small masculine preponderance was present. Patients in their third and fourth decades of life made up the largest group. The majority of cases in males occurred in the first two decades, while the majority of cases in females occurred in the fourth and fifth decades (Table 1). Distribution of salivary gland lesions across different age groups and sexes. The lesions were slightly more common in males (53.7%) than in females (46.3%). The majority of cases (58.5%) occurred between 21 and 60 years of age, with the highest frequency observed in the 21–40-year age group (39%).

Table 1: Age and sex distribution of salivary gland lesions (n=41).

Age group (years)	Female	Male	Grand total
≤20	1	5	6
21-30	3	5	8
31-40	5	3	8
41-50	5	2	7
51-60	3	4	7
61-70	2	3	5
Grand total	19	22	41

Maximum cases were found to involve the parotid gland (25 cases). Ten cases were seen in the submandibular gland. Other locations included only 6 cases, in which the palate was the common location (Table 2). The parotid gland was the most frequently affected site, accounting for 60.9% of cases, followed by the submandibular gland (24.3%) and other minor salivary glands (14.6%)

According to cytology, benign neoplasms accounted for 63.41% of cases, with non-neoplastic lesions coming in

second (26.82%). 9.75% of patients had malignant neoplasms. Of the benign neoplasms, pleomorphic adenoma accounted for 21 of the cases. Among nonneoplastic lesions, chronic sialadenitis predominated (6 instances) (Table 3).

Table 2: Salivary gland lesions by location.

Location	No. of cases	% of cases
Parotid	25	60.9
Submandibular	10	24.3
Others	6	14.6

Table 3 also shows that, on histopathological examination, non-neoplastic and malignant lesions were found in 21.95% of patients each, and benign neoplastic lesions in 56.0% of patients. The results show that the findings of FNAC were in concordance with those of histopathological examination. Cytological categorization of salivary gland lesions showing a predominance of benign neoplasms (63.4%), followed by non-neoplastic lesions (26.8%) and malignant tumours (9.8%). Pleomorphic adenoma was the most frequent benign lesion, while adenoid cystic carcinoma, mucoepidermoid carcinoma, carcinoma ex pleomorphic adenoma, and myoepithelial carcinoma represented the malignant spectrum.

Histopathological evaluation revealed benign neoplastic lesions as the most common category (56.0%), followed by non-neoplastic lesions (21.95%) and malignant neoplasms (21.95%). Pleomorphic adenoma was the predominant benign tumour (17 cases), whereas myoepithelial carcinoma was the most frequent malignant subtype.

Table 4 depicts that out of 41 salivary gland lesions evaluated, FNAC and histopathology showed concordant results in 34 cases (82.9%) and discordance in 7 cases (17.1%). Pleomorphic adenoma was the most frequent lesion, showing minor discrepancies in a few cases. FNAC demonstrated complete concordance for malignant lesions, including adenoid cystic carcinoma, mucoepidermoid carcinoma, carcinoma ex pleomorphic adenoma, and myoepithelial carcinoma. Overall, FNAC exhibited high reliability in distinguishing benign from malignant salivary gland lesions. Comparison of FNAC and histopathological findings demonstrating strong cytohistological concordance across major salivary gland pathologies. FNAC correctly identified the majority of pleomorphic adenomas and chronic sialadenitis cases.

In Table 5, the findings suggest that FNAC and histopathology were concordant in 34 (82.9%) and discordant in 7 (17.1%) of the 41 cases. Discrepancies occurred mainly in pleomorphic adenoma and cystic/inflammatory lesions. Overall, FNAC demonstrated high concordance and diagnostic reliability in evaluating salivary gland lesions. Table 6 shows a statistical evaluation of FNAC performance in diagnosing salivary

gland lesions,showing high reliability, with an overall diagnostic accuracy of 92.7%. The procedure demonstrated a sensitivity of 83.3%, specificity of 94.3%, PPV of 71.4%, and NPV of 97.1%, confirming FNAC as an effective preliminary diagnostic tool for salivary gland pathology. Table 6 also depicts the sensitivity, specificity, positive predictive value and negative predictive value was 83.3%, 94.3%, 71.4% and 97.1% respectively.

Table 3: Cytological and histopathological spectrum (41 cases) of different salivary gland lesions.

Salivary gland lesions	Cytological spectrum		Histopathological spectrum	
	No. of cases	% of cases	No. of cases	% of cases
Non-neoplastic lesions	11	26.82	9	21.95
Submandibular abscess	1		1	
Parotid abscess	1		1	
Cystic lesion	3		5	
Chronic sialadenitis	6		2	
Neoplastic lesions				
Benign tumors	26	63.41	23	56.0
Pleomorphic adenoma	21		17	
Basal cell adenoma	2		2	
Warthin's tumor	2		3	
Benign lymphoepithelial lesion/Mikulicz's	1		1	
Malignant tumors	4	9.75	9	21.95
Adenoid cystic carcinoma	1		2	
Mucoepidermoid carcinoma	1		2	
Carcinoma ex pleomorphic adenoma	1		1	
Myeoepethelial carcinoma	1		3	
Metastatic lesions	0		1	

Table 4: Correlation of FNAC and HPE in different salivary gland lesions.

FNAC	Histopathology	SMA	PA	CL	CS	PLA	BCA	WT	BLL	ACC	MEDC	CEPA	MEPC	METS	Total
SMA	1	1													
PA	1		1												
CL	3			2						1					
CS	6				5		1								
PLA	21					17					1		2		
BCA	2						2								
WT	2							2							
BLL	1								1						
ACC	1									1					
MEDC	1										1				
CEPA	1											1			
MEPC	1												1		
METS	0													1	
Total	41	1	1	2	5	17	2	3	1	2	2	1	3	1	41

SMA: submandibular abscess; PA: parotid abscess; CL: cystic lesion; CS: chronic sialadenitis; PLA: pleomorphic adenoma; BCA: basal cell adenoma; WT: Warthin's tumor; BLL: benign lymphoepithelial lesion; ACC: adenoid cystic carcinoma; MEDC: mucoepidermoid carcinoma; CEPA: carcinoma ex pleomorphic adenoma; MEPC: myeoepethelial carcinoma; METS: metastatic deposits

Table 5: FNAC and HPE correlation table for various salivary gland lesions.

Diagnosis	FNAC (N)	HPE (N)	Concordant cases	Discordant cases
Submandibular abscess	1	1	1	0
Parotid abscess	1	1	1	0
Cystic lesion	3	2	2	1
Chronic sialadenitis	6	5	5	1

Continued.

Diagnosis	FNAC (N)	HPE (N)	Concordant cases	Discordant cases
Pleomorphic adenoma	21	17	17	4
Basal cell carcinoma	2	2	2	0
Warthin tumour	2	2	2	0
Benign lymphoepithelial lesion	1	1	1	0
Adenoid cystic carcinoma	1	1	1	0
Mucoepidermoid carcinoma	1	1	1	0
Carcinoma ex pleomorphic adenoma	1	1	1	0
Myoepithelial carcinoma	1	1	1	0
Metastatic deposits	0	1	0	1
Total	41	41	34	7

The cytology smears were highly cellular, showing cohesive sheets and clusters of round to oval benign epithelial cells. The myoepithelial cells were predominantly plasmacytoid, with occasional spindle-shaped forms embedded within a chondromyxoid stroma. In some cases, the myoepithelial cells exhibited polygonal, epithelioid, or clear cytoplasmic morphology. Certain smears revealed tumour masses predominantly composed of epithelial elements with scant cellularity and abundant myxoid stromal material (Figure 1).

On a background of haemorrhage and fibromyxoid tissue, cellular smears of chronic sialadenitis displayed inflammatory cells, including polymorphs, plasma cells, and lymphocytes, together with plump epithelial and myoepithelial cells (Figure 2).

Table 6: Diagnostic accuracy parameters.

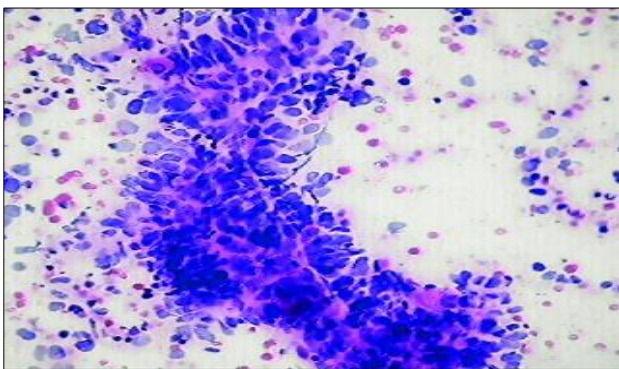| Parameter	Formula	Value (%)
Sensitivity	TP/(TP+FN)	83.3
Specificity	TN/(TN+FP)	94.3
PPV	TP/(TP+FP)	71.4
NPV	TN/(TN+FN)	97.1
Diagnostic accuracy	(TP+TN)/total	92.7

Figure 1: Cytology picture of pleomorphic adenoma displaying spindle-shaped myoepithelial cells in the chondromyxoid stroma and round to oval epithelial cells (H and E, 400X).

Figure 3 picture micrograph shows sheets of homogenous oncocytic cells with round nuclei and abundant cytoplasm in a background of lymphocytes and thin cystic material along with granular amorphous substance.

Numerous dispersed and loose clusters of acinar cells were visible in the highly cellular smears of adenoid cystic carcinoma. The cells had a lot of granular cytoplasm and were big, although they looked like regular acinar cells. A few displayed subtle nucleoli, and the nuclei were spherical, monomorphic, and possessed granular chromatin (Figure 4).
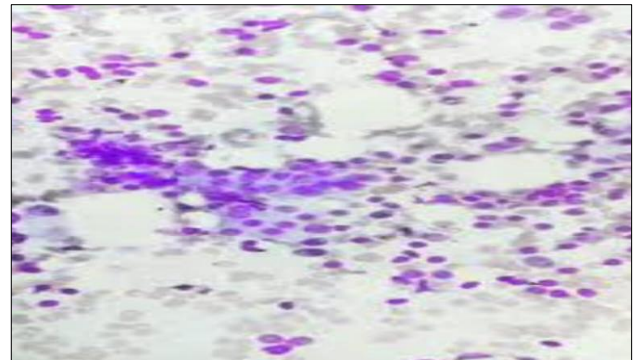

Figure 2: Inflammatory cells with plump epithelial and myoepithelial cells against a hemorrhagic and fibromyxoid stroma are depicted above (FNAC) of chronic sialadenitis (H and E, 400X).
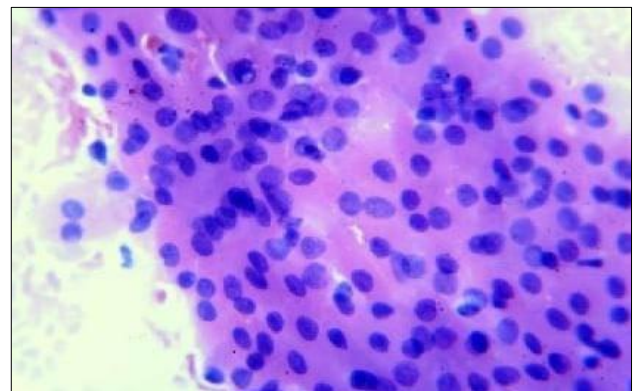

Figure 3: Cytology of Warthin's tumour showing cohesive sheets of oncocytic cells with abundant granular cytoplasm and round, centrally placed nuclei (H and E, 400×).
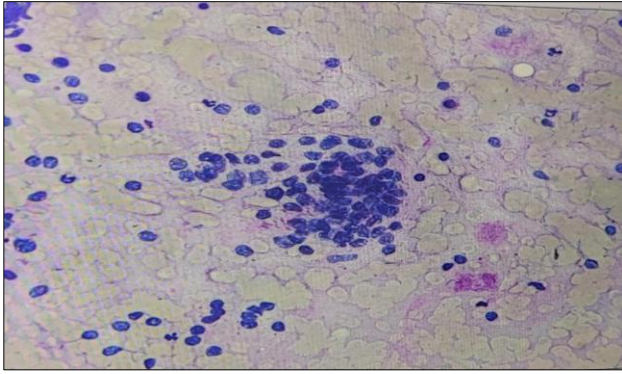
Figure 4: Cytology of adenoid cystic carcinoma showing clusters of cells with uniform spherical nuclei, coarse granular chromatin, and prominent nucleoli (H and E, 400×).

DISCUSSION

In our study, out of 41 cases, 22 (53.7%) were males and 19 (46.3%) were females. This finding is consistent with a study done by Alsanie et al and Mahadevaiah.[5,6] This contrasts with findings from Park et al and Legaspi et al who reported female predominance and near male preponderance, respectively.[7,8]

Our study depicted that the most common site of salivary gland lesions is the parotid gland (60.9%), followed by the submandibular (24.3%), the findings are consistent with the previous studies conducted by Park et al (81.1%), Legaspi et al (78.95%), and Rohilla et al (61.3%).[7-9]

While conducting the FNAC and cytological spectrum of salivary gland lesions, among 41 total cases, we found that the non-neoplastic lesions were found in 26.82% patients, benign lesions in 63.41% (26 cases) and malignant in 9.75% (4 cases). The finding of benign salivary aspirate constituted a large number of cases in this study and this finding is consistent with the study conducted by Rajwanshi et al.[10]

Among the non-neoplastic lesions, the most common cytopathology was consistent with chronic Sialadenitis (5 cases), followed by cystic lesions (2 cases). Among the benign tumors, the most common cytology was consistent with Pleomorphic adenoma (21 cases), followed by basal cell adenoma and Warthin tumour (2 cases each). These results are in agreement with the findings of study conducted by Sandhu et al.[4] In our study, the FNAC showed 4 cases (9.75% of total) having malignant lesions, amongst which adenoid cystic carcinoma, mucoepidermoid carcinoma, carcinoma ex pleomorphic adenoma accounted for one case each. These findings were comparable with the previous studies done by Sridevi et al and Jain et al but while conducting HPE of the above cases, the number of malignant neoplasms rose to 9 (21.95%) cases making it essential to conduct HPE in all the doubtful lesions found in FNAC as shown in Table 4.[11,12]

In our study majority of lesions were in the parotid gland, 25 (60.9%) of all lesions, with pleomorphic adenoma 17, warthin tumor 3, basal cell adenoma 2 and others 1. Similarly, the submandibular gland pathology in our study was found in 10 cases out of which 1 had abscess. 21.95 % of the lesions were malignant and 56% were benign neoplastic lesions. These findings are similar to the findings reported by Kasinathan et al.[13] The most common lesion in our study was pleomorphic adenoma, Warthin tumor, adenoid cystic carcinoma, and mucoepidermoid carcinoma. The findings are consistent with many previous studies.[14,15]

The present study reconfirms the increased incidence of benign neoplastic lesions as compared to malignant lesions. The diagnostic accuracy of FNAC in present study was observed to be 93% for benign and 89% for malignant tumors. This finding of our study was comparable with Omhare et at.[1] The predictive value of salivary gland cytology was 71.4% with diagnostic accuracy of 92.7%. These findings are in coherence with various previous studies.[16-18]

The sensitivity, specificity and accuracy of FNAC for benign and malignant neoplasms were not 100% and the finding is consistent with the previous study conducted by Feinstein et al.[19] According to the published literature, the false negative prediction range falls between 0 and 37%.[20,21]

Our study findings reaffirm the applicability and diagnostic reliability of FNAC. The simple nature of the procedure, with high diagnostic yield with minor complications such as local bleeding in a minor number of cases, establishes its pivotal role in the diagnosis of salivary gland lesions. FNAC remains a screening tool in distinguishing benign from malignant salivary gland lesions, and it must be done as the first investigation of choice to delineate the possible accurate tissue diagnosis. Further, imaging-guided FNAC is very much advisable to enhance its diagnostic yield and to reduce false negative interpretations.

Limitation

The present study was limited by a short study duration and a small sample size derived from a single institution, which restricted the accuracy of statistical interpretation. Therefore, larger randomized multicentric trials are recommended to more reliably assess the cytohistological correlation

CONCLUSION

FNAC is a safe, reliable and cost-effective technique in diagnosing salivary gland lesions. When performed with adequate sampling and interpreted by experienced cytopathologists, fine needle aspiration cytology serves as a highly reliable diagnostic modality for the majority of salivary gland lesions. It is a quick, convenient and

accurate method of diagnosis and should be considered as one of the first-line investigations in the evaluation of salivary gland lesions, particularly in patients undergoing surgical excision. As our study demonstrated that FNAC is not 100% sensitive, sometimes, for final diagnosis, histopathological examination is still necessary for reconfirmation of tissue diagnosis.

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