Diagnostic Value of Fine Needle Aspiration Cytology (FNAC) in Salivary Gland Tumors

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Abstract

Introduction Salivary gland tumors represent the most complex and diverse group of tumors encountered in the head and neck region. The diagnosis of these tumors is challenging and the histological examination in the form of incisional biopsy is the standard preoperative diagnostic method, but for major salivary glands this technique harbors the potential for facial scar, facial nerve injury, development of fistula and tumor cells spillage. This is why it is restricted to the minor gland pathology. Fine-needle aspiration cytology (FNAC), on the other hand, does not have such complications and therefore it is more accepted and preferable as a preoperative diagnostic method. Aim Assessment of diagnostic value of fine needle aspiration cytology (FNAC) in salivary gland tumors. Patients and Methods Twenty patients were involved; FNAC was performed. The study was conducted in the Department of Oral and Maxillofacial Surgery in Alshaheed Ghazi Alhareery for Specialized Surgeries Hospital at Medical City_ Baghdad, in the period from November 2015 to November 2016. FNAC was performed as preoperative diagnostic tool

Results There was no significant difference between benign and malignant salivary gland tumors in terms of patients’ age and gender. The majority of tumors were in the parotid and minor salivary glands in the palate respectively. The malignant tumors showed higher prevalence, Mucoepidermoid Carcinoma followed by Adenoid Cystic Carcinoma were the most common malignant tumors while Pleomorphic Adenoma was the most common benign tumor. The values of FNAC Accuracy, Sensitivity, Specificity, Positive predictive value (PPV) and Negative predictive value (NPV) were: 85%, 84.62%, 85.71%, 91.7% and 75% respectively. Conclusions FNAC has a reasonable reliability in differentiating benign and malignant salivary gland tumors with accepted level of accuracy, sensitivity, specificity, positive predictive value and negative predictive value. The high positive predictive value of FNAC in this study indicates the good reliability to confirm the malignancy.

Keywords Fine Needle Aspiration Cytology (FNAC), Salivary gland tumors, Diagnostic value of FNAC
Introduction

Salivary gland tumors constitute an important aspect in the field of maxillofacial pathology. These tumors are a heterogeneous group of neoplasm in the head and neck area; they have the complex morphologic appearance and different clinical behavior, a fact that renders their difficulty in diagnosis. They are rare lesions and represent less than 1% of all tumors and 3-6% of all head and neck neoplasms in various reports by Wahiduzzaman et al., 2013. The most common site of salivary gland tumors is the parotid gland, it can be stated that two-thirds to three-quarters of all salivary tumors occur in the parotid gland, and two-thirds to three quarters of these parotid tumors are benign. Minor salivary glands in the palate are the second most affected glands (Neville, 2016). The histological examination is the standard diagnostic method in the form of incisional biopsy, but for major salivary glands this technique harbors the potential for facial scar, facial nerve injury, development of fistula and tumor cells spillage so it is restricted to the minor gland pathology. Fine Needle Aspiration Cytology (FNAC) is the study of cells obtained by a small gauge needle generally with a vacuum system provided by an air tight syringe. In recent decades, fine needle aspiration cytology (FNAC) has been established as an efficient diagnostic tool for superficial masses; including salivary gland masses (Song et al., 2015). Salivary gland FNAC does not have the same complications of incisional biopsy and therefore it is more accepted and preferable as a preoperative diagnostic method (Miloro et al., 2011). Despite of FNAC diagnostic value; it seems that this technique has not given enough attention regarding the diagnosis of salivary gland tumors in Iraq.

Patients and Methods

This prospective observational study conducted in the Department of Oral and Maxillofacial Surgery in Alshaheed Ghazi Alhareery for Specialized Surgeries Hospital at Baghdad’s Medical City. Twenty patients were involved who was complaining from major or minor salivary gland tumor, the period of study was from November 2015 to November 2016. FNAC was performed as a preoperative diagnostic tool. All the selected patients underwent aspiration after explaining the procedure and taking a verbal consent. Ethical approval to conduct the research was obtained from the Iraqi Board for Medical Specialization on March, 2015.

A specifically designed case sheet (approved by the department) was formulated and applied for each patient in the consultation clinic, which includes the patient’s demographic data; medical history and some clinical essentials in tumor assessment (side, site, skin tethering and surface ulceration) followed by the examination of regional cervical lymph nodes and assessment of facial nerve function. Relevant investigations to the mass also were performed in the following order: ultrasound imaging of the mass to exclude vascular lesion followed by Computerized tomography (CT) with contrast medium for the assessment of the mass extension and invasion of the adjacent structures, Finally the Fine Needle Aspiration Cytology (FNAC) was carried out (Kocjan, 2006). All of the data were registered on the case sheet with the final histopathological diagnosis after tumor definitive surgery. The procedure was performed in aseptic environment in which the operator wear mask and gloves and the area over the mass wiped with alcohol (70%). The mass is palpated and fixed between the fingers of the left hand and the needle is passed on perpendicular way to the mass then applying negative pressure (by pulling the plunger of the syringe backward) (figure 1 A). Keeping the negative pressure along with a jerking movement forward and back-
ward until aspiration is seen in the hub of the needle, then release the negative pressure and withdraw the syringe fixative.

Figure (1- A): FNA from Right Parotid painless mass of 3 months duration and the result was pleomorphic adenoma

The aspirated material is expelled onto the labeled glass slides. Thin film preparation was done by spreading the slides with each other (Figure 1_ B).

Figure (1-B): Thin Film Preparation

Four glass slides were prepared and labeled with pencil as two groups carrying the patient name and serial number: one group is air dried, stained with May-Grunwald Giemsa (MGG) stain and other group is fixed by immersion in a series of different concentrations of ethanol alcohol fixative, stained with Papanicolaou stain (pap stain) (Figure 1-C).
Case Example of the study is illustrated in (Figure 2)

Figure (2-A): 30 years old lady with 6 months duration right parotid mass
Figure (2-B): FNAC revealed Pleomorphic adenoma (epithelial cells with chondromyxoid material)

Figure (2-C): After complete removal of the superficial lobe.

Figure (2-D): Histopathology confirm the diagnosis by the abundance of myoepithelial cells with chondromyxoid material
Statistical Analysis
Statistically the p value was considered to be significant if p < 0.05. The FNAC independent t test was used to analyze the p value in tumor distribution according to age, this test is performed for comparing the means between two unrelated groups. Fisher exact test was used to analyze the p value in tumor distribution according to gender, this test used for categorical data that result from classifying objects in two different ways, the most common use of this test is 2*2 tables and that’s why it was used here (female, male * benign, malignant). Galan and Gambino method was used to calculate the accuracy, Sensitivity, Specificity, Positive predictive value and Negative predictive value of FNAC.

Results
In this study 20 patients were enrolled with confirmed diagnosis of salivary gland tumors. The majority of tumors were malignant on histopathological examination: 13 cases were malignant while 7 cases were benign. There was no significant difference between benign and malignant tumors in terms of patients’ age and their gender, as illustrated in Table 1, ten cases were female and ten cases were male, male to female ratio was 1:1 of the 20 patients.

Table 1: Tumors distribution according to patients age and gender

<table>
<thead>
<tr>
<th>Patients data</th>
<th>Benign</th>
<th>Malignant</th>
<th>Total</th>
<th>Mean</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Patients</td>
<td>7 (35%)</td>
<td>13 (65%)</td>
<td>20 (100%)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Age (years)</td>
<td>48 ± 11</td>
<td>53 ± 9</td>
<td>50.5 ± 10</td>
<td>0.269 *</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>28.6%</td>
<td>8</td>
<td>61.5%</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>71.4%</td>
<td>5</td>
<td>38.5%</td>
<td>10</td>
</tr>
</tbody>
</table>

Overall mean age of the patients was 51 ± 10 years, ranging from 29 – 77 years, most of the patients concentrated in the age group 50 – 59 years. The study showed only three sites affected by salivary gland tumors. The majority of these tumors were in the parotid gland followed by minor salivary glands in the palate and submandibular gland respectively. All palatal gland tumors and the majority of Parotid gland tumors were malignant while the submandibular gland showed the least involvement by malignancy (Figure 3).
Regarding the prevalence of histological types of the salivary glands tumors; Mucoepidermoid carcinoma followed by Adenoid cystic carcinoma were the most common malignant tumors, whereas Pleomorphic Adenoma was the most common benign tumor. The results were categorized into the following groups: True Positive (+ve) cases (which were malignant in both cytological and histopathological examination), True Negative (-ve) cases (which were benign in both cytological and histopathological examination), False Positive cases (which were malignant on cytological interpretation but benign on histopathological examination) and False Negative cases (which were benign in cytological interpretation but malignant on histopathological examination). The following table (Table 2) demonstrates these mentioned results. The accuracy, sensitivity, specificity, positive predictive value and negative predictive value of FNAC were calculated and the results were in the following table (Table 3).

Table (2): FNA Results related to Histopathological Results

<table>
<thead>
<tr>
<th>Histology (true disease)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Malignant</td>
<td></td>
</tr>
<tr>
<td>FNA (test)</td>
<td></td>
</tr>
<tr>
<td>Malignant</td>
<td>11</td>
</tr>
<tr>
<td>Benign</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
</tr>
<tr>
<td>Benign</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
</tr>
</tbody>
</table>

P-value = 0.002, kappa=0.681 [95% CI: 0.352 ± 1.0]
Discussion
The present study was designed to determine the accuracy of Fine Needle Aspiration Cytology in the diagnosis of salivary gland tumors by comparing its results with the definitive histopathological diagnosis for 20 patients. The study revealed no obvious difference between benign and malignant salivary gland tumors in terms of patients’ age and gender. This is similar to the results obtained in other studies as Ranjbari et al., 2015.
Interestingly, this study found that the prevalence of malignant salivary gland tumors was much higher than the benign tumors, the study of Sarkis et al., 2010 support the idea of high prevalence of salivary gland malignancy in the Iraqi population unlike other studies as Kummar et al., 2011. This could be related to the paucity of reported salivary gland tumors during the study period, which might influence the statistical results, but another possible explanation for this result might be the increased environmental risk factors for malignancy in Iraq, as it has been a war zone for three decades in which forbidden weapons have been used.
An important clinically relevant finding was the site of the tumor, only 3 sites manifested in the whole sample, the majority were in the parotid gland followed by the minor salivary glands in the palate, this is seems to be consistent with other researchers as Torabinia and Khalesi, 2014. There were no recorded cases of tumors in the sublingual gland, probably due to the rarity of tumors incidence in this gland as mentioned in Tian et al., 2010. The study revealed that the most common benign salivary gland tumors were the Pleomorphic Adenoma, whereas the most common malignant tumors were the Mucoepidermoid Carcinoma followed by Adenoid Cystic Carcinoma and this is in agreement with most studies as Arul et al., 2015; Kummar et al., 2011; Ansari, 2007; Al-Khateeb and Ababneh, 2007. The FNAC results were compared to histopathological results and classified into the following categories: true-negative, true-positive, false-negative and false-positive to calculate the diagnostic value of FNAC. False negative results are mainly due to missed malignant foci during aspiration and it could be overcome by repeated aspiration from multiple sites of the tumor at the same time. False positive results which occur rarely are due to either over interpretation of reactive epithelial cells as malignant cells or due to lab errors, therefore the cytological diagnosis of malignancy underwent slide review for confirmation and to overcome the over interpretation. The lab errors occurred when multiple slides pre-

Table (3): Accuracy, Sensitivity and Specificity of FNAC

<table>
<thead>
<tr>
<th></th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Accuracy</th>
<th>PPV</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNA</td>
<td>84.62%</td>
<td>85.71%</td>
<td>85.00%</td>
<td>91.7%</td>
<td>75%</td>
</tr>
</tbody>
</table>

PPV: positive predictive value, NPV: negative predictive value
pared together in the same jars.
The results of FNAC accuracy, sensitivity, specificity, positive predictive value and negative predictive value were comparable with most studies which revealed similar results as (Arul et al., 2015), (Kummar et al., 2011) and (Stramandinoli et al., 2010). Also, these results are almost matching the results of other Iraqi studies as Issa and Ismail, 1997 which was conducted to determine the accuracy of FNAC on cervical lymph nodes.

**Conclusions**
Fine needle aspiration cytology has a reasonable reliability in differentiating benign and malignant salivary gland tumors with the accepted level of accuracy, sensitivity, specificity, positive predictive value and negative predictive value. The high positive predictive value of FNAC in this study indicates the good reliability to confirm the malignancy.

**References**


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