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Fine needle aspiration cytology yields low sensitivity and specificity in the diagnosis of oral and maxillofacial swellings: A cross-sectional study of 82 cases

Mounithaa N[1], Deepak Pandiar[1], Reshma Poothakulath[1]

Aim: To assess the role of Fine needle aspiration cytology (FNAC) in diagnosing oral and maxillofacial lumps and jaw swellings with histopathological correlation.
Materials and methods: The lumps and swellings of 82 cases of oral and maxillofacial region were included in the present cross-sectional study, after obtaining clearance from the institutional human ethical committee. Only those cases were included, where both FNAC and biopsy were performed for diagnosis. The biopsy specimen were processed with modified fast-processing technique. Clinical, cytological and histopathological data were recorded in Microsoft Excel and analyzed using the XLSTAT add-on statistical software. True positive (TP), true negative (TN), false positive (FP), and false negative (FN) values were assessed followed by evaluation of sensitivity, specificity, positive predictive values (PPV) and negative predictive values (NPV).
Results: The mean age of occurrence was 41.4 ±17.32 years with a male preponderance. There were 52 jaw lesions, while the remaining 30 cases belonged to the category of soft tissue lumps/swellings. Low specificity and sensitivity were noted for the diagnosis of jaw swelling and lumps of minor salivary gland lesions. FNAC was fruitful in the diagnosis of keratinizing odontogenic cysts, tuberculosis and metastatic lesions. There was a difference in turn-around time between cytological and histopathology.
Conclusion: The role of FNAC in the cytological diagnosis of minor salivary glands lumps and intra-osseous jaw swelling is limited. FNAC may be reserved only for selective cases where biopsy is not indicated.

Keywords: cytology; FNAC; jaw swelling; minor salivary gland

1. Department of Oral Pathology and Microbiology, Saveetha Dental College and Hospitals, Saveetha Institute of Medical and Technical Sciences, Saveetha University, India.
Corresponding author: Deepak Pandiar, email: deepakpandiar1923@yahoo.com

Introduction

The pathologies of the head and neck region encompass a wide variegated heterogeneous conditions, including, infectious diseases, inflammatory processes or benign and malignant tumors. which bear a significant impact on the health and quality of life of the patient and their caregivers. Thus, an early yet accurate diagnosis of these conditions is crucial for devising an appropriate personalized treatment plan. Cytology, the evaluation of the aspirated or exfoliated cells, has emerged as a vital diagnostic tool in the evaluation of lesions of the oral and maxillofacial region.[1] As compared to incisional biopsy, cytopathological techniques are non-invasive/minimally invasive procedures, and offer faster and cost-effective diagnostic insights, and thus many be considered as a first-line investigation.[2]

Exfoliative cytology is commonly used for oral cancer screening and other oral lesions, however, the role of Fine needle aspiration cytology (FNAC) in the diagnosis of oral lesions still generates variegated results, based on the available literature.[3,4] FNAC is a popular procedure for the diagnosis of salivary gland, thyroid gland, and lymph node swellings; in fact separate reporting systems have been devised, which yield satisfactory and faster results.[5] Previous available data on the utilization of FNAC showed a sensitivity ranging from 66.7% to 93.75%, and specificity values of 91%-100%, which further varies according to the site included in the respective studies.[5-8] The present study was thus devised to assess the role of FNAC in the diagnosis of oral and maxillofacial lumps and jaw swellings and compare it with histopathology.

Materials and methods

Sample selection

The present prospective study included the cases reported to the departments of Oral Surgery and Oral Pathology, after seeking approval from the institutional human ethical clearance committee (IHEC/SDC/UG-2181/24/OPATH/134). All the cases where FNAC was indicated were considered for inclusion in the present study. The FNAC procedure was done using 21-23 gauge needles. The smears were prepared and fixed in 90% ethanol, followed by hematoxylin and eosin (H&E) or PAP staining. The reports were dispatched within 24 hours. For incisional/excisional biopsies of these cases, fast-processing was employed. Briefly, the tissue was fixed in 10% formalin and grossed, the next day. The tissue blocks were then kept for 20 minutes each, subsequently in 100% propanol, 2 changes of acetone and two changes of xylene (total 1 hour 40 minutes). Paraffin wax impregnation was thereafter done for another 2 hours and 30 minutes. The entire processing was carried out in around 4 hours. 4 microns sections were cut on automated microtome and stained in H&E stain. Thus, the report was dispatched within 24 hours even for an incisional biopsy. The turn-around-time (TAT) for both procedures was within 24 hours.

Inclusion and exclusion criteria

Inclusion criteria were, 1) jaw swellings (maxillary or mandibular); 2) soft tissue lumps of intra-oral and maxillo-facial region, and; 3) cases where subsequent incisional/excisional biopsy was performed for final diagnosis. The exfoliative cytology cases, cases with inadequate details and the cases where the biopsy was not done for the final diagnosis were also excluded.

Data analysis and statistics

Clinical, cytological and histopathological data were analyzed for age, gender, site, laterality, provisional diagnosis, cytopathological diagnosis and final histopathological diagnosis (based on incisional/excisional biopsy). The data were

recorded in Microsoft Excel for Mac version 16.88 (2021) and analyzed using the XLSTAT add-on statistical software. Descriptive analysis was done for the calculation of means and ratios. True positive (TP), true negative (TN), false positive (FP), and false negative (FN) values were assessed followed by evaluation of sensitivity, specificity, positive predictive values (PPV) and negative predictive values (NPV).

Results

Clinicopathological profile

A total of 82 subjects were included in the present study who underwent FNAC for soft tissue or bone lesions followed by a confirmatory histopathological diagnosis. Exfoliative cytology cases were not included. Overall, the mean age of the included cases was 41.4 ±17.32 years (median 43 years), with a male preponderance (59M:23F). FNAC material was submitted most commonly for the diagnosis of intraosseous lesions (n=52), while the remaining 30 cases belonged to the category of soft tissue lumps/swellings. The intraosseous lesions consisted of odontogenic cysts, tumors and allied lesions as re-evaluated based on the WHO 2024 classification of head and neck tumors. The mean age 39.44±16.19 years (median 42 years), with a predilection for the male gender (35M:17F). Soft tissue aspirates were mainly obtained from the palate and buccal mucosa. Uncommonly, the samples were obtained from submandibular, and scalp regions. Based on the final histopathological diagnosis these lesions were mainly diagnosed as salivary gland lesions (n=19), cysts of soft tissue, and granulomatous lesions. The salivary gland lesions were also most common in males (14M:5F) with a mean age of 40.89±20.09 years (median- 39 years).

Diagnostic utility of FNAC in oral and maxillofacial lesions

The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated for all the diagnosed lesions and individual classes of the lesions. Overall, FNAC showed a low sensitivity and specificity of 53.94% and 16.67% respectively. The PPV and NPV were 89.13% and 2.78% respectively.

With regards to the cytological diagnosis of odontogenic cysts, tumors and allied lesions, sensitivity, specificity, PPV and NPV were 46.153%, 0%, 100%, and 0% respectively. When only odontogenic cysts were considered, the values improved slightly to 59.46%, 0%, 100% and 0% however, the sensitivity to diagnose odontogenic tumors was very low (14.3%). The most reliable diagnoses could be made in the differentiation of keratinizing cysts viz., odontogenic keratocysts/ orthokeratinized odontogenic cysts. There was a sensitivity of 81.8% and a PPV of 100%. The salivary gland lesion vary cytologically diagnosed based on the Milan system for Reporting Salivary Gland Cytopathology. The sensitivity, specificity, PPV and NPV were 57.143%, 0%, 61.54%, and 0% respectively (Table 1).

Table 1: Table entailing sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for intra-osseous and minor salivary gland swelling

	Overall (%)	Odontogenic and allied lesions (%)	Salivary gland lesions (%)
Sensitivity	53.94	46.153	57.143
Specificity	16.67	0	0
PPV	89.13	100	61.54
NPV	2.78	0	0

Uncommon lesions included tuberculosis (n=3), lipoma (n=2), inclusion cysts (2 dermoid cysts, 1 epidermoid cyst), inflammatory lesion (n=1) and metastatic tumors (oral squamous cell carcinoma to scalp, n=2). 100% specificity and sensitivity were obtained for the diagnosis of tuberculous and metastatic lesions (Figure 1).

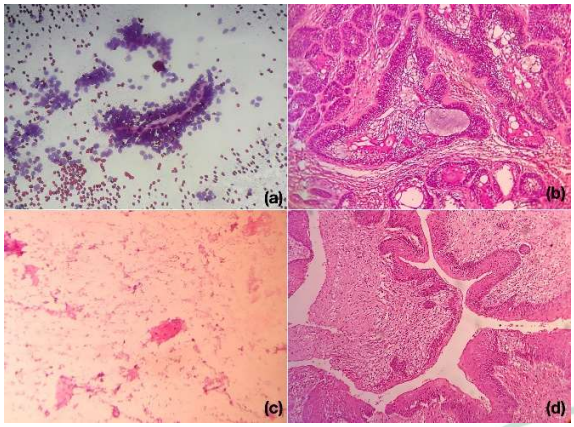

Figure 1: Photomicrograph of a FNAC smear of a case of ameloblastoma showing fragments of basaloid cells arranged around a connective tissue core (a) and corresponding histopathological sections- follicular ameloblastoma (b); Photomicrograph of a cytosmear showing nucleated squames (c) suggestive of a keratinizing cyst, the case was diagnosed as odontogenic keratocyst on subsequent biopsy (d) .

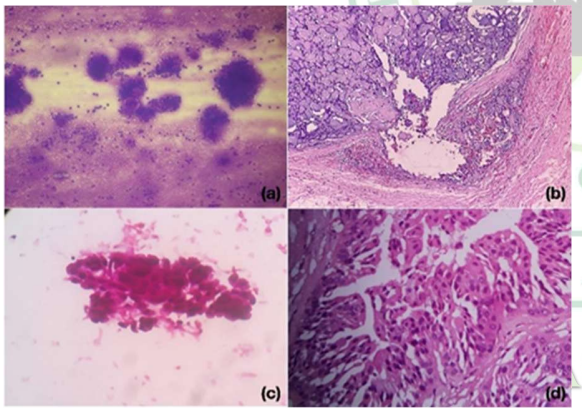

Figure 2: Photomicrograph of a FNAC smear of a case of adenoid cystic carcinoma showing clusters of basaloid cells along with hyaline globules suggestive of MSRSGC category 6 (a) and corresponding histopathological sections- adenoid cystic carcinoma (b); Photomicrograph of a cytosmear showing clusters of atypical epidermoid cells suggestive of suggestive of MSRSGC category 5 (c), the case was diagnosed as intraductal carcinoma on subsequent biopsy (d)

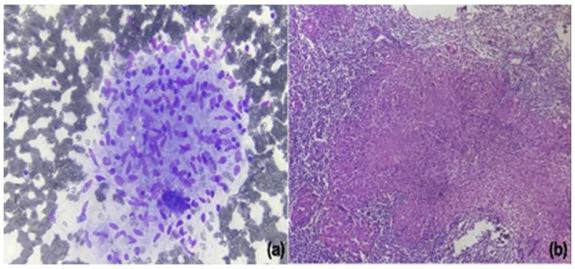

Figure 3: Photomicrograph of a FNAC smear (a) and H&E section of tuberculous node.

Discussion

Fine Needle Aspiration Cytology is considered to be a highly sensitive and specific procedure for the diagnosis of salivary gland, neck, breast and thyroid lumps.[9-12] Martin and Ellis are usually accredited as the pioneers of FNAC techniques, howbeit, aspiration was done by Stanley and Frale in a sixty-two female on her liver mass in 1833.[5,13] Being a non-invasive procedure, FNAC is an ideal diagnostic technique for outdoor patients with minimal to no discomfort or complications. Further, advantages include, prompt distinction between non-neoplastic and malignant growths, verification of recurrent neoplasms and diagnosis of inoperable cases. The success of FNAC relies upon adequate aspirate and identification of specific cellular or nuclear characteristics and, background material.[14-16] The salivary gland tumors and odontogenic tumors are frequently encountered and correct diagnosis is imperative.[17-19] Studies pertaining to the application of FNAC in the diagnosis of maxillofacial lumps or the swellings of the jaws (intra-osseous) yielded contrary findings, with variegated values of sensitivity and specificity. The present study was thus devised to check the diagnostic utility of FNAC in the diagnosis of swellings of the oro-maxillofacial region and jaws, excluding salivary gland and thyroid swellings.

There is limited data available in the purview of the utility of cytology in the diagnosis of odontogenic lesions.[20-23] Goyal S et al., showed an overall sensitivity and

specificity of 94.7% and 100% respectively for intra-osseous jaw lesions with a diagnostic accuracy of 97.3%.[22] The same group of lesions, demonstrated a diagnostic accuracy of 91.6% for oral and gnathic swelling in the same year, depicting fluctuation in values when FNAC is used for jaw swellings.[23] When compared to these findings, we found a very low sensitivity (46.153%) of FNAC in the diagnosis of odontogenic lesions. Considering only the odontogenic cysts, the sensitivity was 59.46% with a 100% positive predictive value. It should be noted that the most reliable diagnosis could be made for keratinizing cysts viz., odontogenic keratocysts/ orthokeratinized odontogenic cysts, but again clear distinction was not possible. The sensitivity to diagnose the odontogenic tumors remained excessively low (14.3%). Goyal S et al in their study, concluded that FNAC does not definitively differentiate odontogenic tumors and cystic lesions from giant cell lesions and benign fibro-osseous lesions.[22-23]

The salivary gland lesions in our study showed a mean age of 40.89±20.09 years. This falls within the range reported in the literature.[24-25] The Milan System for Reporting Salivary Gland Cytopathology (MSRSGC) has shown an overall sensitivity and specificity of 83.33%, and 98.31% respectively with PPV of 95.74%, and 92.80% for NPV.[26] In another study, Singh et al, utilized FNAC in the diagnosis of minor salivary gland tumors and found a sensitivity and specificity of 81% and 95% respectively for the detection of malignancy.

Further, PPV was 94.4% and NPV 82.3%.[24] These values are higher compared to our data, which could be due to comparatively lower sample size in the present study. MSRSGC with modifications not only classifies the pathologies of salivary gland origin in well-defined categories but has the added advantage of limiting the possibilities of false negative and false positive cases. In another study, in a comparative evaluation of modified MSRSGC with the original classification, modified MSRSGC yielded moderate interobserver agreement (fair for MSRSGC).[24] However, these studies included the lumps of major salivary glands with an ease in accessibility and manipulation. While considering the swelling of intraoral minor salivary glands, FNAC procedures need more dexterity for manoeuvrability. Kurasawa Y et al., in cytological evaluation for minor salivary gland tumors found a lower sensitivity of 66.7%. The authors were of the opinion that FNAC is less accurate than biopsies for minor salivary gland lesions.[6] Similarly, in the present study we also demonstrated a low sensitivity of 57.143%. However, the sensitivity for the diagnosis of tuberculous and metastatic lesions was 100%. Diagnosis of tuberculosis on FNAC results in faster provision of treatment which is directly related to the patients outcome.[28] These chronic diseases, bear high amount of microbes, which not only are responsible for initiation and progression but also has environmental and genetic mediated significance in individual distinction in the susceptibility to disease.[29] In general, it has been argued that FNAC is a minimally invasive and highly cost-effective procedure, however, the procedure seems to yield less acceptable results for intra-oral swellings. In negative cases, repeated FNAC may be considered, howbeit in the present study we were able to demonstrate that the TAT for both cytology and corresponding biopsy was less than 24 hours.

Conclusion

As compared to the application of FNAC in major salivary gland and thyroid glands where a definitive role has been set over years, the contribution of cytology (FNAC) in the diagnosis of minor salivary glands lumps and intra-osseous jaw swelling

is limited. The procedure however, serves well in the identification of keratinizing odontogenic cysts, tuberculosis and metastatic tumors.

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Financial interests: The authors declare they have no financial interests.
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