Clinical importance of preoperative fine needle aspiration biopsy and computed tomography in parotid gland masses

Ender Sahin[1], Ilhan Unlu[2], Elif Nisa Unlu[3], Zeynep Kaptan[4], Hakki Uzunkulaoglu[4], Ethem Erdal Samim[4], Kamil Gokce Tulaci[5], Yunus Karadavut[6]

[1] Department of Otorhinolaryngology,Adiyaman Gozde Hospital, Adiyaman, Turkey
[2] Department of Otorhinolaryngology, Duzce University Medical School, Duzce, Turkey
[3] Department of Radiology, Duzce University Medical School, Duzce, Turkey
[4] Department of Otorhinolaryngology, Ankara Numune Training and Research Hospital, Ankara, Turkey
[5] Department of Otorhinolaryngology, Kirikkale State Hospital, Kirikkale, Turkey
[6] Department of Otorhinolaryngology, Varto State Hospital, Mus, Turkey

ABSTRACT

Objectives. To determine the diagnostic value of fine needle aspiration biopsy (FNAB) and computed tomography (CT) in parotid masses in the basis of postoperative histopathological results. ***Methods.*** The records of 68 patients diagnosed with a parotid mass and undergone parotis surgery between November 2004 and February 2011 were evaluated retrospectively. Preoperative FNAB and the CT findings were compared with postoperative histopathological findings. ***Results.*** The study included 36 (58%) female and 26 (42%) male patients. The mean age of the patients was 43.9 years. No statistically significant difference was detected with regards to the performances of both FNAB and the CT (p=0.797). When it was evaluated in a detail, the performance of parotid CT(81.82%) to diagnose a mass in parotid gland was relatively better than FNAB (72.73%). The performance of FNAB (94.12%) to detect healthy ones was also greater than parotid CT (90.2%). ***Conclusion.*** We emphasize that preoperative FNAB and parotid CT should be performed to the patients with a parotid mass. The use of these two tests together can minimize the risk rate have been proved.

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Introduction

Salivary gland benign and malign tumours are responsible for 3% of all head-neck tumours and 80% of these tumours result from parotid gland [1].

Parotid salivary gland tumours are frequently observed by the clinician as a mass under the ear. Clinical history and physical examination are indispensable in the diagnostic course of diseases; however, it has a restricted role. It is essential that parotid salivary gland masses be diagnosed pre-operatively regarding the development of appropriate therapy. If the pre-operative diagnosis is made, the surgeon will have information regarding the issues such as type, duration and limits of operation, even whether surgical treatment is needed or not; and the related patient will be informed. Furthermore, such problems result in unnecessary costs and time waste

and exposing the patient to unnecessary morbidity, not being able to provide a health cure, and applying unnecessary diagnosis and treatment methods, can be prevented. Therefore, we studied the utilities of FNAB and parotid CT inspections, having a prominent place among pre-operative diagnostic methods, in the proper diagnosis of parotid masses.

In this study we evaluated efficacies and utilities of Fine-Needle Aspiration Biopsy (FNAB) and computed tomography (CT) imaging method, two important diagnostic methods, in parotid salivary gland masses, and to submit them in company with the existing literature by comparing the results of preoperative FNAB, and of CT to those of postoperative histopathological examination.

Methods

Sixty-eight patients, have been operated due to parotid masses, were retrospectively evaluated in our otolaryngology-head and neck surgery clinics between November 2004 and February 2011.

Six patients were excluded from the study due to lack of pre-operative parotid CT (4 patients) and FNAB (2 patients).

All CTs were performed with a "HITACHI Pronto" device. Their parotid CTs were received for consideration by a single senior radiologist, without knowing pathological results, so as to make an preoperative diagnosis FNABs of parotid salivary gland masses without USG assistance, without performing a local anaesthesia, performed by using an injector of 2 cc in 21 gauge (green end -0.8x38 mm injector nozzle) - 22 gauge (black end -0.7x32 mm), by primarily extracting 0.5 cc air into the injector and forwarding the nozzle through lesion fixed by means of free hands, by releasing the air into tissue, and after the nozzle is led inside the lesion with forward and backward movements, by applying negative pressure to the piston and leaving it, and by drawing back the injector. The area was cleaned by using Baticon and four eat least smears were prepared. Preparations were sent to the pathology laboratory in a form of being dried in the air. Preparations were stained with May Grünwald Giemsa.

Parotid salivary gland mass specimens of the cases were sent to the pathology laboratory inside 10% formaldehyde solution on the same day. On the following day, after their macroscopic investigations were performed, pieces were taken to the tissue observation, and their histopathological examinations were carried out by being stained with Haematoxylin-Eosin.

Performances of diagnostics tests to determine benign-malign tumours were submitted together with sensitivity, selectivity, positive-negative estimation value, the ratio of positive-negative likelihood and the values remaining under the curve. For the performance comparison, P value belonging to whether or not there exists a statistically significant difference in Area under Curve (AUC) values was compared to 0.05. Analyses were performed using Med Calc 11.2.1.0 software.

Results

Sixty-two patients, having been operated due to parotid masses, were included in the study between the dates November 2004 and February 2011. Ages of cases varied from 16 to 66 and the average age were 43.9±11.1. Gender distribution was in a way of 36 (58%) females and 26 (42%) males.

When examined according to FNAB results, 33 (53.2%) patients were assessed as with pleomorphic adenoma, 12 (19.3%) patients as with Warthin tumour, 6 (9.6%) patients as with mucoepidermoid carcinoma, 4 (6.4%) patients as with adenoid cystic carcinoma, 2 (3.2%) patients as with basal cell adenoma, 2 (3.2%) patients as with oncocytoma, 1 (1.6%) patients as with adipose tissue, 1 (1.6%) patients as with squamous cell carcinoma, and 1 (1.6%) patients as with infected cyst.

When parotid CT early diagnostics results were examined, 2 (3.2%) patients were, without giving any specific diagnosis, reported as with benign lesion, 1 (1.6%) patients, without giving any specific diagnosis, as with malign lesion, 25 (37%) patients as with pleomorphic adenoma (PMA), 17 (19.3%) patients as with Warthin tumour (WT), 8 (12.9%) as with mucoepidermoid carcinoma (MEC), 5 (8%) patients as with adenoid cystic carcinoma (ACC), 3 (4.8%) patients as with lymphadenopathy, and 1 (1.6%) patients as with lipoma.

When histopathological examination results were examined, 32 (51.6%) patients were founded as with PMA, 12 (19.3%) patients as with WT, 7 (11.2%) patients as with MEC, 4 (6.4%) patients as with basal cell adenoma (BCA), 3 (4.8%) patients as with ACC, 2 (3.2%) patients as with oncocytoma, 1 (1.6%)

Table 1. The correlation between FNAB results and histopathological results

FNAB RESULTS	HISTOPATHOLOGICAL RESULTS							
	PMA	WT	MEC	ACC	BCC	OC	SCC	Lipoma
PMA	28 (87.5%)	2 (16.6%)		1 (33.3%)	2 (50%)			
WT	2 (6.2%)	8 (66.6%)	2 (28.5%)					
MEC		1 (8.3%)	4 (57.1%)				1 (100%)	
ACC	2 (6.2%)			2 (66.6%)				
BCC					2 (50%)			
OC						2 (100%)		
SCC			1 (14.2%)					
Lipoma								1 (100%)
IC		1 (8.3%)						

PMA= pleomorphic adenoma, WT= warthin tumor, MEC= mucoepidermoid cancer, ACC= adenoid cystic carcinoma, BCC= basal cell cancer, OC= oncocytoma, SCC= squamous cell carcinoma, IC= infected cyst

patients as with squamous cell carcinoma (SCC), and 1 (1.6%) patients as with lipoma.

According to the FNAB results, 28 of 33 patients reported as PMA were diagnosed as with PMA, 2 of them as with BCA, 2 of them as with WT, and 1 of them as with ACC. Specimen results of 8 of the 12 patients called as with WT were as with WT, those of 2 of them as with PMA, and those of 2 of them as with MEC.

FNAB results of 6 patients diagnosed as with MEC resulted as 4 MEC, 1 SCC, and 1 WT according to histopathological examination. FNAB results of 4 patients diagnosed as with ACC resulted as 2 PMA and 2 ACC. FNAB results of 2 patients diagnosed as with oncocytoma were as they had been diagnosed according to histopathological examination. FNAB results of 2 patients diagnosed as with basal cell adenoma were as they had been diagnosed. FNAB result of a patient diagnosed as lipoma was reported as with lipoma. FNAB result of a patient diagnosed as

Table 2. Parotid CT results and histopathological results correlation

PAROTID CT RESULTS	HISTOPATHOLOGICAL RESULTS							
	PMA	WT	MEC	ACC	BCC	OC	SCC	Lipoma
PMA	20 (62.5%)	3 (25%)			2 (50%)			
WT	8 (25%)	6 (50%)	1 (14.2%)	1 (33.3%)		1 (50%)		
MEC	1 (3.1%)	1 (8.3%)	3 (42.8%)	1 (33.3%)		1 (50%)	1 (100%)	
ACC	1 (3.1%)	1 (8.3%)	2 (28.5%)	1 (33.3%)				
LAP	1 (3.1%)				2 (50%)			
Lipoma								1 (100%)
BT	1 (3.1%)	1 (8.3%)						
MT			1 (14.2%)					

CT= computed tomography, PMA= pleomorphic adenoma, WT= warthin tumor, MEC= mucoepidermoid cancer, ACC= adenoid cystic carcinoma, BCC= basal cell cancer, OC= oncocytoma, SCC= squamous cell carcinoma, LAP=lymphadenopathy, BT= benign tumor, MT= malign tumor

with SCC was reported as with MEC, and a patient diagnosed as with infected cyst by FNAB was reported as with WT (Table 1).

Two patients only diagnosed as with benign lesion by not being able to establish an early diagnosis according to the result of parotid CT, one of them was reported as with PMA and the other one as with Warthin tumor according to the result of the histopathological examination. Histopathological examination result of one patient was resulted as with MEC, which was diagnosed as malign tumor by not being able to give an early diagnosis with CT evaluation. Of the 20 of 25 patients previously diagnosed as PMA, the histopathological evaluations of 3 and two specimens were reported as WT and BCA, respectively. Of the 17 patients previously diagnosed with WT according to the parotid CT evaluation 8, 6, 1, 1 and one specimens were histopathologically diagnosed as with PMA, WT, oncocytoma, MEC, and ACC, respectively. Of the three patients preoperatively diagnosed as lymphadenopathy, 2 were diagnosed as BCA, and the other was PMA. The histopathological result of one patient previously diagnosed as lipoma was the lipoma.

Specimen results of 8 patients diagnosed as with MEC were resulted as 3 MEC, 1 SCC, one oncocytoma, 1 WT and 1 PMA. Of the five patients previously diagnosed as ACC; 2, 1, 1 and 1 of specimens were diagnosed as MEC, ACC, PMA, and Warthin tumour, respectively (Table 2).

In a condition during which the histopathological results are evaluated as the golden standard, performances of FNAB and parotid CT diagnostics tests to determine the difference between benign-malign were assessed through ROC (Receiver Operating Characteristic) Analysis, and compared. According to this, while (AUC-Area under Curve) value remaining under the curve indicating the performance of FNAB test was 0.834, that of parotid CT was founded as 0.86, notably close to the first value.

No statistically significant difference was detected with regards to the performances of both tests (p=0,797). When it is examined in a detailed way, while it can be seen that the performance of parotid CT to diagnose patients is relatively better than that of FNAB test (81.82-72.73), it can also be seen that the performance of FNAB test to detect healthy ones is, even if just a pinch, greater than that of parotid CT (94.12-90.2).

When the diagnostic test indicates as sick (malign), Positive Predictive Value (+PV), the probability of being really sick, is higher in FNAB test (72.7-64.3) whereas, when the diagnostic test indicates as healthy (benign), Negative Predictive Value (–PV), the probability of being really healthy, is, even if just a pinch, higher in parotid CT (95.8-94.1). Positive Likelihood Ratio (+LR) indicating how many wrong positive results FNAB test shows in response to each true positive result is high (12.36-8.35), at the same time, Negative Likelihood Ratio (–LR) indicating how many true negative results shown in response to each wrong negative result is also high (0.29- 0.20).

Values expressing the performances of the tests are shown in Table 3.

Table 3. Performances of the tests

	FNAB	Parotid CT
AUC (with 95% CI)	0.83 (0.718-0.917)	0.86 (0.748-0.935)
Sensitivity (%)	72.73	81.82
Specifity (%)	94.12	90.20
+PV (%)	72.70	64.30
-PV (%)	94.10	95.80
+LR (%)	12.36	8.35
-LR (%)	0.29	0.20

FNAB= fine needle aspiration biopsy, CT= computed tomography, AUC= area under curve, CI= confidence interval, +PV= positive predictive value, -PV= negative predictive value, +LR= positive likelihood ratio, -LR= negative likelihood ratio

Discussion

FNAB was first used in the diagnosis of salivary gland diseases in Radiumhemmet Stockholm in the year of 1953 [2, 3]. However, it's being accepted as a direct approach to the morphological diagnosis of salivary gland diseases could be possible after numerous researches during which cytology and biopsy results were correlated in the said field [4, 5]. Growing and increasing literature information every passing day has presented the importance of such diagnostic method, and indicated that the ratio of the establishment of the final diagnosis of the process varies between 80% and 98% [6]. Such ratio is a notable one for such a tissue as the parotid salivary gland, which is extensive enough to cause mistakes, and where different neoplastic and inflammatory lesions appear.

Basavanandswami *et al.* [7] stated that more than 70% of parotid lesions are benign tumours according to FNAB . In our study, benign cytology was found in 51 (82%) patients. CC Lin *et al.* [8] studied postoperative diagnosis of 276 patients with parotidectomy operations; and recognized 229 (85%) benign, 33 (12%) malign and 9 (3%) chronic inflammation diagnosis. Jose Granel *et al.* [9], reported the postoperative pathologic diagnosis of 52 patients with parotidectomy operation as 39 (75%) with benign, 13 (25%) with malign. In our study, histopathologic results were reported as 51 (82%) patients with benign and 11 patients (18%) with malign.

According to Cohen [10], FNAB has, in salivary glands, a sensitivity rate of 90% and more, and a specificity rate of nearly 95%. Again Cohen, Bottles, Rodriguez, and Zurida stated that accurate cytological diagnosis could be established in 90% of benign lesions, and nearly 75% of malignant lesions [13]. Some positive misdiagnoses were set in early periods of parotid FNAB. However, as the experience in this field increased, and salivary gland tumours and classifications started to be understood better, diagnostic accuracy rates increased as well [14]. In our series, correct and accurate diagnoses were able to be established in 6 of 8 cases, set proper cytological diagnoses, of 11 cases having malign histopathology, but wrong specific diagnoses were established in 2 of them. Real cytological diagnoses were confirmed for 46 of 51 cases, having benign histopathology, and correct specific diagnoses were established for 40 of

them. When accuracy rates of the values are examined, we can see that results of FNAB carried out recently can confirm truer and more accurate diagnoses. This shows us that experiences of both surgeon and cytopathologist in this field have developed over the years. It is essential that clinician and cytopathologist co-operate and increase their experience in this area for success in parotid FNAB.

In our study, sensitivity was calculated as 72.73% and specificity of 94.12% for FNAB. Rates of sensitivity and specificity for parotid FNAB were stated as 57-100% and 75-100% respectively, and utility rates as being 69-100% by various writers. In almost all of these series, specificity values were founded as higher than those of sensitivity.

There exists no evidence indicating that the risks, brought by surgical biopsy, also occur with FNAB. Facial nerve injury, fistula formation, and tumour implantation, as a result of FNAB, are extremely rare cases [10, 15]. In some instances, a minor hematoma can occur, and minor cellulitis responding to anti-biotherapy can happen few and far between as well [13]. No complication was developed in the patients included in our study.

CT is highly helpful, and very commonly used in the detection of parotid salivary gland tumours, the indication of tumour distribution, discrimination of solid/cystic and establishment of lipoma diagnosis depending on its specific density. X-ray exposure and having side effects which are subject to contrast agent as well as facial nerve navigation and its inadequacy in assessing its relation with mass are its disadvantages [17, 18].

Koyuncu *et al.* [19] compared CT and MRI efficiencies in 40 parotid mass patients during a study they performed in 2003. They found both imaging methods as similar with regards to tumour location and infiltration issues. MRI produced a better result with regards to tumour margin; even so this result did not change the operation strategy of the surgical team. They emphasize that it will be more reasonable to use CT method, costing less, since it is not possible to apply all methods in a pre-operative study, and since there exists no difference between the two methods. Moreover, it is emphasized that there exists no need for another imaging method in a patient apart from one of these two tests.

Urquhart *et al.* [20] studied the correlation between CT examinations and clinical assessment and post-operation results in their series of 29 patients, published in 2001, by starting from the idea that CT

examination should be applied to every parotid patient. Specifically, the growth, location, density, and whether it carries malignancy potential were inspected. Urquhart and his friend suggest that CT is used during the routine pre-operative inspection of parotid tumours.

Yalcin *et al.* [21] stated, in their study consisting of 40 patients during which they examined assistant, diagnostic methods in parotid tumours, that USG, CT, and sialography are helpful in pre-operative staging, but not in benign-malign discrimination. McGuirt *et al.* [22] suggest that pre-operative CT or MRI produced the appropriate response at a rate of 87% in benign-malign discrimination, and this rate was 69% in PET, and 78% in FNAB.

McGuirt suggests that MRI is primarily applied in sublingual gland tumours because of very high malignity rate. Spiro suggests in his essay concerning salivary gland masses, published in 1995, that CT can be preferred to more expensive MRI [23].
Owen and his friends [21] stated, following their study in which they examined the usage of CT together with FNAB in parotid masses, as it is in our study, that both tests produced highly valuable information regarding preoperative histology and anatomy, and thus prevented occurrences of unnecessary procedures and complications.

In our study, the sensitivity of CT for benign-malign discrimination was calculated as 81.82%, and its specificity as 90.20%. That the number of patients having malignant tumour was small, and that 5 of total 11 malignant diseases were advanced might have increased the accuracy rate. Valid specific diagnoses were established for 31 of total 62 patients. This ratio can be drawn up to higher levels thanks to the developing technology and increase of experience of radiologist on this issue.

The establishment of pre-operative diagnosis in parotid salivary gland masses is not only of great importance regarding obtainment costs and time savings, but also is significant so as to both decreases the morbidity that patients suffer, and for physicians, to protect himself or herself regarding medico legal responsibilities. Although plenty of studies were carried out to determine inspections to be pre-operatively performed, not a complete consensus has been formed yet. Therefore, we executed this study based on this fact.

We consider that FNAB should be applied to any patient with parotid masses on account of the presence of high accuracy rates, and of minimum complication

risks with history and physical examination of patients.

Since parotid surgery includes substantial risks, it is essential that location, size, histological behaviour and relations with surrounding tissues, of pre-operative mass be well known to minimize the said risks. It is not possible for us to obtain all the mentioned information only through FNAB. Thus, we also consider that it is necessary to take benefit of the information that parotid CT, one of imaging methods, gives on these issues.

Conclusions

Results that we obtained from our study during which we researched utilities of FNAB and parotid CT tests, two of pre-operative assistant diagnosis tests, ended up as being compatible with the literature. We consider that these tests are indispensable for being a guide for surgeons during the pre-operative diagnosis process and formation of treatment, yet they are not alternatives one another. To perform new studies particularly on series in which the number of malignant diseases is high will make a contribution to the literature.

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