Fine Needle Aspiration Biopsy: in the Diagnosis of Salivary Gland Neoplasms Compared with Histopathology

Hasan Mete İnançlı · Mahmut Alper Kanmaz ·
Ahmet Ural · Gulay Bilir Dilek

Received: 11 October 2012 / Accepted: 6 December 2012 / Published online: 15 December 2012
© Association of Otolaryngologists of India 2012

Abstract Fine needle aspiration biopsy is commonly used for pre operative evaluations of salivary gland masses. We would like to focus on this diagnostic tool for the salivary gland lesions by reviewing Ankara Oncology Hospital's case lists. Cytological and postoperatively histological reassessment is done for 115 cases. Fine needle aspiration biopsy's sensitivity was 80.8 %, specificity 95.1 %, positive predictive value was 84 % and negative predictive value was 93.9 %. False positive range was 4.9 % and false negative range was 19.2 %. Salivary gland masses can be assessed by cytology preoperatively.

Keywords Salivary gland mass ·
Fine needle aspiration biopsy · Cytology

Introduction

Fine needle aspiration biopsy (FNAB) has been used in the investigation of salivary gland lesions for many years

[1, 2]. The cytological features of the more common salivary neoplasms and inflammatory processes are well recognized, and accurate cytological diagnosis is therefore possible in most cases [1, 2]. The usefulness of salivary gland FNA relates to the fact that it is easy to perform, is minimally invasive, smear evaluation is immediate, and the procedure can be repeated several times to obtain more tissue for diagnosis or special studies [3, 4]. Although it is controversial in the evaluation of salivary gland lesions. Routine use of FNAB in the evaluation of all salivary gland masses is not absolutely necessary. Well-defined parotid masses are generally treated with surgical resection whether FNAB indicates benign or malignant disease. The extent of surgery and decisions regarding management of the facial nerve are made based on intraoperative findings rather than results of FNAB. However, there are clinical scenarios in which FNAB can be a useful diagnostic tool. FNAB may be useful in evaluating poorly defined salivary gland masses, and to confirm clinical suspicion of malignant disease in order to counsel patients before surgery. FNAB may be useful in diagnosing metastatic carcinoma, especially with submandibular gland masses, and to help distinguish surgically treatable from nonsurgical pathologic conditions, such as lymphoma. FNAB may also be useful in evaluation of salivary gland masses in patients who are poor surgical candidates. Prior studies have reported sensitivity of FNAB in detecting malignant lesions to range widely, from 29 to 97 %. High specificity has been reported, ranging from 84 to 100 % [2, 5–8]. In many of these studies, FNAB was routinely performed for all salivary lesions before surgery. In addition, the rate of malignant lesions in most of these studies was low, ranging from 15 to 32 % [6, 7], consistent with the expected rate of malignant disease in an unselected population. The efficacy of FNAB cytology was determined by comparing cytodiagnoses with histopathology results in 115 cases.

H. M. İnançlı (✉)
Department of Otorhinolaryngology, Faculty of Medicine,
Yakin Doğu Bulvarı, Near East University, Nicosia,
Northern Cyprus, Mersin 10, Turkey
e-mail: hmetei@yahoo.com

M. A. Kanmaz
Otorhinolaryngology Clinic, Sanli Urfa Birecik State Hospital,
Sanli Urfa, Turkey

A. Ural
Department of Otorhinolaryngology, Faculty of Medicine,
Karadeniz Technical University, Trabzon, Turkey

G. B. Dilek
Department of Pathology, Ankara Oncology Education and
Research Hospital, Ankara, Turkey

Patients and Method

A retrospective review of patients' data from the Department of ENT, Ankara Oncology Hospital was carried out. The data reviewed concerned patients who had 1 or more FNABs from a salivary gland-related lesion during the period from January 1, 2009, to December 31, 2009. The FNABs were received from the Department of ENT Head and Neck Surgery. All aspirations were diagnosed at the Department of Pathology. In total, 115 patients were identified. The cytologic diagnosis and the corresponding histology were identified for patients who had received surgical treatment. If more than 1 FNAB was performed, the most recent cytologic diagnosis was recorded. The localization of the patients' lesions, their sex, age, and the number of aspirations were recorded. For patients with both cytologic and histologic diagnosis, the following parameters were taken into consideration: positive predictive value, negative predictive value, sensitivity, specificity, accuracy, and concordance rate with histology. If the cytologic assessment resulted in the diagnosis of malignancy, it was classified as a positive result, whereas a benign or a non-neoplastic lesion was considered negative.

Results

The mean age of patients is 51.1 ± 16.6 (year) and the range were 16 and 86. 68 of 115 patient were (59.1 %) male, 47 of 115 patient were (40.9 %) female. The swellings were mostly located in the parotid and 53 were (46.1 %) right parotid, 41 were (35.7 %) left parotid, 13 were (11.3 %) right submandibular gland and 8 were (7.0 %) left submandibular gland.

The Table 1 shows the FNAB and histopathological distribution results. Total column shows FNAB results and the total line shows histopathological treatment results. Malign atypical FNAB results were also malign in histopathological results. 25 of benign FNAB results were benign non-neoplastic and in histopathological findings of 22 benign results were benign non-neoplastic lesions.

We analyzed the effectiveness of FNAB in treatment in comparison with histopathological results by excluding atypical cytology and inadequate aspirates (Figs. 1, 2). According to this; FNAB sensitivity was 80.8 %, specificity 95.1 %, positive predictive value was 84 % and negative predictive value was 93.9 %. False positive range was 4.9 % and false negative range was 19.2 % (Table 2).

We also analyzed the effectiveness of FNAB in treatment in comparison with histopathological results by excluding only inadequate aspirates. According to this; FNAB sensitivity was 82.8 %, specificity 95.1 %, positive predictive value was 85.7 % and negative predictive value

was 93.9 %. False positive range was 4.9 % and false negative range was 17.2 % (Table 3).

Discussion

FNAB was first used as a diagnostic tool in 1904 by Grieg and Gray [9]. They aspirated trypanosomes from the lymph nodes of patients with sleeping sickness. Over the subsequent 30 years, its role was developed, in particular by Guthrie [10] who attempted to correlate the results of aspiration with a range of diseases being investigated and by Martin and Ellis [11] who, from their base at Memorial Sloan-Kettering Cancer Center in New York, developed its use in the diagnosis of malignancy. FNAB is now the first line investigation for the diagnosis of palpable head and neck masses of all types. Typically, the technique utilizes an 18- to 23-gauge needle. Either suction or capillary action is then employed to draw cells into the hollow needle core. This cellular aspirate can then be transferred onto a glass slide, allowed to air dry or be fixed using an alcohol-based fixative and used to provide an immediate diagnosis following microscopic evaluation. Since the advent of liquid-based cytology, some of the aspirate can be rinsed into the relevant liquid fixative, which allows multiple thin layer preparations of the material to be made. This allows the use of ancillary techniques such as immunocytochemistry, which may aid and refine diagnosis.

With a clinical history and physical examination suggestive, physicians should seek to solidify the diagnosis before employing treatment and before counseling a patient on prognosis. Traditionally, FNAB has been performed preoperatively for histological confirmation of malignancy and to aid in operative planning, such as planning for elective neck dissection. The usefulness of salivary gland FNAB relates to the fact that it is easy to perform, is minimally invasive, smear evaluation is immediate, and the procedure can be repeated several times to obtain more tissue for diagnosis or special studies [3, 4].

Aspiration of only normal salivary gland parenchyma can sometimes be judged as false-negative, since an aspirate exclusively composed of ductular epithelial cells and acinar cell clusters may instead be the representative of a pathologic situation, such as sialosis. Cystic lesions of the salivary glands can be either non-neoplastic or neoplastic and can be either benign or malignant [12]. Examples of non-neoplastic cysts are lymphoepithelial cyst, retention cyst, and mucocele. Warthin's tumor is the commonest cystic neoplasm but PA, cystadenoma, mucoepidermoid tumor, and acinic-cell carcinoma can also be cystic. Sometimes, however, the regenerative ductal epithelial cells may undergo an oncocytic change with the background of inflammatory cells (macrophages, lymphocytes, and neutrophils), and the lesion

Table 1 FNAB and histopathological distribution results

	Histopathology		Total
	Malign	Benign	
FNAB			
Malign			
N	21	4	25
FNAB %	84.0	16.0	100.0
Histopathology %	72.4	4.7	21.7
Benign			
N	5	77	82
FNAB %	6.1	93.9	100.0
Histopathology %	17.2	89.5	71.3
Atypical cytology			
N	3	0	3
FNAB %	100.0	0	100.0
Histopathology %	10.3	0	2.6
Inadequate aspirates			
N	0	5	5
FNAB %	0	100.0	100.0
Histopathology %	0	5.8	4.3
Total			
N	29	86	115
FNAB %	25.2	74.8	100.0
Histopathology %	100.0	100.0	100.0

Fig. 1 CYSTX200-MGG: Example of non-diagnostic material. Non-specific cyst-fluid with macrophages ($\times 200$; MGG)

may be erroneously interpreted as Warthin's tumor. Warthin's tumor has a prominent lymphoid component, which is a characteristic feature in the smears and the admixture with other inflammatory cells is less common.

The main problem with salivary gland FNAB is deciding whether a tumor is benign or malignant. There is considerable overlap between the morphological patterns

Fig. 2 WTX100-HE: Warthin's tumor with characteristic bilayered papillary oncocytic epithelium with prominent lymphoid element from the histopathologic examination of the same patient. Note the cystic component ($\times 100$; H-E)**Table 2** False positive and false negative ranges

	Histopathology		Total
	Malign	Benign	
FNAB			
Malign			
N	21	4	25
FNAB %	84.0	16.0	100.0
Histopathology %	80.8	4.9	23.4
Benign			
N	5	77	82
FNAB %	6.1	93.9	100.0
Histopathology %	19.2	95.1	76.6
Total			
N	26	81	107
FNAB %	24.3	75.7	100.0
Histopathology %	100.0	100.0	100.0

of salivary gland tumors found on cytology and, as many are rare, it is not surprising that their interpretation is difficult, particularly when the pathologist does not have extensive experience.

The single most important factor that decides diagnostic accuracy is experience, as has been amply documented in the literature. The great majority of the common variants of non-neoplastic and both benign and malignant salivary gland tumors can be diagnosed with a high level of accuracy with FNAB. It can avoid unnecessary surgery. Patients with a high operative risk may benefit from the information obtained by FNAB.

In a 5-year experience study Zhang et al. [12] there were 5 false negatives: 2 adenoid cystic carcinomas, 1 acinic cell carcinoma, 1 polymorphous low grade adenocarcinoma

Table 3 Predictive values of FNAB

	Histopathology		Total
	Malign	Benign	
FNAB			
Malign			
N	24	4	28
FNAB %	85.7	14.3	100.0
Histopathology %	82.8	4.9	25.5
Benign			
N	5	77	82
FNAB %	6.1	93.9	100.0
Histopathology %	17.2	95.1	74.5
Total			
N	29	81	110
FNAB %	26.4	73.6	100.0
Histopathology %	100.0	100.0	100.0

and 1 metastatic basaloid squamous cell carcinoma. The only false positive was a pleomorphic adenoma misdiagnosed as adenoid cystic carcinoma. Four reactive processes were diagnosed as benign neoplasms, including 2 granulomatous inflammations and two chronic sialadenitis. Five benign neoplasms were interpreted as reactive processes, including 2 Warthin's tumors, 2 sebaceous lymphadenomas and 1 pleomorphic adenoma. The overall accuracy in distinguishing benign from malignant lesions was 79.1 %, and the sensitivity for salivary neoplasia was 89.4 % [11].

Likewise another 341 cases review study Steward et al. [13]. Clinicopathological review showed that 88 of 91 (97 %) benign epithelial tumors and 27 of 31 (87 %) malignant neoplasms with adequate FNA sampling were accurately diagnosed cytologically. False-negative results were caused by sampling error (7 cases), most notably in cystic tumors, or were due to misinterpretation of uncommon neoplasms (3 cases). The overall accuracy of FNA cytology in this series was 98 %, excluding unsatisfactory specimens, while diagnostic sensitivity for neoplasia was 92 % (97 and 87 % for benign and malignant tumors, respectively). There were no false positive diagnoses of neoplasia (100 % specificity) [12].

The accuracy of FNA cytology for the diagnosis salivary gland tumors has been also questioned [14]. In six studies, the sensitivity of FNA cytology for the diagnosis of neoplasms, especially malignancies of the salivary glands, ranged from 55.0 to 98.0 % (average 81.9 %), the specificity from 92.0 to 99.0 % (average 97.1 %), and the diagnostic accuracy from 84.0 to 98.0 % (average 92.6 %) [14–18].

There were four major reasons for incorrect interpretation in cytologic diagnosis. The first was inadequate sampling with insufficient cellularity of the aspirate. The

second was marked cellular degeneration. The third was erroneous labeling of specimens. The last cause was that the cytologist was unfamiliar with the morphology of rare salivary gland lesions. Through experience, the diagnostic accuracy of pathologic changes in the salivary gland can be improved.

When a malignant diagnosis is given, the surgeon and the patient are in a better position to discuss and plan for the next course of action, while the diagnosis of a benign lesion provides immediate relief to the patient, sparing the anxiety of waiting several days for a surgical biopsy diagnosis [3, 19].

Conclusion

FNAB is a minimally invasive technique that has a pivotal role in the diagnosis and management of patients with salivary gland tumors. When performed properly, FNAB cytology can provide useful preoperative information about a mass lesion arising in the salivary gland, permitting the clinician to appropriately manage the patient. It is still the most preferred diagnostic modality for the salivary gland lesions. However, extreme care and recognition of the limitations of cytology are essential in the evaluation of salivary gland FNAB material to achieve the correct diagnoses, as there are many common and rare tumors that can cause diagnostic confusion.

References

1. Young JA (1995) The salivary glands. In: Gray W (ed) Diagnostic cytopathology. Churchill Livingstone, Edinburgh, pp 301–314
2. Cohen MB, Reznicek MJ, Miller TR (1992) Fine-needle aspiration biopsy of the salivary glands. *Pathol Annu* 27:213–245
3. Sauer T, Freng A, Djupesland P (1992) Immediate interpretation of FNA smears of the head and neck region. *Diagn Cytopathol* 8:116–122
4. MacLeod CB, Frable WJ (1993) Fine-needle aspiration biopsy of the salivary gland: problem cases. *Diagn Cytopathol* 9:216–225
5. Al-Khafaji BM, Nestok BR, Katz RL (1998) Fine-needle aspiration of 154 parotid masses with histologic correlation: ten-year experience at the University of Texas M. D. Anderson Cancer Center. *Cancer* 84:153–159
6. Wong DSY, Li GKH (2000) The role of fine-needle aspiration cytology in the management of parotid tumors: a critical clinical appraisal. *Head Neck* 22:469–473
7. Hee CGQ, Perry CF (2001) Fine-needle aspiration cytology of parotid tumors: is it useful? *ANZ J Surg* 71:345–348
8. Chan MKM, McGuire LJ, King W (1992) Cytodiagnosis of 112 salivary gland lesions. *Acta Cytol* 36:353–363
9. Grieg EDW, Gray ACH (1904) Note on the lymphatic glands in sleeping sickness. *Br Med J* 1:1252
10. Guthrie CG (1921) Gland puncture as a diagnostic measure. *Bull Johns Hopkins Hosp* 32:266–269
11. Martin HE, Ellis EB (1930) Biopsy by needle puncture and aspiration. *Ann Surg* 92:169–181

12. Zhang S, Bao R, Bagby J, Abreo F (2009) Fine needle aspiration of salivary glands: 5-year experience from a single academic center. *Acta Cytol* 53(4):375–382
13. Stewart CJ, MacKenzie K, McGarry GW, Mowat A (2000) Fine-needle aspiration cytology of salivary gland: a review of 341 cases. *Diagn Cytopathol* 22(3):139–146
14. Cristallini EG, Ascani S, Farabi R, Liberati F, Macciò T, Peciarolo A, Bolis GB (1997) Fine needle aspiration biopsy of salivary gland, 1985–1995. *Acta Cytol* 41:1421–1425
15. Frable MAS, Frable WJ (1991) Fine-needle aspiration biopsy of salivary glands. *Laryngoscope* 101:245–249
16. Boccato P, Altavilla G, Blandamura S (1998) Fine needle aspiration biopsy of salivary gland lesions: a reappraisal of pitfalls and problems. *Acta Cytol* 42:888–898
17. Atula T, Grénman R, Laippala P, Klemi PJ (1996) Fine-needle aspiration biopsy in the diagnosis of parotid gland lesions: evaluation of 438 biopsies. *Diagn Cytopathol* 15:185–190
18. Mavec P, Eneroth CM, Franzén S, Moberger G, Zajicek J (1964) Aspiration biopsy of salivary gland tumors. I. Correlation of cytologic reports from 652 aspiration biopsies with clinical and histologic findings. *Acta Otolaryngol* 58:471–484
19. Heller KS, Dubner S, Chess Q et al (1992) Value of fine needle aspiration biopsy of salivary gland masses in clinical decision making. *Am J Surg* 164:667–670