Parotid FNAC Diagnostic Utility and Its Role in Surgical Residency Training

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Abstract

Introduction:

This study aimed to investigate the relationship between preoperative fine needle aspiration cytology (FNAC) for parotid tumors and the level of surgical training among residents, as well as to further elucidate its effectiveness as a diagnostic tool in the hands of the treating physician.

Materials and Methods:

Surgical records from patients who underwent parotid surgery between 2014 and 2022 were retrieved. Residents reported their perceived level of training duringthese procedures. Contingency tables were used to correlate the cytological with final histopathological results.

Results:

A total of 286 patients who had undergone preoperative FNAC were included in the study. A preoperative diagnosis of pleomorphic adenoma or Wharthin's tumor was significantly associated with higher training scores among surgical residents. In contrast, a diagnosis of malignancy, other benign tumors, or indeterminate cytology was correlated with poor training scores ($\chi2 = 176.35$; df = 2; p-value <0.001, Cramer's V 0.79). FNAC demonstrated a sensitivity of 88% and a specificity of 99.2% for detecting malignancy, with a positive likelihood ratio of 103.8 (95% CI: 26.02–414.34) and a negative likelihood ratio of 0.12 (95% CI: 0.06–0.26).

Conclusions:

Our findingssuggest that preoperative cytological diagnoses of parotid tumors with a favorable prognosis, such as Wharthin's tumors, can enhance training and mentorship opportunities provided by senior surgeons. This is particularly significant for academic institutions with residency programs.

Keywords: Parotid tumor; Fine-needle aspiration; Parotid gland; Residency; Training

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Introduction

Fine-needle aspiration cytology (FNAC) was first developed as a diagnostic tool at the Memorial Sloan-Kettering Cancer Center in the 1930s (1). Its use has gained widespread popularity over the last 20 years and has proven to be highly valuable in diagnosing salivary gland lesions. Salivary gland masses present unique challenges to both clinicians and cytopathologists, due to the broad range of histological types and subtypes.

The morphological diversity, presence of hybrid tumors, dedifferentiation, and potential malignancy can further complicate histopathological interpretation (2).

Parotid surgery is similarly challenging. On one hand, the risk of facial nerve paresis or paralysis can be a devastating and irreversible outcome for patients and physicians alike. On the other hand, surgery must be sufficiently aggressive in terms of the extent of gland excision, as even benign tumors carry a risk of recurrence. The experience of the surgeon is crucial for patient safety and the prevention of complications during parotid surgery, as is the use of nerve integrity monitoring (NIM) (3). Additionally, early detection of malignancy through FNAC can facilitate better surgical planning and patient counselling. Despite this, opinions are divided regarding the routine use of FNAC for and its diagnostic accuracy for salivary gland lesions (4-5). While FNAC training is part of the curriculum for cytopathology specialists, its impact on the training programs of the surgical residents has not thoroughly explored (6). Recent studies indicate that FNAC can be performed effectively by either an attending otolaryngologist or a resident, with no significant differences in outcomes (7).

Recognizing the need of performing fine-needle aspirations in parotid tumor cases, we sought to investigate the implications of FNAC results on residents' surgical training within a tertiary university hospital and to further assess its utility as a diagnostic tool for the treating physician.

Materials And Methods

Study design

A prospectively maintained database of patients undergoing parotid surgery was retrospectively reviewed. We examined the surgical records of all patients who underwent superficial parotidectomy, partial superficial parotidectomy, or total parotidectomy between 2014 and 2022 at the 2nd Ear, Nose, and Throat (ENT) Department, Attikon University Hospital, National and Kapodistrian University of Athens, Greece. Cases involving combined surgery with neck dissection, extensive procedures requiring skin excision and the use of flaps, and revision surgeries were excluded from the study. All procedures were performed by four surgeons with comparable surgical experience, andnerve integrity monitoring was used in all cases. Preoperative FNACs were performed by two well-trained cytologists. Residents actively involved in each procedure were asked to rate the level of surgical training they received.

Outcomes measured

Data regarding the preoperative diagnosis of parotid tumors were collected based on the cytology reports. Residents rated their perceived level of each operation on a scale from 1 to 3 (1: skin incision and/or suturing only, 2: elevation of flaps and dissection without nerve dissection, 3: peripheral facial nerve dissection with tumor excision). The primary outcome measured was the impact of preoperative FNA-based cytological diagnosis on the level of residents' surgical training. Secondary outcomes included the diagnostic accuracy of FNAC and its ability to differentiate between malignant and benign parotid lesions, as determined by final histopathological reports.

Statistical analysis

Continuous variables with a normal distribution were presented using the mean, standard deviation (SD), and range. Categorical variables were presented as counts and frequencies(percentages), and analyzed using Pearson's chi-square test. The level of significance was set at $p<0.05$.

Contingency tables were used to assess sensitivity, specificity, and likelihood ratios, presented with their respective 95% confidence intervals (95% CI). Statistical analysis was conducted using IBM SPSS Statistics for Windows, version 19.0 (IBM Corp., Armonk, NY, USA).

Results

During the study period, 439 patients underwent parotid surgery at our institution. Among them, 286 patients who had a preoperative FNA examination were included in the study and furtheranalyzed.

Of these, 168 patients (59%) were male and 118 patients (41%) were female (Table 1). The mean age was 58.59 years (range: 18-94, SD: ± 15.04).

Based on the preoperative FNAC, benign parotid tumors were the most commonly diagnosed pathologies. Specifically, 115 patients (40%) were diagnosed with pleomorphic adenomas, and 73 patients (26%) with Wharthin'stumors. For 52 patients (18%), FNAC indicated other benign tumors or returned indeterminated results. A preoperative diagnosis of malignant parotid tumors was made in 46 patients (16%) (Table 1).

Table 1: Demographics and FNAC results for patients who underwent parotid surgery

	Patients number (%)
Sex	
Male	168 (59%)
Female	118 (41%)
FNAC results	
Pleomorphic adenoma	115 (40%)
Warthin's tumor	73 (26%)
Other benign tumors/indeterminate cytology	52 (18%)
Malignancy	46 (16%)
Total	286 (100%)

All residents involved in the parotid procedures were asked to rate the surgical training they received, with their scores stratified according to the FNAC diagnosis (Figure 1). Analysis of the available data showed that, in 101 out of 115 parotid surgeries for presumed pleomorphic adenoma (88% of cases), residents performed at least the elevation of flaps and subsequent dissection. In 40% of these cases, residents performed facial nerve dissection. This figure increased to 63% for cases operated for Warthin's tumors.
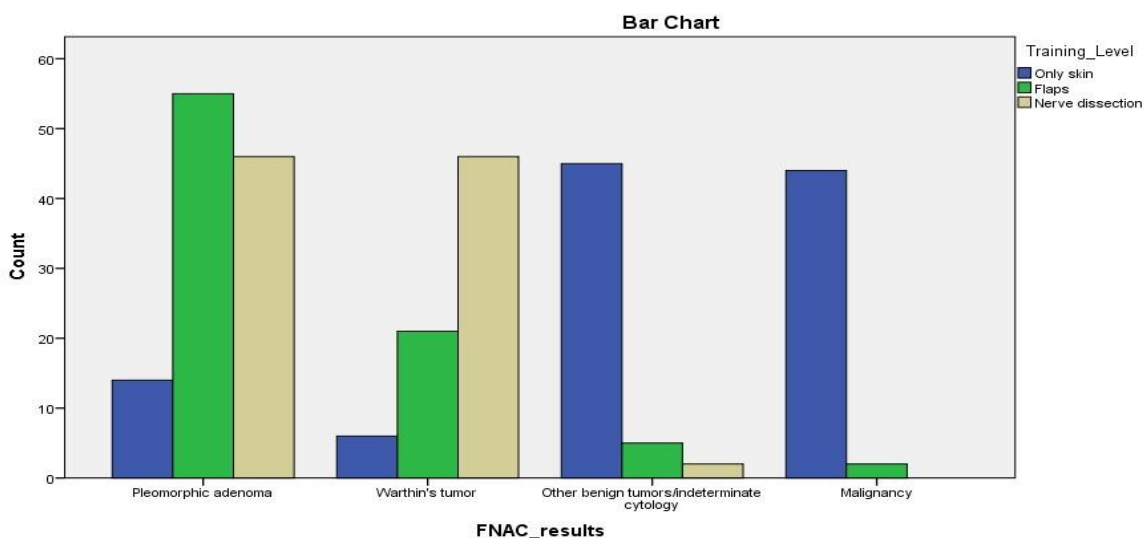

Fig 1: FNAC results in relation to residents' training during the operation

In contrast, when the surgery was performed for a suspected malignancy or the FNAC results indicated either a different benign tumor (other than pleomorphic adenoma or Warthin's tumor) or were inconclusive, residents' training scores were significantly lower. Notably, in none of the cases involving a suspected malignancy did residents perform

facial nerve dissection. Furthermore, residents performed nerve dissection in only 4% of cases involving other benign tumor or inconclusive cytology results. The operations were subsequently divided into two groups; Group A included cases where FNAC indicated a benign diagnosis of either pleomorphic adenoma or Warthin's tumor, while Group B included cases with a presumed malignancy, other benign tumors, or indeterminate cytology (Table 2).

Table 2: Correlation between FNAC results and the training received during the operation

			Residents' training during the operation			Total
			Only skin incision and/or suturing	Elevation of flaps and dissection without facial nerve dissection	Facial nerve dissection	
FNAC results	Group A	Pleomorphic adenoma	14	55	46	115
		Warthin's tumor	6	21	46	73
	Group B	Other benign tumors /Indeterminate cytology	45	5	2	52
		Malignancy	44	2	0	46
		Total	109	83	94	286

A significant correlation was observed between residents' training scores and the preoperative diagnosis provided by FNAC ($\chi 2$ = 176.35; df = 2; p-value <0.001, Cramer's V 0.79). A preoperative diagnosis of malignancy or other benign/indeterminate pathologies was strongly associated with lower resident training scores. The odds of residents performing facial nerve dissection were 46 times higher when FNAC indicated a diagnosis of pleomorphic adenoma or Warthin's tumor compared to cases of malignancy, other benign tumors, or indeterminate cytology (odds ratio (OR): 46;

95% CI: 11.02–192.06; p-value <0.001).

The preoperative FNAC results were cross-tabulated with the final (postoperative) histopathological findings, as shown in Table 3. In total, 50 cases revealed a malignant parotid tumor upon final histological examination, with mucoepidermoid carcinoma being the most common subtype. FNAC demonstrated a sensitivity of 88% and a specificity of 99.2% for detecting malignancy. The positive likelihood ratio was 103.8 (95% CI: 26.02–414.34), while the negative likelihood ratio was 0.12 (95% CI: 0.06–0.26).

Table 3: Cross tabulation between FNAC results and the final histopathological results

FNAC results	Final histology				
	Pleomorphic adenoma	Warthin's tumor	Other benign	Malignant	Total
Pleomorphic adenoma	106	0	5	4	115
Warthin's tumor	4	69	0	0	73
Other benign or indeterminate	12	3	35	2	52
Malignant	2	0	0	44	46
Total	124	72	40	50	286

Discussion

Primary treatment of malignant parotid gland tumors is typically surgical, with the extent of surgery largely dependent on the histopathological subtype (8). FNAC plays a crucial role, particularly in enhancing preoperative surgical planning, and providing valuable guidance for patient counseling.

While numerous studies have validated the diagnostic accuracy of FNAC, some have highlighted that the heterogeneity of evidence prevents a definitive conclusion regarding its overall clinical utility (5).

FNAC is generally more accurate in detecting benign tumors and is highly reliable in identifying Warthin tumors and pleomorphic

adenomas of the parotid glands (8-10). However, evidence regarding its sensitivity, specificity, and accuracy for diagnosing other types of tumors remains limited(1). According to our findings, FNAC can identify malignant parotid tumors with relatively high sensitivity and specificity. Nonetheless, its ability to distinguish between malignant and benign lesions varies in the literature. This variability may contribute to the ongoing debate about its preoperative value, which is heavily dependent on the expertise of both the clinician performing the biopsy and the pathologist interpreting the cytological material (11).

The challenge of effective surgical training in parotid surgery is not a new content (12). While the use of neuromonitoring in our armamentarium has provided significant support over the last 15 years, the potential role of FNAC as a tool for enhancing residency training has not been previously addressed (11). Residency training programs differ across countries, with many lacking standardized curricula and relying on informal apprenticeship and mentorship by experienced surgeons (13). In our study, FNAC results were significantly correlated with the level of training residents received during surgery. When FNAC indicated a benign diagnosis of pleomorphic adenoma or Wharthin's tumor, residents reported more hands-on experience including flap elevation, dissection, and even facial nerve dissection.

These findings may be attributed to the high sensitivity of FNAC for diagnosing pleomorphic adenomas and Wharthin'stumors, as well as the lower likelihood of recurrence and generally favorable outcomes associated with such cases. Our results suggest that a reassuring preoperative diagnosis can increase the attending surgeon's confidence in involving residents more actively, fostering effective mentorship and advancing surgical training. We believe that optimal preoperative planning is critical not only for ensuring but also for improving training outcomes, making a strong case for including FNAC in surgical residency training programs. Of course, certain limitations apply to our presented study. It is a small, single-center retrospective analysis, and the self-reporting nature of the training experience introduces a degree of recall and reporting bias. Nonetheless, our findings offer valuable insights that inform future efforts to enhance the training of surgical residents.

Conclusion

FNAC remains a valuable tool for preoperative planning and patient counseling. Our findings suggest that a preoperative FNAC diagnosis of favorable parotid tumors, such as Wharthin's tumors, can significantly enhance training opportunities and mentorship for surgical trainees. This is particularly relevant in academic institutions with structured residency programs, where such opportunities are integral to the development of surgical skills.

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