

## ORIGINAL ARTICLE

## Cost effectiveness of fine needle aspiration cytology for breast masses

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Received: February 22<sup>nd</sup>, 2015Accepted: April 13<sup>th</sup>, 2015**ABSTRACT**

**Background:** Fine Needle Aspiration Cytology (FNAC) is an excellent method for diagnosing palpable lesions. It is very cost effective and saves huge amounts of money for the patients when compared with open surgical biopsy.

**Objective:** A prospective study carried out to evaluate the cost effectiveness of FNAC for palpable breast masses at Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi.

**Methodology:** A total of 180 patients were recruited into the study. All the patients had FNAC but only 110 patients had histopathological reports and the latter were used for test of validity. The total cost for FNAC and histopathology as well as cost saving between FNAC and histopathology for the 110 patients were calculated.

**Result:** The total cost for FNAC procedure and cytological evaluation of each smear was one thousand, seven hundred naira (N1,700.00 = US\$11). The total cost for open surgical biopsy and histopathological evaluation was thirteen thousand, six hundred naira (N13,600 = US\$88) per patient. It took an average of 2 days +/- SD 1 day to obtain FNAC results while, on the other hand, it took an average of 28days +/- SD 7days to obtain histopathological diagnosis.

**Conclusion:** Fine Needle Aspiration Cytology (FNAC) is very cost effective and saves huge amount of money and time for the patients when compared with open surgical biopsy.

DISCLOSURE: NONE

*Keywords: Accuracy, biopsy, cost effective, histology, safety*

## INTRODUCTION

Aspiration cytology has been practised for decades to diagnose lesions in many anatomical locations. Breast lesions were identified as particularly suitable for the technique due to their easy accessibility. The use of smear from needle aspiration for diagnostic purposes was reported as early as 1933, when Stewart described his experience with aspiration smears from approximately 2,500 specimens, including nearly 500 breast lesions.<sup>1</sup> Fine needle aspiration (FNAC) was first introduced by Martin and Ellis in 1930.<sup>2</sup> FNAC is highly sensitive, easy to perform and cost effective and can be carried out as an office procedure.<sup>3,4,5</sup> Fine needle aspiration (FNA) cytology and core needle biopsy were originally used for diagnosis of palpable breast lesions. Both methods have high degree of sensitivity and specificity. Fine Needle Aspiration Cytology is an excellent method for diagnosing palpable lesions; its sensitivity has been reported to be between 89% and 98% and its specificity between 98% and 100%.<sup>6,7</sup>

The diagnosis of breast diseases can be achieved like in other clinical conditions using: history, physical examination and investigation which include cytological or histological confirmation. Breast lump which is one of the most common presentations of breast lesion is usually detected by means of self-breast examination, clinical breast examination and mammography. Due to the fact that clinical assessment and mammography cannot accurately confirm or rule out malignant breast conditions, several studies have advocated the use of 'Triple test' which consists of clinical examination, radiologic examination and cytopathology.<sup>6,7,8,9</sup> When all the three components are positive, diagnostic accuracy approaches 100% for malignancy.<sup>8</sup> When one of the components is positive, further investigation by open surgical biopsy which is still the gold standard may be advocated.

Cytopathology could be by means of Fine Needle Aspiration (FNA) or Core biopsy. Fine Needle Aspiration Cytology is widely used

and has been credited with a lot of advantages. It was initially introduced as an alternative to open surgical biopsies which were associated with the likelihood of tumour implantation, scarring, increased cost of treatment, morbidity, complications, delay in diagnosis, need for anaesthesia, overloading of waiting list and operation time and unnecessary benign excision biopsies.<sup>7</sup> The reliability of FNAC depends on the skills of the aspirator, the cytopathologist and the histological type of the lesion.<sup>6,10</sup> Also, the age of the patient, size of the lesion and method of detection (clinically detected or image detected) influence reliability.<sup>11</sup>

Generally, FNAC is very cost effective and saves huge amounts of money for the patients when compared with open surgical biopsy. This is particularly so, considering the cost saving with some conditions like benign breast cysts and mastitis or breast abscesses that may not require open surgical biopsy for their treatment. Sampling procedure for FNA cytology is quicker to perform than core biopsy and can be done as out-patient procedure in the clinic.<sup>8,9,10,11,12,13,14,15,16,17,18</sup> Fine Needle Aspiration Cytology is also credited with being less painful and does not require the use of anaesthesia.<sup>8,12</sup>

No study has been done in our institution on numerical cost or cost effectiveness of FNAC compared with open surgical biopsy. This study, therefore, aims at evaluating the cost effectiveness of FNAC for palpable breast masses at Nnamdi Azikiwe University Teaching Hospital (NAUTH), Nnewi.

## METHODOLOGY

This is a one-year prospective study from February 2009 to January 2010. All the consecutive patients with palpable breast lesion presenting at the two general surgery out-patient clinics of NAUTH were recruited. Approval was sought from the Ethical Committee of NAUTH before the commencement of the study. The study was carried out at no extra cost to the patients. The procedure was duly explained to the patients, including the benefits and possible

complications after which their informed written consent was obtained. Those who refused to give their consent were excluded from the study but their overall treatment was not affected.

The needling process and smear making were done by the investigator in the clinic while the staining and reading of the slides were done in the laboratory by the pathologist. The wet slides were stained with *Papanicolaou* staining technique while the dry slides were stained using *May-Grunwald-Giemsa* staining technique. Only one pathologist read all the cytology smears. Subsequently, open surgical biopsy specimens were sent to the pathologists for histology report. The cytology results were reported according to the National Health Services Breast Screening Programme (NHSBSP) of Britain.<sup>19</sup>

Patients who had FNA cytology were followed up until the histology report was obtained following open biopsy. After performing FNAC in the clinic, the surgeon in the research team worked-up the patients and performed open biopsy in the theatre. The biopsy specimens were put in a container containing 10% buffered formalin and transported to the institution's histopathology laboratory for histological evaluation. The total cost and average time it took to obtain the results for both FNAC and open surgical biopsy were calculated for each patient. The patients' information, cytology and histology reports were documented in the proforma when they were ready. The data were entered into a database and statistical analyses carried out using the Statistical Package for Social Sciences (SPSS) version 17.0.

## RESULTS

A total of 180 patients were enrolled into the study, and all had FNAC of their breast lesions. However, only 113 patients had open biopsy with histology reports. Sixty-seven patients defaulted from open surgical biopsy due to one reason or another. The above finding gives a biopsy rate of about 63% and default rate of about 37%. Out of the 67 patients that defaulted, the following were

reasons for default: five patients had benign cysts cured by FNAC; six patients had breast abscess cured by incision and drainage with antibiotic therapy; 20 patients could not finance their open surgical biopsy; while 36 patients were lost due to long theatre waiting time. These findings were obtained from patients when they came back for the cytology report. Only patients who had open biopsy with histology reports were further evaluated.

Out of the 113 patients with histology reports, two had normal breast tissues and another one, inadequate specimen. The three were further excluded leaving only 110 patients for analysis. Fine Needle Aspiration Cytology reports for the 110 patients showed that 17 (15.5%) were categorized as unsatisfactory (C1), 46 (41.8%) were categorized as benign (C2), 5 (4.5%) were categorized as atypia & probably benign (C3), 4 (3.6%) were categorized as suspicious for malignancy (C4), and 38 (34.5%) were categorized as malignant (C5). However, only smears from 84 patients, C2 (46 cases) and C5 (38 cases), were used for test of validity in this study. This was because C1, C3 and C4 reports are inconclusive and would require further evaluation.

Correlation with histopathology showed that out of the 46 benign smears 42 were true negative and 4 were false negative. On the other hand, out of the 38 malignant smears 36 were true positives while 2 were false positives, giving a sensitivity of 90.0% and specificity of 95.5%. Other diagnostic validities are as shown in *Table 1*.

**Table 1. Diagnostic validities of FNAC excluding unsatisfactory and suspicious smears**

Diagnostic Validity	Value in Percentage
Sensitivity	90.0
Specificity	95.5
False Positive Rate	5.3
False Negative Rate	8.7

Positive Predictive Value	94.7
Negative Predictive Value	91.3
Overall Diagnostic Accuracy	92.9

The cost of carrying out FNAC in NAUTH during the study period was approximately one hundred naira (N100 = US\$0.65) for each patient. This included the cost for consumables like sterile injection packs, surgical gloves, syringes, needles and frosted slides. The cost for the cytology proper was one thousand, six hundred naira (N1,600 = US\$10.4) making a total of one thousand, seven hundred naira (N1,700 = US\$11) for the procedure and cytological evaluation of the smears. On the other hand, the cost of carrying out open surgical biopsy in the same hospital was approximately twelve thousand naira (N12,000 = US\$78) per patient. This included the theatre fee, anaesthetic drugs and other consumables. The cost for histopathology proper was one thousand, six hundred naira (N1,600 = US\$10.4) bringing the total cost to thirteen thousand, six hundred naira (N13,600 = US\$88) per patient. The total cost for FNAC and histopathology as well as cost saving between FNAC and histopathology for the 110 patients is as shown in *Table 2*.

**Table 2. Average cost for FNAC and open surgical biopsy**

Procedure	Cost per Patient	No. of Patients	Total Cost
FNAC	N1,700.00	110	N187,000.00
Open Biopsy	N13,600.00	110	N1,496,000.00
Difference (cost saving)	N11,900.00	110	N1,309,000.00

It took an average of 2days +/- SD 1day to obtain FNAC results, while on the other

hand, it took an average of 28days +/- SD 7days to obtain histopathological diagnosis. The difference in time interval for obtaining FNAC and histopathological results is statistically significant ( $p < 0.05$ ).

**DISCUSSION**

All the 180 patients in this study had FNAC, giving an acceptance rate of 100% for FNAC. This shows that FNAC was very acceptable to the patients and that within a given period, more FNAC than open surgical biopsy can be done. Fine needle aspiration cytology was found to be more specific than sensitive in this study; 95.5% and 90.0% respectively with overall diagnostic accuracy of 92.9%. These values are comparable to those documented in similar studies and much higher than >60% for specificity and >80% for sensitivity recommended by NHSBSP of Britain.<sup>8,20,21,22,23,24</sup>

Fine Needle Aspiration Cytology is very cost effective and saves huge amounts of money for the patients, when compared with open surgical biopsy. This is more so when one considers the cost benefit to some patients with some conditions like benign breast cysts and mastitis or breast abscesses who may not require open surgical biopsy for their treatment.

With the fact that in this study the total cost for FNAC was N1,700 and that for open surgical biopsy N13,600 for each patient, it becomes obvious the huge amount of money that could be saved the patients. Several other studies done on FNAC in different parts of the country reported similar findings cost effectiveness.<sup>20,21,22,23,24</sup> Gukas, in a similar study in 1997 at Jos, quoted the average cost of FNAC to be N500 and that for open surgical biopsy to be N2,500.<sup>21</sup> This includes the cost for the procedure as well as the cytology/histology as the case may be. Panchalingam, in 1999 at Lagos, got N400 and #8,500 for FNAC and open surgical biopsy, respectively.<sup>22</sup> Ewaem, in his study at Benin in 2006, recorded the cost of FNAC to be N1,000 and that for open surgical biopsy to be between N7,000 and N15,000.<sup>23</sup> Also, in a

study by Bukhari, *et al*, done in Pakistan, open surgical biopsy cost Rs700 (US\$9.5) as compared to Rs200 (US\$2.5) for each FNAC.<sup>25</sup> Rubin, *et al*, also, mentioned a saving of US\$1000 with this cost effective procedures.<sup>26</sup> It, therefore, establishes that FNAC is very cost effective and saves huge amounts of money for the patients when used as an alternative to open surgical biopsy especially in benign breast cysts where FNAC is also curative.

Results of FNAC are available relatively fast, within a few hours, in good centres.<sup>8</sup> This is possible because the procedure and staining ideally require less than an hour. However, due to few cytopathologists and heavy workload, the waiting period could be longer. In this study, however, it took an average of 2days +/- SD 1day to obtain FNAC results while on the other hand, it took an average of 28days +/- SD 7days to obtain histopathological diagnosis. The difference in time interval for obtaining FNAC and histopathological results is statistically significant ( $p < 0.05$ ). The same cytopathologist who read all the smears had other duties as well. Despite this, FNAC was able to reduce the waiting period to obtain a diagnosis significantly ( $p < 0.05$ ) compared to the waiting period for a histopathological report. In the study by Gukas, it took an average of 3.7days to obtain the result of FNAC as against 7.5days for Trucut biopsy and 14.8 days for open surgical biopsy.<sup>21</sup> The 3.7days for FNAC was too long and was attributed to the heavy workload on the pathologist that read the slides. Therefore, FNAC in good centres is time saving.

#### CONCLUSION

The practice of FNAC is very cost effective and saves huge amounts of money as well as time for the patients when compared with open surgical biopsy. It is also very safe and well tolerated by most patients.

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