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Fine needle and core needle biopsy in salivary tumor diagnostic

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Abstract

Based on the literature reviews summarize the diagnostic value of fine needle and core needle biopsy in salivary gland masses, revealing the advantages and disadvantages of these two methods. Salivary gland tumors are diagnostic challenge in a clinical practice and an accurate diagnosis is essential for its adequate management. Fine needle aspiration cytology and core needle aspiration cytology are a useful techniques for evaluating masses suspected of being of salivary gland origin. The reported diagnostic accuracy of FNAC can be as high as 98% when adequate material is obtained, but the rate of insufficient or non-diagnostic rate is up to 29%. Core needle biopsy aids in differentiating malignant from benign masses with reported sensitivities of 75~89%, specificities of 96.6~100%, and accuracies of 91.9~100%. **Conclusions:** Studies have shown that fine needle and core needle aspiration cytology have high sensitivity and specificity for salivary gland lesions. In the absence of ultrasound-guidance, or on-site cytopathologist, the accuracy of these methods often falls off dramatically.

Key words: salivary gland, tumors, fine needle, core needle, biopsy

Background

Apart from the normal morphology, salivary glands give rise to no fewer than 30 histologically distinct benign and malignant tumors (1).

The symptoms of benign and malignant salivary gland neoplasm often overlap.

Most salivary gland tumors are benign and mainly consist of pleomorphic adenoma and Warthin's tumor. Malignant salivary tumors account for 15.7~26% of salivary gland lesions, of which mucoepidermoid carcinoma is most common, followed by adenoid cystic carcinoma, and acinic cell carcinoma (2).

The standard for the definitive diagnosis of salivary gland masses is made by hystopatological examination. Tissue can be obtained in a variety of ways: fine needle aspiration biopsy (FNAB), core-needle biopsy (CNB), incisional biopsy, excisional biopsy, and resection. Open biopsy includes incisional and excision biopsy, usually reserved for small lesions of the minor salivary glands, while resection is usually used for major salivary gland tumours. Incisional open biopsy has many of the disadvantages of a resection: general anaesthesia, wide excision, possible nerve damage and bleeding. Open biopsy is generally avoided due to tumour spillage or seeding, nerve damage, scarring and possible fistula development (3,4,5).

The disadvantages of open biopsies have allowed aspiration cytology to come into favour as a well accepted means of procuring tissue. Immediate adequacy assessment and triage is superior to other methods, often times resulting in rapid diagnosis (3,4,5).

Of all the anatomical sites at which to perform a fine needle aspiration cytology and core needle aspiration cytology, the head and neck area is the most complex. This area can be site of different types of salivary tumors or metastases (1).

Trends in the evaluation of salivary gland masses have changed as imaging studies have improved and sampling techniques have evolved over the past several decades (4). Imaging modalities for salivary gland lesions including ultrasonography, computed tomography and magnetic resonance imaging may help to narrow the differential diagnosis (2). Tissue diagnosis remains a standard requirement to establish a definite diagnosis. In recent years, percutaneous image-guided fine needle aspiration cytology and core needle aspiration have been increasingly used as they are less invasive than surgical biopsy (2).

In the absence of ultrasound-guidance, or on-site cytopathologist, the accuracy of fine needle and core needle biopsy often falls off dramatically tumors (1).

Review Results

Fine needle aspiration biopsy (FNAB), fine needle aspiration cytology (FNAC)

Fine-needle aspiration biopsy (FNAB) offers a rapid, low cost technique for assessing the nature of salivary gland mass lesions, it is commonly used as a first-line procedure in clinical practice (2,6). The reported diagnostic accuracy of FNAC can be as high as 98% when adequate material is obtained, but the rate of insufficient or non-diagnostic rate is up to 29% (7,8,9).

Ashok R. Shaha et coworkers have performed 160 needle aspirations of parotid, submandibular, and submucosal lesions. The major difficulty for authors was in distinguishing between malignancy and

obstructive sialadenitis in the submandibular region. No complications such as hematoma, nerve injury, or infection developed was observed (10).

In another study P. Zbären , et al was performed preoperative FNAC in 228 and the results of FNAC were analyzed and compared with the corresponding histopathological diagnosis. Histological evaluation revealed 65 malignant tumors and 163 benign lesions. The cytological findings were nondiagnostic in 13 (5.7%). Nineteen of 39 (49%) malignant tumors (true-positive) and 123 of 146 (84%) benign lesions (true-negative) were classified accurately. The accuracy, sensitivity, and specificity were 86%, 64%, and 95% respectively (7).

In a retrospective study based on 249 patients who had undergone operation, preoperative FNAC was performed. 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). The autors concluded that FNAC is a reliable examination providing important information to the surgeon in the preoperative diagnostic assessment (9).

Recent researches made point out that sonography can characterize salivary gland massesand identify accurate needle placement during the biopsy, sonographically guided FNAB of salivary gland masses is known to be more accurate than a biopsy performed via direct percutaneous puncture (2,11).

Yu-Ting Huang et coworkers reported in own study, the accuracy and specificity of UGFNAB were 92.7% and 98.2%, respectively, supporting UGFNAB as a highly accurate and specific method of detecting salivary gland malignancy. The sensitiv-

ity was 66.7%, falling into the lower end of the reported range (2).

The false-negative lesions was 33.3% and were misdiagnosed as benign were adenoid cystic carinoma, mucoepidermoid carcinoma, acinic cell carcinoma, lymphoma, and lymphoepithelioma-like carcinoma, while the false-positive lesions were pleomorphic adenoma (2).

Study of Hee Woo Cho et coworkers included 245 major salivary gland tumors who had undergone sonographically guided FNAB followed by surgical excision with a goal to evaluate the diagnostic accuracy of FNAB. The authors compared the histopathologic diagnoses with the preoperative cytology results obtained from FNAB. The overall sensitivity, specificity, and accuracy of sonographically guided FNAB in differentiating malignant from benign tumors was 75.7%, 100%, and 95.8%, respectively. The false-negative diagnostic rate was 4.2% (9/215), but there were no false-positive diagnoses of malignancy. Among the 47 malignancies, only 28 cases (59.6%) were detected preoperatively by FNAB.The conclusion of the study is that for the preoperative evaluation of major salivary gland tumors, sonographically guided FNAB is feasible for distinguishing between benign and malignant salivary gland tumors in the subset of patients with satisfactory cytologic diagnoses. However, negative or nondiagnostic cytologic results cannot always guarantee benignity of the final diagnosis, and therefore careful consideration of the sonographic features and cytologic results is necessary to avoid false reassurance (11).

Kraft found that ultrasound-guided core needle biopsy was superior to UGFNAB in the assessment of head and neck lesions because it provided a specific diagnosis (90% vs. 66%) and achieved a higher accuracy in the detection of malignancy (99% vs. 90%),but the sensitivity and specificity did not differ significantly between the two methods (12).

One of the limitation of UGFNAB is the rather high rate of unsatisfactory aspiration. About 6% to 25.5% of UGFNAB do not yield a conclusive cytological diagnosis because of insufficient cellularity or poor cellular quality, related to operator experience in performing aspiration, sampling error (needle targeting to tissue outside the lesion or a necrotic, hemorrhagic or cystic part of the tumor), technically suboptimal smears, and interpretative skills of cytopathologists (2).

Core needle aspiration biopsy (CNAB), core needle aspiration cytology (CNAC)

Generally, large-gauge needles substantially improve diagnostic feasibility as the pathologist can more readily determine the specific type of malignant or benign mass from the larger core of tissue. Core needle biopsy aids in differentiating malignant

from benign masses with reported sensitivities of 75~89%, specificities of 96.6~100%, and accuracies of 91.9~100% (13).

Ultrasound guided core needle biopsy (USCB) has recently been described in the diagnosis of salivary gland malignancies. It is safe, requiring only local anaesthetic and provides a core of tissue, which can be used for immunohistochemical analysis (6) and was chosen as a preferable method in several study (1,2,6,14).

Syed Qaiser Husain Naqvi et coworkers performing core needle biopsy in 108 patients. Histological findings of ultrasound-guided core needle biopsy showed non-neoplastic lesions in 29(26.8%) cases;. Benign neoplastic lesions were found in 54(50%);. Malignant lesions were found in 25(23.1%);. Excisional biopsy confirmed the diagnosis of ultrasound-guided core needle biopsy, except in one case of Warthin tumor which was mucoepidermoid carcinoma on excisional biopsy (1). No false positive case was noted,only one (0.9%) false negative case was detected on US-CNB. The diagnostic accuracy in non-neoplastic and malignant neoplastic lesions was 100%. The overall sensitivity was 96.2% and specificity 100% (1).

Howlett David C and coworkers had a purpose to evaluate the accuracy of sonographically guided core biopsy in the evaluation of parotid masses.In135 patients consecutively presenting with a parotid mass were prospectively performed initial diagnostic sonography and then sonographically guided core biopsy. In 76 (56%) of the 135 patients who underwent surgery, sonographically guided core biopsy and surgical histologic findings were correlated for 74 patients. In two cases sonographically guided core biopsy and surgical histologic findings did not correlate. In one case, the sonographically guided core biopsy finding was mucoepidermoid carcinoma, but the final diagnosis was squamous cell carcinoma. In the other case, the finding at sonographically guided core biopsy was squamous cell carcinoma, but the final diagnosis was mucoepidermoid carcinoma (15).

The clinical significance of the study is that in differentiation of benign from malignant disease, sonographically guided core biopsy had a sensitivity, specificity, and diagnostic accuracy of 100%. onographically guided core biopsy also had positive and negative predictive values of 100% in the diagnosis of malignancy (15).

U. Mandalia et coworkers made a review of 14 year experience of diagnosing benign and malignant salivary gland tumours. The diagnostic techniques of fine needle aspiration cytology (FNAC), and ultrasound guided core biopsy (USCB) are compared to surgical excision. Based on their own experience the authors conclude that ultrasound guided core biopsy provides a greater diagnostic accuracy with regard to the detection of salivary gland tumours than FNAC, with a sensitivity and specificity approaching 100%. They recommend that USCB should be the first line investigation for preoperative management of salivary gland tumours (6).

Value of fine-needle aspiration cytology in the operative decision

It is generally agreed that FNA of salivary glands is a good diagnostic test with reasonable sensitivity and specificity, ranging from 60% to 100% and 90% to 100%, respectively.

FNAC is a fast, safe and well tolerated by the patients technique with a number of advantages in assessment of salivary gland masses. The accuracy of FNAC can be enhanced within a specialist clinic, which may be led by a cytologist (16) or a radiologist (17). Outside the specialist clinic, however, the accuracy of FNAC decreases significantly with acquisition of large numbers of aspirate samples that do not give enough information for diagnosis (18).

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 (9).

In a recent study, Lin et al. demonstrated that preoperative knowledge of the malignant nature of a parotid tumour modified the postoperative course (19). If the surgeon know the preoperative diagnosis of the salivary tumor the number of concomitant lymph node dissections and the number of negative margins on histological examination of the operative specimen will be significantly increased if it is a malignant tumour (19). 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.

FNAC alone obviously cannot be used to guide surgical management. MRI now has a very important place in the management of parotid masses in combination with FNAC (20).

The preoperative information provided by FNAC in the case of a malignant result allows (9):

- 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 (9).

False-negative and false-positive results occur in salivary gland FNA. False-negative results are due mainly to errors of underdiagnosing low-grade tumors because of their bland cytologic features and the difficult evaluation of hypocellular cystic lesions so common in this area, while false-positive diagnoses emanate from “overcalls”of reactive changes, such as occur in the setting of associated inflammatory

reactions (14). In view of the considerable false-negative rate, FNAC cannot formally exclude malignancy and therefore cannot reliably reassure the surgeon and the patient (9).

Core-needle biopsy has several advantages (4):

1. Lack of morbidity of an open biopsy;
2. No general anaesthesia, with its attendant additional planning and scheduling;
3. Little to no scarring in a cosmetically sensitive region;
4. Low risk of fistula formation (4).

The potential disadvantages include:

1. Requires radiology coordination and scheduling, different from a FNA;
2. Patient discomfort (4).

One of the significant advantages of core-needle biopsy over FNA is architectural preservation. Many of the most common salivary gland neoplasms show identical cytologic features, while the architecture will make the separation possible; these include basal cell adenoma, basal cell adenocarcinoma, and adenoid cystic carcinoma, to name just one group of tumours with overlapping findings (4).

The pitfalls of FNAC have led some authors to study the use of sonographically guided core biopsy in assessment of parotid masses (3,21,22). The use of sonographic guidance for biopsy is important because it allows accurate needle placement (14).

Although there were no major complications of sonographically guided core biopsy. The advantages of US-CNB include its simplicity, low cost, low morbidity and the rapidity of obtaining an accurate diagnosis. The procedures can be done as an out door, can be processed with routine histopathological techniques, can differentiate between in situ and invasive disease and can exclude the possibility of false positive results in benign lesions.It is also helpfull in tumor grading, and various immuno-histochemical analysis before surgery (1).

The main objections to core biopsy of salivary gland are the risk of hemorrhage , facial nerve injury when the procedure is performed in a parotid gland mass and tumor seeding along the needle tract (1). The retromandibular vein and external carotid artery are the major intraparotid vessels; their injury can be avoided when they are visualized with sonography (15). The facial nerve is not readily identified with sonography, the nerve passes in a plane superficial to the retromandibular vein and can be avoided (15). The risk of tumor seeding varies according to the organ involved and the size of the used needle (23, 24). The data indicate that tumor seeding can occur after larger-bore needles, probably because these needles allow aspiration of sizable stromal fragments and allow survival of malignant cells (23). Tumor

seeding in the parotid gland is extremely rare after needle biopsy and has been described only in association with the use of large-bore needles (25).

Another main problem in salivary diagnostic is pitfalls in histological evaluation of different types of salivary gland lesions. Theodore R. Miller make a point that not only correct performing biopsy is important to the correct diagnosis, but also competence of histological evaluation (26).

Conclusion

US-CNB and fine needle biopsy in salivary gland lesions are well tolerated and has demonstrated a high degree of diagnostic accuracy. Preoperative recognition of malignant tumors may help prepare both the surgeon and patient for an appropriate surgical procedure.

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