

## RESEARCH ARTICLE

# Accuracy, Sensitivity and Specificity of Fine Needle Aspiration Biopsy for Salivary Gland Tumors: A Retrospective Study from 2006 to 2011

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### Abstract

**Objective:** This article concerns evaluation of the sensitivity, specificity and accuracy of FNAB for pre-surgical diagnosis of benign and malignant lesions of major and minor salivary glands of patients treated in the Department of Head and Neck Surgery of Erasto Gartner Hospital. **Methods:** This retrospective study analyzed medical records from January 2006 to December 2011 from patients with salivary gland lesions who underwent preoperative FNAB and, after surgical excision of the lesion, histopathological examination. **Results:** The study had a cohort of 130 cases, but 34 cases (26.2%) were considered unsatisfactory regarding cytology analyses. Based on the data, sensitivity was 66.7% (6/9), specificity was 81.6% (71/87), accuracy was 80.2% (77/96), the positive predictive value was 66,7% (6/9) and the negative predictive value was 81.6% (71/87). **Conclusion:** Despite the high rate of inadequate samples obtained in the FNAB in this study the technique offers high specificity, accuracy and acceptable sensitivity.

**Keywords:** Salivary Gland Tumor- fine-needle aspiration- sensitivity- accuracy- specificity.

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### Introduction

The salivary gland neoplasms are uncommon conditions and constitute about 3% to 10% of all tumors of the head and neck, characterized by great heterogeneity on the histological characteristics, biological behavior and clinical outcome (Wang et al., 2012). This low incidence may be related to racial and geographic factors and, according to (Mejia-Valazquez et al., 2012; Jaafari-Ashkavandi et al., 2012), the annual age-adjusted incidence is 4.7% for benign lesions and 0.9% for malignant lesions.

Due to the diversity of cell types, growth patterns and morphological characteristics, histological and cytological analysis of salivary gland tumors becomes highly specific, hard even for experienced pathologists (Colella et al., 2010).

For the treatment of salivary gland lesions, it is necessary to know the extent of the injury, if there is involvement of vital structures and especially the histological types of the entity. Considering that most of the alterations in salivary glands are benign and the treatment chosen is generally conservative, differentiation with accuracy between benign and malignant lesions is essential before surgery (Colella et al., 2010; Saha et al., 2011; Pfeiffer and Ridder 2012; Derin et al., 2015).

To guide a prior provisional diagnosis, some minimally invasive techniques have been used, including incisional biopsy, fine needle aspiration and biopsy by cutting needle (Santos et al., 2011).

The incisional biopsy of major salivary glands is considered a surgical procedure that deserves a prominent attention, given the susceptibility to trans and postoperative complications, especially infection, suture dehiscence, bleeding and neuropathies. Recent studies have sought alternative methods for better diagnose of early lesions, with specificity, accuracy, easy technique and minimal surgical trauma and complications (Nelson and Thompson 2012).

The biopsy through fine needle aspiration (FNAB) is widely used for preoperative diagnosis of palpable masses and deep lesions of difficult access. In the head and neck, is typically used for diagnosis in thyroid, lymph nodes, major salivary glands and cervical cancers. In the oral cavity, it is used in odontogenic tumor biopsies, intra-osseous lesions, small salivary gland tumors and other lesions that show fluid accumulation on the inside (Santos et al., 2011). FNAB is a procedure realized in outpatient setting that uses disposable syringes with needles of varying gauges, inserted into the lesion in order to aspirate liquid and explore the texture of the lesion. The procedure is well tolerated by patients and the use

of local anesthesia is usually unnecessary (Saleh et al., 2008). The collected material can be analyzed under a light microscope (Howlett et al., 2015). Another advantage of FNAB is the possibility of acquiring more samples in the same procedure, only by changing the direction of the needle during a single puncture (Zerpa-Zerpa et al., 2014). Complications such as bleeding, swelling and tenderness are minimized when compared with biopsy. The procedure does not disrupt tissue planes, minimizing the risk of postoperative infection (Nelson and Thompson 2012).

In intraoral lesions, the sensitivity and specificity of FNAB may vary from 80% to 100%, while accuracy vary between 60% and 100% (Santos et al., 2011). Santos (2011) and Colella (2010) reported a false positive rate variable between 0 and 3% and a false negative rate from 0 to 20%. However, the major limitation of this procedure is the insufficient amount of material, which may occur mainly due to inadequate collection of material by the examiner or interpretation problems by the cytopathologist (Frankel et al., 2011).

Although there are several scientific papers reporting that the FNAB has the same efficacy and specificity that the incisional biopsy in the diagnosis of salivary gland lesion, FNAB alone has not shown satisfactory results (Cross et al., 1990; Kesse et al., 2002).

This article aims to evaluate the sensitivity, specificity and accuracy of FNAB in pre surgical diagnosis of benign and malignant lesions of major and minor salivary glands of patients treated in Head and Neck Surgery Department of the Erasto Gartner Hospital (EGH) in the period between January 2006 and December 2011.

## Materials and Methods

This retrospective study analyzed medical records (from January 2006 to December 2011) of patients with salivary gland lesions treated in the Department of Head and Neck Surgery (EGH). All patients underwent preoperative FNAB and, after surgical excision of the lesion, histopathological examination was conducted. The two examinations were then compared to determine the sensitivity, specificity and accuracy of FNAB. Demographic information was also collected, such as gender, location of the lesion, tumor size, FNAB result and histopathological examination.

Both cytological and histological analyzes were performed by three pathologists. Cytological examinations were classified as benign, malignant or inconclusive. In some cases, the pathologist suggested a diagnosis. The diagnosis was inconclusive when the material was insufficient for a proper analysis.

The results were analyzed by dichotomous scale of values on the diagnoses obtained by FNAB and final histopathological examination. The amount of false-negative and false-positive results of the FNAB has been verified. The sensitivity was calculated based on malignancies, while specificity was based on benign lesions including benign neoplasms and inflammatory lesions. The accuracy was calculated by dividing the total number of truly positives and truly negatives tumors by the total number of injuries.

## Results

In the period analyzed, the Department of Head and Neck Surgery performed 3,235 surgeries and 1,850 FNAB. Considering only the cases of salivary gland lesions, the total number of surgeries was 194 (5.9%), and from those cases, 15 were excluded for not having FNAB, 4 cases due to metastasis in salivary gland, and 45 cases who did not undergo surgery or biopsy of the lesion after initial FNAB, resulting in a cohort of 130 cases.

Most of patients were female (53.8%), with an average age of 48.9 years old. The age ranged from 20 to 82 years old for men, with a mean of 47.8 years and between 20 and 79 years old for women with a mean of 49.9 years. The tumors varied in size from 0.5 cm to 12 cm diameter with an average of 3.38 cm. The most frequent site was the parotid gland (94/72.3%), followed by submandibular gland (32/24.6%) and minor salivary glands (4/3.1%). Thirty-four samples were insufficient for analysis (26.2%). FNAB classification included 87 (90.6%) benign and 9 (9.4%) malignant diagnosis.

Histopathological analysis revealed that 98 samples (75.4%) were benign and 32 (24.6%) malignant (Table 1). According to this, the most common benign tumor was pleomorphic adenoma with 63 cases (46.5%), followed by Warthin Tumor (10 cases) and chronic sialadenitis (9 cases). Among malignant tumor, squamous cell carcinoma was the most prevalent with 11 cases (8.5%), followed by mucoepidermoid carcinoma (8 cases) and undifferentiated malignant neoplasm (4 cases) (Supplement 1). Considering the results of malignancy on FNAB, it was observed 3 false-positive cases of malignancy, 16 false-negative cases of malignancy, 71 true-negative cases of malignancy and 6 true-positive for malignancy.

Cases with inconclusive diagnosis in FNAB were excluded from the sensitivity, specificity and accuracy analysis. Sensitivity of the exam was 66.7% (6/9), specificity was 81.6% (71/87) and accuracy was 80.2% (77/96). The positive predictive value was 66.7% (6/9) and the negative predictive value was 81.6% (71/87) (Table 1).

Among benign tumors of the salivary glands, FNAB identified 71 of 98 benign lesions (sensitivity of 72.4%). There were 24 cases not identified by FNAB and 3 false-positive results. From the 24 cases not identified by FNAB, histological examination revealed 12 cases of pleomorphic adenoma, 2 cases of chronic sialoadenitis, 2 Warthin tumors, 2 squamous cyst, 2 epithelial cysts, 1 lipoma, 1 monomorphic adenoma, 1 ectopic tissue and 1 lymphoepithelial lesion. Of the 3 FNAB false-positive cases, 2 were diagnosed as pleomorphic adenoma and 1 case as lymphoid hyperplasia. Therefore, when the

Table 1 . Analysis of the Results by FNAB in Relation to Histological Results

Histological Results	FNAB Result			
	Inconclusive	Benign	Malignant	Total
Benign	24 (24.5%)	71 (72.4%)	3 (3.1%)	98 (100%)
Malignant	10 (31.3%)	16 (50.0%)	6 (18.7%)	32 (100%)
Total	34	87	9	130

inconclusive results (n = 24) were excluded from analysis, FNAB correctly identified 71 of 87 benign lesions, increasing sensitivity from 72.4% to 81.6%.

On the analysis of the malignant salivary gland tumors, FNAB identified 6 of 32 malignant lesions (sensitivity: 18.7%). There were 10 inconclusive cases and 16 false-negative cases. Therefore, when unidentified results were excluded from the analysis (n = 22), FNAB correctly identified 6 of 9 malignant tumors in salivary glands, increasing sensitivity of 18.7% to 66.7%.

For 17 cases, immunohistochemistry (IHC) was necessary to assist on the confirmation of the final diagnosis, being 12 malignant and 5 benign (Supplement 2). The malignant lesions generated the main doubts on the final diagnoses. Among five cases of squamous cell carcinoma, IHC generated four different final diagnoses (1 acinar cell carcinoma, 1 ex pleomorphic adenocarcinoma, 2 squamous cell carcinoma, 1 mixed tumor). Among four cases of undifferentiated malignant neoplasm, IHC diagnosed 1 myoepithelioma, 1 high-grade sarcoma, 1 rhabdomyoma and 1 hemangiosarcoma. Regarding the five benign lesions, IHC confirmed the result from Histopathological exam in all cases. Comparing the data obtained by the histopathological diagnosis and IHC, there was no difference on the results in terms of benign and malignant classification.

On the other hand, comparing the data obtained by the FNAB and IHC, there was 1 case diagnosed as pleomorphic adenoma by FNAB, a benign lesion, that IHC confirmed to be a mucoepidermoid carcinoma, a malignant one. Fourteen inconclusive FNAB cases were diagnosed with IHC (Supplement 3). Among them, there were 2 chronic sialadenitis and 2 squamous cell carcinoma. Twelve of the 14 inconclusive cases turned out to be malignant lesions.

## Discussion

FNAB is an easy diagnostic technique of low cost that is well tolerated by the patient (Colella et al., 2010). According to Medline (US National Library of Medicine), there are approximately 393 studies published during the period 2000-2011 on the sensitivity, specificity and accuracy of needle aspiration, designed to assess the effectiveness of this diagnostic method (Schmidt et al., 2013).

According to the literature, salivary gland tumors represent from 3% to 10% of all head and neck tumors (Wang et al., 2012). The present study found a rate of 5.9% of patients with salivary gland lesions treated during the study period, results similar to those described on the literature.

Benign lesions represent a rate greater than 50% according to studies worldwide (Shishegar et al., 2011). Histopathological samples collected in this study showed a 75.4% rate of benign lesions and 24.6% of malignant.

The predominance of pleomorphic adenoma (46.5%) between the benign tumors followed by Warthin's tumor (10.2%) are consistent with the literature. Chronic sialoadenitis in 9.2% of cases was not expected, since it is an inflammatory lesion, although in some cytological and

histopathological analyzes these lesions presented with a diagnosis of pleomorphic adenoma. The inclusion of inflammatory lesions to evaluate the sensitivity, specificity and accuracy of needle aspirates is rarely found in the literature (Singh Nanda et al., 2012).

Comparing the current study (sensitivity 66.7%, specificity 81.6%, accuracy 80.2%, positive predictive value 66.7%, negative predictive value 81.6%) with the previous study realized on the same hospital (sensitivity 68.2%, specificity 87.7%, accuracy 82.3%, positive predictive value of 68.2%, negative predictive value 87.7%), it was not found a significant difference in sensitivity on the present study when comparing with the literature, which varies between 53% and 100% (Vaidya et al., 2011).

A major disadvantage of FNAB is the amount of unsatisfactory/ inconclusive diagnosis. A rate of 26.1% (34 cases) was observed, compared with the previous study with 25.5% (27 cases) unsatisfactory/inconclusive cases. Both rates remain within the results described on the literature that ranges between 0% and 34% (Frankel et al., 2011; Singh Nanda et al., 2012).

The variation in results may be influenced by some changes made on the project. The addition of inflammatory lesions and the modification of the inclusion criteria impel new results. This study was modified in order to fit a more effective method of diagnosis. The variation of the study design is still not very clear in the literature, which leads to a deficiency in comparing results, as shown by Schmidt (Schmidt et al., 2013).

The cytology obtained by FNAB has limited accuracy due to the experience of the operator and the examiner, but is considered a safe method with good acceptance to differentiate benign and malignant tumors. Preoperative differentiation of neoplasms is very important for therapeutic planning, especially in patients with significant comorbidities (Stramandinoli et al., 2009).

With advancing technology, even the histological examination (H&E) called "gold standard" is being questioned with regard to diagnostic accuracy. As seen in our study, some malignant lesions did not obtain the diagnostic accuracy compared with immunohistochemistry and, according Adisa (2010) this margin is acceptable. But when comparing immunohistochemistry with cytology collected by FNAB, we noticed a significant mismatch.

The study suggests that FNAB is a method still widely used for preoperative diagnosis of salivary gland lesions. Despite the high rate of inadequate / inconclusive samples (26.2%), the survey showed a high specificity (81.6%), accuracy (80.2%), and an acceptable sensitivity (66.7%). New techniques and technologies are being applied to achieve a more accurate diagnosis, such as cutting needle biopsy and puncture guided by ultrasound. However, many services do not have access to such technologies, which leads us to emphasize the importance of using FNAB technique, due to technical facilities and low cost. The need for standardized studies and the continuation of these studies are of great importance for improving the efficiency of this method, given that the technique has a susceptibility to error, in the case of inexperience of the operator and the examiner.

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