

Correlation of USG Guided FNAC with Histopathology in Diagnosing Salivary Gland Swelling

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Abstract

Introduction: Salivary gland swellings represent a heterogeneous group of lesions ranging from inflammatory conditions to benign and malignant neoplasms, often posing diagnostic challenges due to overlapping clinical features. Ultrasonography (USG)-guided fine needle aspiration cytology (FNAC) has emerged as a minimally invasive, cost-effective, and widely used diagnostic modality. The aim of this study was to evaluate the correlation between USG-guided FNAC and histopathological findings in diagnosing salivary gland swellings.

Methods: This hospital-based cross-sectional study was conducted in the Department of Otolaryngology Head and neck surgery, Specialized ENT Hospital of SAHIC, from April 2025 to March 2026, including 72 patients presenting with salivary gland swellings. Data were analyzed using statistical software SPSS version 26.0, and the correlation between FNAC and histopathology was assessed using the Chi-square test, with $P < 0.05$.

Result: The study included 72 patients, predominantly middle-aged (mean age 46.2 ± 14.8 years) with slight male predominance (55.6%), and the parotid gland was the most commonly affected site (66.7%). FNAC findings showed 50.0% benign, 30.6% non-neoplastic, and 19.4% malignant lesions, which were closely comparable to histopathology results (52.8% benign, 27.8% non-neoplastic, 19.4% malignant). A high concordance rate of 86.1% was observed between FNAC and histopathology, with a statistically significant correlation ($P < 0.001$). FNAC demonstrated good diagnostic performance with sensitivity of 78.6%, specificity of 93.1%, and overall accuracy of 90.3%.

Conclusion: USG-guided fine needle aspiration cytology (FNAC) is one of the easiest and most accurate preoperative diagnostic methods to determine the nature of salivary gland swellings. According to the results, the overall agreement rate of FNAC with histopathology was quite high at 86.1%, which was statistically a significant finding ($P < 0.001$). FNAC also proved to have notable diagnostic properties, such as high specificity (93.1%), quite decent sensitivity (78.6%), and an overall accuracy in identifying malignancy of 90.3%.

Keywords: Salivary gland, histopathology, FNAC

Introduction

Salivary gland swellings are a very diverse group of lesions that range from inflammatory conditions

to benign and malignant neoplasms and hence can be a major challenge for diagnosis in clinical practice. Such lesions are responsible for about 3 to 10 percent of all head and neck tumors and

they are markedly variable in terms of histopathology and clinical behavior.^[1] In order to provide proper treatment and avoid unnecessary surgery, it is extremely important to make the correct preoperative diagnosis. Historically, histopathological examination has been considered the gold standard for confirming the diagnosis but it involves invasive procedures and is generally only possible post-surgery.^[2] Fine needle aspiration cytology (FNAC) is one of the diagnostic methods that have rapidly gained acceptance. It is a simple, less invasive, and effective way to diagnose salivary gland swellings. With this technique, it is very convenient to diagnose if it is affected by a non-neoplastic lesion or by a neoplastic one. Further subclassification of the tumors into benign and malignant ones is also possible and this is very helpful for the clinician in deciding the treatment plan.^[3] Basically, FNAC is one of the diagnostic tools with high diagnostic performance and this is backed up by data from various studies reporting a sensitivity of 54%-98% and specificity of 88%-99%.^[1,4] Along with all its good qualities, FNAC still has some shortcomings such as errors in sampling, obtaining insufficient number of cells, and due to the fact that there are some overlapping cytological features among certain tumor subtypes, it is sometimes very difficult to differentiate between them.^[1] Ultrasonography (USG) has given an extra boost to the diagnostic potential of FNAC by enabling image-guided aspiration, especially in deep-seated or non-palpable lesions. USG-guided FNAC enhances the precision of sampling, lowers the possibility of false negatives, and offers essential details about the size, vascularity, and internal features of the lesion. Research has indicated that the joint application of USG and FNAC leads to a considerable rise in diagnostic accuracy, with FNAC precision being as high as 97.2% when compared with histopathology.^[5] This dual method is progressively gaining prominence in the new diagnostic protocols for salivary gland lesions. Many studies have assessed the level of agreement between FNAC results and histopathological diagnosis. One study found that FNAC of

salivary gland lesions gave very high specificity (up to 100%) and good diagnostic accuracy overall, whereas in spite of this sensitivity for malignancy was relatively low (57.14%).^[6] In the same way, a different study found excellent sensitivity and specificity for benign lesions (98.52% and 87.05%, respectively), but the sensitivity for malignant tumors was comparatively low (77.77%).^[7] Several studies have shown that FNAC is a very handy diagnostic tool for identifying salivary gland lesions. They noted the procedure's sensitivity and specificity to be 94% and 75%, respectively, and insisted on its role as a useful preoperative diagnostic tool despite the limitations.^[8] Another research done in Greece showed that the sensitivity and specificity of benign versus malignant tumors by FNAC were about 98-100% supporting the fact that FNAC is highly reliable for diagnosis when combined with histopathology.^[9] On the other hand, differences between cytological and histological results may still arise due to the heterogeneous nature of tumors, cystic changes, and technical factors.^[10] So, this paper is reporting on the USG-guided FNAC and its correlation with histopathology for checking salivary gland swellings.

Methods

This is a hospital-based cross-sectional study, done in the Department of Otolaryngology Head and neck surgery, Specialized ENT Hospital of SAHIC, during the period from April 2025 to March 2026. We selected 72 patients who came to the hospital with salivary gland swellings. We included patients of any age and sex with a clinical or radiological suspicion of salivary gland lesions who underwent USG-guided fine needle aspiration cytology (FNAC) and surgical removal was done followed by the histopathological examination. On the other hand, those with the recurrent lesions or inadequate cytological smears were excluded. Obtained informed consent forms were a prerequisite for the performance of FNAC, which was done by ultrasonographic guidance

using a 22-23 gauge needle. Smears were made and allowed to air-dry and alcoholic-fix one set is stained with May- Grünwald-Giemsa and Papanicolaou respectively while another set had alcohol-fixed. Cytology based diagnoses were divided into non-neoplastic, benign, or malignant and then compared with histopathology results, which are considered the most reliable standard. The analysis of data was done with statistical software SPSS version 26.0, and the relationship between FNAC and histopathology was tested with the Chi-square test. P values less than 0.05 were considered statistically significant. Various diagnostic parameters such as sensitivity specificity positive predictive value, negative predictive value, total accuracy, etc. were calculated to assess the performance of USG-guided FNAC in detecting the disease.

Results

The mean age of the patients was 46.2 ± 14.8 years, with the highest proportion in the 41–60 years group (38.9%, $n = 28$). There was a slight male predominance (55.6%, $n = 40$) compared to females (44.4%, $n = 32$) [Table 1].

The parotid gland was most commonly involved (66.7%, $n = 48$), followed by the submandibular gland (27.8%, $n = 20$). Sublingual and minor

salivary gland involvement were rare (2.8% each) [Table 2].

FNAC showed that benign tumors were the most common (50.0%, $n = 36$), followed by non-neoplastic lesions (30.6%, $n = 22$) and malignant tumors (19.4%, $n = 14$) [Table 3].

Histopathology confirmed that benign tumors were predominant (52.8%, $n = 38$), followed by non-neoplastic lesions (27.8%, $n = 20$) and malignant tumors (19.4%, $n = 14$) [Table 4].

A strong correlation was observed between FNAC and histopathological findings. Among 22 non-neoplastic FNAC cases, 18 (81.8%) were correctly diagnosed, while 4 cases (18.2%) were misclassified. Of the 36 benign FNAC cases, 33 (91.7%) were confirmed on histopathology, with 3 cases (8.3%) showing discordance. Among the

Table 1: Demographic characteristics of the study population ($n = 72$)

Variable	Frequency (n)	Percentage (%)
Age group (years)		
≤20	6	8.3
21–40	24	33.3
41–60	28	38.9
>60	14	19.5
Mean ± SD	46.2 ± 14.8	—
Gender		
Male	40	55.6
Female	32	44.4

Table 2: Distribution of salivary gland involvement ($n = 72$)

Gland involved	Frequency (n)	Percentage (%)
Parotid gland	48	66.7
Submandibular gland	20	27.8
Sublingual gland	2	2.8
Minor salivary glands	2	2.8

Table 3: FNAC diagnosis of salivary gland lesions ($n = 72$)

FNAC diagnosis	Frequency (n)	Percentage (%)
Non-neoplastic	22	30.6
Benign tumors	36	50.0
Malignant tumors	14	19.4

Table 4: Histopathological diagnosis ($n = 72$)

Histopathology diagnosis	Frequency (n)	Percentage (%)
Non-neoplastic	20	27.8
Benign tumors	38	52.8
Malignant tumors	14	19.4

14 malignant cases diagnosed by FNAC, 11 (78.6%) were accurately identified, while 3 cases (21.4%) were benign on histopathology. Overall, 62 out of 72 cases were correctly diagnosed, yielding a concordance rate of 86.1%. The Chi-square test demonstrated a highly significant correlation ($P < 0.001$) [Table 5].

For detection of malignancy, FNAC correctly identified 11 out of 14 malignant cases, giving a sensitivity of 78.6%, while correctly ruling out malignancy in 54 of 58 non-malignant cases, resulting in a specificity of 93.1%. The overall diagnostic accuracy was 90.3% [Table 6].

Discussion

In the present study, the majority of patients were in the 41–60 years age group (38.9%), with a mean age of 46.2 ± 14.8 years and a slight male predominance (55.6%). These findings

are comparable to those reported by Naz et al., who observed a mean age of 42 ± 21 years with no significant gender predilection.^[10] Similarly, Khandekar et al. reported that most patients belonged to the third to fifth decades, with a slight male predominance.^[3] Although the exact age distribution varies, all studies consistently demonstrate that salivary gland lesions are more common in middle-aged individuals. In terms of anatomical distribution, the parotid gland was the most commonly involved site (66.7%), followed by the submandibular gland (27.8%). This is consistent with Ashraf et al., who reported parotid gland involvement in 68% and submandibular gland in 30% of cases.^[7] Likewise, Koirala et al. also found that the majority of lesions arose in the parotid gland.^[6] This similarity supports the well-established observation that the parotid gland is the most frequently affected salivary gland. Regarding cytological diagnosis, our study showed that 50.0% of cases were benign tumors, 30.6% non-neoplastic, and 19.4% malignant on FNAC, while histopathology revealed 52.8% benign, 27.8% non-neoplastic, and 19.4% malignant lesions. A similar predominance of benign lesions was reported by Khandekar et al., where benign tumors constituted approximately 61%, while malignant tumors accounted for 31%.^[3] Additionally, Kakoty et al. reported that benign lesions formed the majority, with malignant lesions comprising a smaller proportion.^[2] Although the proportion of malignant cases differs slightly, the overall pattern of benign predominance remains consistent across studies. The correlation between FNAC and histopathology in our study demonstrated that 62 out of 72 cases were correctly diagnosed, yielding a concordance rate of 86.1%, with a statistically significant correlation ($P < 0.001$). This finding is in line with Koirala et al., who also reported a strong correlation between FNAC and histopathology in salivary gland lesions.^[6] Similarly, Kakoty et al. found a high level of agreement between cytological and histopathological diagnoses, emphasizing the reliability of FNAC.^[2] Despite the overall high accuracy, a few discordant cases

Table 5: Correlation of FNAC with histopathological diagnosis ($n = 72$)

FNAC diagnosis	Non-neoplastic (HPE)	Benign (HPE)	Malignant (HPE)	Total
Non-neoplastic	18	2	2	22
Benign	2	33	1	36
Malignant	0	3	11	14
Total	20	38	14	72

Chi-square test: $P < 0.001$.

Table 6: Diagnostic accuracy of USG-guided FNAC (Malignancy Detection)

Parameter	Value (%)
Sensitivity	78.6
Specificity	93.1
Positive predictive value (PPV)	78.6
Negative predictive value (NPV)	93.1
Overall accuracy	90.3

were observed in our study, including misclassification of some benign and malignant lesions. This is comparable to the findings of Naz et al., who reported false negative cases in mucoepidermoid carcinoma and acinic cell carcinoma, as well as false positive diagnoses in certain benign tumors.^[10] Similarly, Rossi et al. highlighted that overlapping cytological features and sampling errors can contribute to diagnostic discrepancies in salivary gland FNAC.^[11] In terms of diagnostic performance, our study demonstrated a sensitivity of 78.6%, specificity of 93.1%, and overall diagnostic accuracy of 90.3% for detecting malignancy. Comparable results were reported by Ashraf et al., who observed a sensitivity of 77.77% and specificity of 98.78%.^[7] Likewise, Naz et al. reported sensitivity of 77.7%, specificity of 86.3%, and overall accuracy of 83.8%.^[10] A more recent study by Kalogirou et al. (2023) reported even higher diagnostic performance, with sensitivity and specificity approaching 98–100% in certain categories.^[9]

Limitations of the Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community

Conclusion

In this article, we have shown that USG-guided fine needle aspiration cytology (FNAC) is one of the easiest and most accurate preoperative diagnostic methods to determine the nature of salivary gland swellings. According to the results, the overall agreement rate of FNAC with histopathology was quite high at 86.1%, which was statistically a significant finding ($P < 0.001$). FNAC also proved to have notable diagnostic properties, such as high specificity (93.1%), quite decent sensitivity (78.6%), and an overall accuracy in identifying malignancy of 90.3%.

Recommendation

Routine use of USG-guided FNAC as the first diagnostic tool in patients with salivary gland swellings is advisable because this method brings about a very high level of accuracy, is least invasive, and less costly. Nevertheless, the clinicians should interpret the cytological results in conjunction with clinical and radiological examination features to enhance the accuracy of diagnosis.

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