Diagnostic Accuracy of Fine-Needle Aspiration Cytology in Head and Neck Lesions from a Tertiary Health Facility in Southwestern Nigeria

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Abstract

Background: Fine-needle aspiration cytology (FNAC) is widely employed as an initial investigative tool in the diagnosis of various lesions in the body, however, it is limited in the provision of precise architectural detail of lesions. This is said to be responsible for the wide variation in the documented usefulness and accuracy relative to histopathology. This study aimed to correlate cytopathological and histopathological examination (HPE) of head and neck lesions, and assess the usefulness and accuracy of FNAC in our center. **Materials and Methods:** This was a retrospective study that utilized historical data obtained from case notes and histopathology records of 91 patients that had both FNAC and HPE done for head and neck lesions in our center during the study. The FNAC results were correlated with that of the histopathological diagnosis to obtain the accuracy of the FNAC diagnosis. Diagnostic validity of FNAC in terms of sensitivity, specificity, and predictive value were also evaluated. **Results:** A total of 91 FNAC-HPE sample pairs were included. The Sensitivity and specificity for benign lesion was 95.4% and 42.3%, respectively, while for sensitivity and specificity for malignant lesion was 31.8% and 96.9%, respectively. The overall Sensitivity and specificity for cytology was 96.8% and 30.4%, respectively. **Conclusion:** FNAC appears to be a useful tool in the initial assessment of head and neck lesions in our center, however, the high rate of missed diagnosis especially as concerned malignancies has dire negative treatment implications. There is need to develop capacity for improved skill in making cytopathologic diagnoses among anatomical pathologists involved in the use of FNAC as diagnostic and screening tool.

Keywords: Fine-needle aspiration cytology, head and neck, histopathological examination, lesions

INTRODUCTION

Since its introduction in 1930, fine-needle aspiration cytology (FNAC) has gained acceptance over the years as a useful tool in the preliminary investigation of various lesions at different sites of the body.[1-3] This is largely due to its positive attributes, namely: relatively painless, easy to perform, can be employed in variety of patients including children and debilitated adult patients, it may not require anesthesia and associated complications are rare.[4] It is also relatively cheap, has high specificity and results are rapidly available making it an indispensable diagnostic and screening tool in resource scarce countries like Nigeria. FNAC basically differentiates benign (inflammatory and reactive lesions) from malignant lesions and can help further subtype the malignant lesion, for example, into epithelia, lymphoid, and spindle cell lesions. In addition, it has evolved into one of the basic investigative techniques for lesions in a number of tissues like the salivary gland and lymph nodes.[5,6] Despite these advantages and usefulness, however, it's been suggested that FNAC cannot replace histopathological examination (HPE) since the biological material obtained does not provide precise cellular architectural details, making HPE to be regarded as the gold standard for the diagnosis of a number of lesions.[2,7]

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FNAC is widely employed in various centers and a number of authors have documented their experience on the usefulness and accuracy of the technique relative to HPE and results so far remains varied.[2,5] FNAC is widely employed in our center for investigating head and neck lesions and this study was carried out to correlate cytopathological and HPE of head and neck region and assess the usefulness of FNAC in our center.

MATERIALS AND METHODS

This was a descriptive retrospective survey within the study from January 1, 2008 to December 31, 2017 in which the study sample was derived from a population of patients who presented to our hospital, the University College Hospital, Ibadan, Nigeria for lesions in the Head and Neck region. These patients had FNAC of their head and neck lesions primarily and subsequently had incisional biopsy of the lesion for HPE. This study was carried out in accordance with the declaration of Helsinki and in such a way as to ensure that the anonymity of all the participants included was guaranteed.

The inclusion criteria for this study were patients with complete biodata who had a head and neck lesion and had both FNAC and HPE done for such lesions while exclusion criteria was patients with incomplete data. For the sake of this study, the lesions were grouped into; benign, malignant, reactive and suspicious. Case files and Pathology records of all patients that fulfilled the inclusion criteria were retrieved and relevant data including patients' age, gender, date, and type of investigation (FNAC, incisional biopsy, excisional biopsy or surgical resection specimen), anatomical site of the lesion, FNAC and histopathological diagnosis of the lesion were obtained. Included in the final analysis were cases in which both FNAC and histopathological diagnosis results were available, while cases with incomplete records were excluded. These relevant data were entered and statistically analyzed using IBM SPSS version 21(IBM SPSS Statistics Inc, Chicago, Il, USA). The FNAC results were correlated with that of the histopathological diagnosis (considered as the gold standard) to determine the accuracy of the FNAC diagnosis. The diagnostic validity of FNAC in terms of sensitivity, specificity, and predictive value were also evaluated. A $P < 0.05$ was considered as statistically significant.

RESULTS

Ninety-one patients fulfilled the inclusion criteria and consisted of 69 females (75.8%) and 22 males (24.2%). The mean age of these patients was 41.0 ± 16.3 within an age a range of 5–82 years.

Table 1 shows the correlation between the cytopathological and histopathological diagnosis of the participants with a value of 92.3% for benign lesions and 25.9 for malignant lesions.

Sensitivity and specificity of benign lesion was 95.4% and 42.3%, respectively, and the overall test accuracy was 69.2% [Table 2]. Sensitivity and specificity of malignant lesion was 31.8% and 96.9% respectively, and the overall test accuracy was 80.2% [Table 3]. The overall Sensitivity and specificity was 96.8% and 30.4% respectively, and test accuracy for FNAC in head and neck lesions was 79.1% [Table 4].

Figure 1 illustrates a discordant case between FNAC and histopathological diagnosis.

Table 1: Correlation of cytological and histological diagnosis

Cytology	Histology (%)			Total (%)
	Benign	**Reactive**	**Malignant**	
Benign	48 (92.3)	7 (58.3)	12 (44.4)	67 (73.6)
Reactive	3 (5.8)	3 (25.0)	4 (14.8)	10 (11.0)
Malignant	0 (0.0)	2 (16.7)	7 (25.9)	9 (9.9)
Suspicious	1 (1.9)	0 (0.0)	4 (14.8)	5 (5.5)
Total	52 (100.0)	12 (100.0)	27 (100.0)	91 (100.0)

Table 2: Sensitivity, specificity, positive and negative predictive values and overall test accuracy for benign lesions

Cytology	Histology (%)		Total (%)
	Yes	**No**	
Yes	62 (95.4)	15 (57.7)	77
No	3 (4.6)	11 (42.3)	14
Total	65	26	91

Sensitivity - 95.4%, Specificity - 42.3%, PPV - 80.5%, NPV - 78.6%, Test accuracy - 69.2%. NPV - Negative predictive value, PPV - Positive predictive value

Table 3: Sensitivity, specificity positive and negative predictive values and overall test accuracy for malignant lesions

Cytology	Histology (%)		Total (%)
	Yes	**No**	
Yes	7 (31.8)	2 (3.1)	9
No	15 (68.2)	62 (96.9)	77
Total	22	64	86

Sensitivity - 31.8%, Specificity - 96.9%, PPV - 77.8%, NPV - 80.5%, Test accuracy - 80.2%. NPV - Negative predictive value, PPV - Positive predictive value

Table 4: Overall sensitivity, specificity positive and negative predictive values and test accuracy for fine needle aspiration cytology in head and neck lesions

Cytology	Histology (%)		Total (%)
	Benign	**Malignant**	
Benign	61 (96.8)	16 (69.9)	77
Malignant	2 (3.2)	7 (30.4)	9
Total	63	23	86

Sensitivity - 96.8%, Specificity - 30.4%, PPV - 79.2%, NPV - 77.7%, Test accuracy - 79.1%. NPV - Negative predictive value, PPV - Positive predictive value
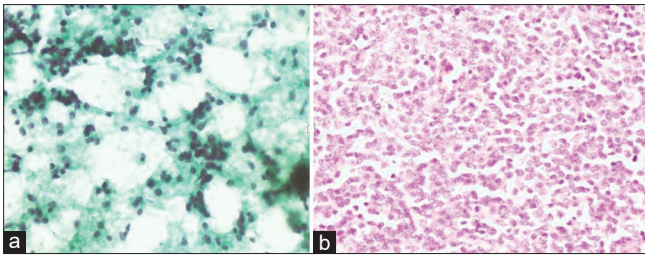
Figure 1: Photomicrograph of discordant cases showing the aspirate cytology which was diagnosed as chronic inflammation (a) and the excisional biopsy which showed undifferentiated nasopharyngeal carcinoma (b)

DISCUSSION

The role of FNAC in the diagnosis of head and neck lesions has been investigated by several authors in the literature using various parameters to assess its utility. Most of the authors have affirmed its efficacy as a first line investigative tool in the evaluation of head and neck lesions albeit with varying results.[8-10] In the present study, the overall diagnostic accuracy of FNAC for detecting malignant and benign lesions was 79.1%, this is lower than values reported in the studies of Poorey *et al.* (90.2%), Balakrishnan *et al.* (83.0%), Rajbhandari *et al.* (87.4%) and Faro *et al.* (83.7%).[11-14] The lower value could be partly due to the fact that a number of these studies were carried out on limited types of specific lesions, for instance cervical lymphadenopathy.[15] FNAC has been reported to be more accurate in diagnosing some lesions like salivary gland and lymph node lesions while diagnosing some others with less accuracy.[9,15,16]

An overall sensitivity of 96.8% was recorded in this study and this is in agreement with previous studies that have shown FNAC sensitivity for head and neck lesions to vary between 79 and 100%.[11,12,17] The specificity obtained in the present study however showed a much lower value (30.4%) than those reported in other studies.[11-13] The pattern of higher sensitivity than specificity found in this study is in agreement with the findings in the study of Hafez *et al.* (90.9% sensitivity and 67.2% specificity) but at variance with some other studies.[18-20]

This study showed a higher positive predictive value (79.2%) over the negative predictive value (77.7%) and this finding is similar to that obtained in the study of Hafez *et al.* but at variance with the predictive values found in the study of Qureshi *et al.*[18,20]

The correlation done between FNAC and HPE in this study was 92.3% for benign lesion in which out of the total 52 histopathologically diagnosed benign lesions, 42 were correctly diagnosed by FNAC. On the other hand, out of a total of 27 histopathologically diagnosed malignant lesions, only seven were correctly diagnosed by FNAC, giving a correlation of 25.9%. Similarly, a correlation of 25.0% was obtained for reactive lesions in this study. The sensitivity for benign and malignant lesions was found to be 95.4% and 31.8%, respectively. Benign lesions showed a high rate of false positives while the malignant lesions showed a high rate of false negatives. This high rate of false negatives may explain the low sensitivity recorded for malignant lesions in this study given that a high number of the malignant lesions were missed. Similarly 12 out of the 67 lesions diagnosed as benign by FNAC turned out to be malignant on HPE. This is similar to the findings of Saraf *et al.*, where a low sensitivity of FNAC was reported for malignancy with no false positive although in this study a false positive rate of 4.6% was found.[16] Balakrishnan *et al.* in another study also concluded that FNAC failed to reliably distinguish benign from malignant salivary gland tumours.[12]

Overall discordance in this study is 37.2% which is higher than 17.8% reported in the study of Hafez *et al.* and 9.8% in the study of Qureshi *et al.*[18,20]

This study shows that FNAC have a higher specificity than sensitivity in the diagnosis of malignant lesions of head and neck region and this agrees with findings in other studies.[16,20] The possible reasons sighted for inability of FNAC to correctly diagnose malignant lesions include sampling error, harvesting of inflammatory cells or necrotic tissue.[16,21,22] The procedure for obtaining these FNAC specimen, its preparation and interpretation may also affect the ultimate result. Although, the anatomical pathologists in conjunction with anatomical pathology laboratory technicians are involved in all these steps in our tertiary health center, however, there are different cadres of anatomical pathologists and anatomical pathology laboratory technicians with different levels of experience and expertise that are involved in this diagnostic process; all these influence the ultimate cytopathologic results obtained. This fact is also reflected in the study of Singh *et al.* where it was stated that different types of tumors may have similar cell pattern which may pose cytological difficulties and there is therefore a need for careful interpretation of cytopathological findings.[23]

Ancillary investigations such as immunocytochemistry and cell blocks are sometimes used by anatomical pathologists in conjunction with cytopathological and histopathological investigations for increasing diagnostic accuracy. The utility of immunocytochemistry as an ancillary technique to routine cytological evaluation in FNAC of head and neck lesions is to enhance the diagnostic accuracy of FNAC.[24]

Immunocytochemistry as an ancillary technique to routine cytopathological evaluation in FNAC of head and neck lesions compares in diagnostic accuracy as immunohistochemistry as an ancillary technique to routine histopathological evaluation of the head and neck lesions. It is also possible for cell blocks to be constructed from the smears of FNAC of the head and neck lesions with subsequent immunohistochemistry. Some of the usefulness of immunocytochemistry include: differentiation between neoplastic lesions, for example separating lymphomas from carcinomas and sarcomas, helping in the characterization of lymphomas as well as differentiating primary tumors from metastatic tumours.[24]

However, as part of the limitations to this study, immunocytochemistry was not routinely done in all the cases of FNAC of head and neck lesions in our center during the study period due to logistic reasons.

CONCLUSION

The overall result in this study shows FNAC to be a useful tool in the initial assessment of head and neck lesions, however, the high rate of missed diagnosis especially for malignancies has dire negative treatment implications. There is possibility of suboptimal treatment (such as treating malignancies as benign or reactive lesions), over-treatment (with risk of high morbidity and mortality) or delayed treatment. All these may have grave implications for outcome of treatment and underscores the fact that HPE is still necessary to make definitive diagnosis before commencement of treatment.

There is need to develop capacity for improved skill in making cytopathologic diagnoses amongst the different cadres of anatomical pathologists involved in use of FNAC as diagnostic and screening tool.

There is also need to carry out prospective studies to investigate the cause of this observed high rate of missed diagnosis by anatomical pathologists while utilizing FNAC of head and neck lesions.

Future studies investigating the role of ancillary investigations like immunocytochemistry in enhancing the accuracy of FNAC in our setting in Nigeria are encouraged.

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Conflicts of interest
There are no conflicts of interest.

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