

THE DIAGNOSTIC VALUE OF FINE NEEDLE ASPIRATION CYTOLOGY IN MASSES OF THE SALIVARY GLANDS

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ABSTRACT

Objective: To determine the sensitivity and specificity of fine needle aspiration cytology in masses of the various salivary glands.

Methodology: The study included 49 cases. It was conducted at the Departments Of ENT, Hayatabad Medical Complex, Peshawar and Saidu Teaching Hospital, Saidu Sharif, Swat from January 1, 2002 to December 31, 2009. Patients undergoing Fine Needle Aspiration Cytology followed by open biopsy were included in the study. The results obtained on FNAC were compared with those obtained on biopsy findings of the respective specimens and the specificity and sensitivity of FNAC were calculated from the data.

Results: The FNAC findings in salivary glands were; Benign 38, Malignant 7 and Suspicious 4. The biopsy findings were; Benign 33 and Malignant 16. Comparison of FNACs and biopsy in the salivary glands taken as True Negative, True positive, False Negative and False Positive respectively was; 32, 10, 6 & 1. The Sensitivity and Specificity for FNAC were calculated at 62.50% & 96.97% respectively.

Conclusion: The results of this study show that FNA cytologic diagnoses in the salivary gland tumours are reliable and treatment can be planned on its basis. However, owing to a higher number of false negative cases occurring in this study, it is recommended that a negative cytology report should be viewed with suspicion. The diagnosis should be confirmed by open biopsy if clinical suspicion persists.

Key words: Fine Needle Aspiration Cytology, Salivary Glands, Histopathology.

INTRODUCTION

Fine needle aspiration cytology is a well accepted procedure for diagnosing soft tissue tumours^{1,2}. This technique for evaluation of a neck mass was first reported by Kun in 1847. The first organized attempts at aspirations of head and neck masses were made by Martin & Ellis at the Memorial Sloan-Kettering Hospital as early as the 1930's using an 18G needle². Later Fred Stewart published the results of 2,500 tumour aspirations with very impressive results. These days, tumour marker studies, special stains and the modern imaging techniques are also being employed to improve the safety and accuracy of FNAC³.

Superficial masses in relation to the salivary glands are easily aspirated, deep seated lesions can be aspirated using imaging techniques. As open biopsy of salivary glands tumours is not advisable in the majority of cases and clinical & radiological assessment of the tumours cannot

distinguish reliably between benign and malignant, FNAC becomes the only means to evaluate the lesion. However the definitive diagnosis is based on biopsy findings. Due to its potential for identifying infectious and inflammatory conditions, unnecessary surgical intervention can be avoided.

Problems can occur in differentiating tumour types but the main aim of preoperative cytology is to differentiate between benign and malignant conditions⁴. Haemorrhage from the major neck vessels can occur and there is a very small but definite risk of tumour implantation along the needle track^{5,6,7}. The occurrence of inadequate aspirates is yet another problem⁵. The problems of interpretation due to meager amount of cellular material demand great experience on part of the histopathologist⁷. Besides these disadvantages, there is no doubt that FNAC is less invasive, easy to perform and the diagnosis is made quickly. This

has made it equally popular both among the patients & surgeons. Using this technique, many patients can be spared surgery and surgical therapy can be planned on the basis of its results. This study was thus planned to determine the sensitivity and specificity of fine needle aspiration cytology in masses of various salivary glands.

METHODOLOGY

This prospective, cross-sectional analytical study, using the non-probability convenience sampling technique was conducted in the ENT Departments of PGMI, Hayatabad Medical Complex, Peshawar and Saidu Teaching Hospital, Saidu Sharif, Swat from January 1, 2002 to December 31, 2009. The study included 49 cases of masses of the various salivary glands. The sample size was calculated using 98% specificity and 90% sensitivity and 19% of mass (assumed) and 95% confidence level and 9% margin of error & using SK Lawanga and S Lemeshow formulae. The inclusion criteria for the study was,

1. Patients of all ages and both sexes presenting either as indoor or in the OPDs.
2. Patients presenting with masses in relation to salivary glands.
3. All those cases undergoing initial FNAC and followed by open biopsies.

The patients with the following were excluded,

1. Acute inflammatory lesions in relation to the salivary glands.
2. Inconclusive aspirates & frank pus obtained on FNAC.

This study included 49 patients who presented with masses of the various salivary glands. Patients fulfilling both the inclusion and exclusion criteria were included in the study. In all these cases the main indication for FNAC was a palpable lump in relation to the various salivary glands. After obtaining informed consent, detailed history and examination of each case was carried out before advising FNAC. The following laboratory investigations were carried out, as and when necessary to determine the patients' fitness for the procedure and subsequent surgery:

FBC, BT, CT, Blood Sugar & Urea Levels, Serum Creatinine & Electrolytes Estimation and LFTs, Urine R/E, ECG, Echoardiography, X-Ray Chest & Imaging Studies such as ultrasonography, CT & MR Imaging.

All the FNAs were performed by the qualified and expert histopathologists. No imaging techniques were employed for localization of target tissues during aspiration procedure. The results

obtained on FNAC were categorized into three categories viz, Benign, Malignant & Suspicious. 2 inadequate aspirates were excluded from the study. An aspirate was considered "inadequate" when it contained less than six epithelial clumps in at least two smears, had preparative artefacts or excessive blood on the smear making its assessment impossible. A cytology report was taken as suspicious when the cells showed atypia but lacked the overt features of malignancy. Considering the "suspicious" cases on cytology as positive for malignancy, the results obtained on biopsy examination of the respective specimens were compared with those of FNAC. Final diagnosis was made on the basis of histopathological examination of biopsy which was categorized as either benign or malignant. The diagnostic value of FNAC was calculated from the data using the following formulae;

$$\text{Accuracy} = (\text{True Positive} + \text{True Negative}) \times 100 / (\text{True Positive} + \text{True Negative} + \text{False Positive} + \text{False Negative}).$$

$$\text{Sensitivity} = (\text{True Positive} \times 100) / (\text{True Positive} + \text{False Negative}).$$

$$\text{Specificity} = (\text{True Negative} \times 100) / (\text{True Negative} + \text{False Positive}).$$

$$\text{Positive predictive value} = (\text{True Positive} \times 100) / (\text{True Positive} + \text{False Positive}).$$

$$\text{Negative predictive value} = (\text{True Negative} \times 100) / (\text{True Negative} + \text{False Negative}).$$

The results were compared with local and international studies.

RESULTS

The ages of the patients included in the study ranged from 8 – 70 yrs with a mean age of 35 yrs. The male to female ratio was 1: 2.45. All the aspirations were made without anaesthesia. In 92% cases FNAC was performed as in out patient procedure and in 8% of cases the patients were admitted to ward during the procedure. All the biopsies were carried out on indoor patients. FNAC was repeated in 1 case. Tumour marker studies were employed in 1 case. In 2 cases incision biopsies were performed under local anaesthesia and in the rest biopsies were carried out under general anaesthesia administered as part of the definitive procedure.

Out of the total 49 cases, parotid glands were most commonly involved (57.14%) followed by the submandibular (24.49%) and the minor salivary glands (18.36%).(Table 1). The total number of benign and malignant cases as determined on biopsy examination was 33 and 16 respectively. The comparison of FNACs and

Table 1: The Distribution of Disease in the Various Salivary Glands (FNAC)

S#	Type of salivary gland	Benign	Malignant	Suspicious	Total	%age
1.	Parotid glands	22	5	1	28	57.14%
2.	Submandibular glands	8	2	2	12	24.49%
3.	Minor salivary glands	8	0	1	9	18.36%

Table 2: Comparison of Fnac And Biopsy in the Salivary Glands

S#	Type of salivary gland	TN	TP	FN	FP	Total
1.	Parotid glands	17	6	5	0	28
2.	Submandibular glands	7	3	1	1	12
3.	Minor salivary glands	8	1	0	0	9
4.	Salivary glands (as a whole)	32	10	6	1	49

TN = True Negative, TP = True Positive, FN = False Negative, FP = False Positive

Table 3: FNAC and Biopsy Crosstabulation

FNAC and Biopsy results for Salivary Glands

Count		Biopsy Result		Total
		Benign	Malignant	
FNAC results	Benign	32	6	38
	Malignant	1	10	11
Total		33	16	49

Table 4: The Diagnostic value of FNAC in Salivary Glands.

S#	Diagnostic Parameters	Value
1.	Sensitivity	62.50%
2.	Specificity	96.97%
3.	Accuracy	85.71%
4.	Positive predictive value	90.91%
5.	Negative predictive value	84.21%

biopsy in the various salivary glands taken as True Negative (TN), True Positive (TP), False Negative (FN) and False Positive (FP) respectively was;

(1) Parotid glands: 17, 6, 5 & 0
 (2) Submandibular glands: 7, 3, 1 & 1
 (3) Minor salivary glands: 8, 1, 0 & 0
 (4) The overall picture as 32, 10, 6 & 1. (Table 2). The FNAC and biopsy cross tabulation has been shown in Table-3. The diagnostic value of FNAC thus calculated was; Sensitivity 62.50%, Specificity 96.97%, Positive predictive value 90.91%, Negative predictive value 84.21% and Accuracy of 85.71%. (Table-4)

DISCUSSION

The major salivary glands have a complex structure. The minor salivary glands are collections of salivary acini scattered throughout the oral and oropharyngeal mucosa⁹. The histopathology of salivary gland neoplasms, therefore, poses many problems to the pathologist. They are rarely homogenous in structure and many present in a variety of patterns. Clinically the vast majority of malignant salivary gland tumours behave in a manner similar to benign tumours. Therefore the primary challenge of FNA is differentiating benign

from malignant disease, than differentiating the type of malignancy¹⁰.

Pleomorphic adenoma or benign mixed tumor is the most common (75%) of all salivary gland neoplasms. It is composed of varying proportions of gland-like epithelium and mesenchymal stroma¹¹. Though FNAC is fairly accurate in diagnosing pleomorphic adenomas, problems may occur in differentiating pleomorphic adenomas from adenoid cystic carcinoma, monomorphic adenoma and mucoepidermoid carcinoma. Carcinoma ex-pleomorphic adenoma is difficult to identify on FNAC¹². In this study, out of the 17 cases of pleomorphic adenoma, 14 cases were correctly identified by FNAC.

Mucoepidermoid carcinoma is the most common (5-9%) pediatric salivary gland malignancies. It is often mistaken for a squamous cell carcinoma. Positive immunohistochemical staining for mucin indicates a high-grade mucoepidermoid carcinoma rather than a squamous cell carcinoma¹³. None of these carcinomas could be identified on cytology in our series. Adenoid cystic carcinoma is the second most common salivary gland malignancy. Microscopic appearance is described as cribriform, tubular or solid¹³. The cribriform pattern is the most common and most easily recognizable. In the present study, cytology was able to correctly identify only one case and one case of adenoid cystic carcinoma was wrongly diagnosed as benign on cytology.

Primary squamous cell carcinoma of the salivary glands is very aggressive but quite rare (1-1.6%) of salivary gland neoplasms. Local invasion and metastases to intraglandular nodes can occur quite often. It can easily be confused with high-grade mucoepidermoid carcinoma. In this study, out of the two cases diagnosed as squamous cell carcinomas on cytology, one case was confirmed as such and the other was a mucoepidermoid carcinoma. Besides this, two cases of squamous cell carcinomas were labelled as "sialadenitis" on cytology. In a 1991 report, Birchall and colleagues demonstrated that FNA of neck masses was 100% specific for squamous cell carcinoma of the neck¹⁴. In our series this might have happened due to the likely chance of 'missing' the target and sampling the surrounding inflammatory tissues.

Use of FNA for salivary gland masses is broadly accepted. A wide range of values for the diagnostic value of FNAC in salivary glands can be seen in the literature. In 1991, Frable and Frable studied 227 aspirations from salivary glands. FNA had 92% sensitivity for tumor and specificity of 99% with only 2 false negative cases. We had a high false negative rate of 12.24%

as compared to this study. The diagnostic efficiency in their series was 96.4%, with an overall predictive value of a positive aspiration for a malignancy of 98.3%¹⁵. Hee and Perry in a study of 169 patients on parotid found that fine-needle aspiration cytology had an overall accuracy of 56%. 10% of the FNAC results were non-diagnostic in their series. The sensitivity and specificity for the following diagnoses were, respectively: benign 86% and 61%; malignant 57% and 100%; pleomorphic adenoma 78% and 95%; squamous cell carcinoma 52% and 99%; mucoepidermoid carcinoma 14% and 99% and adenocarcinoma 20% and 100%. Six non-neoplastic conditions were misdiagnosed. They concluded that fine-needle aspiration cytology was highly specific for malignancy but its sensitivity for malignancy was poor¹⁶. We also found a low sensitivity for determination of malignancy. Zafar A and colleagues in a study on parotid of 28 patients found these values for FNAC as; 8 true positive, 17 true negative, 1 false positive and 2 false negative cases. Sensitivity was 80%, specificity 94.4% and diagnostic accuracy 89.3%.¹⁷ Obaid MA & Yusaf A found FNAC as a useful adjunct in the management of epithelial parotid tumours and recommend the pre-operative use of FNAC on such cases¹⁰. In a similar study, Cohen et al showed that FNA of salivary masses had a sensitivity and specificity of 66% and 88% respectively, for lesions found to be malignant on final histologic examination¹⁸. These results suggest that FNA alone may not be sufficient to rule out salivary malignancies and that further clinical evaluation, including surgical resection, may be necessary.

CONCLUSION

The results of this study suggest that FNAC is a useful tool in the diagnosis of salivary gland tumours and treatment can be planned on its basis. Its use is recommended on almost all patients presenting with masses of the salivary glands. However, in view of a significant number of false negative results, it is important that a strong clinical suspicion of malignancy should be placed on a negative cytology report and at no point the surgeon should compromise his clinical acumen. Open biopsy should confirm the diagnosis in doubtful cases.

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