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Evaluation of Fine Needle Aspiration Biopsy and Histopathology Results in Salivary Gland Masses

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Abstract

Objective: The aim of this study was to compare the Fine Needle Aspiration Biopsy (FNAB) results with histopathological outcomes in salivary gland masses and to determine the sensitivity, specificity, accuracy, positive predictive value, and negative predictive value of FNAB.

Methods: The study included 103 patients who underwent surgery for salivary gland masses between 2019 and 2022. FNAB was performed under ultrasound guidance, and the samples were examined. Preoperative FNAB results were classified as benign, malignant, or nondiagnostic and compared with the postoperative histopathological results.

Results: Of the patients included in the study, 48 (46.6%) were female and 55 (53.4%) were male. The most frequent FNAB was performed on the parotid gland, and histopathological results were reported as benign in 89 patients and malignant in 14 patients. The sensitivity of FNAB was found to be 80%, specificity 100%, positive predictive value 100%, and negative predictive value 97%. The nondiagnostic result rate was 6.8%.

Conclusion: FNAB is a safe, rapid, and cost-effective method for diagnosing salivary gland masses. The study demonstrates that FNAB provides high accuracy in the early detection of malignant tumours. However, false-negative results may occur in low-grade malignant tumours. The results demonstrate that the accuracy of FNAB varies depending on the pathologist's experience and the quality of sampling.

Keywords Biopsy · Needle · Parotid Gland · Salivary Glands · Submandibular Gland

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INTRODUCTION

Salivary gland diseases encompass a wide range, from infections to malignant tumours. Fine Needle Aspiration Biopsy (FNAB) is a rapid, safe, and easy-to-perform method used in the differential diagnosis of these diseases, preoperative diagnosis, and planning the treatment of patients. While radiological imaging provides valuable information regarding the size and location of salivary gland tumours, it does not provide definitive information about whether the tumour is benign or malignant. Preoperative accurate pathological diagnosis is particularly important for patients with malignant tumours, as it aids in the selection of appropriate surgical procedures and the communication of necessary information to the patients.

The use of FNAB is controversial due to the diversity of histological subtypes of salivary gland lesions and the morphological similarities of these lesions (1). The accuracy of FNAB depends on the technique used and the experience of the pathologist (Figure 1-3).

The aim of this study was to compare FNAB results with histopathology findings in salivary gland masses and to determine the sensitivity, specificity, accuracy, positive predictive value, and negative predictive value of FNAB.

MATERIALS AND METHODS

The study included 103 patients who underwent surgery for salivary gland masses at the ENT clinic of Kayseri City Hospital between 2019 and 2022. Ethical approval was obtained from the local ethics committee of Kayseri City Hospital (Date: 03.01.2023, No: 776). The patients' age, gender, tumour size, preoperative FNAB results, and postoperative histopathological diagnoses were recorded. Patients with inflammatory findings such as pain and redness were excluded from the study. All FNAB procedures were performed under ultrasound guidance. The procedure was performed without local anaesthesia using a 23-gauge needle and a 10 ml plastic syringe. Depending on the accessibility of the mass, 2-3 aspirations were performed. The extracted material was spread on glass slides and air-dried. It was then sent to the pathology laboratory for examination and stained with giemsa. No complications occurred in any of the biopsy patients.

Preoperative FNAB results were recorded as benign, malignant, or nondiagnostic. The postoperative histopathological results were recorded as benign or malignant. The FNAB results were compared with the histopathological outcomes. When histopathology was malignant but FNAB was benign, it was considered a false negative, whereas when histopathology was benign and FNAB was malignant, it was considered a false positive. Cases with matching results between histopathology and FNAB were considered true positive or true negative. The positive predictive value, negative predictive value, false positive and false negative rates, and accuracy of the FNAB results were calculated. Patients whose FNAB and pathology results were not registered in the hospital records were excluded from the study. Statistical analysis was performed using SPSS Statistics v. 24 (IBM Corp., Armonk, NY, USA). The means and standard deviations of the numerical variables and the percentages of the categorical variables were calculated.

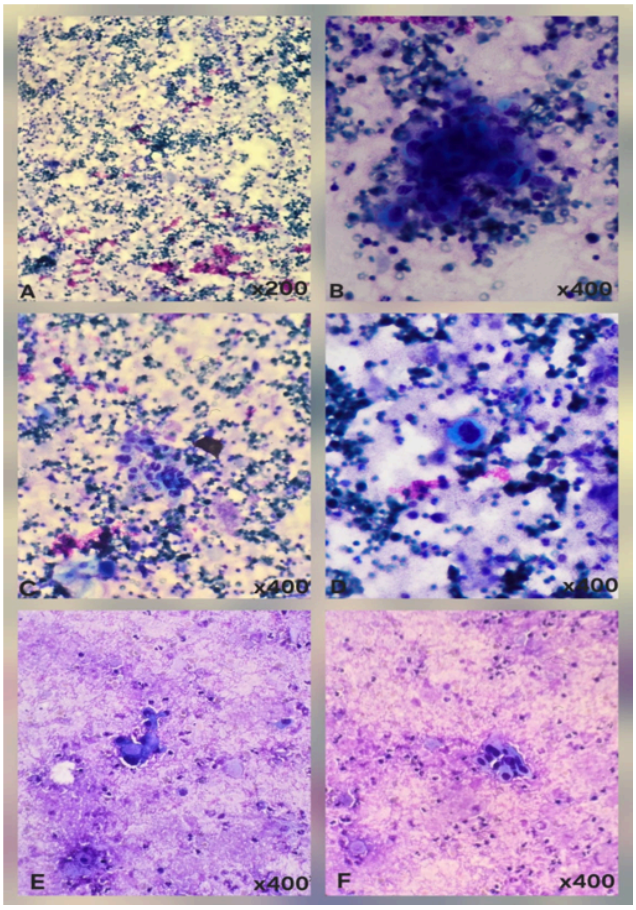

Figure 1. Mucoepidermoid Carcinoma: A) Mucinous material with a pale blue-purple colour in the background, B) Keratinising squamous cells with atypical nuclei, C) Prominent nucleoli in squamous cells, D) High Nucleus/Cytoplasm (N/C) ratio, pleomorphic squamous cells, E) Mucinous cells with abundant mucous cytoplasm and nuclei pushed to the periphery, F) Atypical squamous cell group showing pleomorphism and nuclear membrane irregularity.

RESULTS

Of the 103 patients included in the study, 48 (46.6%) were female and 55 (53.4%) were male. The average age was 50.16 (±15.48), with males having an average age of 51.65 (±14.68) and females having an average age of 48.44 (±16.34). The female-

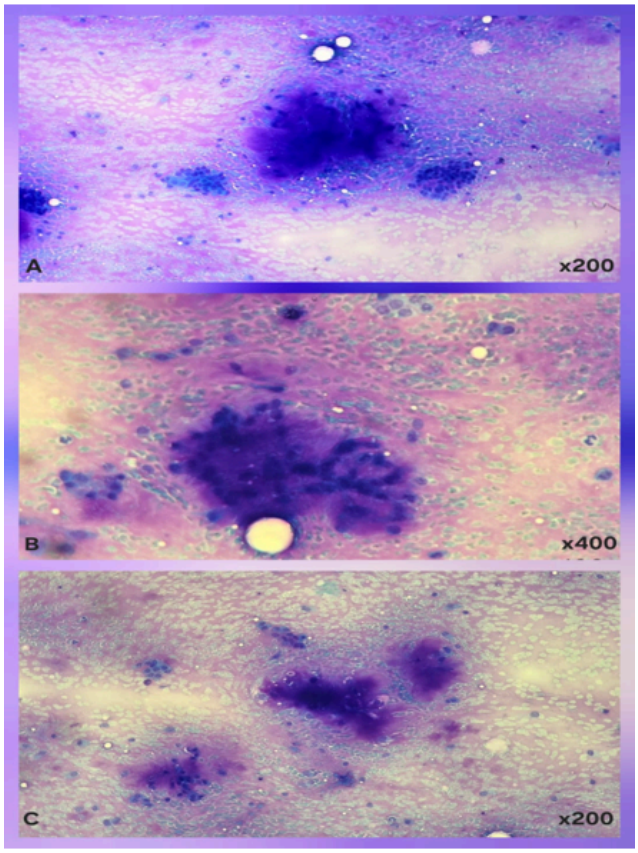

Figure 2. Pleomorphic Adenoma: (A/B/C) Pink-stained fibrillar matrix areas, myoepithelial cells embedded within these areas, and ductal cell groups exhibiting a honeycomb appearance along with plasmacytoid myoepithelial cells scattered in the background are observed. (May-Grünwald Giemsa stain)

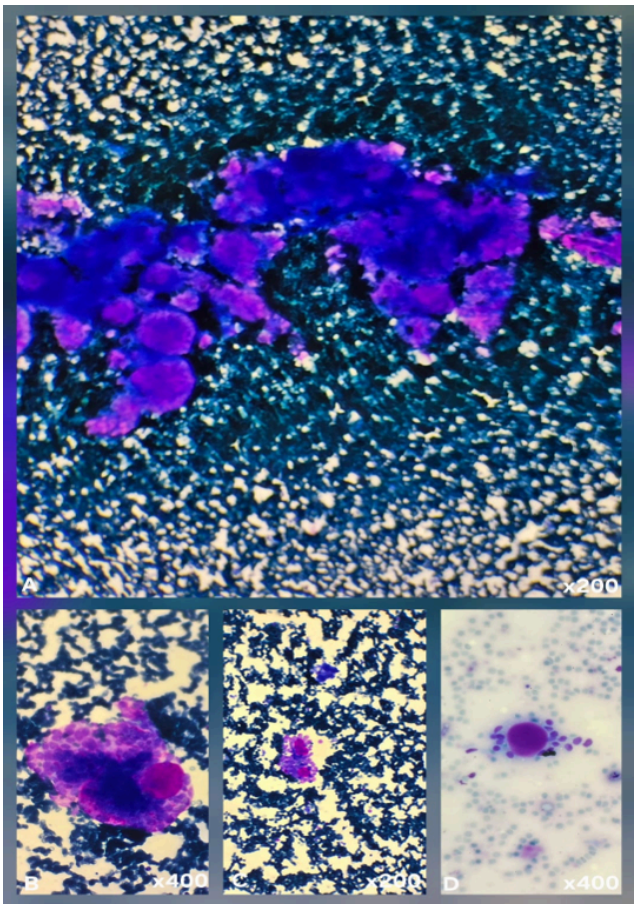

Figure 3. Adenoid Cystic Carcinoma: A) Globules with extensive hyalinized matrix, B) Prominent hyalinized matrix globules containing basaloid cells, C/D) Well-defined matrix globules surrounded by clusters of basaloid cells. (May-Grünwald Giemsa stain)

to-male ratio was 0.87. Fifty-five of the salivary gland masses were located on the right side, and 48 were on the left side.

The most frequently biopsied salivary gland was the parotid gland, followed by the submandibular gland. No FNAB was performed on the sublingual or other minor salivary glands (Table 1). In the cytological evaluation, 93 patients were reported as benign, three as malignant, and seven as nondiagnostic (Table 2). The most commonly observed lesion in the cytological evaluation was pleomorphic adenoma (59 patients, 57.3%), followed by Warthin tumour (29 patients, 28.2%) (Table 3). Among the 7 patients with a cytological diagnosis of pleomorphic adenoma, 1 was diagnosed with Warthin tumour, 1 with sialoadenitis, 2 with mucoepidermoid carcinoma, 1 with acinic cell carcinoma, 1 with myoepithelial carcinoma, and 1 with oncocytoma. Histological evaluation reported 89 patients as benign and 14 as malignant (Table 2). Pleomorphic adenoma was the most common benign neoplastic lesion (52 patients, 50.5%), followed by Warthin tumour (28 patients, 27.2%). The most common malignant tumour was mucoepidermoid carcinoma (4 patients, 3.9%) (Table 4). Of the 52 pleomorphic adenomas,

Table 1. Salivary glands undergoing FNAB

Gland	n	%
Parotid	93	90.3
Submandibular	10	9.7
Total	103	100.0

FNAB: Fine needle aspiration biopsy, n: Number of cases, %: percentage

six were located in the submandibular gland, and two of the four mucoepidermoid carcinomas were located in the submandibular gland . The FNAB and histological evaluation results were reported differently in 19 patients. The lesions with differing reports are shown in Table 5. In the cytological and histopathological evaluation, 89 patients were found to be true negative and three patients were found to be true positive (Table 6). The sensitivity of FNAB was 80%, specificity was 100%, positive predictive value was 100%, negative predictive value was 97%, and accuracy was 91%.

Table 2. FNAB and histopathology results

	FNAB results		Histopatology results	
	n	%	n	%
Benign	93	90.3	89	86.4
Malign	3	2.9	14	13.6
Nondiagnostic	7	6.8		
Total	103	100.0	103	100.0

FNAB: Fine needle aspiration biopsy, n: Number of cases, %: percentage

Table 3. FNAB results

Diagnosis	n	%
Pleomorphic adenoma	59	57.3
Warthin tumour	29	28.2
Neuroendocrine malignant tumour	1	1.0
Sialoadenitis	4	3.9
Schwannoma	1	1.0
Mucoepidermoid carcinoma	1	1.0
Myoepithelial carcinoma	1	1.0
Nondiagnostic	7	6.8
Total	103	100.0

FNAB: Fine needle aspiration biopsy, n: Number of cases, %: percentage

Table 4. Surgical specimen histopathology results

Diagnosis	n	%
Pleomorphic adenoma	52	50.5
Warthin tumour	28	27.2
Sialoadenitis	4	3.9
Schwannoma	2	1.9
Mucoepidermoid carcinoma	4	3.9
Acinic cell carcinoma	2	1.9
Adenoid cystic carcinoma	1	1.0
Myoepithelial carcinoma	2	1.9
Adenocarcinoma	1	1.0
Lymphoma	1	1.0
Malign melanoma	1	1.0
Oncocytoma	1	1.0
Keratinous cyst	1	1.0
Carcinoma ex pleomorphic adenoma	2	1.9
Lymphoepithelial lesion	1	1.0
Total	103	100.0

n: Number of cases, %: percentage

DISCUSSION

Salivary gland lesions exhibit a wide variety. In addition to the physical examination, ultrasound and magnetic resonance imaging (MRI) are used to assess the lesion's location and size.

Table 5. Lesions with discordant histopathology results

#	FNAB	Histopathology
1	Pleomorphic adenoma	Warthin tumour
2	Pleomorphic adenoma	Sialoadenitis
3	Pleomorphic adenoma	Mucoepidermoid carcinoma
4	Pleomorphic adenoma	Mucoepidermoid carcinoma
5	Pleomorphic adenoma	Acinic cell carcinoma
6	Pleomorphic adenoma	Myoepithelial carcinoma
7	Pleomorphic adenoma	Oncocytoma
8	Pleomorphic adenoma	Carcinoma ex pleomorphic adenoma
9	Warthin tumour	Sialoadenitis
10	Neuroendocrine tumour	Adenocarcinoma
11	Sialoadenitis	Acinic cell carcinoma
12	Sialoadenitis	Lymphoma
13	Nondiagnostic	Pleomorphic adenoma
14	Nondiagnostic	Schwannoma
15	Nondiagnostic	Mucoepidermoid carcinoma
16	Nondiagnostic	Adenoid cystic carcinoma
17	Nondiagnostic	Malignant melanoma
18	Nondiagnostic	Carcinoma ex pleomorphic adenoma
19	Nondiagnostic	Lymphoepithelial lesion

FNAB: Fine needle aspiration biopsy

Table 6. Correlation between the cytopathology and histopathology results

		Histopathology		Total (n)
		Benign (n)	Malign (n)	
Cytopathology	Benign	86	7	93
	Malign	0	3	3
	Nondiagnostic	3	4	7
Total		89	14	103

n: number of cases

Although radiological imaging is helpful for surgery, FNAB is preferred as a test to determine the pathological diagnosis of the lesion preoperatively (2). FNAB is a cytodiagnostic method that evaluates cells, cell clusters, and tissue microparticles. FNAB is a simple, rapid, safe, and cost-effective method that does not require expensive equipment, and it differentiates inflammatory lesions from tumour lesions by reducing the need for surgery. However, an experienced pathologist and high specimen quality are necessary for an accurate diagnosis (3).

Because salivary gland tumours are relatively rare, few pathologists have experience in this area. FNAB, which samples a limited area, does not sample the entire tumour. Salivary gland tumours have a complex morphology, and their cell types and growth patterns vary (4). The differences

between FNAB and histopathology results are due to the high morphological variation of salivary gland tumours, and the experience of the clinician performing the biopsy and the pathologist evaluating the cytological material is crucial. Due to the false-positive and false-negative results of FNAB, there are discrepancies among the authors regarding whether FNAB should be used.

In this study, the youngest age was 9 and the oldest age was 82. The average age was 50.16 ± 15.48. The female-to-male ratio was 0.87. No significant gender differences were found between females and males. Salivary gland tumours account for 3% of head and neck tumours. Approximately 80% of salivary gland tumours are found in the parotid gland (5). In our study, 90.3% of the tumours were located in the parotid gland, and 9.7% were located in the submandibular gland. No tumours were found in the minor salivary glands. These results are similar to other studies in the literature (6, 7).

Previous studies have reported FNAB sensitivity ranging from 57.3% to 95% and specificity between 75% and 100% (8, 9). In our study, when nondiagnostic pathology results were excluded, the sensitivity and specificity values were found to be 80% and 100%, respectively. The positive predictive value was 100%, the negative predictive value was 97%, and the accuracy rate was 91%. These values were found to be similar to those in the literature.

In this study, FNAB results were benign in 93 patients (90.3%), malignant in three patients (2.9%), and nondiagnostic in seven patients (6.8%). The nondiagnostic biopsy rate in the literature is reported to range from 2% to 10% (10). In our study, the nondiagnostic biopsy rate was found to be 6.8%. In the histopathological evaluation of nondiagnostic biopsies, four patients had malignant tumours, and three patients had benign tumours. The experience of pathologists with benign tumours or insufficient sampling may lead to a higher rate of nondiagnostic results for malignant tumours. Insufficient sampling could be due to haemorrhagic or necrotic areas within the mass or sampling from outside the target area. Performing FNAB under ultrasound guidance may reduce the risk of insufficient sampling. Histopathology results were benign in 89 patients (86.4%) and malignant in 14 patients (13.6%). These rates are similar to those in previous studies (11, 12).

Although the diagnosis of pleomorphic adenoma with FNAB is largely accurate, malignancy cannot be definitively excluded; therefore, a detailed examination using clinical and imaging findings should be performed. In our study, the diagnosis of 51 of 52 pleomorphic adenomas was made by FNAB, while only one diagnosis of mucoepidermoid carcinoma and myoepithelial carcinoma (4 and 2 cases, respectively) could be made by FNAB. The difficulty in diagnosing low-grade mucoepidermoid tumours is that when an adequate number of cells are not available, they cannot be distinguished from reactive conditions such as chronic sialadenitis. FNAB cannot be used to differentiate reactive lymphoid tissue, benign lymphoepithelial lesions, and low-grade lymphoma (13). FNAB failed to diagnose acinic cell carcinoma, adenoid cystic carcinoma, carcinoma ex pleomorphic adenoma, or lymphoma. The small number of patients with these tumours in the study could be one reason for this. The higher sensitivity of FNAB in benign tumours may be due to the smaller histopathological variety of benign tumours and the higher frequency of pleomorphic adenoma and Warthin tumour, making pathologists more experienced in these areas.

The reason for the false-negative FNAB results may be insufficient sampling. Particularly in cystic lesions, when enough material is not obtained, they may be reported as benign cysts or Warthin tumours. Although FNAB is a simple method, its accuracy may vary depending on the experience of the pathologist. Pleomorphic adenoma, basal cell adenoma, low-grade mucoepidermoid carcinoma, and acinic cell carcinoma are the tumours that are most difficult to diagnose using FNAB. Low-grade mucoepidermoid carcinoma, due to its morphological heterogeneity, may be mistakenly diagnosed as Warthin tumour or mucous retention cyst (11). To reduce this, the needle may be inserted multiple times, aspirate material may be obtained from different areas of the lesion, or a biopsy may be performed under ultrasound guidance (14).

The differences between FNAB and histopathology are largely due to the extensive morphological variations of salivary gland tumours. Therefore, the experience of the clinician performing the biopsy and the pathologist evaluating the cytological material is highly important. Performing this procedure under ultrasound guidance increases the accuracy of FNAB (15). Ultrasound-guided biopsies allow for assessing the nature of the lesion, considering its solid and cystic components. Performing the biopsy under ultrasound guidance ensures that these components are considered, which may contribute to an increased accuracy rate. Additionally, the literature indicates that repeated aspirations are another factor that enhances the quality of cytological evaluation. Furthermore, an increase in the lesion size has been reported as a factor that improves the success rate of FNAB (16). A previous study has shown that the physician's level of experience affects the diagnostic accuracy of FNAB. This highlights the importance of the technique and demonstrates that identifying physicians with a high accuracy

rate in FNAB and transferring their techniques to other physicians can improve the overall accuracy rates (17).

Most parotid masses present as slow-growing masses. Facial paralysis occurs in 10-15% of cases (18). Therefore, it is clinically difficult to distinguish whether these masses are malignant. In this study, only two patients (1.9%) had facial paralysis due to parotid masses. The fact that most of the masses were benign and the small number of malignant patients may have contributed to the low rate of facial paralysis in our study.

Our study has some limitations. This was a single-centred, retrospective study with a relatively limited number of patients. Prospective, multicenter studies with larger sample sizes could improve the generalizability of the results. The small number of malignant tumours in the study made it difficult to fully evaluate the ability of FNAB to detect malignant lesions. Furthermore, the pathology results were not classified according to the Milan system, which may have impacted the diagnostic categorisation. Considering all these factors, larger-scale and controlled studies are needed to more clearly determine the effectiveness of FNAB in the diagnosis of salivary gland tumours.

CONCLUSION

In conclusion, FNAB is a fast, safe, and cost-effective method that can be used for diagnosing salivary gland masses. It is easily tolerated by patients, and the complication rate is low. Early recognition of malignant tumours will help the surgeon in selecting the appropriate treatment plan and in informing the patients preoperatively.

Ethics Committee Approval:	This study was approved by the Kayseri City Hospital (Date: 03.01.2023, No: 776).
Informed Consent:	Written informed consent was obtained from all participants.
Peer Review	Externally peer-reviewed.
Author Contributions:	Conception/Design of Study- Y.K., N.Ü., E.D.; Data Acquisition- E.D., S.B.Ç.; Data Analysis/Interpretation- Y.K., H.K.; Drafting Manuscript- Y.K., A.K.; Critical Revision of Manuscript- M.Y., A.B.; Final Approval and Accountability – İ.Ö., A.B., M.Y.; Technical Support- H.K.; Supervision- İ.Ö., A.B., M.Y.
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