# FEASIBILITY AND COST EFFECTIVENESS OF USING FINE NEEDLE ASPIRATION BIOPSIES FOR THE DIAGNOSIS OF PALPABLE BREAST MASSES IN PERIPHERAL HOSPITALS IN TANZANIA.

PRAXEDA ATIENO OGWEYO, MD

A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT FOR THE DEGREE OF MASTER OF MEDICINE IN ANATOMICAL PATHOLOGY OF THE UNIVERSITY OF DAR ES SALAAM, 1996

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## ABSTRACT

A prospective study to determine the feasibility and cost effectiveness of fine needle aspiration cytology (FNAC) was done in Ndanda and Morogoro (the peripheral hospitals) and Muhimbili the national referral hospital in Dar es Salaam, Tanzania. All patients with breast lump(s) who presented at the surgical outpatient clinic(s) or surgical ward(s) in these three hospitals were studied from November 1993 to August 1995.

Fine needle aspiration smears from the peripheral hospitals, were posted to Muhimbili for staining and interpretation by the pathologist. The surgeons followed these patients with open tissue biopsies. For Muhimbili patients aspiration was done in the pathology cytology laboratory by the pathologist, whereas tissue biopsies were sent to the laboratory by the surgeons after operation. For both smears and tissue biopsies, dates of posting from peripheral hospital, receiving (taking in, in case of tissue biopsies) at the pathology laboratory, making diagnosis and getting cytology or histology report by the surgeon were noted by the author in each patient through collaboration with the surgeons. The mean number of days taken for each procedure was calculated from the day of aspiration or operation.

A total of the 256 FNAC paients were studied, of these 206 (80.5%) were from Muhimbili, 41 (16.0%) from Morogoro and 9 (3.5%) were from Ndanda. Of the 256 FNAC patients, 86 (33.6%) had traceable tissue biopsies. Results showed that compared to tissue biopsies FNAC significantly reduced the mean number of days in posting, receiving specimens at the laboratory, making diagnosis and getting report.

Seventy three (28.5%) patients who had adequate cytological material and had histological follow up, were analyzed to assess the accuracy of FNAC compared to histological diagnosis. FNAC was found to be a highly accurate method in diagnosis of palpable breast masses with an accuracy of 95.8%, sensitivity of 94.8% and specificity of 97.0%.

Cost effectiveness analysis indicated that FNAC was highly cost effective, reducing the cost of diagnosing breast masses in peripheral hospitals by 63.3% and 60.2% for one outpatient and inpatient respectively. The respective cost reduction at Muhimbili referral hospital were 70.4% and 65.7% for one outpatient and inpatient. Therefore FNAC provides a rapid, accurate and cheap method of accurately diagnosing breast lumps. The findings of this study suggest that FNAC should be recommended for diagnosis of breast lumps in all hospitals in Tanzania.

## LIST OF ABBREVIATIONS

| | |
|---|---|
| FNAC | Fine needle aspiration cytology |
| FNAB | Fine needle aspiration biopsy |
| FNA | Fine needle aspiration |
| I.E | That is |
| ETC | Et Cetera |
| PAP | Papanicolaou stain |
| H & E | Haematoxylin and Eosin |
| n:c | Nuclear-cytoplasmic ratio |
| T.SHS. | Tanzanian Shillings |
| FBP | Full Blood Picture |
| ESR | Erythrocyte Sedimentation Rate |
| SD | Standard deviation |

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**DECLARATION**

I declare that this is a result of my work, and that it has not been submitted for a degree in any other University.

Signed: Praxeda Atieno Ogweyo.

Date: 14/8/1996

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## ACKNOWLEDGEMENTS

Many people contributed in one way or another towards the accomplishment of this work, but I am so much indebted to the following:

The Norwegian government through NUFU Programme for the financial support.

Prof. dr. N. P. Aardal for sparing so much of his valuable time to read, comment and advice as a supervisor.

Prof. dr. J. N. Kitinya for his continuous advice and comments as a supervisor.

Prof. dr. L. A. Akslen for his persistent support and advice.

Dr. M. Mbonde for his assistance in arranging with the surgeons to participate in the study.

Dr. H. M. Chande for collecting the smears and keen interpretation.

Dr. D. Mwambe for accepting to participate in this study despite having a lot of work.

Dr. S. R. Koshuma for accepting to participate in this study and his tireless help.

All staff members of Muhimbili Pathology Laboratory for their cooperation.

Last but not least to my husband Joseph, sons Edgar and Rodgers, and my mother for their patience while I was working.

## INTRODUCTION AND REVIEW OF LITERATURE.

Breast cancer is the most common malignant disease and the leading cause of cancer deaths in women[44]. It has been estimated that nearly 600,000 new cases of breast cancer are diagnosed annually in the West[41]. In 1989, there were about 140,000 new cases of breast cancer in women and about 1,200 new cases of breast cancer in men in the U.S[23]. Although the literature on breast tumours in Africa is scanty[6,1], the prevalence of breast cancer in sub-Saharan Africa is high. In the majority of these countries, its position is exceeded only by the larger number of uterine cervical cancers[7,51] except in Sudan[38]. In Tanzania it forms 8.1% of all female cancers[1], 9.4% in Kenya[28] and 34.5% in Khartoum Sudan[19]. Epidemiological studies have shown marked geographical variation in the incidence of various breast lesions. Many reports state that the incidence of cancer of the breast is lower in Africa and Asia than in Europe and north America[9,59].

The most notable characteristic of the descriptive epidemiology of breast cancer in recent years is perhaps the dramatic increase in prevalence rates in developing countries[25]. Several methods have been used in the detection and evaluation of breast tumours. Clinical examination, particularly palpation, is the time honoured method. It remains an extremely useful and practical

technique, however, both its sensitivity and specificity are limited as only 60% of tumors detected by mammography are palpable[44]. Mammography, a method which relies primarily on the presence of calcification, has been used widely in the diagnostic approach to breast cancer.

Diagnosis of cancer of the breast can never be absolutely certain without morphological confirmation, that is, without microscopic demonstration on material obtained by some form of biopsy. The techniques that are available for obtaining material for examination under the microscope include excisional, incisional and various needle biopsy techniques. In excisional biopsy the whole lesion is excised whereas in incisional biopsy only a segment of the tumour is removed. In needle biopsy, a tiny fragment of tissue or even just a suspension of cells is obtained. The science of making a diagnosis from cells is known as Cytology. Two methods that have been used to obtain cytological material from breast lesions are nipple secretion and aspiration of the lesion by a fine needle. Whereas the nipple secretion cytology is of limited value, the situation with fine needle aspiration is quite different. In experienced hands the technique is highly reliable[44]. Fine needle aspiration cytology (FNAC) sometimes called fine needle aspiration biopsy (FNAB), is a method that does not require anaesthesia or surgical

incision.

Although several studies have documented the efficacy of FNAC in the diagnosis of breast masses[55,60,61], and the procedure has gained wide acceptance in the preoperative work up of such lesions, many surgeons are still reluctant to accept a positive aspirate as the sole criterion for proceeding with definitive management of breast cancer[49]. Their main concern is that a lesion interpreted as malignant on cytological examination may subsequently be proved (on permanent section) to be benign. This has led them to perform an open biopsy for histological confirmation of malignancy. However, fine needle aspiration cytological examination has been shown in several studies to be a safe[4,43,45,52], and cost effective[24,29,50] means of evaluating breast masses. Several studies document it as a highly accurate procedure[3,15,17,22,39,57,60]. It can be performed in an office or clinical setting with essentially no morbidity, other than an occasional hematoma at the site of aspiration. In cases where the results clearly show malignant conditions, it provides the opportunity for early discussion of treatment options with the patient. In this way, patients are spared the traumatic experience of being uncertain of the diagnosis in the interval between the initial evaluation and surgical therapy.

Screening is defined as a process of detecting early disease in an asymptomatic patient. It permits treatment before irreversible damage has occurred and with breast cancer, implies that cure is possible[21]. Screening for breast cancer can reduce mortality from the disease[9]. Despite its use in the diagnosis of breast cancer, some studies have incorporated FNAC in the "triple assessment" system for the screening of breast cancer in women aged 35 years or less[2]. In this triple assessment screening study, clinical examination was unreliable in predicting malignancy with a sensitivity of only 37%. Mammography indicated carcinoma in 69% of patients while FNAC was the best single investigation in this series with an indication of malignancy in 93% of patients and a specificity of 100%. Radiological methods were less sensitive in detecting malignancy in this age group than in older patients.

**Historical background of fine needle aspiration.**

In the 17th century, long before pathologists were able to prepare tissue sections, the features of individual cells were being studied by scientists such as von Leeuwenhoek, Virchow, and Muller. Specimens were obtained either from effusions and exudates or by teasing out tissues in saline to produce smears. The introduction of paraffin wax embedding and the development of microtome facilitated the study of finely cut histological sections, which dominated

microscopy in the late 19th and early 20th centuries[42]. Over the last 50 years a revival of cytology has taken place, such that it is becoming widely accepted as a diagnostic technique with a role that complements that of histology. Exfoliative cytology which evolved largely because of the work in the United States of America by Papanicolaou[40] is now particularly important in screening asymptomatic populations for malignant and premalignant conditions of female genital tract. By contrast, aspiration cytology has been developed largely in Europe following the work of early hematologists who used fine needle punctures for diagnosing disorders of bone marrow, lymph nodes, and spleen.

After 1920, the non hematological branch of aspiration cytology was developed by Martin and Ellis in New York and Dudgeon in London[35]. The two American workers aspirated various palpable tumors from 1926 onward. In 1930 they reported their experience with a series of 1,400 malignant lesions, 280 of which were tumors of the breast[35]. They used an 18 gauge needle, which they considered to cause little trauma and few of the surgical risks encountered in open biopsy. Meanwhile, at St. Thomas Hospital in London, Dudgeon and Patrick had developed the wet film technique of fixation, which they used to make imprint smears. They extended their method to exfoliative and aspiration

cytology, and in 1927 they reported an accuracy of 98.6% in the diagnosis of breast cancer[10]. These early workers made an important contribution to the development of aspiration cytology in that they advocated a different and advantageous method of obtaining biopsy material. They however, concentrated more on recognition of patterns than on diagnosis by interpretation of features of individual cells. The success of exfoliative cytology familiarized many pathologists with the principles of cytodiagnosis[56], although the growth of aspiration cytology was by no means world wide in extent.

By 1950, surgical pathology in the United States had developed rapidly and had attained such a high degree of diagnostic accuracy that there was little interest in or need for pursuing aspiration cytology. This was not the case in Europe, particularly in Scandinavia, where, rapid and accurate alternative to surgical biopsy was required because large numbers of patients travelled long distances to city hospitals. Improvement in the methods of fixation and staining together with the use of finer needles (23 gauge) led to the widespread use and acceptance of aspiration cytology in the 1940s and 1950s. By 1972, over 12,000 aspirates were being performed annually in Sweden. About 3,000 of these were from breast lesions, the rest were mainly from thyroid, prostate, and lymph nodes[60]. Fox[12]

discussed the reasons for low rates of acceptance of aspiration cytology by clinicians particularly in America before 1970s. He suggested that the chief reason for its low acceptance was the inherent subjectivity of the technique. However, since 1970, it has grown in popularity and is now used routinely in the initial diagnosis of palpable breast masses by workers in the United States[5,48,59] and in other parts of the world[46] most of whom report comparable sensitivity and specificity.

**RATIONALE OF THE STUDY**

Tanzania is a large country but with poorly developed communication lines, including the postal service. Pathology services are divided into zones which are covered by the zonal consultant hospitals of KCMC in Moshi, Bugando in Mwanza, Mbeya in the South and the Muhimbili National Referral hospital in Dar es Salaam. At the moment only the facilities at KCMC in Moshi and Dar es Salaam are operational because they have pathologists.

Breast cancer is the second commonest malignancy in females in Tanzania[1,47]. At the moment no breast cancer screening programmes or educational programmes on breast self examination (BSE) exist in Tanzania. Such programmes teach women the techniques for detecting early breast lumps. In addition mammography is not available in Tanzania at the

moment. Due to lack of these facilities, breast cancer is often in a very advanced stage when patients are finally seen at the referral hospitals.

Currently in Tanzania, the diagnosis of breast cancer from palpable lesions is done by taking tissue biopsy by the surgeon. In a lesion that looks clinically malignant excisional biopsy is taken, but in the majority of lesions incisional biopsy is routinely done. The process of taking biopsy requires the patient to be prepared for surgery. Biopsy is then sent by mail to one of the pathology laboratories for morphological diagnosis. At the pathology laboratory, the biopsy is then processed, sectioned and stained. If FNAC were to be used as the basis of morphological diagnosis instead of biopsy, all the above procedures would be reduced considerably, probably resulting in earlier definitive treatment and improved survival of patients with breast cancer. Because every regional hospital in Tanzania has a trained surgeon, breast cancer treatment by surgery can be done in the regions successfully if morphological diagnosis can be made early.

**AIMS AND OBJECTIVES**

1. To investigate whether the transportation of cytological smears by post, which are smaller than biopsies, would be faster and feasible.

2. To investigate whether use of FNAC would result in earlier diagnosis of patients with breast masses.

3. To investigate whether FNAC in Tanzania can be used to make a diagnosis of malignancy of palpable breast masses as the only preoperative method, before definitive surgery.

4. To compare the cost of using pretreatment FNAC instead of biopsy and that for biopsy as basis for morphological diagnosis.

## MATERIALS AND METHODS

### Selection of hospitals

Two peripheral hospitals and one referral hospital were selected for the study. Selection of the hospitals was based on the following criteria:

1. If the hospital had a trained surgeon who could be taught how to perform FNAC of the breast lumps and later on could follow the patients by taking tissue biopsies. Morogoro hospital was chosen on this criteria and the fact that it is a regional hospital with easy communication lines to the National Referral Hospital at Muhimbili.

2. Communication system between the hospital and the main referral hospital. Ndanda mission hospital was chosen basing on this criteria. Despite the fact that it had a well trained surgeon, the hospital is located in the southern part of Tanzania where there is poor communication.

3. Hospital with pathology laboratory and a pathologist; where FNAC and tissue biopsies could be processed, stained and interpreted by the pathologist. Selection of Muhimbili hospital was based on this criteria.

**HYPOTHESES**

1. Fine needle aspiration cytology can speed up the diagnosis and management of patients with breast cancer.

2. Fine needle aspiration cytology can reduce the cost of diagnosis of palpable breast masses.

3. Fine needle aspiration cytology can be performed by surgeons in the peripheral hospitals for the diagnosis of breast masses instead of tissue biopsy.

**Training workshop for surgeons**

Before the initiation of the study, a pathologist from Muhimbili visited the two selected peripheral hospitals to discuss with the surgeons the aims of the study and to request their consent and participation. Two weeks later a letter was sent to each surgeon requesting him to attend a two days seminar on FNA of the breast lumps which was to be held in Muhimbili. The main aim of this seminar was to teach the surgeons how to perform FNA of breast lumps. It was to be conducted by a visiting pathologist from University of Bergen (Norway) who is responsible for cytological interpretation of breast smears being aspirated by surgeons. The pathologist from Muhimbili who has been performing FNAC on various lesions referred to him by

surgeons taught the surgeons how to do aspiration of the breast lumps.

During the seminar eight patients who had appointment for FNA had aspiration of the breast lumps performed on them. The first two patients were aspirated by the pathologist as a demonstration to the surgeons. Three smears were made from each patient and immediately fixed in 95% ethyl alcohol and later stained using Papanicolaou stain. The surgeons had to do aspiration on the other patients under the guidance of the pathologist. During this seminar, emphasis was put on the value of the aspirator regarding the quality of the smears for a definitive diagnosis of the breast lesion.

The registration forms which were used for registering all patients for this study (see appendix I), were discussed with the surgeons each item being elaborated thoroughly. Emphasis was also made on the need to write a clear and elaborate clinical information indicating the clinical provisional diagnosis when sending the smears to the pathologist. The breast smears aspirated during the seminar were examined by the pathologist. The errors which arose either during aspiration or smear preparation and their implication on the ultimate diagnosis of the breast lesion were discussed.

After the seminar, the surgeons went back to their respective hospitals with the following materials:

1. Glass slides.
2. One diamond pencil: for labelling the slides.
3. Absolute alcohol: to be diluted to make the fixative.
4. Coplin jars: container for keeping the fixative during smear preparation.
5. Small plastic slide containers: for transporting already fixed slides to the national referral hospital.
6. Needles (Size 23-gauge, hub of 0.8 mm diameter).
7. Disposable plastic syringes (20 mls).
8. Metal syringe holder.

**Patients**

Included in this study were all patients who presented themselves or as referred cases to these three hospitals either at the surgical clinics or in surgical wards with a complaint of breast lump(s) during the study period. In addition to the breast lumps, the surgeons were encouraged to make FNAC from lesions other breast and send them to the pathologist for cytological diagnosis.

**Procedure of making smears**

With the patient seated, the skin over the site to be aspirated was cleaned with a small swab impregnated with

alcohol. No local anaesthesia was administered. The aspirator using one hand to locate and stabilize the lump, inserted the needle into the presumed center of it. Often, the proprioceptive feedback from the palpating fingers confirmed accurate insertion. The plunger in the syringe was drawn out to its maximum length. The 20 mls syringe was necessary for attaining negative pressure strong enough to draw the cellular material into the lumen. With the mass firmly held in place, the aspirator moved the needle back and forth 10 to 20 times while angling it to sample cellular material from all areas of the mass at the same time maintaining pressure. There was a distinct sensation in the aspirators fingers that helped to pass the needle through the lesion which reduced the chance of obtaining the sample from the wrong area. With enough material in the hub of the needle, negative pressure was released slowly for about 2 seconds. The slow release of the negative pressure was important because sudden release could force the cells back through the needle. The aspirator withdrew the needle from the breast only after the release of the negative pressure. Firm pressure with a cotton swab was applied to the site by the patient after aspiration to prevent hematoma which usually arises as a complication of this procedure.

**Preparation of smears**

About three glass slides were polished and marked with diamond pencil indicating the cytological number of the patient and the date of the aspiration, the same information appeared in the request and registration forms. Meanwhile the aspirator quickly detached the syringe from the needle and filled the syringe with air, the needle was reconnected, and the aspirate was blown sharply onto the three slides. The procedure was repeated until no more material were obtained, usually four or five "blows" were required. If excess blood or tissue was present, it was sucked back from the slide leaving a predominance of tissue fragments.

To smear the cellular material, the aspirator touched the slide with cellular material with a second empty slide. The empty slide was placed with the tip at about sixty degrees angulation touching the edge of cellular material and pulled over the length of the first slide. Macroscopic examination of the aspirate aided in assessing the adequacy of the material. About three slides were made from each aspiration. To prevent the cells from drying, which could distort the nuclear parameters and impede accurate cytological interpretation, the aspirator needed to prepare the slides quickly and place them in a coplin jar filled with 95% ethyl alcohol. The slides were placed back to back

with cellular material sides facing the outside.

**Staining**

The fixed smears were stained by Papanicolaou method for 6 minutes. No special favour was given to the breast lump smears. The slides were stained together with other tissue smears.

**Reporting**

Criteria for cytological diagnosis were based on those developed by Koss[27]. The FNA smears were evaluated for adequacy of cells i.e cellularity, cellular distribution i.e whether the cells were loose and single with necrotic background which denoted malignancy or they were arranged in cohesive clusters with clear background (benign lesion). Noted also was the nuclear cytoplasmic ratio (n:c), whether it was markedly increased, moderately increased or not increased. The smear was also examined for the variation in the size of the individual cells (pleomorphism) and prominence of the nucleoli. Noted also in the smear was the presence of inflammatory cells and presence of mitotic figures.

For the purpose of evaluating results, the cytological report was classified into six categories.

1. **Inadequate (not representative):** This was reported

when a smear contained no epithelial cells, making cytological diagnosis impossible and repeat of the FNAC was advised.

II. **Normal breast smear:** This was reported in the presence of adequate number of epithelial cells that were normal.

III. **Benign lesion:** This was reported in a smear which contained cohesive groups of epithelial cells with normal nuclear cytoplasmic ratio and no variation in size of cells.

IV. **Suspicious of malignancy:** This report was issued when the smear despite having cohesive groups of epithelial cells, it also had loose cells with moderately increased nuclear cytoplasmic ratio, slight hyperchromasia, and slight variation in size of the individual cells.

V. **Malignant:** This was reported when definitive features of malignancy were seen in most cells such as high cellularity of the smear, necrotic background, loose, single cells with high nuclear cytoplasmic ratio, hyperchromasia, prominence of nucleoli, marked variation in size of the individual cells and

presence of mitotic figures.

VI. **Other lesions:** These were specified by the pathologist.

For all malignant FNAC diagnoses, the surgeon was advised to carry out definitive treatment as he would in cases where open tissue biopsy was used to diagnose breast carcinoma. In most cases mastectomy was expected. In those cases with inadequate material, repeat of aspiration was advised.

**Data analysis**

On receipt of the smears from the peripheral hospitals at the laboratory at Muhimbili, the date of FNAC was noted from the request form which accompanied the slides. Date of posting was noted on the envelop stamp, while the date of receiving the smear at the pathology laboratory was noted by entering the patient in the cytology registration book. All these dates were also entered on the registration forms for each patient, form which was calculated the number of days from the date of FNAC. After registration procedures, the smears were handled in the same manner as those aspirated at Muhimbili i.e. they were stained and dispatched to the pathologist. After making diagnosis, the reports were typed and sent to the surgeon who did the

aspiration. Indicated in the report forms was the date of aspiration, date of making cytological diagnosis and the date of typing the report. The date FNAC report reached the respective hospital was noted by the surgeon. These patients were followed to their respective hospitals in order to record the date of getting cytology report into their registration forms. This was calculated as the number of day(s) from the day of aspiration. For patients with a cytology diagnosis of suspicious or malignant, a follow up tissue biopsy was expected. Re-aspiration was expected in cases with inadequate smears. For tissue biopsies from peripheral hospitals, the date of operation was noted from the request form, posting date was noted by looking at the postage stamp on the envelop. For patients from Muhimbili, most tissue biopsies were sent to the pathology laboratory on the day of the operation. This date corresponded to posting date for peripheral hospital specimens. Receiving (taking in) date (for both Muhimbili and peripheral hospital tissue biopsies), is the day when the pathologist examined the tissues and cut the most representative part(s) into smaller sections which could be handled by tissue processing machine. This date was obtained from the histology registration book. For patients with breast biopsies this date was entered into their registration forms and was calculated as the number of day(s) from the date of operation.

After reception, specimens were processed as routinely done together with other tissue biopsies and then stained by Hematoxylin and Eosin (H & E). No special favour was given to breast biopsies as this could defeat the objectives of the study. Reporting and making diagnosis on tissue biopsies was done by the pathologist. In most cases the pathologist had no prior information of the FNAC diagnoses. The date of diagnosis on tissue biopsy was indicated in the request form of each patient before the report was typed. The date of getting breast tissue histology report was noted by the surgeons. Again the author had to follow these cases to their respective hospitals and enter the date of receiving the tissue biopsy report into the registration forms. All dates were calculated as the number of day(s) from the date of operation.

**Cost effectiveness analysis**

For all patients with breast lumps diagnosed by using FNAC and by open tissue biopsy, the cost of using FNAC as compared to that of tissue biopsy was considered at two levels of the hospitals i.e. the regional hospital and the referral hospital. This is because the charges for various procedures tend to differ at these two hospital levels. Patients were further divided into two groups as follows:

(a) Those who had FNAC done while outpatients i.e. not admitted in the wards.

(b) Those in whom this procedure was done while they were inpatients (admitted in the wards).

Usually there is an extra cost for admission into the ward, as these patients have to pay admission charges. The hospital registration number of the patient as shown in the request form indicated whether the FNAC was done to an outpatient or inpatient. The request form also indicated whether the patient was admitted in Grade 1 ward, as these have different admission charges which is affected by the duration of stay in the ward.

Most of the open tissue biopsies were done while the patient was admitted in the ward (inpatient). The procedure was done in the operation theater, usually under general anaesthesia. Items considered in cost analysis were those involved directly in the patient's management from the time he/she was seen by the surgeon until the aspiration or biopsy report was received and definitive treatment started. The charges to be used for each item were according to the rates recently released by the Ministry of Health in Tanzania for District, Regional and Referral Hospitals.

**Costs considered in FNAC done on an out-patient included:**

(a) Consultation Fee: This was the fee paid so that the

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patient could be attended at the surgical outpatient clinic by the surgeon.

(b) Disposable syringe and needle: For obtaining the aspirate.

(c) Postage: This was considered two ways i.e Posting of smear from the peripheral hospital to Muhimbili and posting of the cytology report from Muhimbili to the surgeon.

(d) Pathology laboratory charges: Included all procedures in the laboratory until the diagnosis was made. It was difficult to estimate the cost of individual reagents as only a small amount is used for each patient.

(e) Admission fee: This was an additional cost for those who were inpatients.

(f) Other investigations: Included investigations which are routinely done to patients suspected of having breast cancer such as:

(i) Chest X -ray : To rule out metastases to the chest.

(ii) Full blood picture (FBP) and erythrocyte sedimentation rate (ESR).

**Costs considered in open tissue biopsy included:**

(a) Consultation fee: A fee paid so that patient could be attended at the surgical outpatient clinic.

(b) Admission fee: A fee paid so that the patient could be admitted in the ward. Duration of staying in the wards was not taken into account as the charge is constant irrespective of how many days the patient stays in the ward before the initiation of the definitive treatment, unless the patient was in Grade 1 ward.

(c) Investigations charges: Included routine investigations done to a patient with breast lump undergoing surgery such as:

(i) FBP and ESR

(ii) Chest X-ray: In cases where breast cancer was suspected, to rule out metastases to the chest.

(d) Theater charges: Included here were:

(i) Surgeon charges

(ii) Anaesthetist charges

(iii) General anaesthesia charges

(iv) Recovery room charges

(e) Wound dressing charges

(f) Postage: Was considered two ways i.e posting of the biopsy from the peripheral hospital to Muhimbili and posting of the histology report from Muhimbili to the surgeon.

(g) Laboratory charges: Included all pathology laboratory procedures i.e. from receiving the biopsy, processing, sectioning, staining with all reagents necessary to make the diagnosis.

**Statistical analysis**

All the statistical analysis in this study were done by using Statistical Package for Social Sciences (SPSS) version 6.1. Chi squared test ($\chi^2$) was used to test significance between proportions. Non-parametric tests (Wilcoxon Paired Sign Rank Test) for 2 related samples was used to test significant differences in the mean number of days in pairs of procedures involved in the FNAC compared to open tissue biopsy in those patients who had both FNAC and tissue biopsy. This test was also chosen from the fact that the number of days in these procedures were not normally distributed and there were many outliers so a

parametric test could not give the right comparison. All *P* values were 2 sided and were considered significant if *P* was ≤0.05.

**RESULTS**

A total of 256 patients with breast lumps were studied, 249 (97.3%) were women and 7 (2.7%) men (Table 1). The age ranged from 14 to 79 years with a mean of 36.3 years (standard deviation [SD] = 14.0), age was not indicated in 17 (6.6%) (see also fig.1). Patients aged less than 40 years constituted 64.9% of the total cases. As can be seen in Table 1, 201 (80.5%) of the patients were from Muhimbili, 41 (16.0%) from Morogoro and 9 (3.5%) from Ndanda Hospital.

Table 2 shows that, 34 (82.9%) of the FNAC from Morogoro hospital were posted 1 day after aspiration, and 7 (17.1%) after 2-3 days. Thirty three (80.5%) of the smears from Morogoro were received within 1 to 4 days after aspiration and 8 (19.5%) within 5 to 7 days. Eight (19.5%) FNAC from Morogoro were diagnosed within 2 to 4 days after the aspiration, 30 (73.2%) took 5 to 10 days, and for 3 (7.3%) the diagnosis took 11 to 16 days after aspiration. Morogoro hospital received the cytological report within 5 to 10 days after the aspiration in 23 (56.1%) patients and for the other 18 (43.9%) patients, cytological reports were received within 11-16 days.

All 9 smears from Ndanda hospital were posted the day after aspiration. Of these 5 (55.5%) arrived at the Muhimbili pathology laboratory within 1 to 4 days after aspiration and 4 (45.5%) after 5 to 7 days. In all 9 smears from Ndanda, cytological diagnosis was made between 5 and 10 days after the aspiration. Ndanda hospital surgeons received cytological report within 5 to 10 days after the aspiration in 3 (33.3%) patients and in the remaining 6 (66.6%) cytological report arrived within 11-17 days.

In 6 (2.9%) of the Muhimbili FNAC patients cytological diagnoses were made the same day, in 99 (48.0%) patients the diagnoses were made within 2-4 days after aspiration, whereas in 101 (49.0%) the cytological diagnoses took 5 to 16 days. In 60 (29.1%) of these patients cytological report reached Muhimbili surgeons 2 to 4 days after the aspiration, in 117 (56.8%) patients the cytological report took 5 to 10 days to arrive while in 29 (14.1%) patients it took 11-17 days before the surgeons got the report.

In general, the delay in receiving smears at the Muhimbili pathology laboratory from Morogoro hospital ranged from 3 to 6 days with a mean of 3.8 days (median 4.0 days), whereas smears from Ndanda reached the laboratory in 2 to 7 days with a mean of 4.3 days (median 4.0 days). The laboratory time taken for the cytological diagnosis ranged

from 1 to 16 days with a mean of 5.4 days (median 5.0). For smears from Morogoro hospital, the time used for cytological diagnosis ranged from 2 to 14 days with a mean of 6.5 days (median 6.0 days), while those from Ndanda diagnosis took 5 to 9 days with a mean of 6.4 (median 7.0) days. In smears from Muhimbili making diagnosis ranged from 1 day to 16 days with a mean of 5.2 (median 4.0) days.

Receiving the FNAC report ranged from 2 to 17 days, with a mean of 7.4 days (median 7.0). For Morogoro this process took 5 to 17 days (mean 10.4), for Ndanda 9 to 13 days (mean 11.2) and for Muhimbili 2 to 17 days (mean 6.8) days.

Of the 256 FNAC patients, 86 (33.6%) were followed up by tissue biopsies, the remaining cases had no further work up or were lost to follow up (Table 3). Of the 206 FNAC patients from Muhimbili, 60 (29.1%) were followed by tissue biopsies, 20 (48.8%) of Morogoro FNAC patients had biopsies and 6 (66.7%) of Ndanda had biopsies. Of the 86 patients with tissue biopsies, 60 (69.7%) were from Muhimbili, 20 (23.3%) from Morogoro and 6 (7.0%) from Ndanda.

Tissue biopsies from Morogoro and Ndanda hospitals were posted within 1 to 22 days after the operation. Nineteen (95.0%) of Morogoro tissue biopsies were posted within 5-22 days, the same was true for 5 (83.3%) of Ndanda tissue

biopsies.

Of the 20 tissue biopsies from Morogoro, 9 (45%) were received (taking in) at the Muhimbili pathology laboratory within 14 days after the operation, 9 (45%) took 15 to 30 days to be taken in and the remaining 2 (10.0%) took 39 and 45 days. Fourteen (70%) were diagnosed within 15-30 days and 6 (30%) in 31-84 days. In 9 (45%) of Morogoro tissue biopsies, surgeons got histological report within 8-14 days after the operation while in 11 (55%) of the patients it took 31 to 90 days. Of the 6 tissue biopsies from Ndanda hospital, 2 were received within 14 days after operation, 3 within 15 to 30 days and the remaining one was received after 70 days. Four (66.6%) of the 6 Ndanda tissue biopsies, were diagnosed within 15-30 days and in 2 (33.3%) the diagnosis was made after 33 and 84 days.

All 60 (100%) Muhimbili tissue biopsies were sent to the laboratory on the day of operation. Fifty one (85.0%) were received (taking in) within 14 days, 7 (11.7%) were received within 15 to 30 days and 2 (3.3%) were received 39 and 70 days following operation. The delay in taking in these two tissue biopsies were due to acute shortage of absolute alcohol needed for tissue processing. Some of the Morogoro and Ndanda hospitals tissue biopsies received during period of shortage of alcohol were affected, as they

had to stay for long period before processing. Of the 60 Muhimbili tissue biopsies, in 11 (18.3%) the diagnosis was made within 7-14 days after the operation, 39 (65.0%) were diagnosed within 15-30 days and in 10 (16.7%) the diagnosis was made within 31-84 days after the operation. For Muhimbili tissue biopsies, histology report reached surgeons within 8-14 days after the operation, however, none of the Morogoro and Ndanda surgeons could get the histology report within 8-14 days. In 39 (65.0%) of the Muhimbili cases, surgeons got histology report 15 to 30 days from the day of operation.

It took 1 to 70 days after operation to receive tissue biopsies at the pathology laboratory from these three hospitals. Mean number of days were 17.5 for Morogoro, 25.0 from Ndanda and 9.5 for Muhimbili. Time taken in the laboratory before making a histological diagnosis ranged from 7 to 84 days. Mean number of days taken for this process, from the day of operation were 30.7 for Morogoro, 35.3 for Ndanda and 24.1 for Muhimbili. This parameter was also affected by the acute shortage of alcohol, in which case we expect the mean days taken for diagnosis to have been fewer than as observed in this study. In general, the total time from operation to receiving the report ranged from 8-90 days, with a mean of 37 days for Morogoro, 40.8 days for Ndanda and 27.2 days for Muhimbili.

Table 4 shows the difference in mean number of days taken by the four processes i.e posting, receiving, making diagnosis and getting report in both FNAC and tissue biopsies. The table shows comparison between patients in each hospital who had both FNAC and tissue biopsy. Each process in FNAC was compared with the counterpart in tissue biopsy to see whether the existing difference in the mean number of days taken for the two related procedures were statistically significant. As can be seen, there was reduction in mean number of days in those processes in FNAC compared to their counterparts in tissue biopsy. The results using non parametric test (Wilcoxon Matched Pair Sign Rank Test) showed that the reduction in mean number of days were statistically significant in each hospital ($P \leq 0.05$). Only posting of FNAC and tissue biopsies in Muhimbili did not show significant difference. However, this was expected as the pathology laboratory is within this hospital and both smears and tissue biopsies are sent to the laboratory on the same day of operation and aspiration. Generally, in Muhimbili, cytology report was received 22 days faster than histology report, while receiving cytology report in Morogoro was 27 days earlier than histology report and for Ndanda it was faster by 29 days compared to histology report.

Table 5 shows that of the 256 aspirations studied, 39

(15.2%) had inadequate material for permitting meaningful cytological diagnosis, 154 (60.2%) were benign lesions (fig.3a, 3b, 3c, 4, 5a & 5b) while 63 (24.6%) were malignant lesions (figs.6a, 6b, 7a, 7b, 8a & 8b).

Two hundred and six (80.5%) of the materials were aspirated by the pathologist in Muhimbili and 50 (19.5%) were aspirated by the surgeons in Ndanda and Morogoro hospitals (Table 6). Twenty nine (14.1%) of the smears made by the pathologist had inadequate material while in 10 (20.0%) of the surgeons patients, the smears were inadequate or insufficient. However, the results were not statistically significant ($\chi^2$ = 0.934, df = 1, $P$ = 0.31).

Seventy three patients with adequate FNAC material had histological follow up and were analysed to determine the accuracy of this technique. Of these, 33 benign cytological lesions had concordant histological diagnosis, while 37 patients who had malignancies on cytology showed the same diagnosis on histology giving FNAC accuracy rate of 95.8% in the present study (Table 7).

In this study the sensitivity of FNAC is (94.8%) and the specificity is (97.0%). Sensitivity is the proportion of true positives (had breast cancer) that were correctly identified. Specificity is the proportion of true negatives

(had no breast cancer) that were correctly identified. Only smears which had adequate cells to permit meaningful cytological diagnosis were analysed. Thirteen FNAC patients with inadequate smears had histological follow up, but were not analysed as they had no cytological diagnosis. One FNAC patient had a malignant diagnosis on cytology but on histological follow up was found to be benign. Two FNAC patients were benign on cytology but on follow up by tissue biopsy were found to be malignant.

Of the 43 surgically managed benign lesions, 22 (51.2%) were fibroadenomas (see fig.3a, 3b & 3c), 8 (18.6%) were fibroadenosis, 3 were non-specific chronic inflammation, and 4 were fibrocystic disease (Table 8). Diagnoses of the remaining masses included 1 vasculitis, 1 lipoma, 1 granulomatous inflammation, 1 granulation tissue, 1 cyst (see fig.4) and 1 intraductal papilloma (fig.5a, 5b). Fourty three malignant lesions had histological follow up (Table 9). Of these, 36 (84%) were infiltrating ductal carcinoma (fig.6a, 6b). Two (4.7%) were mucinous carcinoma (fig.7a, 7b), 1 (2.3%) medullary carcinoma, 1 (2.3%) lobular carcinoma (fig.8a, 8b) and 3 (7%) were carcinoma which were not further classified.

Of the 86 FNAC patients who had histological follow up, 23 were in the age group 21-30 ( Table 10). Of these, 20

(87.0%) had benign lesions and 3 (13.0%) had malignancy. Of the 15 tissue biopsies from the age group 50-60 years, 13 (86.7%) proved to be malignant histologically. Six tissue biopsies were from the age group 60 years and above, of these 5 were malignant. All the 6 tissue biopsies from the age group less than 20 years were benign histologically. Of the 43 malignant cases, 3 (6.9%) were patients aged less than 30 years.

Table 11 shows the relationship between the cytological diagnosis and the size of the breast lump. Malignant lesions were more likely to measure 5 cms or more than benign lesions, (44.1% versus 5.9%). Lumps with inadequate smears were significantly smaller than those in other diagnostic categories. All (100%) lumps with inadequate smears measured 5 cm or less as shown by 94.7% of benign compared to 55.9% of malignant lesions that were the same size ($\chi^2 = 60.4$; df = 4, $P \leq 0.001$).

Two hundred twenty seven (88.7%) FNAC patients had the duration of the lumps indicated in their clinical history (Table 12). In 29 (11.3%) patients the duration of the lump was not indicated. Seventy four (54.8%) of the benign lesions were of less than 10 months duration, whereas 31 (55.4%) of the malignant lesions had the same duration. Eleven (8.1%) of the benign lesions were noted by the

patients for more than 24 months compared to 3 (5.3%) of the malignant lesions. This shows that malignant lesions were reported to have been present for a significantly shorter duration than the benign lesions ($\chi^2$ = 26.85; df = 8, $P$= 0.001).

Of the 256 FNAC patients, 213 (83.2%) were out-patients and 43 (16.8%) patients had this procedure done while admitted in the wards (in-patients) (Table 13). There were more out-patients than in-patients in each hospital but the difference was not statistically significant ($\chi^2$ = 2.13; df = 2, $P$ = 0.34).

Table 14 shows that, of the 154 FNAC benign cases, 147 (95.5%) were out-patients and 7 (4.5%) were in-patients. As can be seen in table 14, almost equal numbers of patients from the out-patient and in-patient group were diagnosed cytologically to have malignancy.

Table 15 shows that, 36 (73.5%) FNAC out-patient cases were found to have benign lesions histologically and in 13 (26.5%) it showed malignancy. Of the 37 FNAC in-patient cases, 7 (18.9%) had benign lesions on histological follow up and 30 (81.1%) had malignancy.

As can be seen in table 16, of the 86 FNAC patients who had

tissue biopsies in the three hospitals, out-patients had a significantly higher probability of being followed by incisional rather than excisional biopsy (53.5% versus 3.5%) ($\chi^2$ = 103.47; df = 2, $P \leq 0.001$).

Of the 38 malignant FNAC lesions which had histology, 16 (42%) underwent incisional biopsy and 22 (57.9%) had excisional biopsy, (Table 17).

As can be seen in Table 18 in both Ndanda and Morogoro hospitals, for one out-patient with either a malignant or benign breast lump, using FNAC as the pre-treatment diagnostic tool saved Tanzanian shillings (T.shs) 5,300 as compared to routinely done open tissue biopsy. Use of FNAC instead of open tissue biopsy in these hospitals, one in-patient with malignant or benign breast lump saved T.shs 5,000. The percentage cost reduction by using FNAC in one outpatient was 63.8% and 60.2% for the inpatient.
For a patient managed in Muhimbili one out-patient with breast lump, use of FNAC saved T.shs. 7,400 and for inpatient the saving was T.shs 6,900 (Table 19). The percentage FNAC cost reduction per case of breast lump seen in Muhimbili as out-patient or as in-patient was 70.4% and 65.7% respectively.

**DISCUSSION**

Fine needle aspiration cytology (FNAC) of the breast is not a new procedure[37], but it has been slow in gaining wide acceptance. This study was carried out to determine the feasibility and cost effectiveness of FNAC in the diagnosis of breast masses in peripheral hospitals in Tanzania and compare with Muhimbili referral hospital which has a pathology laboratory.

The age of patients studied ranged from 14 - 79 years with a mean of 36.3 years. The low mean age observed in this study is due to the fact that it included all breast lumps, and did not focus only on malignant breast lesions. The mean age for breast cancer in Tanzania ranges between 41 years as reported recently by Kitinya[26] and 44 years as reported by Amir[1]. It is lower than those reported for breast cancer in developed countries which is 49 years in Nortons[39] series and 54 years in Flemings[11] series. This may be explained by the fact that in Tanzania most women are young at first birth, tend to have many pregnancies and low fat content diet of most Tanzanians as have been observed in other African countries[7]. So breast cancer in these women tends to differ epidemiologically from those in developed countries.

The literature on time saved using FNAC compared to open

tissue biopsy is scant. However, in the present study FNAC was significantly faster than tissue biopsy. To the best of my knowledge, no study comparing the total diagnostic time from sampling to reporting of fine needle aspiration biopsy and open tissue biopsy has ever been done in Tanzania. Although FNAC gives quick results, looking at the results obtained in this study, one can see that the main cause for delay on some of the cytology reports occurred during staining and diagnosis. This means that greatest saving in time can be obtained by making some changes in the procedures within the laboratory. Taking example of smears from Morogoro and Ndanda both with a mean of 6.5 days for cytological diagnosis, if smears can be stained and interpreted on the same day or the next day it would save 5 days or almost one week. This means that cytology reports could be received 5 days earlier than the days observed in the present study. Although the number of FNAC patients from Ndanda hospital was small, it still indicated that using FNAC resulted in quicker postage and earlier diagnosis of breast lumps as compared to tissue biopsy.

Some authors[42] advocate that air dried smears from breast aspirates, if evenly and thinly spread, can be fixed and stained in one minute by modified Giemsa stain (Diff-Quik) and is very convenient for immediate reporting in outpatient clinics. In this study immediate wet fixation

and staining by Papanicolaou's method was preferred as it ensures maximum resemblance between aspirated cells and corresponding cells in tissue sections. Wet fixation also causes the chromatin to precipitate, clumping and irregularities of pattern are more obvious than in air dried smears in which the chromatin coagulates. Even with use of PAP method, it is still possible to make a cytological diagnosis on the day of aspiration.

Most of the delay in histology report occurred in posting and receiving (taking in). To get faster reports in histology, the surgeons are supposed to post the tissues immediately and on reaching the laboratory they are processed immediately.

In this study inadequate smears accounted for 15.2% of the cases. This was consistent with those reported in larger series elsewhere[37,50,62]. However, extrapolation of data reviewed by Frable[13] reveals inadequate aspirate rate of 2-22%. The results in the present study are within this range for smears aspirated by a pathologist. However, for the material aspirated by the surgeons in Morogoro and Ndanda the frequency of inadequate smears was on the higher side of this range. This may be accounted for by the fact that the surgeons were not experienced on how to do FNAC. Several studies have shown that the frequency of inadequate

material is affected by "who performs" the aspiration[13,37,62]. In a study by Zarbo[62] to determine factors with potential influence on performance in breast FNAC, frequency of inadequate aspirates were twice as high at the institutions where pathologists did not do the aspiration. In the present study the surgeons had a higher frequency of inadequate material than the pathologist (20.0% versus 14.1%) but the difference was not statistically significant. This study shows that with good training and practice surgeons can produce smears with as good a quality as those aspirated by pathologist.

Most of the inadequate materials were obtained in the small lumps with a diameter of 1-5 cm compared to large tumors of 6-12 cms in diameter (100.0% versus 0.0%). This difference was statistically significant. A similar observation has been reported by Zajelda[60] when reporting on his experience with aspiration biopsy.

The accuracy of FNAC in diagnosing palpable breast masses was 95.8%. This is consistent with those reported in the literature ranging from 80-99%[18,22,34,62]. This is similar to 96% reported by Lyaruu[33]in Dar es Salaam. He reported an accuracy of FNAC when used in the diagnosis of malignant conditions from 350 cases with lesions on the neck, axilla and groin lymph nodes.

Other series in Europe report an accuracy of 92%[54] and 95%[36]. Chande[8] in 1993 reported an accuracy of 54.3% when studying the accuracy of FNAC for malignant conditions from various body sites. The present study reports higher accuracy as compared to FNAC from various body sites. This might be due to the fact that in this study FNAC was done on a single easily accessible organ.

Considering only cases with adequate material who had histological follow up, the sensitivity of FNAC in the diagnosis of breast cancer was 94.8%, specificity was 97.0%, positive predictive value 97.3% and negative predictive value 94.3%. Frable[14] reports sensitivity of 84.5% for European experience of FNA of mammary carcinoma and 70.8% in American experience. The specificity rate in his review was 96.5% for European experience and 96.7% for American experience. The results in the present study compare favourably with the specificity rate in the literature ranging from 91-100%[2,23,50]. The positive predictive value in the present study compares favourably with that reported by Chande[8] in 1993 when he found a positive predictive of 97.4% of FNAC when this technique was used in the study of 1654 cases.

There was one false positive FNAC case, giving a false positive rate of 2.6% in the cases with adequate material

that were followed. This had been reported as suspicious for malignancy and request for confirmation by an incisional biopsy was made that revealed a benign lesion. For the purpose of calculating the accuracy, a cytological report of suspicious for malignancy was considered positive for breast cancer during data analysis. The false positive rate in the present study is consistent with those reported in literature ranging 0-2.5% [14,20,31,62]. The main reason is due to error in pathologist interpretation and the tendency of using insufficient material for making the diagnosis[37].

Of the 73 cases with adequate cytology material which were followed up by histology, there were 2 (5.5%) false negative cases when cytological diagnosis was compared to histological diagnosis, giving a false negative rate of 5.5% in this study. These were women, aged 59 and 67 years. The smears in the 67 years old patient consisted mainly of fibrous tissue and very few groups of epithelial cells scattered within the fibrous tissue. The pathologist reported the smears as a benign lesion which was not further classified. Unfortunately the age of the patient was not indicated in the request form accompanying the smears, but it was indicated in the follow up tissue biopsy request form. If the age of the patient was indicated it could have assisted the pathologist in arriving at a correct diagnosis as benign lesions are rarely seen in this

age . The surgeon decided to make an incisional biopsy which revealed infiltrating ductal carcinoma of the scirrhous type (fig.10). When both cytology and histology slides were reviewed by a panel of pathologists it was agreed that the smear contained too few groups of epithelial cells to allow a definite cytological diagnosis. During aspiration ion 59 years old patient by a pathologist and it was very hard to pass the needle through it. The smear contained few groups of epithelial cells in which the nuclear details were obscured due to staining problems. A diagnosis of unclassified benign lesion was made , but a note was given to the surgeon that this case needed follow up by tissue biopsy as the cells in the smear were too few to give a definitive diagnosis. Incisional biopsy on follow up revealed infiltrating ductal carcinoma of the scirrhous type. False negative rate in literature ranges from 2-26%[43,50]. Reasons given for false negative results include poor sampling due to aspirator error or small tumor size, poor yield of tumor cells due to tumor fibrosis, difficulty in identifying few well differentiated cancer cells, and inaccurate diagnosis[42,53]. The main reason for the two false negative cases in the present study was the poor yield of tumour cells due to fibrosis. However, in this study aspiration was done without the aid of imaging techniques such as mammography or ultrasound, so there was a problem of accuracy of needle placement within

the tumour.

Fibroadenoma was the most common benign lesion in the present study. It accounted for 51.2% of all the benign lesions managed surgically (figs.3a, 3b & 3c). Bjerregard[6] in his histological study of benign lesions in Kenya, reports fibroadenoma as the most common benign breast lesion followed by mastopathy. Funderburk[16] reported a rate of 27.4% for fibroadenomas in all benign breast lesions among black patients in the USA. With a high specificity obtained in this study it could give clear justification for surgeons in the conservative management of benign lesions. In small fibroadenomas, operation could be entirely avoided as about one third of these lesions will disappear completely especially in females aged less than 20 years[30].

Of the 43 malignant lesions which were managed surgically, the predominant histological type was infiltrating ductal carcinoma which accounted for 84% of the cases. The same observation was reported by Hadju[18] in 1973 when reviewing the diagnostic value of aspiration smears by studying 996 aspiration materials obtained from the breast, lymph nodes, bone and soft tissue tumors. Bjerregard[7] in a recent study of breast cancer in Kenya reported invasive ductal carcinoma as the commonest type of breast cancer. In the

present study there was low frequency of invasive lobular carcinoma. This may be explained by the fact that most cancers were seen at an advanced stage where the special characteristics of the lobular carcinoma may be lost[7]. Four of the infiltrative ductal carcinomas had inadequate material on cytology. In this study it was the most common malignant lesion which had high inadequate smear rate (fig.10). The same was reported by Muchiri[37] in Kenya, where, of the inadequate smears followed histologically, 40% proved to be infiltrating ductal carcinoma on subsequent histology.

All the tissues from the age group of 14-20 years were benign histologically. Only 6.9% of malignant lesions were seen in women below 30 years of age. This figure is lower than that reported by Amir[1] in a 13 years retrospective study of female breast cancer in Tanzania. He found 8.0% of female breast cancer bearers were below 30 years of age. The low prevalence of malignancy in this age group as seen in the present study may be explained by the fact that this study was not basically on breast cancer but on all breast lumps.

In this study 29 (11.3%) patients had no duration of the lump indicated in the clinical history by the surgeon. This shows that due to pressure of work, most surgeons tend to

forget to write an elaborate clinical history when sending specimen to the pathology laboratory despite the fact that this was emphasized during the seminar. A clear and elaborate clinical history helps the pathologist to reach an accurate diagnosis especially in equivocal cases.

The high sensitivity of FNAC observed in this study means that, 94.8% of patients with breast cancer could be picked up and surgeons could safely carry out with definitive treatment on those cases which were reported as malignant. A test with high sensitivity was needed in this case to make sure that mastectomy as definitive treatment was done only to patients with breast cancer so that the possibility of operating on false positives is minimized.

We found that 35 (100%) of those who had benign lesions on cytology underwent incisional biopsy. This means that, relying on the high specificity of FNAC observed (the test being negative in a patient with no breast cancer) surgeons were justified to follow these patients conservatively rather than subjecting them to any surgical procedure. Because there is scarcity of beds in most hospitals in Tanzania, following these cases conservatively could save 36 beds needed for admission of more seriously sick patients. This also means that for a poor country like Tanzania with very little budget on health sector, it could

have saved a lot of money used to hospitalize these patients and to operate on them.

This study shows that surgeons are still reluctant and rarely rely on FNAC diagnosis as the sole criteria for malignancy before definitive therapy. Of the 13 patients who were out-patients during FNAC and had histology, only 3 (23.1%) had excisional biopsy as definitive treatment, the remaining 10 (76.9%) underwent further incisional biopsy to exclude malignancy before initiation of definitive treatment. It also shows that, of the 30 inpatients with malignant FNAC diagnoses, 19 (63.4%) had excisional biopsy and the remaining 11 (36.6%) underwent incisional biopsy. Following of malignant breast lesions by incisional biopsy after a FNAC not only makes the disease progress to more advanced stage because of the delay in treatment, but it also increases the cost.

During cost effectiveness analysis, the following points were considered. First, all patients who underwent open tissue biopsy must be admitted as no open tissue biopsy is done on an out-patient basis. Second, open tissue biopsies were to be done under general anaesthesia as no open tissue biopsy of breast lumps is done on local anaesthesia in Tanzania. Third, mastectomy was regarded as excisional biopsy to differentiate it from lumpectomy done in benign

lesions which has the same cost as incisional biopsy. Fourthly, none of the patients included in this study was admitted in grade 1 ward(s).

This study shows that there was a great reduction in cost when FNAC was used instead of open tissue biopsy in the diagnosis of breast lump whether it was done to out-patients or to in-patients. Few studies have been done to determine the cost effectiveness of FNAC as compared to open tissue biopsy. Lannin[29] reviewing two years cost reduction of using FNAC in their institution, reported that when FNAC was followed by excision biopsy in 100 patients there was saving of $39,000 as compared to saving of only $10,000 when it was followed by incisional biopsy and then excisional biopsy as definitive treatment. Smith[50] reports a cost effectiveness of 25% in 153 patients with lesions of the breast, soft tissues and lymph node when FNAC was used in the diagnosis as compared to excisional biopsy. Kaminsky[24], discussing on the cost comparison of conventional tissue biopsy versus aspiration biopsy in breast cancer diagnosis, reports cost reduction by 90% when aspiration biopsy is used as diagnostic method. Layfield[30] reported cost saving of $714.

Taking example of Muhimbili hospital which receives an estimated 1000 breast biopsies per year, total saving would

be T.shs 7,400,000 (7400 x1000) for out-patients and T.shs. 6,900,000 (6900 x1000) for in-patients. At the time of this study the exchange rate was 1 US$ = 600 T.shs. The money saved by using FNAB per year could be used to improve health services in Tanzania.

Much of the delay for the smear reports occured in the laboratory. To improve the situation there should be a technician responsible only for processing of the smears and if possible a pathologist (cytopathologist) responsible only for interpreting the smears. Or else as there are very few pathologists in Tanzania, to enable them diagnose both tissue biopsies and smears as fast as possible there should be a cytotechnologist to screen all smears before handing them to pathologist for interpretation. This would reduce tremendously the time taken in receiving the smears and making cytological diagnosis.

**SUMMARY**

A total of 256 fine needle aspiration biopsies from breast lumps in three hospitals were studied. Of these, aspiration material was sufficient and of good quality to permit meaningful cytological diagnosis in 217 (84.8%) cases. Of the 256 cases, 154 (60.2%) were benign, 63 (24.6%) were

malignant and 39 (15.2%) had insufficient material.

Eighty six (33.6%) cases had traceable tissue biopsies and formed the basis for comparison of the difference in mean number of days taken between fine needle aspiration biopsy (FNAB) and open tissue biopsy. Sixty (69.7%) of these cases were from Muhimbili of which cytology report was received 22 days faster than histology report. Twenty (23.3%) were from Morogoro which received cytology report 27 days faster than histology report and 6 (7.0%) cases were from Ndanda where cytology report was received 29 days earlier than histology report. Other procedures such as posting, receiving of smears at the pathology laboratory and making cytological diagnosis were also significantly faster in FNAB than in tissue biopsy.

The present study has shown that FNAC has an accuracy of 95.8%, sensitivity of 94.8%, specificity of 97.0%, positive predictive value of 97.3% and negative predictive value of 94.3% when compared with histological diagnosis as the gold standard.

There were two false negatives (benign by cytology but malignant by histology) and one false positive (malignant by cytology but benign by histology).
FNAC was highly cost effective when used as a diagnostic

tool in breast lumps compared to open tissue biopsy. It could reduce the cost in peripheral hospital by 63.3% and 60.2% for a single out-patient and in-patient respectively. Cost reduction using FNAC in Muhimbili was 70.4% and 65.7% for a single out-patient and in-patient respectively.

**CONCLUSIONS AND RECOMMENDATIONS**

With experienced personnel, fine needle aspiration cytology can be as accurate as open surgical biopsy. It is especially valuable for debilitated or critically ill patients when open tissue biopsy can be contraindicated. It is fast, safe simple and cheap. It can be done in the outpatient clinic. It is highly recommended for a country like Tanzania where cost sharing in health sector is at hand.

It should be introduced to all peripheral hospitals in Tanzania, so that medical officers can do the aspiration and send smears to the pathology laboratory. Medical students should rotate in the pathology department and learn this procedure, when they become medical officers they can perform aspiration on their own and send the smears to the pathology laboratory for a faster diagnosis

rather than depending on the routinely done open tissue biopsy. To make surgeons more competent with aspiration biopsy, they should also rotate in the pathology cytology laboratory during their postgraduate training. This will enable them to appreciate that a diagnosis made on a smear is as good as one made on tissue biopsy and can proceed with definitive treatment on a malignant cytology report.

Because the present study involved only three hospitals, further studies may be required to evaluate the findings of this study using a larger number of hospitals.

**Table 1:** Frequency Distribution of FNAC Patients by Age and Sex in the Three Hospitals in the Study.

| | N | % | Females N (%) | Males N (%) |
|---|---|---|---|---|
| **Age group (years)** | | | | |
| 14-20 | 29 | (11.4) | 29 (11.6) | 0 |
| 21-30 | 71 | (27.7) | 71 (28.5) | 0 |
| 31-40 | 66 | (25.8) | 66 (26.5) | 0 |
| 41-50 | 33 | (12.9) | 31 (12.5) | 2 (28.6) |
| 51-60 | 26 | (10.1) | 25 (10.0) | 1 (14.2) |
| 61-79 | 14 | (5.5) | 12 (4.8) | 2 (28.6) |
| Not indicated | 17 | (6.6) | 15 (6.0) | 2 (28.6) |
| **Hospitals** | | | | |
| Muhimbili | 206 | (80.5) | 201 (80.7) | 5 (71.4) |
| Morogoro | 41 | (16.0) | 40 (16.1) | 1 (14.3) |
| Ndanda | 9 | (3.5) | 8 (3.2) | 1 (14.3) |
| TOTALS | 256 | | 249 (97.3) | 7 (2.7) |

**Table 2:** Days Taken to Post, Receive, Make Diagnosis and Get the Report on FNAC by the clinician From the Day of Aspiration in the Three Hospitals.

| | | | Muhimbili | | Morogoro | | Ndanda | |
|---|---|---|---|---|---|---|---|---|
| DAYS | N | % | N | (%) | N | (%) | N | (%) |
| **Posting** * | | | | | | | | |
| same day | 206 | (80.4) | 206 | (100.0) | 0 | | 0 | |
| 1 day | 43 | (17.0) | 0 | | 34 | (82.9) | 9 | (100.0) |
| 2-3 days | 7 | (2.7) | 0 | | 7 | (17.1) | 0 | |
| **Receiving** ** | | | | | | | | |
| Same day | 206 | (80.4) | 206 | (100.0) | 0 | | 0 | |
| 1-4 days | 38 | (14.8) | 0 | | 33 | (80.5) | 5 | (55.5) |
| 5-7 days | 12 | (4.7) | 0 | | 8 | (19.5) | 4 | (45.5) |
| **Making diagnosis** *** | | | | | | | | |
| Same day | 6 | (2.3) | 6 | (2.9) | 0 | | 0 | |
| 2-4 days | 107 | (41.8) | 99 | (48.0) | 8 | (19.5) | 0 | |
| 5 -10 days | 122 | (47.6) | 83 | (40.3) | 30 | (73.2) | 9 | (100.0) |
| 11-16 days | 21 | (8.3) | 18 | (8.7) | 3 | (7.3) | 0 | |
| **Getting cytological report** **** | | | | | | | | |
| 2-4 days | 60 | (23.4) | 60 | (29.1) | 0 | | 0 | |
| 5-10 days | 143 | (55.8) | 117 | (56.8) | 23 | (56.1) | 3 | (33.3) |
| 11-17 days | 53 | (20.7) | 29 | (14.1) | 18 | (43.9) | 6 | (66.6) |
| TOTALS | 256 | | 206 | (80.4) | 41 | (16.0) | 9 | (3.5) |

* ranged from 0-3 days with mean of 0.2 days (median 0.0)
** ranged from 0-7 days with mean of 0.6 days (median 0.0)
*** ranged from 1-16 days with mean of 5.4 days (median 5.0)
**** ranged from 2-17 days with mean of 7.4 days (median 7.0)

**Table 3:** Days Taken to Post, Receive, Make Diagnosis and Get the Report on the Tissue Biopsies by the clinician From the Day of Operation in the Three Hospitals.

| | | Muhimbili | Morogoro | Ndanda |
|---|---|---|---|---|
| DAYS | N (%) | N (%) | N (%) | N (%) |
| **Posting*** | | | | |
| Same day | 60 (69.7) | 60 (100.0) | 0 | 0 |
| 1-4 days | 2 (2.3) | 0 | 1 (5.0) | 1 (16.6) |
| 5-22 days | 24 (27.9) | 0 | 19 (95.0) | 5 (83.3) |
| **Receiving** ** | | | | |
| 1-14 days | 62 (72.1) | 51 (85.0) | 9 (45.0) | 2 (33.3) |
| 15-30 days | 19 (22.1) | 7 (11.7) | 9 (45.0) | 3 (50.0) |
| 31-70 days | 5 (5.8) | 2 (3.3) | 2 (10.0) | 1 (16.7) |
| **Diagnosis** *** | | | | |
| 7-14 days | 11 (12.8) | 11 (18.3) | 0 | 0 |
| 15-30 days | 57 (66.3) | 39 (65.0) | 14 (70.0) | 4 (66.7) |
| 31-84 days | 18 (20.9) | 10 (16.7) | 6 (30.0) | 2 (33.3) |
| **Getting report** **** | | | | |
| 8-14 days | 8 (9.3) | 8 (13.3) | 0 | 0 |
| 15-30 days | 51 (59.3) | 39 (65.0) | 9 (45.0) | 3 (50.0) |
| 31-90 days | 27 (31.4) | 13 (21.7) | 11 (55.0) | 3 (50.0) |
| TOTALS | 86 | 60 (69.7) | 20 (23.3) | 6 (7.0) |

* ranged from 0-22 days with mean of 2.1 days (median 0.0)
** ranged from 1-70 days with mean of 12.5 days (median 10.0)
*** ranged from 7-84 days with mean of 26.4 days (median 23.0)
**** ranged from 8-90 days with mean of 30 days (median 26.0)

**Table 4.** Mean Number of Days Taken for Procedures Involved in Tissue Biopsy as Compared to FNAC in Each Hospital Among Patients who Had Both FNAC and Tissue Biopsy.

| Procedure | Muhimbili | | Morogoro | | Ndanda | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD |
| **Posting**** | | | | | | |
| FNAC | 0.0 | 0.0 | 1.2 | 0.5 | 1.0 | 0.0 |
| Biopsy | 0.0 | 0.0 | 7.2 | 3.8 | 6.8 | 1.4 |
| **Receiving**** | | | | | | |
| FNAC | 0.0 | 0.0 | 3.8 | 1.0 | 4.5 | 1.0 |
| Biopsy | 9.7 | 10.4 | 17.5 | 9.2 | 30.1 | 33.8 |
| **Diagnosis** | | | | | | |
| FNAC | 4.0 | 2.1 | 6.6 | 2.5 | 6.5 | 0.8 |
| Biopsy | 24.4 | 14.7 | 30.7 | 13.3 | 35.3 | 24.1 |
| **Getting report** | | | | | | |
| FNAC | 5.4 | 2.4 | 10.7 | 2.7 | 11.5 | 1.0 |
| Biopsy | 27.2 | 14.4 | 37.2 | 16.3 | 40.8 | 24.5 |

** 0.0 = Same day

**Table 5.** Cytological Diagnosis of the 256 Breast Lumps

| Diagnosis | N | % |
|---|---|---|
| Inadequate | 39 | (15.2) |
| Benign | 154 | (60.2) |
| Malignant | 63 | (24.6) |
| TOTALS | 256 | 100.0 |

**Table 6.** Relationship Between Aspirator and Outcome of the Cytological Diagnosis.

| | | | Cytological diagnosis | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Inadequate | | Benign | | Malignant | |
| Aspirator | N | % | N | % | N | % | N | % |
| Pathologist | 206 | (80.5) | 29 | (14.1) | 126 | (61.2) | 51 | (24.7) |
| Surgeons | 50 | (19.5) | 10 | (20.0) | 28 | (56.0) | 12 | (24.0) |
| TOTALS | 256 | | 39 | (15.2) | 154 | (60.2) | 63 | (24.6) |

$\chi^2 = 0.934$, df=1, p = 0.3 .

**Table 7:** Accuracy of FNAC in Diagnosing Breast Lumps when Compared with Histological Diagnosis Among 73 Patients.

| | Histological diagnosis | | |
|---|---|---|---|
| Cytological diagnosis | Malignant | Benign | TOTAL |
| Malignant | 37 | 1 | 38 |
| Benign | 2 | 33 | 35 |
| TOTAL | 39 | 34 | 73 |

$$\text{Sensitivity} = \frac{37}{39} \times 100 = 94.8\%$$

$$\text{Specificity} = \frac{33}{34} \times 100 = 97.0\%$$

$$\text{Positive Predictive value} = \frac{37}{38} \times 100 = 97.3\%$$

$$\text{Negative Predictive value} = \frac{33}{35} \times 100 = 94.3\%$$

$$\text{Accuracy of FNAC} = \frac{(33+37)}{73} \times 100 = 95.8\%$$

**Table 8.** Histological Diagnosis of Surgically Managed Benign Breast Lesions (N = 43)

| Histological type | N | % |
|---|---|---|
| Fibroadenoma | 22 | 51.2 |
| Fibroadenosis | 8 | 18.6 |
| Non specific chronic inflammation | 3 | 6.9 |
| Fibrocystic disease | 4 | 9.3 |
| Others** | 6 | 13.9 |
| TOTALS | 43 | 100.0 |

** Included 1 vasculitis; 1 lipoma; 1 granulomatous inflammation of the breast; 1 granulation tissue; 1 lactational cyst; 1 intraductal papilloma.

**Table 9.** Histological Diagnosis of the Surgically Managed Malignant Breast Lesions (N = 43)

| Histological diagnosis | Number | % |
|---|---|---|
| Infiltrating ductal carcinoma* | 36 | 84.0 |
| Medullary Carcinoma | 1 | 2.3 |
| Mucinous Carcinoma | 2 | 4.7 |
| Lobular carcinoma | 1 | 2.3 |
| Unclassified malignant tumours | 3 | 7.0 |
| TOTALS | 43 | 100.0 |

* Four cases had inadequate FNAC material

**Table 10:** Distribution of FNAC Patients by Age and Histological Diagnosis.

| Age group (yrs) | | | Benign | | Malignant | |
|---|---|---|---|---|---|---|
| | N | % | N | (%) | N | (%) |
| 14-20 | 6 | (7.0) | 6 | (100.0) | 0 | |
| 21-30 | 23 | (26.7) | 20 | (87.0) | 3 | (13.0) |
| 31-40 | 22 | (25.7) | 10 | (45.5) | 12 | (54.5) |
| 41-50 | 14 | (16.3) | 4 | (28.6) | 10 | (71.4) |
| 51-60 | 15 | (17.4) | 2 | (13.3) | 13 | (86.7) |
| 60+ | 6 | (7.0) | 1 | (16.7) | 5 | (83.3) |
| TOTALS | 86 | | 43 | (50.0) | 43 | (50.0) |

**Table 11:** Relationship Between the Size of the Breast Lump and the Outcome of the Cytological Diagnosis.

| | | Size of the lump (cm) | | |
|---|---|---|---|---|
| | | < 2 | 2-5 | >5 |
| | N | N (%) | N (%) | N (%) |
| **FNAC diagnosis** | | | | |
| Malignant | 59 | 0 (0.0) | 33 (55.9) | 26 (44.1) |
| Benign | 133 | 2 (1.5) | 124 (93.2) | 7 (5.3) |
| Inadequate | 37 | 2 (5.4) | 35 (94.6) | 0 (0.0) |
| TOTALS | 229 | 4 (1.7) | 192 (83.8) | 3 (14.4) |

**Table 12:** Relationship Between the Cytological Diagnosis and the Duration of the Breast Lump.

| | | | Duration of lump (months) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | <2 | | 2-10 | | 11-24 | | > 24 | |
| | N | (%) | N | (%) | N | (%) | N | (%) | N | (%) |
| Inadequate | 36 | (15.8) | 2 | (5.5) | 29 | (80.5) | 2 | (5.5) | 3 | (8.3) |
| Benign | 135 | (59.5) | 18 | (13.3) | 56 | (41.5) | 50 | (37.0) | 11 | (8.1) |
| Malignant | 56 | (24.6) | 2 | (3.6) | 29 | (51.8) | 22 | (39.3) | 3 | (5.3) |
| TOTALS | 227 | | 22 | (9.7) | 114 | (50.2) | 74 | (32.6) | 17 | (7.5) |

* In 29 patients duration of the lump was not indicated in the clinical history.

$\chi^2 = 26.85$, df= 8, $p \leq 0.0001$.

**Table 13:** Status of Patients at the Time of FNAC in the Three Hospitals Included in the Study.

| Hospital | Outpatient | | Inpatient | | |
|---|---|---|---|---|---|
| | N | (%) | N | (%) | Total |
| Muhimbili | 174 | (84.5) | 32 | (15.5) | 206 |
| Morogoro | 31 | (75.6) | 10 | (24.4) | 41 |
| Ndanda | 8 | (88.9) | 1 | (11.1) | 9 |
| TOTALS | 213 | (83.2) | 43 | (16.8) | 256 |

**Table 14:** Cytological Diagnosis by the Status of Patients During FNA

| | Outpatient | Inpatient | Total |
|---|---|---|---|
| Cytological diagnosis | N (%) | N (%) | N (%) |
| Inadequate | 35 (89.7) | 4 (10.3) | 39 (15.2) |
| Benign | 147 (95.5) | 7 (4.5) | 154 (60.2) |
| Malignant | 31 (49.2) | 32 (50.8) | 63 (24.6) |
| TOTALS | 213 (83.2) | 43 (16.8) | 256 |

**Table 15:** Status of Patients who had Both FNAC and Histological Follow up.

| Status | | Histology | |
|---|---|---|---|
| | | Benign | Malignant |
| | N (%) | N (%) | N (%) |
| Outpatient | 49 (57) | 36 (73.5) | 13 (26.5) |
| Inpatient | 37 (43) | 7 (18.9) | 30 (81.1) |
| TOTALS | 86 | 43 (50.0) | 43 (50.0) |

**Table 16:** Status of Patients at the Time of FNAC by Method Used to Obtain Tissue Biopsy on Follow up in the Three Hospitals.

| | Incisional | | Excisional | | |
|---|---|---|---|---|---|
| | OPD N (%) | IP N (%) | OPD N (%) | IP N (%) | Total N (%) |
| Muhimbili | 29 (63.0) | 16 (88.9) | 2 (66.6) | 13 (68.4) | 60 (69.8) |
| Morogoro | 12 (26.0) | 2 (11.1) | 1 (33.3) | 5 (26.3) | 20 (23.2) |
| Ndanda | 5 (10.9) | 0 (0.0) | 0 (0.0) | 1 (5.3) | 6 (7.0) |
| TOTALS | 46 (53.5) | 18 (20.9) | 3 (3.5) | 19 (22.1) | 86 |

OPD = outpatients
IP = inpatients
$\chi^2$ = 103.47, df = 2, $p \leq 0.001$.

**Table 17:** Cytology Diagnosis by Method Used to Obtain tissue Biopsy on Follow up.

| Cytology diagnosis | Incisional | | Excisional | |
|---|---|---|---|---|
| | N | (%) | N | (%) |
| Inadequate* | 13 | (100.0) | 0 | 13 |
| Benign** | 35 | (100.0) | 0 | 35 |
| Malignant | 16 | (42.1) | 22 | (57.9) 38 |
| TOTALS | 64 | (74.4) | 22 | (25.6) 86 |

* Four had malignant diagnosis on histological follow up.
** One had malignant diagnosis on histological follow up.

**Table 18:** Cost Analysis of Using FNAC as the Diagnostic Tool for Breast Lumps Compared to Open Tissue Biopsy in Ndanda and Morogoro Hospitals.

| | Outpatient | | Inpatient | |
|---|---|---|---|---|
| | Malignant | Benign | Malignant | Benign |
| **(a) Cost of FNAC** | | | | |
| Consultation fee | 300 | 300 | 300 | 300 |
| Syringe and needle | 100 | 100 | 100 | 100 |
| Pathology FNA report | 1000 | 1000 | 1000 | 1000 |
| Admission fee | | | 300 | 300 |
| Chest x-ray | 500 | 500 | 500 | 500 |
| FBP & ESR | 800 | 800 | 800 | 800 |
| Posting of smear | 300 | 300 | 300 | 300 |
| Total cost (i) | 3000 | 3000 | 3300 | 3300 |
| **(b) Cost of open tissue biopsy** | | | | |
| Consultation fee | 300 | 300 | 300 | 300 |
| Admission fee | 300 | 300 | 300 | 300 |
| FBP & ESR | 800 | 800 | 800 | 800 |
| Chest X-ray | 300 | 300 | 300 | 300 |
| Biopsy report | 3000 | 3000 | 3000 | 3000 |
| Operation charges (incisional biopsy) | 2000 | 2000 | 2000 | 2000 |
| Postage of biopsy | 600 | 600 | 600 | 600 |
| Wound dressing | 1000 | 1000 | 1000 | 1000 |
| Total cost (ii) | 8300 | 8300 | 8300 | 8300 |
| Difference (ii-i) | 5300 | 5300 | 5000 | 5000 |
| Cost reduction (%)* | 63.8 | 63.8 | 60.2 | 60.2 |

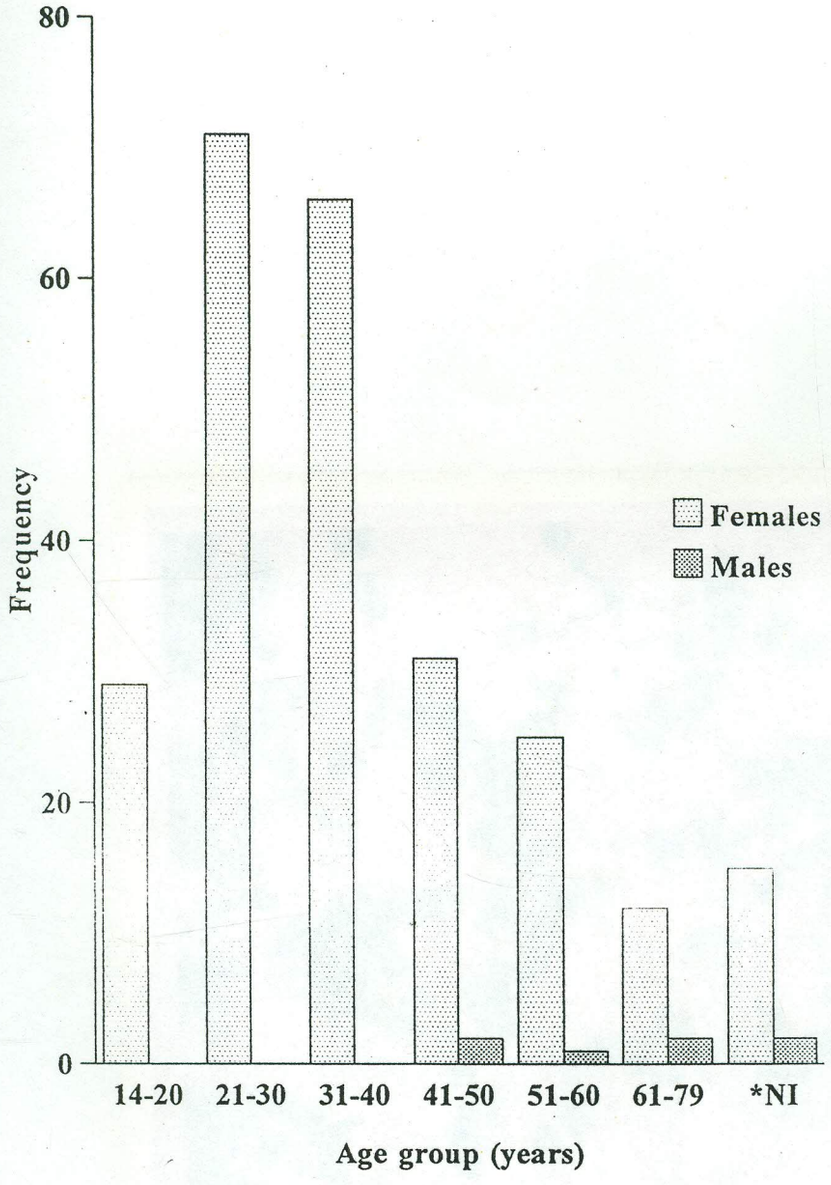
$$*\text{Cost reduction} = \frac{\text{Cost of open tissue biopsy - Cost of FNAC}}{\text{Cost of open tissue biopsy}} \times 100$$

**Table 19:** Cost Analysis of Using FNAC as the Diagnostic Tool for Breast lumps Compared to Open Tissue Biopsy in Muhimbili Hospital.

| | Outpatient | | Inpatient | |
|---|---|---|---|---|
| | Malignant | Benign | Malignant | Benign |
| **(a) Cost of FNAC** | | | | |
| Consultation fee | 500 | 500 | 500 | 500 |
| Syringe and needle | 100 | 100 | 100 | 100 |
| Pathology FNA report | 1000 | 1000 | 1000 | 1000 |
| Admission fee | | | 500 | 500 |
| Chest X-ray | 500 | 500 | 500 | 500 |
| FBP & ESR | 1000 | 1000 | 1000 | 1000 |
| Total cost (i) | 3100 | 3100 | 3600 | 3600 |
| **(b) Cost of open tissue biopsy** | | | | |
| Consultation fee | 500 | 500 | 500 | 500 |
| Admission fee | 500 | 500 | 500 | 500 |
| FBP & ESR | 1000 | 1000 | 1000 | 1000 |
| Chest X-ray | 500 | 500 | 500 | 500 |
| Pathology biopsy report | 3000 | 3000 | 3000 | 3000 |
| Incisional biopsy | 3000 | 3000 | 3000 | 3000 |
| Wound dressing | 2000 | 2000 | 2000 | 2000 |
| Total cost(ii) | 10500 | 10500 | 10500 | 10500 |
| Difference (ii-i) | 7400 | 7400 | 6900 | 6900 |
| Cost reduction (%) | 70.4 | 70.4 | 65.7 | 65.7 |

$$\text{*Cost reduction} = \frac{\text{Cost of open tissue biopsy - Cost of FNAC}}{\text{Cost of open biopsy}} \times 100$$

**Figure 1: Frequency distribution of FNAC cases by age and sex**




*NI = Age was not indicated

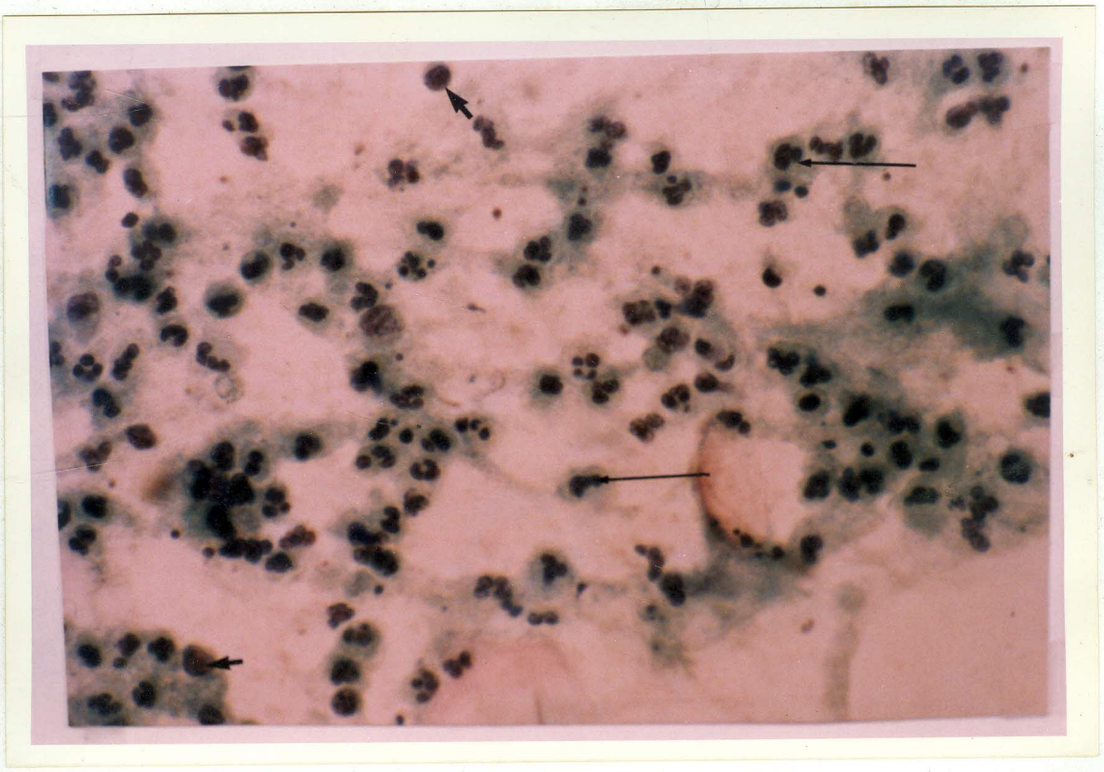


Fig.2. Aspiration smear from acute mastitis showing predominance of granulocytes (long arrow) and few macrophages (short arrow). (PAP x 450).

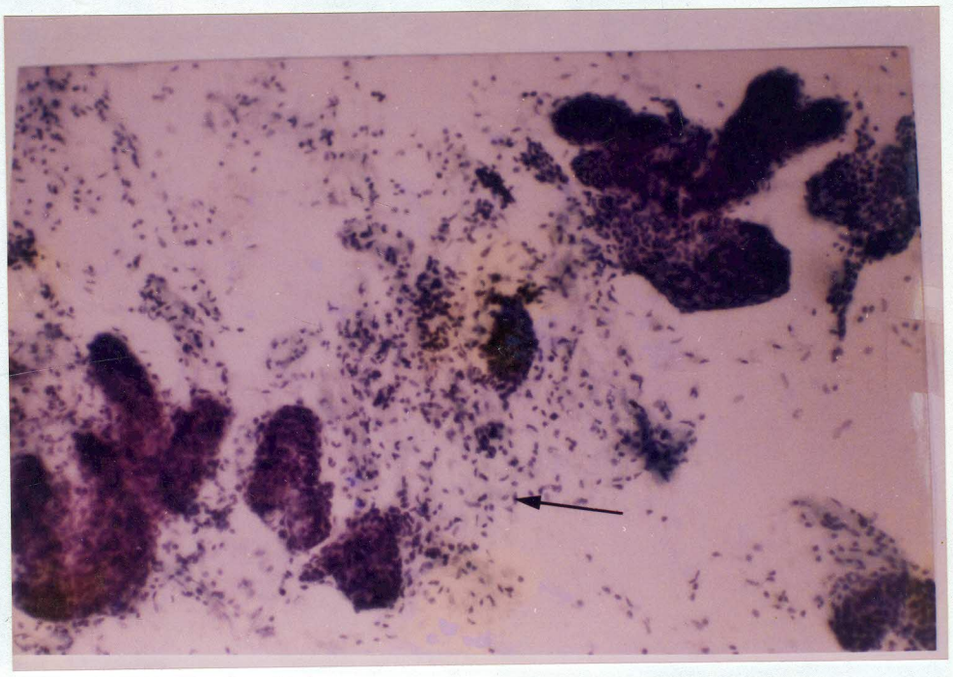


Fig.3a. Smear of a FNAB from fibroadenoma showing large sheets of mammary duct cells with many dissociated stromal and myoepithelial cells in the background (arrow) (PAP x 160).

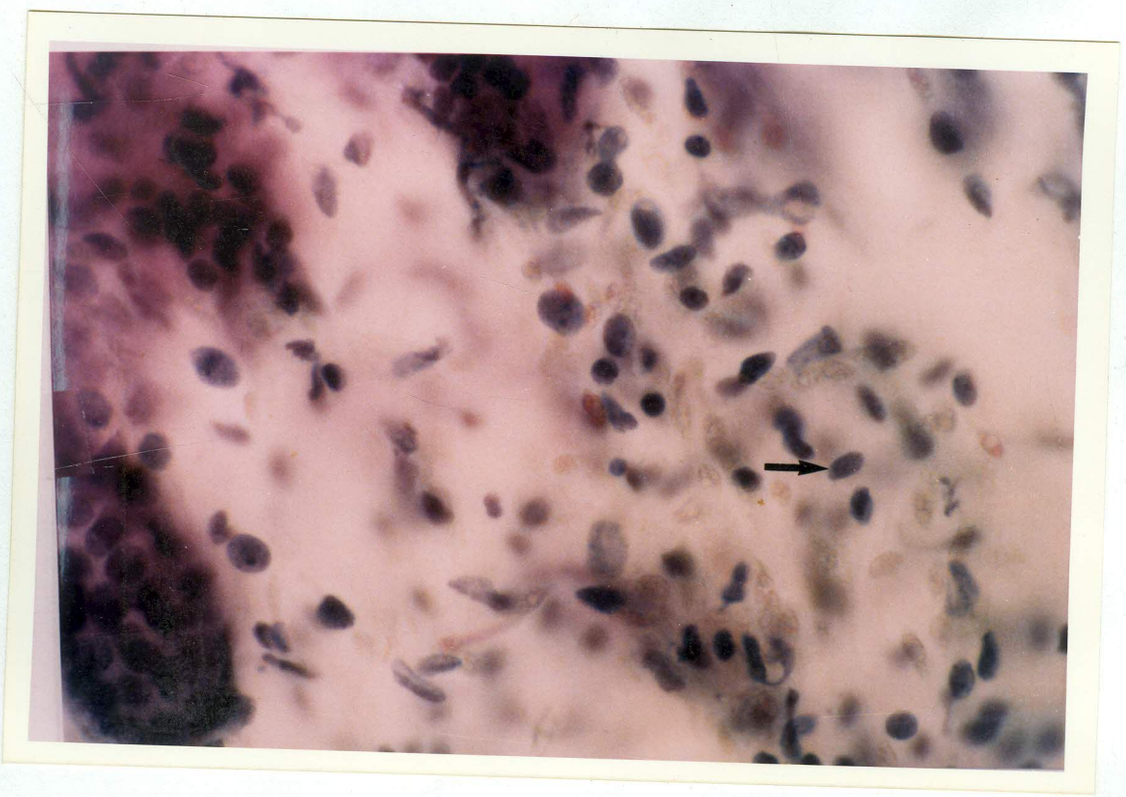


Fig.3b. A higher power view of the cluster of epithelial cells from fig.3a showing presence of oval myoepithelial cells with naked nuclei in the stroma (arrow) characteristic of fibroadenoma (PAP x 450).

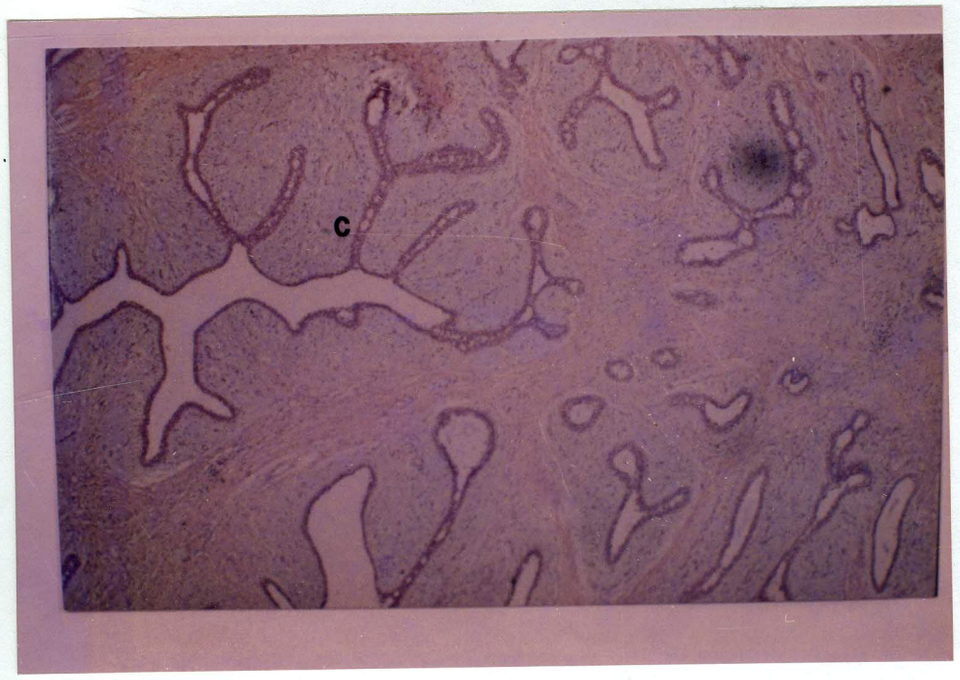



Fig.3c. Tissue section from a pericanalicular fibroadenoma (same case as in fig.3a & 3b) showing ducts surrounded concentrically by connective tissue with mucoid degeneration (c) (H & E x 450).

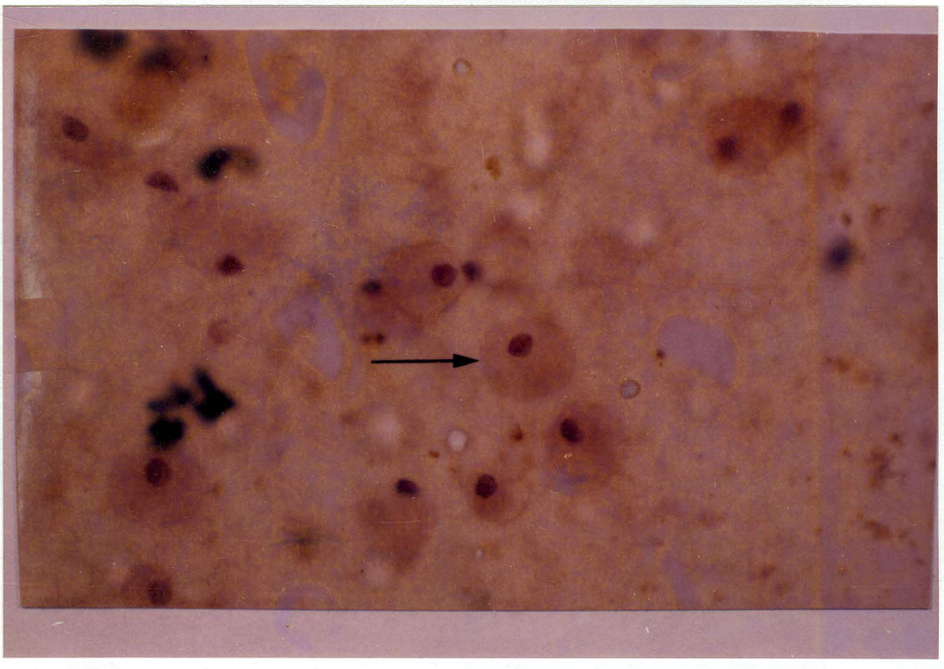


Fig.4. Aspiration smear from a breast cyst showing numerous macrophages (arrow) which normally feed on the cyst contents (PAP x 560).



Fig.5a. Smear of a FNAB from intraductal papilloma showing numerous cohesive clusters of columnar ductal epithelia cells with finger-like projections (arrow) (PAP x 450).

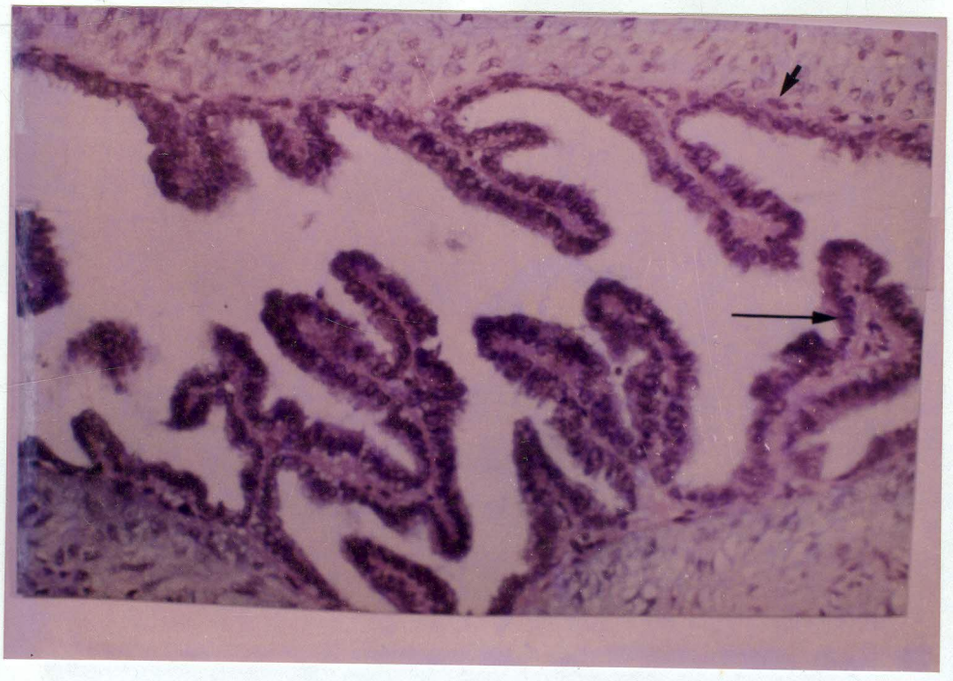


Fig.5b. Intraductal papilloma (tissue section) (same case as in fig.5a) showing papillary configuration of the ductal epithelium (long arrow) and presence of myoepithelial layer (short arrow) indicating the benign nature of this lesion ( H & E x 450).

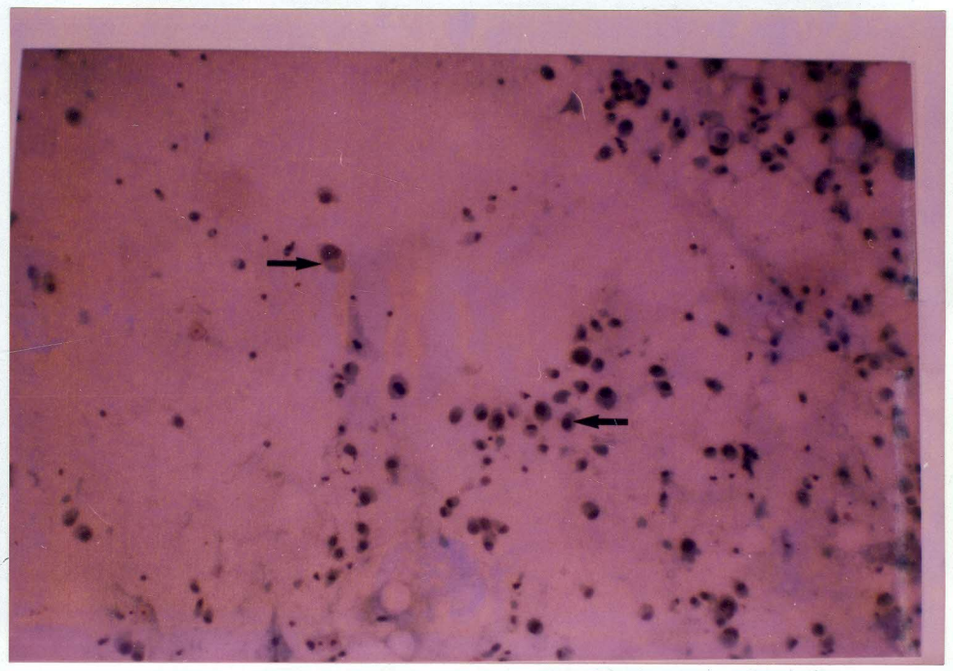


Fig.6a. Smear from infiltrating ductal carcinoma showing single cells with marked variation in size (pleomorphism) (arrows). Note also the characteristic peripheral placement of the nuclei (PAP x 450).

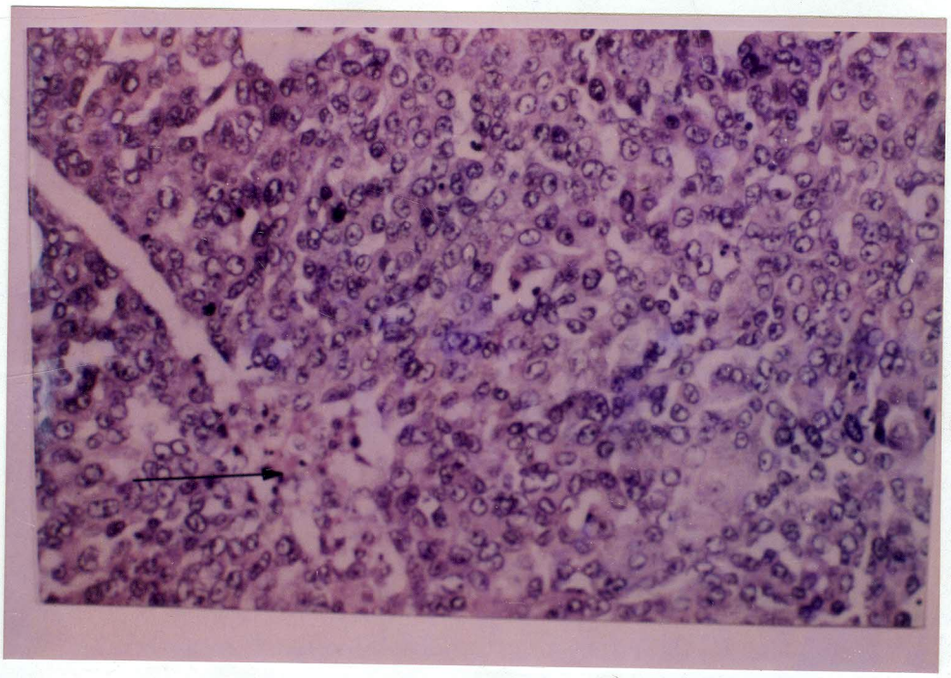


Fig.6b. Infiltrating ductal carcinoma (tissue section) (same case as in fig.6a) showing large carcinoma cells exhibiting decreased intracellular cohesiveness and a foci of necrosis (arrow) which is characteristic of this tumour (H & E x 450).

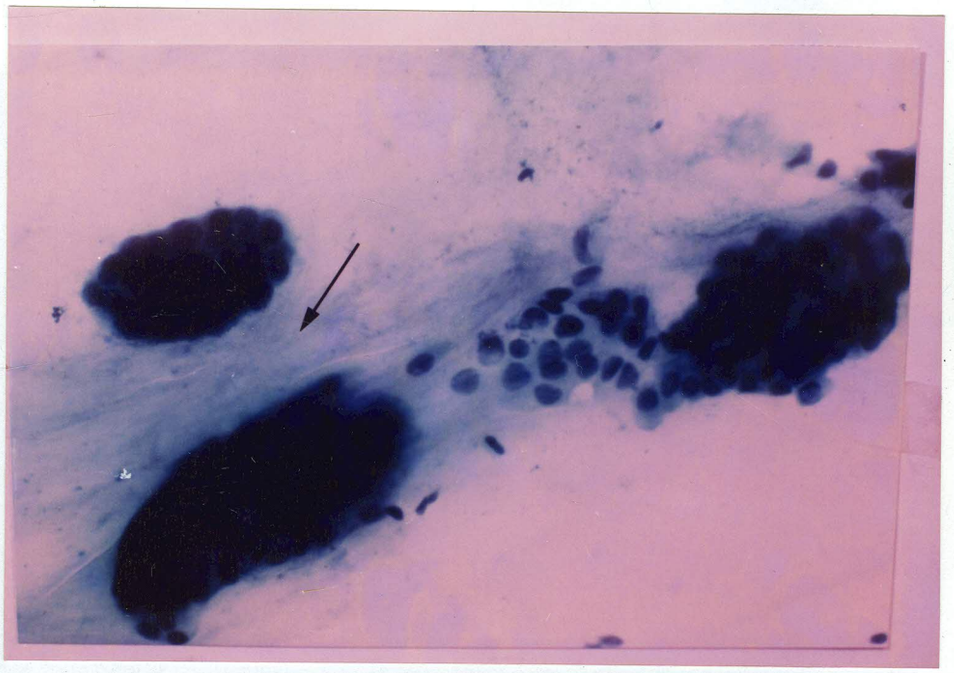


Fig.7a. Fine needle aspiration smear from mucinous carcinoma showing cancer cells forming cohesive clusters. The diagnosis is based on the presence of mucus (arrow) bathing the clusters and high atypia of the cells (PAP x 450).

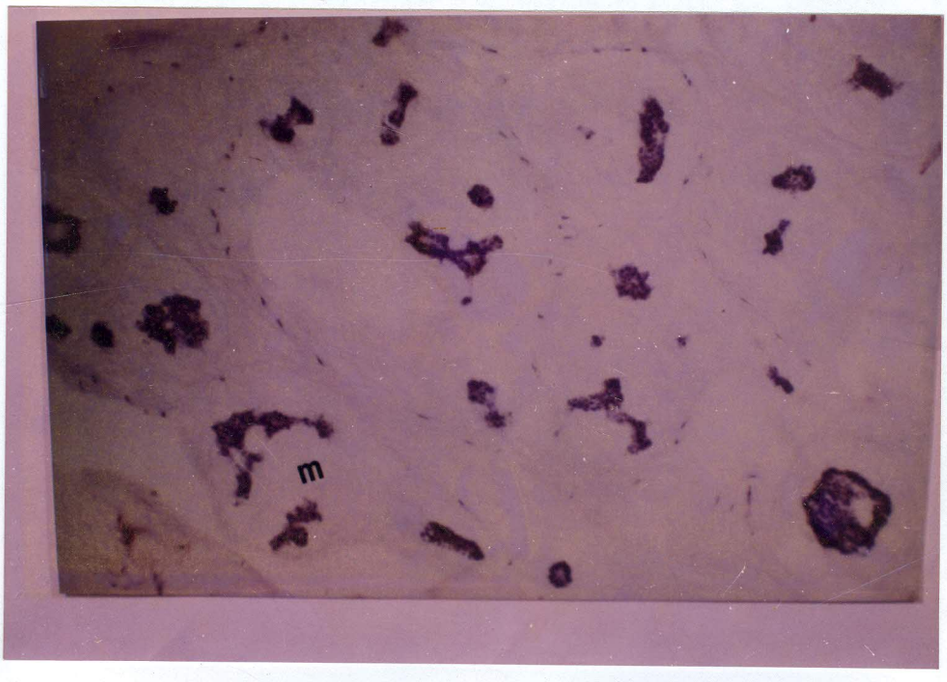



Fig.7b. Mucinous carcinoma (tissue section) (same case as in fig.7a) showing groups of cancer cells floating in a sea of mucin (m) (H & E x 450).

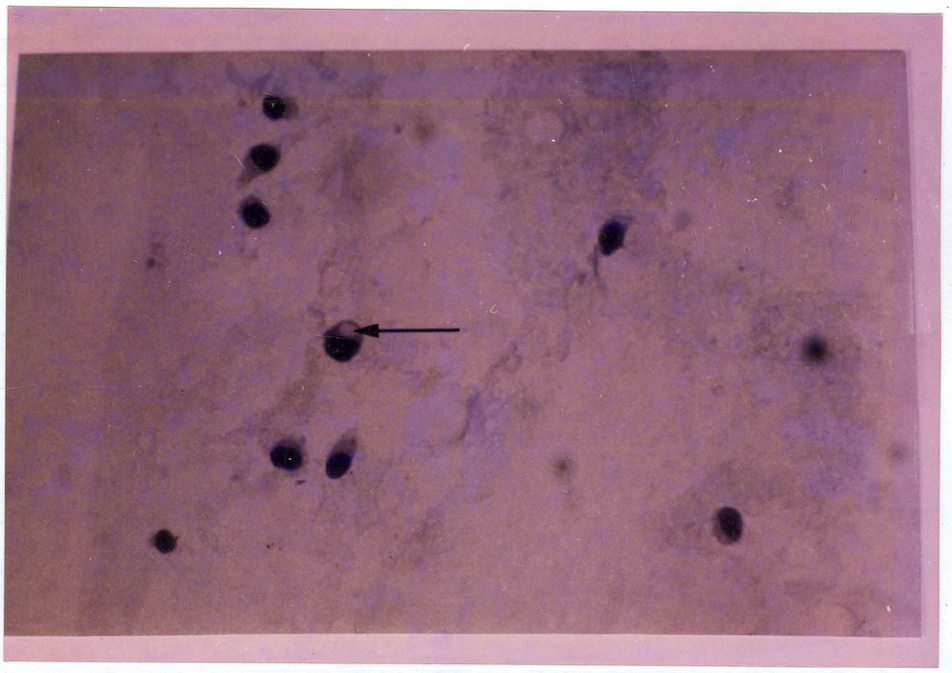


Fig.8a. Infiltrating lobular carcinoma aspiration smear showing small cancer cells with large, cytoplasmic mucous vacuole (arrow) which are characteristic of this tumour (PAP x 450).

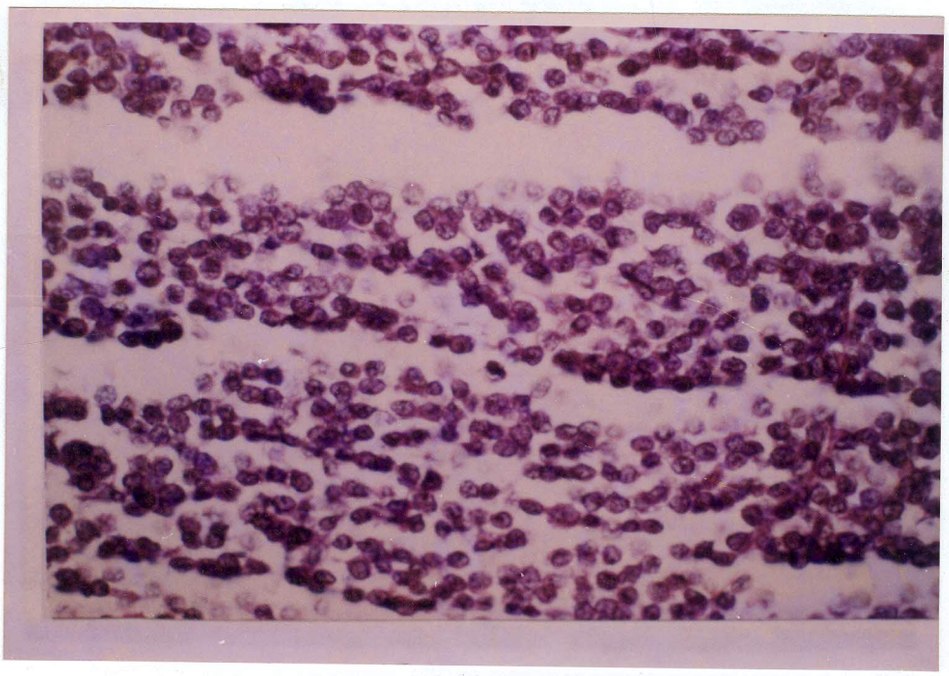


Fig.8b. Infiltrating lobular carcinoma (tissue section) (same case as in fig. 8a) showing cells which are quite uniform with round, normochromatic nuclei, minimal atypia and absence of necrosis. The typical "indian file " pattern was missing in this case (H & E x 450).

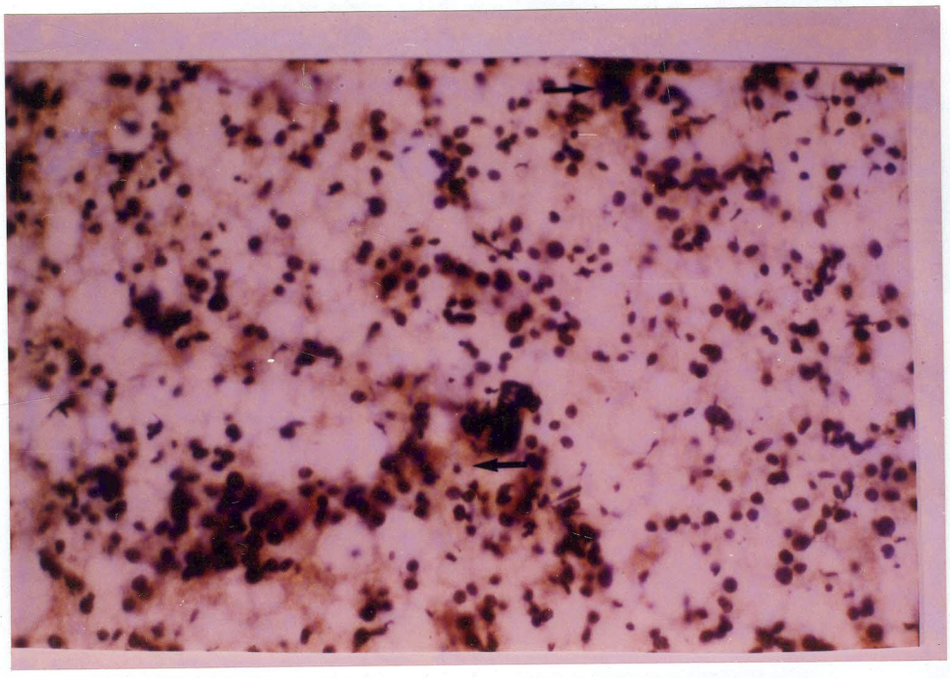


Fig.9a. Fine needle aspiration smear of a malignant breast lesion showing highly cellular smear composed of loose single cells in a necrotic background (arrows). Necrotic background is characteristic feature of malignancy in breast lesions. (PAP x 160).

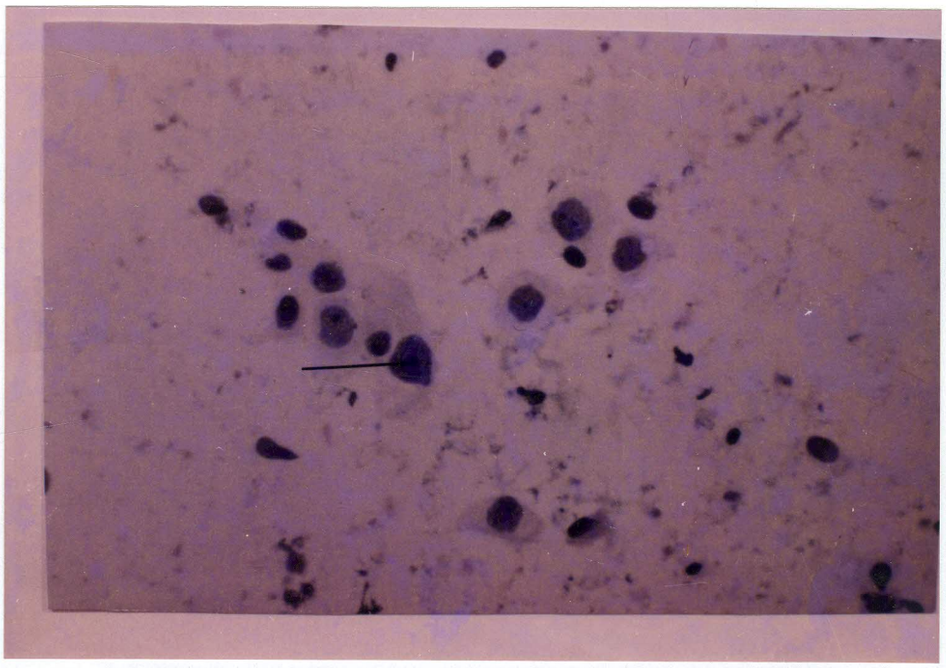


Fig.9b. Fine needle aspiration biopsy in a malignant breast lesion showing cells with high nuclear cytoplasmic ratio and prominent nucleolus (arrow) (PAP x 450).

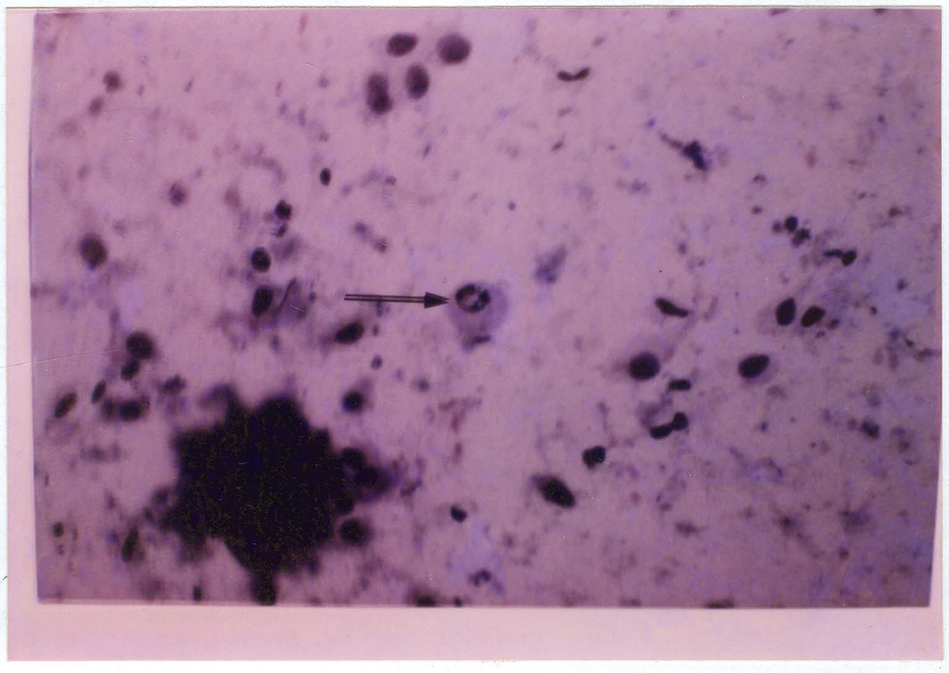


Fig.9c. Fine needle aspiration biopsy of a malignant breast lesion showing smear composed of clusters of epithelial cells with loss of cohesiveness, dissociated single carcinoma cells and presence of mitosis (arrow) (PAP x 450).




Fig.10. Infiltrating ductal carcinoma scirrhous type (tissue section) showing few cancer cells (c) in a highly fibrotic stroma (f). Due to marked fibrosis, FNAC may yield only a few epithelial cells or inadequate smear (H & E x 450).