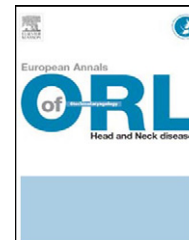




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ORIGINAL ARTICLE

# Fine-needle aspiration cytology in the management of parotid masses: Evaluation of 249 patients

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## KEYWORDS

Parotid tumour;  
Parotid gland;  
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tumour;  
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## Summary

**Introduction:** The role of fine-needle aspiration cytology (FNAC) in the management of parotid tumours is still the subject of controversy. The purpose of this study was to determine the diagnostic value of FNAC in our institution in order to define its place in the diagnostic strategy.

**Patients and methods:** This retrospective study was based on 249 patients who had undergone preoperative FNAC before being operated in our institution between 2001 and 2008. All examinations were performed and interpreted by the same experienced pathologist.

**Results:** Among the 249 patients included in this study, 187 (75%) had a benign tumour and 62 (25%) had a malignant tumour. No complications of FNAC were observed. Cytological findings were non-contributory in 47 patients (18%). The sensitivity of FNAC for the diagnosis of malignancy was 80% with a specificity of 89.5%. Among the 11 false-negative results, lymphomas and low-grade mucoepidermoid carcinomas were the most common histological types. Among the 16 false-positive results, Warthin's tumours, pleomorphic adenomas and lymphoepithelial lesions were the most common histological types. Accurate histological classification of the tumour was reported in 79.5% of cases (86% for benign tumours and 44% for malignant tumours).

**Conclusion:** FNAC is a reliable examination providing important information to the surgeon in the preoperative diagnostic assessment.

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## Introduction

Fine-needle aspiration cytology (FNAC) is a well tolerated, relatively painless, easy to perform, and inexpensive examination with few contraindications. Some authors consider FNAC to be an essential element of the diagnosis and treatment decision (particularly certain English-speaking teams who do not systematically perform frozen section biopsy when preoperative FNAC is diagnosed), while others consider that this technique is not sufficiently accurate. FNAC has been used for the diagnosis of parotid disease since the 1980s and there is consequently an abundant literature on this subject with very variable results from one team to another (Table 1) [1–16].

Although FNAC is now part of routine clinical practice for the evaluation of thyroid tumours [17] and cervical lymph nodes, no consensus has been reached concerning the role of this examination in the management of parotid disease, as some authors consider that it has a low sensitivity for malignant tumours [2, 18–20].

The purpose of this study was to determine the diagnostic value of FNAC in our institution in order to define its place and its advantages in the diagnostic strategy.

## Patients and methods

A retrospective study was conducted on 249 patients who had undergone preoperative FNAC before being operated in our institution between 2001 and 2008. All examinations were performed and interpreted by the same experienced pathologist.

Data were obtained from pathology reports. FNAC results were compared to the results of final histological examination of the operative specimen.

## Fine-needle aspiration cytology technique

A 25 Gauge needle was introduced into the mass and a rotation movement associated with to and fro vertical movements were applied to the needle. The histological material was collected by capillarity without aspiration. A syringe containing 5 mL of air was then attached to the needle and the collected material was expelled onto three glass slides, by placing the tip of the syringe on the slide. The material was then smeared and dried in air before being sent to the cytology laboratory. Three aspirations were performed for each tumour in order to optimise cytological examination and to reduce the number of non-contributory slides due to insufficient material.

## Analysis of the results

Three types of histological results were provided by the cytology laboratory:

- benign aspiration cytology;
- suspicious or malignant aspiration cytology;
- non-contributory aspiration cytology (indeterminate).

The performances of FNAC: sensitivity (Se), specificity (Sp), negative predictive value (NPV), positive predictive value (PPV), likelihood ratios (LR) and global efficacy were analysed by SPSS® version 15.0 statistical software (SPSS, Chicago, IL).

## Results

Among the 249 patients included in this study, 187 (75%) presented a benign tumour and 62 (25%) presented a malignant tumour. No complication of FNAC was observed. The FNAC results are summarized in Table 2.

**Table 1** Summary of studies on the fine-needle aspiration cytology of the parotid gland for differentiation of benign/malignant disease.

	<i>n</i>	Se (%)	Sp (%)	Accuracy (%)	PPV (%)
Orell 1995 [1]	325	85.5	99.5		98.5
Al-Khafaj 1998 [2]	154	82	86	84	
Stewart 2000 [3]	341	92	100	98	
Zbaren 2001 [4]	228	64	95	86	83
Postman 2004 [5]	388	88	99	96	
Cohen 2004 [6]					84
Bajaj 2005 [7]	69	84	96	94	
Seethala 2005 [8]	220	86	92	90	
Aversa 2006 [9]	310	83	100	97	
Uguz 2007 [10]	29	54	100		
Herrera 2007 [11]	46	54	90		70
Lim 2007 [12]	91	80	100		
Lin 2007 [13]	279	63	97		81
Carillo 2009 [14]	135	92	98		
Jafari 2009 [15]	110	67	96		80
Schmidt 2011 [16] (Meta-analysis)	6169	80	97		90
Present study	202	80	89.5	86.5	73

Se: sensitivity; Sp: specificity; PPV: positive predictive value.

**Table 2** Results of fine-needle aspiration cytology compared to final histology.

	Benign lesion in final histology	Malignant lesion in final histology	Total
Benign cytology	132 (true positives)	11 (false-negative)	143
Suspicious-malignant cytology	16 (false-positive)	43 (true negatives)	59
Indeterminate cytology	39	8	47
Total	187	62	249

**Table 3** Results of the fine-needle aspiration cytology for the diagnosis of malignancy.

		[95%CI]
Se	79.63%	[65.06–86.8]
Sp	89.19%	[84.55–94.01]
PPV	72.88%	[61.02–83.35]
NPV	92.31%	[86.62–95.4]
PLR	7.99	[4.85–13.15]
NLR	0.25	[0.07–0.20]
Efficacy	86.623%	[81.77–90.92]

Se: sensitivity; Sp: specificity; PPV: positive predictive value; NPV: negative predictive value; PLR: positive likelihood ratio; NLR: negative likelihood ratio.

FNAC was non-contributory in 47 patients (18% of cases). These non-contributory cases were excluded from the statistical analysis, as FNAC has no informative value in these situations.

Among the 202 FNAC samples analysed, a correct diagnosis was obtained in 87% of cases, a false-negative result was obtained in 11 cases (7.7%) and a false-positive result was obtained in 16 cases (27%). The calculated sensitivity for the diagnosis of malignancy was 79.63% with a specificity of 89.19%. The positive likelihood ratio (PLR) was 7.99 and the negative likelihood ratio (NLR) was 0.25 (Table 3).

Among the 11 false-negative results (Table 4), lymphomas and low-grade mucoepidermoid carcinomas were the most common histological types (nine out of 11 cases, 81.8%). Among the 16 false-positive results (Table 5), Warthin’s tumours, pleomorphic adenomas and lymphoepithelial lesions were the most common histological types.

Histological typing of the tumour was able to be performed on 161 (79.5%) of the 202 contributive FNAC specimens of this series. The accuracy of histological typing was 86% (106/123) for benign tumours and 44% (17/38) for malignant tumours.

## Discussion

### Performances of fine-needle aspiration cytology

FNAC was able to correctly classify parotid tumours in 87% of cases. A recent review of the literature (Table 1) reported a sensitivity ranging from 54 to 92% depending on the series and a specificity ranging from 86 to 100% [1–16]. A meta-analysis conducted in 2011 also demonstrated an estimated global sensitivity of 80% and an estimated specificity of 97% [16]. This low sensitivity can be explained by the high false-negative rate for the diagnosis of malignancy, as tumours were falsely classified as benign in 8 to 46% of cases depending on the series. In the present study, the sensitivity and specificity were 80% and 89%, respectively, in line with the data of the literature.

The rate of non-contributory FNAC is one of the major drawbacks of this diagnostic technique, as it ranges from 3 to 34% depending on the series [3,4,21,22]. In the meta-analysis by Schmidt, this non-contributory FNAC rate was estimated to be 8.6% [16]. In the present study, this rate was relatively high at 18%, but in line with the literature. This high rate could be explained by the fact that all aspiration cytologies in this series were performed without ultrasound guidance, which could result in a lower diagnostic yield for cystic tumours and/or tumours situated deep in

**Table 4** Summary of false-negative fine-needle aspiration cytology results (n = 11).

Cytology	Cytological diagnosis	Final histological diagnosis
Benign	Mixed benign tumour	Low-grade mucoepidermoid carcinoma
Benign	Mixed benign tumour	Acinar cell carcinoma
Benign	Lymphoepithelial cyst	Follicular B-cell lymphoma
Benign	Indeterminate	Follicular B-cell lymphoma
Benign	Indeterminate	Hodgkin’s lymphoma
Benign	Warthin’s tumour	Low-grade mucoepidermoid carcinoma
Benign	Warthin’s tumour	Acinar cell carcinoma
Benign	Warthin’s tumour	Non-Hodgkin’s malignant lymphoma
Benign	Warthin’s tumour	Hodgkin’s Lymphoma
Benign	Warthin’s tumour	Low-grade mucoepidermoid carcinoma
Benign	Indeterminate	Low-grade mucoepidermoid carcinoma

**Table 5** Summary of false-positive false-negative fine-needle aspiration cytology results ( $n = 16$ ).

Cytology	Cytological diagnosis	Final histological diagnosis
Suspicious	Malignant mixed tumour	Mixed benign tumour
Suspicious	Indeterminate	Warthin's tumour
Suspicious	Indeterminate	Warthin's tumour
Suspicious	Indeterminate	Warthin's tumour
Suspicious	Indeterminate	Warthin's tumour
Suspicious	Indeterminate	Lymphoepithelial cyst
Suspicious	Indeterminate	Lymphoepithelial cyst
Suspicious	Indeterminate	Obstructive parotiditis
Malignant	Malignant mixed tumour	Mixed benign tumour
Malignant	Malignant mixed tumour	Mixed benign tumour
Malignant	Malignant mixed tumour	Mixed benign tumour
Malignant	Malignant mixed tumour	Warthin's tumour
Malignant	Acinar cell carcinoma	Oncocytoma
Malignant	Adenocarcinoma	Warthin's tumour
Malignant	Indeterminate	Lymphoepithelial cyst
Malignant	Indeterminate	Mixed benign tumour

the parotid parenchyma. Bajaj in 2005 and Pratap in 2009 showed that the sensitivity of FNAC was increased by 20%, from 65% to 85%, with the use of ultrasound guidance [7,23]. Our clinical practice has been modified since this series, as we now increasingly tend to perform ultrasound-guided FNAC.

No published study has reported a sensitivity of FNAC higher than 92%. There is therefore a relatively high risk of false-negative results for malignant tumours and FNAC can therefore never formally exclude a malignancy and therefore cannot reliably reassure the surgeon and the patient. In the present series, 18% of malignant tumours were diagnosed as benign lesions on FNAC.

The results for histological typing of tumours by FNAC range from 29 to 84% depending on the series [2,4,20]. In the present series, among the 161 cases in which histological typing was possible, this typing was accurate in 86% of benign tumours and 44% of malignant tumours. Histological typing of primary parotid tumours is a difficult exercise and our results are comparable to those published in the literature. These results can be explained by the fact that primary malignant tumours of the parotid are much rarer than benign tumours and, according to the WHO 2005 classification of parotid tumours, there are more than 25 different types of malignant tumours while only nine types of benign tumour have been described, predominantly composed of pleomorphic adenomas and Warthin's tumours, which makes typing of benign tumours less complex than that of malignant tumours.

### Value of fine-needle aspiration cytology in the operative decision

The value of FNAC in the management of parotid tumours remains controversial. The majority of surgeons do not plan their surgical procedure as a function of the FNAC results, but propose exploratory parotidectomy with frozen section biopsy and modify the procedure

(complementary lymph node dissection) according to the operating findings.

In a recent study, Lin et al. demonstrated that preoperative knowledge of the malignant nature of a parotid tumour modified the postoperative course [13]. When the surgeon operates with the intention to treat a malignant tumour, the number of concomitant lymph node dissections and the number of negative margins on histological examination of the operative specimen are significantly increased. According to these authors, preoperative knowledge of the malignant nature of the tumour based on FNAC improves the success of initial surgical management and therefore has an impact on long-term survival. However, it should be noted that these authors did not systematically perform frozen section biopsy and that their approach was therefore mainly guided by FNAC.

In contrast, O'Brien considered that FNAC should only be recommended when the cytology results would be likely to modify management: patients in poor general health, in whom a benign diagnosis on FNAC would justify conservative management, doubt about the intraparotid site of the mass, evaluation of a parapharyngeal mass, for which a diagnosis of malignancy would modify the surgical incision, when the swelling appears to be clinically malignant and when nerve sacrifice appears to be necessary, or when a metastasis of a skin cancer is suspected and concomitant lymph node dissection is required [24].

The meta-analysis conducted by Schmidt in 2011 and based on 64 studies and more than 6000 patients demonstrated excellent performances of FNAC [16]. However, due to the marked heterogeneity of recruitment, methodologies and results between the various studies, the authors were unable to reach any clear conclusions or define a consensus concerning the approach to a parotid mass.

FNAC alone obviously cannot be used to guide surgical management and imaging, especially MRI, comprising the use of new sequence (diffusion-weighted sequences), now has a very important place in the management of parotid masses in combination with FNAC [25].

## Conclusion

Parotid tumours raise diagnostic problems due to their histological diversity, while the histological nature of the tumour determines planning of the surgical procedure and its resulting consequences and complications. As the complication rate logically increases with the degree of invasiveness of the surgical procedure, it is important to be able to characterize the tumour preoperatively in order to correctly inform the patient about the type of surgery that will be performed, the need for lymph node dissection and the possibility of nerve sacrifice.

FNAC is a reliable examination that provides valuable information for the preoperative diagnostic work-up and alerts the surgeon to the possible presence of malignancy.

The preoperative information provided by FNAC in the case of a malignant result allows:

- staging;
- definition of a surgical plan in terms of resection margins, the need for lymph node dissection, the degree of urgency of treatment;
- the surgeon to give more appropriate information to the patient about the surgical plan and the risk of postoperative facial palsy.

Finally, in view of the considerable false-negative rate, FNAC cannot formally exclude malignancy and therefore cannot reliably reassure the surgeon and the patient. Apart from a few selected cases (patients in poor general health, for example), histological examination after parotidectomy is always necessary.

## Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

## References

- [1] Orell SR. Diagnostic difficulties in the interpretation of fine-needle aspirates of salivary gland lesions: the problem revisited. *Cytopathology* 1995;6:285–300.
- [2] Al-Khafaji BM, Nestok BR, Katz RL. Fine-needle aspiration of 154 parotid masses with histologic correlation: ten-year experience at the University of Texas M. D. Anderson Cancer Center. *Cancer* 1998;84:153–9.
- [3] Stewart CJ, MacKenzie K, McGarry GW, et al. Fine-needle aspiration cytology of salivary gland: a review of 341 cases. *Diagn Cytopathol* 2000;22:139–46.
- [4] Zbaren P, Schar C, Hotz MA, et al. Value of fine-needle aspiration cytology of parotid gland masses. *Laryngoscope* 2001;111:1989–92.
- [5] Postema RJ, van Velthuysen ML, van den Brekel MW, et al. Accuracy of fine-needle aspiration cytology of salivary gland lesions in The Netherlands Cancer Institute. *Head Neck* 2004;26:418–24.
- [6] Cohen EG, Patel SG, Lin O, et al. Fine-needle aspiration biopsy of salivary gland lesions in a selected patient population. *Arch Otolaryngol Head Neck Surg* 2004;130:773–8.
- [7] Bajaj Y, Singh S, Cozens N, et al. Critical clinical appraisal of the role of ultrasound-guided fine-needle aspiration cytology in the management of parotid tumours. *J Laryngol Otol* 2005;119:289–92.
- [8] Seethala RR, LiVolsi VA, Baloch ZW. Relative accuracy of fine-needle aspiration and frozen section in the diagnosis of lesions of the parotid gland. *Head Neck* 2005;27:217–23.
- [9] Aversa S, Ondolo C, Bollito E, et al. Preoperative cytology in the management of parotid neoplasms. *Am J Otolaryngol* 2006;27:96–100.
- [10] Uguz MZ, Onal HK, Eroglu OO, et al. Sensitivity and specificity of fine-needle aspiration biopsy in parotid masses. *Kulak Burun Bogaz Ihtis Derg* 2007;17:96–9.
- [11] Herrera Hernandez AA, Diaz Perez JA, Garcia CA, et al. Evaluation of fine-needle aspiration cytology in the diagnosis of cancer of the parotid gland. *Acta Otorrinolaringol Esp* 2008;59:212–6.
- [12] Lim CM, They J, Loh KS, et al. Role of fine-needle aspiration cytology in the evaluation of parotid tumours. *ANZ J Surg* 2007;77:742–4.
- [13] Lin AC, Bhattacharyya N. The utility of fine-needle aspiration in parotid malignancy. *Otolaryngol Head Neck Surg* 2007;136:793–8.
- [14] Carrillo JF, Ramirez R, Flores L, et al. Diagnostic accuracy of fine-needle aspiration biopsy in preoperative diagnosis of patients with parotid gland masses. *J Surg Oncol* 2009;100:133–8.
- [15] Jafari A, Royer B, Lefevre M, et al. Value of the cytological diagnosis in the treatment of parotid tumors. *Otolaryngol Head Neck Surg* 2009;140:381–5.
- [16] Schmidt RL, Hall BJ, Wilson AR, et al. A systematic review and meta-analysis of the diagnostic accuracy of fine-needle aspiration cytology for parotid gland lesions. *Am J Clin Pathol* 2011;136(1):45–59.
- [17] Sellami M, Tababi S, Mamy J, et al. Interest of fine-needle aspiration cytology in thyroid nodule. *Eur Ann Otorhinolaryngol Head Neck Dis* 2011;128(4):159–64.
- [18] Zanaret M, Chevalier D, Brasnu D, et al. Parotid tumor. *Ann Otolaryngol Chir Cervicofac* 2007;124:41–5.
- [19] Zbaren P, Guelat D, Loosli H, et al. Parotid tumors: fine-needle aspiration and/or frozen section. *Otolaryngol Head Neck Surg* 2008;139:811–5.
- [20] Atula T, Greenman R, Laippala P, et al. Fine-needle aspiration biopsy in the diagnosis of parotid gland lesions: evaluation of 438 biopsies. *Diagn Cytopathol* 1996;15:185–90.
- [21] Wong DS, Li GK. The role of fine-needle aspiration cytology in the management of parotid tumors: a critical clinical appraisal. *Head Neck* 2000;22:469–73.
- [22] Bartels S, Talbot JM, DiTomasso J, et al. The relative value of fine-needle aspiration and imaging in the preoperative evaluation of parotid masses. *Head Neck* 2000;22:781–6.
- [23] Pratap R, Qayyum A, Ahmed N, et al. Ultrasound-guided core needle biopsy of parotid gland swellings. *J Laryngol Otol* 2009;123:449–52.
- [24] O'Brien CJ. Current management of benign parotid tumors—the role of limited superficial parotidectomy. *Head Neck* 2003;25(11):946–52.
- [25] Habermann CR, Arndt C, Graessner J, et al. Diffusion-weighted echo-planar MR imaging of primary parotid gland tumors: is a prediction of different histologic subtypes possible? *AJNR Am J Neuroradiol* 2009;30(3):591–6.