



The Role of Fine Needle Aspiration Cytology in the Diagnostic Evaluation of Palpable Breast Lesions Seen in a Low-resource Hospital Setting

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Authors' contributions

This work was carried out in collaboration between all authors. Author OOO designed the study, performed the procedures, viewed all the slides, wrote the protocol and wrote the first draft of the manuscript. Author GOOE was involved in the initiation of the research, supervised the work, viewed all the slides and proofread the article. Author AOK co-supervised the research and also viewed all the slides. Author DS was involved in the initiation of the project, literature search and reviewed the manuscript thoroughly. Author OOO was very helpful in the statistical analysis of the research. All authors read and approved the final manuscript.

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ABSTRACT

Background: Preliminary diagnosis of palpable breast lesions often requires the use of fine needle aspiration cytology (FNAC). The aim of this study was, therefore, to determine the diagnostic utility of this procedure in the evaluation of palpable breast masses seen at our institution.

Methods: FNAC was performed on all patients who presented with palpable breast lesions over

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the period of one year. These were classified according to the United Kingdom National Health Services Breast Screening Programme (UKNHSBSP) and were compared with the corresponding histopathologic diagnosis in each case. The sensitivity, specificity, positive predictive value as well as negative predictive value were subsequently determined.

Results: A total of 164 cytological reports were obtained from 153 patients during the study period. The patients seen during the study period were between the ages of 15-86 years (Mean 42.3 ± 15.8 SD). The peak age range of presentation of benign lesions was 20-29 years while that for malignant was 40-49 years. Fifty (50.6%) were reported as benign (C2) and 31.7% were reported as malignant (C5). About 7.8% and 8.5% were reported as inadequate (C1) and suspicious for malignancy (C4) respectively. Histopathology was performed on 87 (biopsy rate of 53.0%). There was good correlation between the cytological and histological diagnosis with the sensitivity of FNAC for benign lesions being 97.3% while that for malignant lesions was 100%. The correlation between fine needle aspiration cytology of palpable breast lumps and histological diagnosis was found to be statistically significant.

Conclusion: FNAC of palpable breast lesions has a high predictive value for the histologic diagnosis especially when performed by experienced cytopathologists.

Keywords: FNAC; role; breast lesions; diagnosis.

1. INTRODUCTION

Fine needle aspiration cytology has become popular as a valuable tool in the preoperative assessment of breast masses being now a well-established tool for the preliminary investigation of suspected breast carcinoma [1]. Differentiating benign from malignant lesions is one of the major goals of fine needle aspiration cytology.

Since the majority of patients attending a breast clinic have benign disease, they benefit from rapid diagnosis and discharge from the clinic [2]. Thus fine needle aspiration cytology can be a very useful tool to triage patients presenting to the clinic with a breast lump. Fine needle aspiration is also a very cost effective diagnostic technique in developing countries where financial constraints constitute a formidable challenge to good access to quality health care. In our institution, fine needle aspiration cytology of breast lumps as at the time of carrying out the research would cost 1000Naira (\$4) as against a core needle biopsy that would cost about 12000 Naira (\$48).

There has been variability in results reported with the use of fine needle aspiration of the breast [3]. Some authors have obtained a sensitivity of 96.42% with the use of FNAC while others have observed the sensitivity of FNAC to be in a range between 79-96.1% [4,5].

The diagnostic accuracy of FNAC depends on several factors including the site and type of lesion, the experience of the aspirator, the quality of the specimen preparation and the diagnostic

skills of the pathologist [6]. A previous study revealed that the experience of the pathologist was the most important factor in increasing the adequacy rate of the fine needle aspiration and also in increasing the sensitivity of the procedure [7].

A number of pitfalls may, however, be encountered while performing fine needle aspiration cytology of the breast. For example, aspirates from fibroadenomas, fibrocystic change and papilloma may be misinterpreted as carcinoma for various reasons which range from hypercellularity to the appearance of anisonucleosis, atypical cells, haemorrhagic or necrotic background [8-10].

False negative reports may also be encountered in breast FNAC. False diagnosis of breast lesions during FNAC may be as a result of different factors which may include the nature of the breast lesion, inadequate localization of the lump or poor sampling technique [11-13].

Inadequacy of the aspirate in breast fine needle aspiration may be another challenge in this procedure. Factors that may cause inadequate aspirates include aspiration of ill-defined masses, hyalinized lesions, deeply located lumps and sub-optimal processing of smears. Some fibrotic lesions like Fibrocystic disease as well as some desmoplastic malignant breast lesions may also give rise to inadequate smears [14].

Some studies advocated that both aspirator and interpreter should ideally be the same as the number of inadequate aspirates was far lower

and the accuracy of diagnosis was higher when the same person aspirated and reported on the specimen [15].

This study aims at assessing the usefulness of fine needle aspiration cytology in diagnosing palpable breast lesions using routine haematoxylin and eosin stains and the results compared with histological diagnosis of same tumours.

2. MATERIALS AND METHODS

This is a one-year prospective study of all palpable breast lesions for which fine needle aspiration cytology was performed at the Department of Morbid Anatomy and Forensic Medicine of the Obafemi Awolowo University Teaching Hospitals complex, Ile-Ife, Nigeria. The patients' demographic data and gross tumour characteristics were recorded.

The patients were educated on the nature of the procedure and verbal informed consent was obtained from them. The patients were told to lie supine and the lumps palpated. The skin area overlying the lump was cleaned with methylated spirit. The suspected lesion was held with one hand in position favourable for aspiration. A 23-gauge needle fitted to 20 mls syringe was used to aspirate from the lump. The aspiration was done by inserting the needle into the lump and making to and fro movements within the lump after exerting negative pressure on the syringe by pulling the plunger. About three or more passes were made on each lump depending on the yield of each pass. The aspirates were smeared on six glass slides, three of which were stained with diff-quick after air-drying. The other three slides were fixed in 95% alcohol and sent for haematoxylin and eosin staining. Hemostasis was secured with pressure applied with a dry swab. The smears were reviewed immediately by the primary investigator and other senior colleagues. The pathologists have more than 5-10 years' experience in practice. The cytological reports were signed out within 1-3 days.

The cytological evaluation in each case was categorized into one of the five diagnostic categories recommended by the United Kingdom National Health Services Breast screening Programme (NHSBSP). Aspirates categorized as malignant were further graded using the Robinson's cytological grading system for breast cancer.

For patients who had their breast masses surgically removed, the histological sections

were reviewed and their breast lesions classified according to the World Health Organization (WHO) histological classification of breast tumours. The histologic grade of each malignant lesion was determined using the Nottingham Histologic Grading System.

The final histologic diagnosis in each case was then correlated with its previous cytological diagnosis using performance indicators of quality assurance according to the NHSBSP.

Limitations encountered in the study included lack of imaging facility to guide the aspiration due to financial constraints. Also many patients who had their breast lumps aspirated did not turn up for either a biopsy or an excision thereby reducing the number of histological reports available for comparison with the cytology reports. Facilities for hormone receptor studies and molecular tests to characterize the malignant breast lesions were not available.

Ethical approval was obtained from the Ethics and research Committee of the Obafemi Awolowo University Teaching Hospitals Complex, Ile-Ife, Nigeria.

3. RESULTS

The data collection was carried out from September 1st, 2012 to August 31st, 2013. A total of 164 fine needle aspirates were obtained from 153 patients because 11 patients had bilateral palpable breast masses. The patients' ages ranged from 15 years to 86 years with a mean age of 42.29 (± 15.784) years. There were 13 males and 140 females with a male to female ratio of 1:10.8. There were 74 right breast masses, 68 left breast masses and 11 bilateral breast masses.

Of the 164 aspirates (Table 1), 12(7.3%) were inadequate (C1), 83(48.3%) were benign smears (C2) while 52(31.7%) were malignant smears (C5) (Table 1). Moreover, 4 smears were categorized as atypical, probably benign (C3) while 13 smears were suspicious for malignancy (C4).

Only 87 (53.0%) cases had further surgical intervention to remove the breast masses under investigation for histopathological appraisal. There was, however, no histological diagnosis in 5 of these cases. Thus a correlation with the cytological diagnosis could only be performed in 82 cases. These included 4 of the 12 cases with C1 cytologic smears. Two each of these four cases were respectively benign and malignant

histologically. The histological diagnoses were stromal fibrosis and fibrocystic change for the benign tumours and infiltrating ductal carcinoma (not otherwise specified) for the other two masses (both malignant tumours were Nottingham histologic grade II). All masses with cytologic C2 smears were histologically confirmed to be benign tumours while 29(96.7%) of 30 cases with C5 cytologic smears were histologically confirmed to be malignant. The only discordant C5 smear was histologically diagnosed as fibrocystic change with florid ductal hyperplasia. Of the ten cases with C4 smears, 5(50.0%) were histologically benign and the remainder (50.0%) were malignant. Three of these benign tumours were diagnosed as *fibrocystic change* while one was diagnosed as *fat necrosis*. There was no final histologic diagnosis in the fifth case. Table 2 shows some of the quality control performance indicators for FNAC. The absolute and complete sensitivities were found to be 96.6% and 87.6% respectively while the full specificity was 80.6% and the positive predictive value for C5 diagnosis was 98.1%. The false positive and negative rates were 1.7% and 0% respectively. The suspicious rate was 10.4% and the Inadequacy rate was 3.4%. The sensitivity of fine needle aspiration cytology (FNAC) for diagnosing benign breast lesions in this study was 97.3% while the specificity was 100.0%, the positive

predictive value was 100.0% and the negative predictive value was 96.7%. The sensitivity of FNAC for diagnosing malignant lesions according to this study was 100.0% while the specificity was 97.3%, the positive predictive value was 96.7% and the negative predictive value was 100.0%. The correlation between fine needle aspiration cytology of breast lumps and histological diagnosis was found to be statistically significant.

4. DISCUSSION

Several studies have demonstrated good correlation between FNAC and histology results. The values for the quality assurance indicators for FNAC as defined in this study are significantly higher than the ranges of preferred standards [4,5]. The reason for this is likely to be due to the fact that patients in our environment tend to present with large, easily accessible locally advanced tumours thereby minimizing sampling errors. This fact is further buttressed by the very low inadequacy rate of 3.4% for FNAC obtained from our study as against the suggested minimum and preferred rates of less than 20% and 15% respectively [16]. The positive predictive value of 98.1% obtained in this study compares well with the suggested minimum value of more than 98.0% [16,17].

Table 1. Summary of the cytologic and histologic diagnostic categories of cases

Histology	Inadequate (C1)	Benign (C2)	Atypia probably benign (C3)	Suspicious for malignancy (C4)	Malignant (C5)	Total
Total malignant	2	0	0	5	29	36
Invasive	2	0	0	5	29	36
Non-invasive	0	0	0	0	0	0
Total benign	2	36	2	5	1	46
No histology	8	47	2	3	22	82
Total cytology	12	83	4	13	52	164

P value= 0.000

Table 2. Some quality assurance indicators for fine needle aspiration cytology

Parameters	Present study (%)	Minimum (%)	Preferred (%)	Current median (%)
Complete sensitivity	96.6	> 80	> 90	81.5
Absolute sensitivity	87.9	> 60	> 80	57.1
Specificity (full)	80.6	> 55	> 65	58.5
Positive predictive value	98.1	> 98	>99	99.6
False positive rate	1.7	< 6	< 4	6.3
False negative rate	0.0	< 1	< 0.5	0.2
Suspicious rate	10.4	< 25	< 15	23.4
Inadequacy rate	3.4	< 20	< 15	15.8

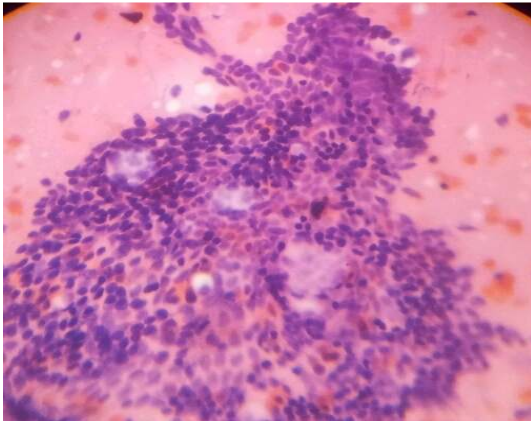


Fig. 1. Photomicrograph of a breast mass showing monomorphic epithelial cells in an antler-horn pattern (H&E X400)

Table 3. Frequency of various histological diagnoses

Histological diagnosis	Frequency	Percentage (%)
Fibroadenoma	23	26.4
Fibrocystic change	10	11.6
Gynaecomastia	3	3.5
Stromal fibrosis	2	2.3
Fat necrosis	1	1.1
Breast abscess	1	1.1
Chronic necrotizing inflammation	2	2.3
See description	2	2.3
Inadequate for histological appraisal	3	3.5
Intraductal papilloma	1	1.1
Lactating adenoma	3	3.5
Infiltrating ductal carcinoma	29	33.4
Infiltrating lobular carcinoma	2	2.3
Mucinous carcinoma	4	4.6
Papillary carcinoma	1	1.1
Total	87	100

Other researchers have also observed similar levels of sensitivity and specificity for fine needle aspiration cytology. Kujur got sensitivity and specificity of 96.15% and 96.29%. another researcher also observed a sensitivity and

specificity of 88.37% and 96.42% for malignant lesions. These results have good correlation between fine needle aspiration cytology and histological diagnosis. The two studies were also carried out in a developing country and may have had similar circumstances like late presentation of patients with breast lumps which made it more likely to have had correct diagnosis on cytology as the breast lesions were more likely to be in an advanced stage [18,19]. The importance of the size and palpability of the tumour is further buttressed by the fact that some researchers have obtained lower values of 85-88% and 55.6-90.5% respectively for sensitivity and specificity of fine needle aspiration for breast lumps even with image guidance [20]. The values were lower in this study because the research was carried out on non-palpable breast lumps.

False positivity is a worrisome outcome of breast FNAC because a mastectomy could be performed for an otherwise benign lesion with serious medico-legal implications. Interestingly, only one of the 30(3.6%) cases with C5 cytology report turned out to be benign histologically. The advanced stage at which most patients presented to the clinic may have also contributed to the very low false positive rate encountered in this study. It has been shown that false positive fine needle smears often occur with peculiar histologic categories of breast lesions such as intraductal papilloma, fat necrosis and tubular adenomas. In this study, the only false positive report that was diagnosed as malignant cytologically was a fibrocystic disease with florid epithelial hyperplasia. Other researchers have also had similar experiences with fibrocystic disease of the breast [17].

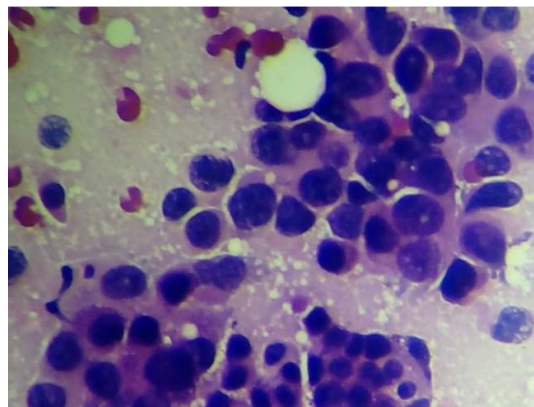


Fig. 2. Photomicrograph of a breast lump showing individual malignant cells with marked nuclear hyperchromasia (H&E X400)

False negative diagnosis is another area of concern in the cytological evaluation of breast lesions [11-13]. In the most experienced centres, at least 1.0% of cancers have a false negative cytology. The false negative rate in the present study of 0.0% is well below the recommended minimum threshold of <1.0% [16]. This is most likely due to the fact that most of our patients presented with malignant breast lumps at advanced stages.

Unsatisfactory smears may also prove to be a challenge in fine needle aspiration cytology of breast lumps [7]. The inadequacy rate of 3.4% found in this study is well below the recommended minimum and preferred values. There were four unsatisfactory smears for which histology was performed in this study. Two of these were found to be benign histologically while the remaining two were malignant. One of the benign lesions was diagnosed as stromal fibrosis. This is not surprising since the fibrotic nature of the lesion could give rise to a cell poor aspirate. The other benign lesion was found to be a fibrocystic change. Fibrocystic change may also give rise to an unsatisfactory smear especially if the fluid part of the lesion that is cell poor is aspirated. The two malignant lesions were infiltrating ductal carcinomas with desmoplastic response of the stroma. The desmoplasia may result in a poor aspirate.

5. CONCLUSION

This study shows that FNAC of palpable breast lumps in Ile-Ife is a clinically effective tool and its correlation with histological diagnosis was found to be statistically significant especially when performed by an experienced pathologist. It should, therefore, be incorporated into the preliminary evaluation of palpable breast lesions. Moreover, because of the high level of accuracy of FNAC as shown in this study, we recommend that a multidisciplinary team comprising surgeons, radiologists and pathologists should work together in a breast clinic to triage patients with breast lumps for subsequent management with the use of fine needle aspiration cytology by the pathologists.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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