

THE ROLE OF MAMMOGRAPHY AS A DIAGNOSTIC AID

IN DISEASES OF THE BREAST

AT

THE AGA KHAN HOSPITAL, NAIROBI

A dissertation submitted in
part fulfilment for the Degree
of Master of Medicine (Diagnostic Radiology),
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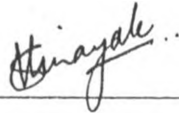
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DECLARATION

Candidate:

This dissertation is my original work and has not been presented for a degree in any other University.

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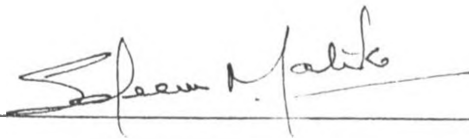


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D E D I C A T I O N

To my wife, PRAMILA.

For her support and patience
during the preparation of
this dissertation.

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INTRODUCTION

Breast cancer presents a significant public health problem in countries with a high socio-economic level. The relentless train of suffering and death following in its wake continues despite the therapeutic advances in the combined fields of surgery, radiotherapy and chemotherapy. It has become evident, therefore, that our efforts should be directed towards making an early diagnosis of minimal carcinoma and it is here that Mammography endeavours to excel itself.

Mammography became acceptable when, in 1956, a radiographic technique was first developed that consistently detected breast cancers at an assuredly curable stage. Since then, Clinicians have had to admit that not every lump in the breast is palpable - be it benign or malignant. This heralded the beginning of Mammographic screening in the western countries, especially in the high-risk age groups.

The role of mammography in screening of women is now well established and archaic views on the importance of risk factors such as family history, nulliparity, breast feeding, previous biopsy, or density of the breast on mammography need to be revised. Besides, the detection of an incipient

breast cancer allows the choice of various suitable treatments adopted for each case, following discussion with the patient and her family. This is in addition to prolonging the survival rate.

Here in Kenya just a handful of studies have been done on breast cancer - and all these from a surgical point of view. In fact minimal work has been carried out with regard to benign disease as this always takes a back seat in evaluation of breast diseases. Reports on breast cancer appear to show that although it may not be as prevalent as it is in Europe and North America, it is definitely on the increase. This can be attributed in part to our upstepping into a higher socio-economic level by adapting western lifestyles and also because many more cases are being diagnosed as patients from rural areas now have better access to medical services.

No work has been done in East and Central Africa on Mammographic diagnosis of breast diseases. The Mammographic Clinic at the Aga Khan Hospital, Nairobi was set up in September 1979. Running costs of such a facility are high and it has never come to be used as a screening centre for the general population. It receives referrals from doctors and surgeons in

East and Central Africa. A small percentage of patients visit the clinic on their own accord and very few asymptomatic patients in the high-risk age groups attend the clinic on an annual or biannual basis.

It is the purpose of this study to try and evaluate the facility being provided at the clinic. The demographic data of the patients together with a history and clinical examination assist in reaching a diagnosis when interpreting films. These were therefore recorded and will be analysed. The study will endeavour to compare all mammographic reports with the final diagnosis attributed to the patient (this may be after biopsy of a lump, cyst aspiration, cytology from Nipple discharge or mastectomy specimens).

The objectives of this study are, therefore, to critically evaluate the accuracy of the radiological reports and to ascertain as far as possible whether or not the facility is a useful diagnostic aid in the management of Breast disease with special reference to Breast cancer.

This study is therefore aimed at the following:-

- To determine the age and ethnic patterns of Breast disease in Eastern Africa.
- To determine and describe the various types of

benign and malignant breast diseases seen in our environment.

- Most importantly, to evaluate the efficacy of Mammography as a diagnostic tool in the management of Breast disease.
- Finally to make any criticisms and/or recommendations arising as a result of this evaluation. This would relate to both the radiographic and radiologic aspects.

MAMMOGRAPHY

The practice of mammography can be divided into two broad categories; screening and diagnosis. Screening involves examination of asymptomatic women in an attempt to detect breast cancer before a lesion is clinically palpable while diagnostic mammography is done on women who, by virtue of symptoms or physical findings, are considered to have a substantial likelihood of having breast cancer. The usefulness of mammography in the symptomatic women is well documented (12,15,21,25,44,45); mammography is primarily used to demonstrate the presence or absence of breast cancer and, specifically to indicate the size, location and extent of tumour.

There is also considerable evidence indicating

the ability of mammography to detect nonpalpable cancer (13,16,17). The most pertinent is the randomized controlled trial of screening mammography done in the 1960's (the HIP, Health Insurance Plan of Greater New York Study), which demonstrated a significant decline in breast cancer mortality among screened women aged 50 and older.

Similarly there is little, if any, opposition to the practice of diagnostic mammography, probably because of the compelling clinical need for the information obtained. This aspect of mammography will be critically analysed in this study.

An essential component in determining the efficacy of a mammographic unit (especially with reference to screening programmes) is an evaluation of benefits versus risk of harm, and for mammography, the main risk to be addressed is that of radiation-induced breast cancer. Although, as discussed elsewhere, the benefit-risk ratio is overwhelmingly in favour of the former, it must be emphasised that this is only possible with optimum choice of equipment, technique and patient positioning.

In further chapters, the technique of mammography employed will be discussed with emphasis laid on the working of the unit.

ANATOMY

It is necessary to understand the anatomy of the breast to design mammography techniques to detect breast cancer effectively and to determine the average glandular dose from X-rays.

The human female breast is a well differentiated apocrine sweat gland which secretes milk during lactation. This is the description given by Haagensen (23). The two breasts lie anterior to the right and left pectoral muscles, extending from the sternum laterally, to the mid-axillary line. The shape and size of the breast varies from one individual to another and during ones lifetime.

Each breast consists of a thin outer layer of skin, beneath which is a subdermal layer of adipose tissue varying in thickness from several millimeters to about one centimeter thick. Beneath the fat layer lies the supportive connective tissue stroma which contains blood vessels, lymph channels and variable amounts of adipose tissue. The stroma also contains the glandular tissue consisting of 15 to 20 lobes which subdivide into milk forming lobules and drain via an extensive ductal system through the nipple.

The body of the gland is surrounded by a connective tissue capsule from which septa extend through the anterior fatty layer to the dermis. These are DURET'S CRESTS whose general orientation is perpendicular to the skin. These are very helpful to the radiologist in differentiating between hyperglandular breasts and fibroadenotic ones.

The nipple is surrounded by an area showing some measure of pigmentation, the areola. It presents multiple swellings, Montgomery's tubercles.

The glandular tissue in males is rudimentary as in pre-pubertal females. Pubertal proliferation in the latter begins early in the second decade. The hormonal variations related to the menstrual cycle, pregnancy and lactation cause additional proliferation of the glandular tissue, but generally, the amount of glandular tissue is maximal at the end of puberty and gradually recedes with advancing age.

The ratio of glandular tissue to total breast tissue also depends upon each woman's genetic predisposition and her ratio of total body adipose tissue to total body weight. Therefore, it is not surprising that one often encounters young women

whose breasts consist primarily of adipose tissue, or elderly women with extremely dense glandular tissue.

The upper outer quadrant, because of an additional axillary tail of glandular tissue, is the thickest portion and extends furthest from the nipple, towards the axilla.

It is important to note that virtually all breast cancers arise from the glandular tissue. Therefore the main objective of mammography should be to visualize the glandular tissue with as high a resolution and contrast as feasible within the constraints of the desired low X-Ray exposure.

Finally, the blood vessels and ducts must also be clearly shown on the mammogram. The lymphatic drainage of the breast is rather complicated and it is not within the scope of this discussion to go into its details. However, during breast examination one must always palpate nodes especially the axillary; Supraclavicular and Infraclavicular nodes.

CASE MATERIAL

This study was carried out at the Mammography Clinic of the Aga Khan Hospital, Nairobi. A total of 1,744 consecutive patients were included in the study over a period of six and a half years from 1st January, 1981 to 30th June, 1987. They were all female patients and although three males were mammographed, they were excluded from the results.

The clinic was first started in September 1979. At the time, a new machine was installed and both the radiographer and radiologist were inexperienced. However, by the end of 1980, the techniques and the manner of reporting were sufficiently stabilized to allow for the retrospective part of the study to begin.

Since then a total of 1,446 retrospective and 298 prospective patients have been seen at the clinic. Reporting bias can be excluded as only one radiologist reported all the mammograms over this period.

Every patient attending the clinic was interviewed by the radiologist and a standard history taken. Following this the patients were asked to strip to the waist and a clinical examination of the breasts was done. The radiographer then took mammograms of both

breasts in every patient.

HISTORY

Besides every patients demographic data which included the age, sex, marital status, race and blood group, general and specific questions were asked related to symptoms. These included:-

- Reason for referral e.g. for check up, pain, tenderness, lump, nipple discharge etc.
- Parity
- Age at first pregnancy
- Age at menarche
- Breast feeding
- Use of Oral Contraception
- Regularity of monthly periods
- Age at menopause - if applicable
- Reasons for Hysterectomy (if done)
- Family history of breast cancer
- Others - usage of antihypertensives, previous medical illnesses etc.

The significance of various aspects of the history are mentioned in the discussion. It is imperative to note that a good history is essential in mammography. It is an adjunct to clinical examination in the interpretation of mammograms.

The clinical examination carried out on the patients was done systematically and is discussed in the methods. A record was made of all the findings - positive or negative.

Mammograms were taken and reports sent to the referring doctor. An attempt was made to get as much clinical information on each referral as possible. All referring doctors were approached about patients seen at the clinic so that a follow-up of the course of the disease could be made.

Where possible, histopathological reports of biopsies, aspirations or cytology of nipple discharges were obtained to label a diagnosis on each patient. Patients reported as normal or having benign disease such as fibroadenosis were not so easy to "label". If follow-up of these patients over six months showed resolution or no improvement then, they were labelled on clinical grounds. As a result, all patients seen during the final months of the study could not be categorised until December 1987 when six months had elapsed. As the results will show, it was not possible to get a feedback on every patient.

During the prospective period, once a week

evaluation was done of the film quality produced.
As the clinic is open three times a week,
• approximately one third of films were therefore
evaluated in this respect.

METHODOLOGY

A clinical examination of both breasts was done regardless of whether one or both breasts were symptomatic. This is described below.

First the patient is asked to sit upright. The hands are kept on the waist and the chest is forwardly placed. The breast is inspected for any asymmetry. Obvious abnormalities of the skin (e.g. Peau d'orange), subcutaneous veins, change in colour, nipple elevation or retraction are noted.

The breasts are then separately palpated - first superficially and then deep palpation of all four quadrants. The nipple is milked to express any discharge or normal milk secretion. Both axillae are examined for nodes and the supra and infra clavicular nodes are also palpated.

Any areas of tenderness found on examination are more closely examined. Lumps are common and their site, size, consistency and delineation are recorded. The lumps are further examined for skin or posterior wall fixation and presence of tenderness. Finally, distant metastasis are looked for in suspicious cases.

After the clinical examination, the patients

were mammographed by the radiographer.

MAMMOGRAPHY EQUIPMENT

The machine used in this project is a stationary radiographic unit - the CGR Senograph - which is specifically designed for mammography. For good quality radiographs, a dedicated Mammography unit is essential and a modified conventional apparatus is a mediocre compromise. The reasons for having such a specialised unit are mentioned in the discussion.

As soft tissue radiography is practised in mammography, the type of x-rays produced is important. The ideal situation is such that the x-ray tube produces rays only in the 0.6 to 0.9 angstrom wavelengths. The Senograph consists of a tube with a fixed molybdenum anode of 0.7 mm focus which allows monochromatic emission of x-rays within the band of emission of low-energy photons. Because it has a grounded anode with a beryllium window, the x-rays produced are practically unfiltered thereby minimising inherent filtration. The tube is operable from 20 to 40 KVP and 30 to 40 mA. The anode is water cooled and it is supplied with a molybdenum filter 30 microns thick

which contributes to homogenizing the special response.

The machine has eleven collimated cones for breasts of all sizes. The localizer cones are easily interchangeable on the X-ray tube housing and are securely locked into position. Each cone has a graduated scale which is important as it is used to calculate exposure times. In this machine, the cones also act as a compression device to attain suitable compression of the breast.

A film-screen combination using the Kodak Min-R system is presently being used at the clinic. It incorporates a single emulsion film for good contrast and rare-earth screen. The latter is made of oxysulphide of gadolinium activated to terbium which not only enhances contrast, but lowers the skin dose by about 15% as compared to standard film-screen combinations. The use of rare-earth screens also reduces motional blurr as exposure times are low.

The senograph is equipped with an automatic exposure time control - the phototimer. No manual settings are being used so that all mammograms are done using 28 KVP and 38 mA and the exposure time controlled by the phototimer.

TECHNIQUE

The normal technique of breast radiography is discussed.

The importance of producing good radiographs cannot be over-emphasized. Microcalcifications, duct ectasia and ductal papillomas are but a few pathologies that can easily be missed on poor quality radiographs. The exposure factors are responsible for good contrast and correct positioning enhances the superiority of the radiograph. All parts of the breast should be radiographed on as few films as possible. Normally two radiographs are taken of each breast but an additional axillary view to include the axillary tail may be necessary, or a 30° oblique. Four basic views are recognised

- Frontal or Axial or Craniocaudal view.
- Lateral
- 30° - 60° oblique
- Axillary

The axial view is done with the cassette placed caudad to the breast and the x-ray beam directed from cranial to caudad, through the breast. This view yields best images of the subareolar, central and medial portions of the breast.

The lateral similarly is done with the cassette placed lateral to the breast and the x-ray beam directed medial to lateral.

The axillary view is a special view done to show an axillary tail. This situation is usually found in women with medium to small breast size who are over-weight. It is essentially a modified lateral view incorporating the axillary tail.

The oblique view is not being taken at the clinic but it is extremely useful and will be mentioned in the discussion.

When radiographing any of these views, the patients' arms should be raised to 90° (but be kept as close to the breast as possible) or the hands placed on the waist for all positioning, since pulling the arm back or raising it too high tightens the skin in the breast region, making it difficult for the radiographer to pull the breast away from the chest and onto the film.

A stiff compression of the breast was achieved by using the cone. On this machine, a special compression device is not available. Vigorous compression is essential for screen-film mammography. The average breast can usually be compressed to

about 4 cm in thickness using the above device. The value of compression is always explained to the patient and her co-operation requested. It can often be painful to the patient especially in those with symptoms of mastodynia. However, it is essential to achieve adequate and equal compression of both breasts. Although it is outside the scope of this dissertation to discuss the reasons why compression is important, they are summarized (33) as follows:-

- (a) Reduced geometric unsharpness
- (b) Contrast improvement
- (c) Diminished motion unsharpness
- (d) Reduction of X-ray dose
- (e) More uniform film density
- (f) More accurate assessment of the density of masses
- (g) Spreading apart of glandular tissue so that the borders of suspicious lesions can be better seen.

Once positioned, the patient is asked to stop breathing and exposures taken.

RESULTS

The total number of patients seen at the clinic were 1,744. The amount of data collected was lengthy, especially with regard to the history of the patients. It is only practical to present the data which is relevant to the main objectives of this study, and is presented in the following pages.

TABLE I

AGE DISTRIBUTION - PERCENTAGES IN ()

AGE	TOTAL	NORMAL	BENIGN	* MALIGNANT
< 10	2 (<1%)	0 (0%)	2 (<1%)	0 (0%)
11 - 20	60 (3%)	9 (1%)	51 (5%)	0 (0%)
21 - 30	381 (22%)	126 (19%)	254 (26%)	1 (2%)
31 - 40	685 (39%)	293 (43%)	370 (37%)	22 (30%)
41 - 50	420 (24%)	161 (24%)	240 (24%)	19 (26%)
51 - 60	150 (9%)	63 (9%)	66 (7%)	21 (29%)
61 - 70	38 (2%)	18 (3%)	13 (1%)	7 (9%)
71 - 80	7 (<1%)	3 (<1%)	1 (<1%)	3 (4%)
> 80	1 (<1%)	1 (<1%)	0 (0%)	0 (0%)
TOTALS	1744 (100%)	674 (100%)	997 (100%)	73 (100%)

* Malignancy as diagnosed on Mammography

GRAPH 1.AGE DISTRIBUTION CURVES

— NORMAL
 — BENIGN
 — MALIGNANT

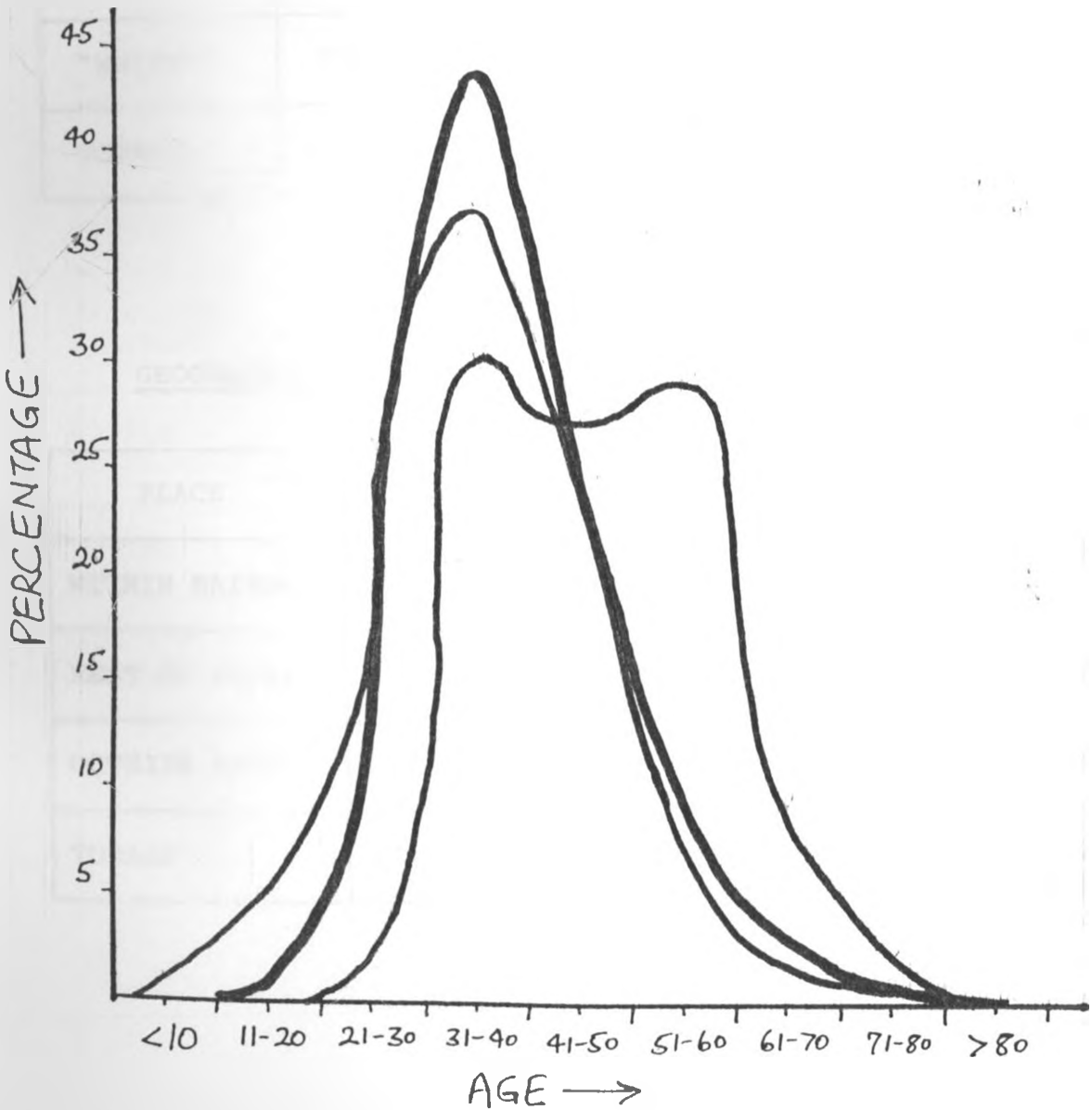


TABLE 2ETHNIC DISTRIBUTION

RACE	TOTAL	NORMAL	BENIGN	MALIGNANT
INDIGENOUS AFRICANS	534 (31%)	243 (36%)	274 (27%)	17 (23%)
ASIANS	654 (37%)	254 (38%)	364 (37%)	36 (49%)
"WHITES"	556 (32%)	177 (26%)	359 (36%)	20 (28%)
TOTALS	1744 (100%)	674 (100%)	997 (100%)	73 (100%)

TABLE 3GEOGRAPHIC DISTRIBUTION (BASED ON REFERRALS)

PLACE	TOTAL	NORMAL	BENIGN	MALIGNANT
WITHIN NAIROBI	1313 (75%)	525 (78%)	737 (74%)	51 (70%)
REST OF KENYA	314 (18%)	112 (17%)	186 (19%)	16 (22%)
OUTSIDE KENYA	117 (7%)	37 (5%)	74 (7%)	6 (8%)
TOTALS	1744 (100%)	674 (100%)	997 (100%)	73 (100%)

TABLE 4
INDICATIONS FOR REFERRAL

INDICATION	TOTAL	NORMAL	BENIGN	MALIGNANT
PAIN/ TENDERNESS	681 (39%)	305 (44%)	350 (35%)	26 (39%)
PREMENSTRUAL MASTALGIA	500 (29%)	179 (26%)	314 (32%)	7 (10%)
NIPPLE DISCHARGE	241 (14%)	73 (10%)	157 (16%)	11 (16%)
ILL-DEFINED NODULARITY	104 (6%)	29 (5%)	75 (8%)	0 (0%)
SKIN SIGNS/ SYMPTOMS	85 (5%)	22 (3%)	50 (5%)	13 (20%)
NIPPLE RETRACTION	2 (<1%)	2 (<1%)	0 (0%)	0 (0%)
OTHERS	4 (<1%)	3 (<1%)	1 (<1%)	0 (0%)
ROUTINE CHECK-UP	127 (7%)	79 (11%)	38 (4%)	10 (15%)

100%

100%

100%

100%

TABLE 5

PARITY

PARITY	TOTAL	NORMAL	BENIGN	MALIGNANT
Nulliparous 0	464 (27%)	103 (15%)	355 (36%)	6 (8%)
1	171 (10%)	52 (8%)	113 (11%)	6 (8%)
2	438 (25%)	188 (28%)	235 (24%)	15 (21%)
3	309 (18%)	138 (20%)	156 (16%)	15 (21%)
4	176 (10%)	94 (14%)	73 (7%)	9 (12%)
5 or MORE	186 (10%)	99 (15%)	65 (6%)	22 (30%)
TOTAL	1744 (100%)	674 (100%)	997 (100%)	73 (100%)

TABLE 6BREAST FEEDING OF THREE MONTHS OR MORE

	TOTAL	NORMAL	BENIGN	MALIGNANT
YES	813 (47%)	371 (55%)	393 (40%)	49 (67%)
NO	931 (53%)	303 (45%)	604 (60%)	24 (33%)
TOTAL	1744 (100%)	674 (100%)	997 (100%)	73 (100%)

TABLE 7USE OF ORAL CONTRACEPTION

	TOTAL	NORMAL	BENIGN	MALIGNANT
YES	459 (26%)	186 (28%)	254 (25%)	19 (26%)
NO	1285 (74%)	488 (72%)	743 (75%)	54 (74%)
TOTAL	1744 (100%)	674 (100%)	997 (100%)	73 (100%)

TABLE 8FAMILY HISTORY OF BREAST CANCER

	TOTAL	NORMAL	BENIGN	MALIGNANT
YES	175 (10%)	64 (9%)	100 (10%)	11 (15%)
NO	1569 (90%)	610 (91%)	897 (90%)	62 (85%)
TOTAL	1744 (100%)	674 (100%)	997 (100%)	73 (100%)

TABLE 9LOCATION OF BREAST LUMPS ON MAMMOGRAMS

LOCATION	RIGHT		LEFT	
	BENIGN	MALIGNANT	BENIGN	MALIGNANT
UOQ	121 (43%)	21 (70%)	127 (63%)	14 (52%)
UIQ	132 (46%)	5 (17%)	31 (15%)	2 (7%)
LOQ	17 (6%)	1 (3%)	26 (13%)	2 (7%)
LIQ	6 (2%)	1 (3%)	7 (3%)	1 (4%)
ALL QUADRANTS AND RETROAREOLAR	8 (3%)	2 (7%)	12 (6%)	8 (30%)
	284 (100%)	30 (100%)	203 (100%)	27 (100%)

KEY

UOQ - Upper outer quadrant

UIQ - Upper inner quadrant

LOQ - Lower outer quadrant

LIQ - Lower inner quadrant

TABLE 10LOCATION OF BREAST CANCER ON MAMMOGRAPHY

LOCATION	THIS STUDY	HAAGENSEN (1971)
UOQ	61%	45%
UIQ	12%	15%
LOQ	5%	10%
LIQ	4%	5%
ALL QUADRANTS/ RETROAREOLAR	18%	25%
TOTAL	100%	100%

The figures shown in this study are the average for both breasts.

TABLE 11TYPES OF BENIGN MASTOPATHIESDIAGNOSED ON MAMMOGRAPHY

BENIGN DISEASE	NUMBER	PERCENTAGE
FIBROCYSTIC MASTOPATHY	802	80%
CYSTS	89	9%
SECRETORY DISEASE	49	5%
GALACTOCOELE	16	2%
INTRADUCTAL PAPILLOMAS	14	1%
OTHERS	27	3%
TOTAL	997	100%

TABLE 12

Histologically proven and follow-up
results:-

Ca breast	60
Benign disease	241
Normal breasts	<u>182</u>
Total	483

MAMMOGRAPHIC ACCURACY

CONDITION	TRUE POSITIVES	FALSE POSITIVES	FALSE NEGATIVES
MALIGNANT	57	5	3
BENIGN	233	10	8
NORMAL	175	3	7

TABLE 13
RADIOLOGICAL ACCURACY IN MAMMARY CANCER

AUTHOR	TRUE POSITIVE		FALSE POSITIVE	
	NUMBER OF CARCINOMAS	CORRECTLY DIAGNOSED	NUMBER OF BENIGN LESIONS	DIAGNOSED AS MALIGNANT
EGAN (1964)	728	706 (97%)	482	44 (9.1%)
EGAN (Combined series) (1964)	602	528 (87%)	1254	82 (6.5%)
CLARKE (1965)	475	376 (79%)	1095	106 (9.6%)
FRIEDMAN (1966)	233	159 (68%)	543	50 (9.2%)
JAMES (1969)	55	50 (90%)	46	2 (4.3%)
STEWART (1969)	228	209 (92%)		
NATHAN (1971)	84	74 (88%)	145	14 (9.7%)
PRESENT STUDY (1987)	60	57 (95%)	241	5 (2%)

TABLE 14

MAMMOGRAPHIC INTERPRETATION OF BREAST
CANCER COMPARED WITH HISTOLOGICAL DIAGNOSIS

MAMMOGRAPHIC DIAGNOSIS	CASES OF HISTOLOGICALLY CONFIRMED BREAST DISEASE		
	BREAST CANCER	NO BREAST CANCER (NORMAL & BENIGN)	TOTAL
BREAST CANCER	57	5	62
NO BREAST CANCER (NORMAL & BENIGN)	3	418	421
TOTAL	60	423	483

From above:-

- SENSITIVITY is $(57/60 \times 100\%)$ 95%
- SPECIFICITY is $(418/423 \times 100\%)$ 99%
- POSITIVE PREDICTIVE VALUE is $(57/62 \times 100\%)$ 92%
- NEGATIVE PREDICTIVE VALUE is $(418/421 \times 100\%)$ 99%

TABLE 15

COMPARISON OF SENSITIVITY AND SPECIFICITY OF
MAMMOGRAPHY IN VARIOUS STUDIES

AUTHOR	DATE PUBLISHED	SENSITIVITY %	SPECIFICITY %	FIRST SCREENING DATA ONLY
CHAMBERLAIN	1979	59	96	YES
CHAMBERLAIN	1984	68	96	YES
GOHAGON [*]	1982	53	98	NO
HICKS [*]	1979	62	51	NO
GOIN [*]	1983	72	72	NO
GOLDBERG & WITTES ^{**}	1978	29	NR	YES
MOSKOWITZ [*]	1983	72	96	NO
NBSS CENTRES	1985	69	94	YES
TABAR	1984	95	96	YES
PRESENT STUDY	1987	95	99	NOT A SCREENING CENTRE

* Data from U.S. Breast Cancer Detection Demonstration Programme

** Data from New York Health Insurance Plan Study.

NR - Not Reported.

TABLE 16

BLOOD GROUP	NORMAL	BENIGN	MALIGNANT	TOTAL	KENYA POPULATION
A	22% (86)	26% (147)	42% (12)	25% (245)	27%
B	22% (87)	22% (121)	10% (3)	22% (211)	21%
AB	6% (22)	6% (32)	10% (3)	6% (57)	4%
O	50% (194)	46% (253)	38% (11)	47% (458)	48%
TOTAL	100% (389)	100% (553)	100% (29)	100% (971)	100%

RHESUS	NORMAL	BENIGN	MALIGNANT	TOTAL	KENYA POPULATION
NEGATIVE	12% (45)	14% (75)	14% (4)	13% (124)	3%
POSITIVE	88% (344)	86% (478)	86% (25)	87% (847)	97%
TOTAL	100% (389)	100% (553)	100% (29)	100% (971)	100%

() ACTUAL number of Patients



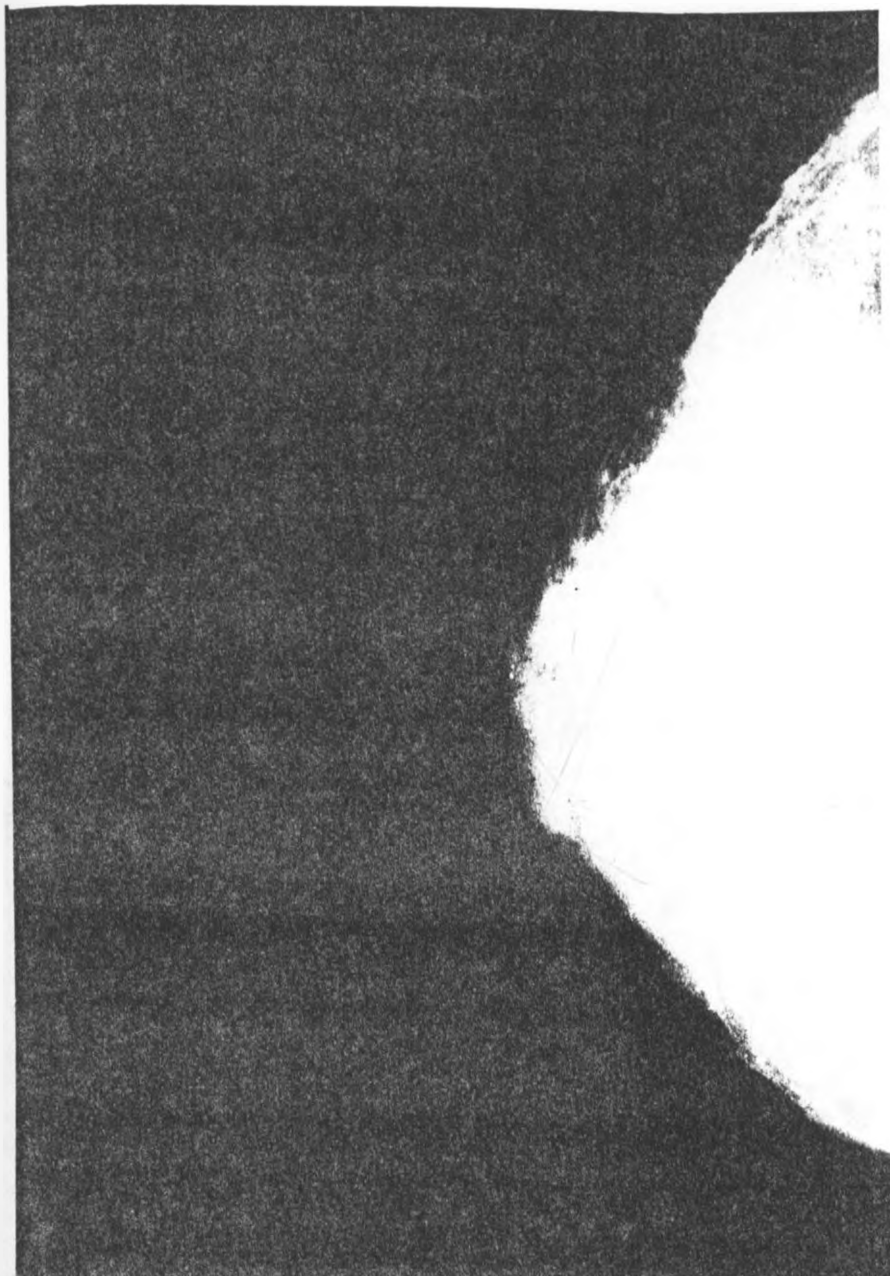
A 22 year old Asian woman, Para 2+0 whose main complaint was bilateral premenstrual mastalgia. She had been on the contraceptive pill for one year. Clinically the breasts were normal.

Mammogram: Modified lateral view (alternative to oblique).

Normal breast with well formed glandular parenchyma and equal distribution of fibroadipose tissue. The nipple is seen in profile.

"Durets Crests" are well demonstrated.

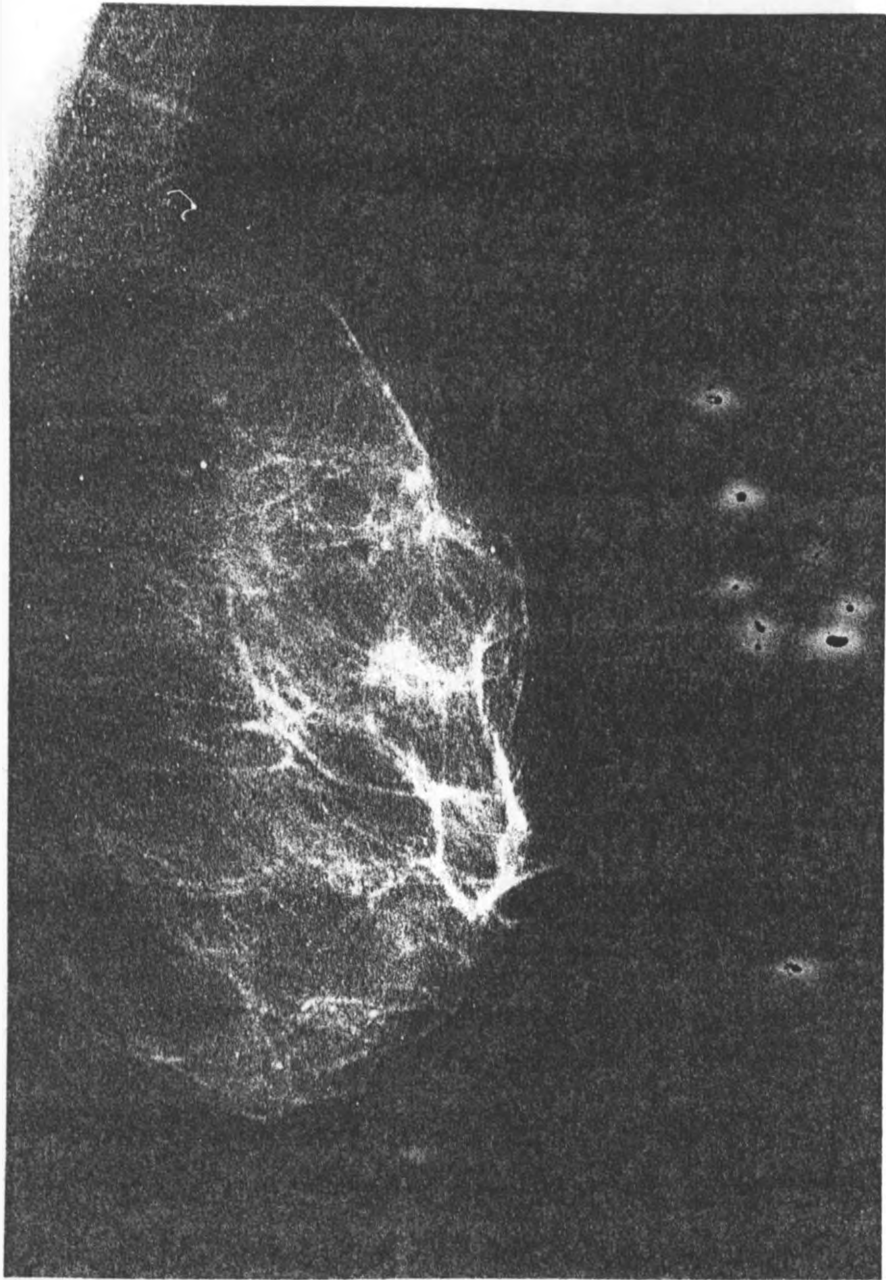
Conclusion: Normal Breast.



A 15 year old black patient whose main complaint was "lumpiness" in the left breast. Clinically no lumps were felt but there was slight tenderness bilaterally.

Mammogram: Adolescent breast with poorly differentiated glandular parenchyma and minimal adipose tissue. There is no pathology seen.

Conclusion: Normal adolescent breast.



A 46 year old black woman who complained of a "heaviness" in the left breast for 2 days. Clinically the breasts were normal.

Mammogram: Very fatty breasts with scanty glandular parenchyma. This is an ideal breast to demonstrate an early carcinoma, if present. The skin thickening in the inferior mammary fold is a normal finding.

Conclusion: Involutional breasts (normal).



A 46 year old white patient who complained of lumpiness in both breast for 5 days. She had had two cysts removed previously from both breasts. Clinically no mass was palpated.

Mammogram: There are multiple rounded opacities of varying sizes with fatty "halos". No radiological features of malignancy are present, and no axillary lymphadenopathy is seen.

Conclusion: Fibrocystic mastopathy.

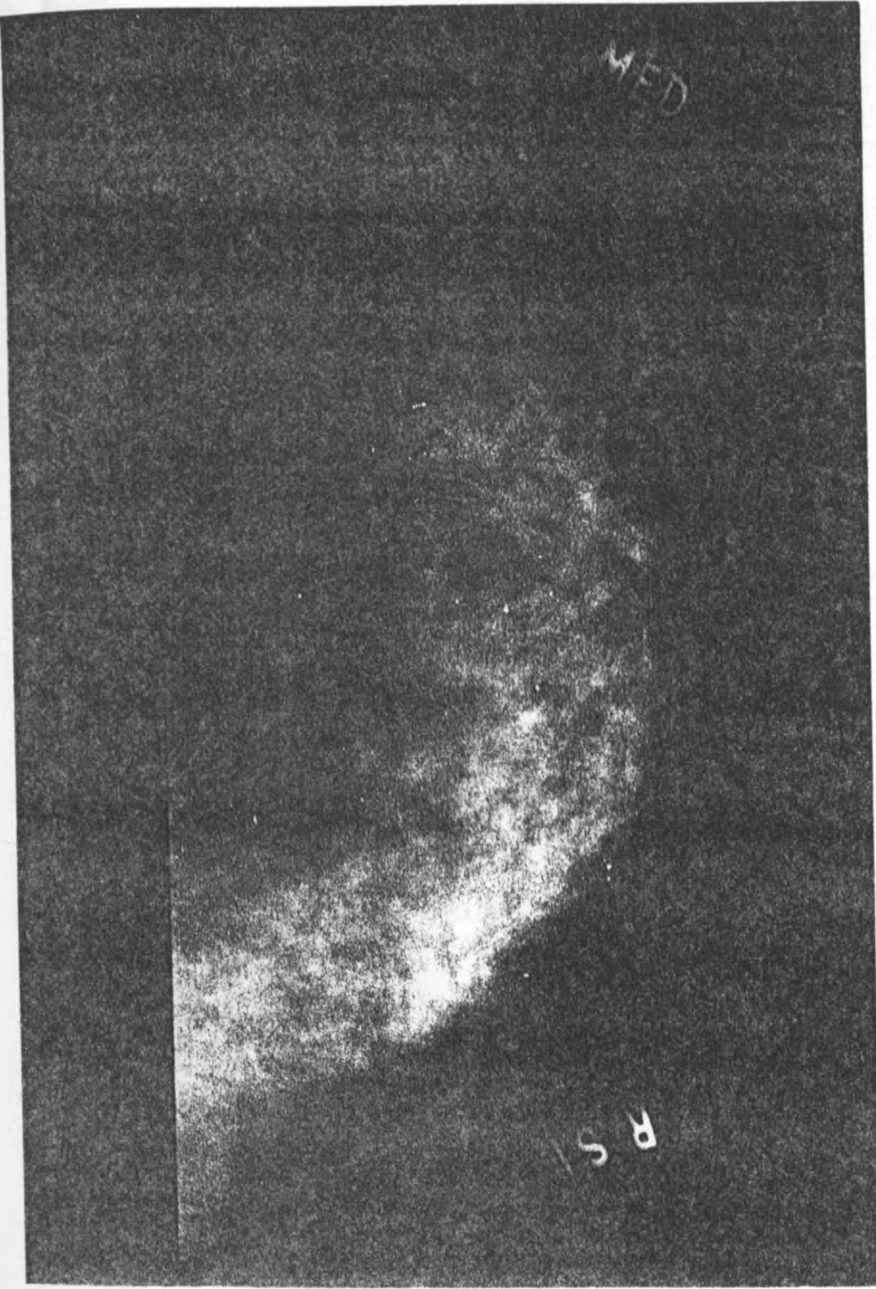
Note: The small black specks are artifacts.



A 42 year old white woman whose main complaint was a lump in the left breast noticed 10 days previously. She was a Para 2. Clinically there was bilateral tenderness.

Mammogram: An oval shaped opacity measuring 2cm x 1.5 cm with a benign fatty halo is seen in the lower inner quadrant. Histologically this was a benign cyst. The irregular opacity along the nipple line posteriorly is a Summation shadow.

Impression: Benign cyst.



A 37 year old Black woman whose main complaint was a "prickly" feeling in both breasts for 3 months. She was a Para 4 and had been on the contraceptive pill for 9 years. Clinically the breasts felt nodular and were tender on deep palpation.

Mammogram: There is bilateral fibroadenosis with numerous "microcysts". This has also been described as "snowstorm fibroadenosis".

Conclusion: Fibroadenosis.

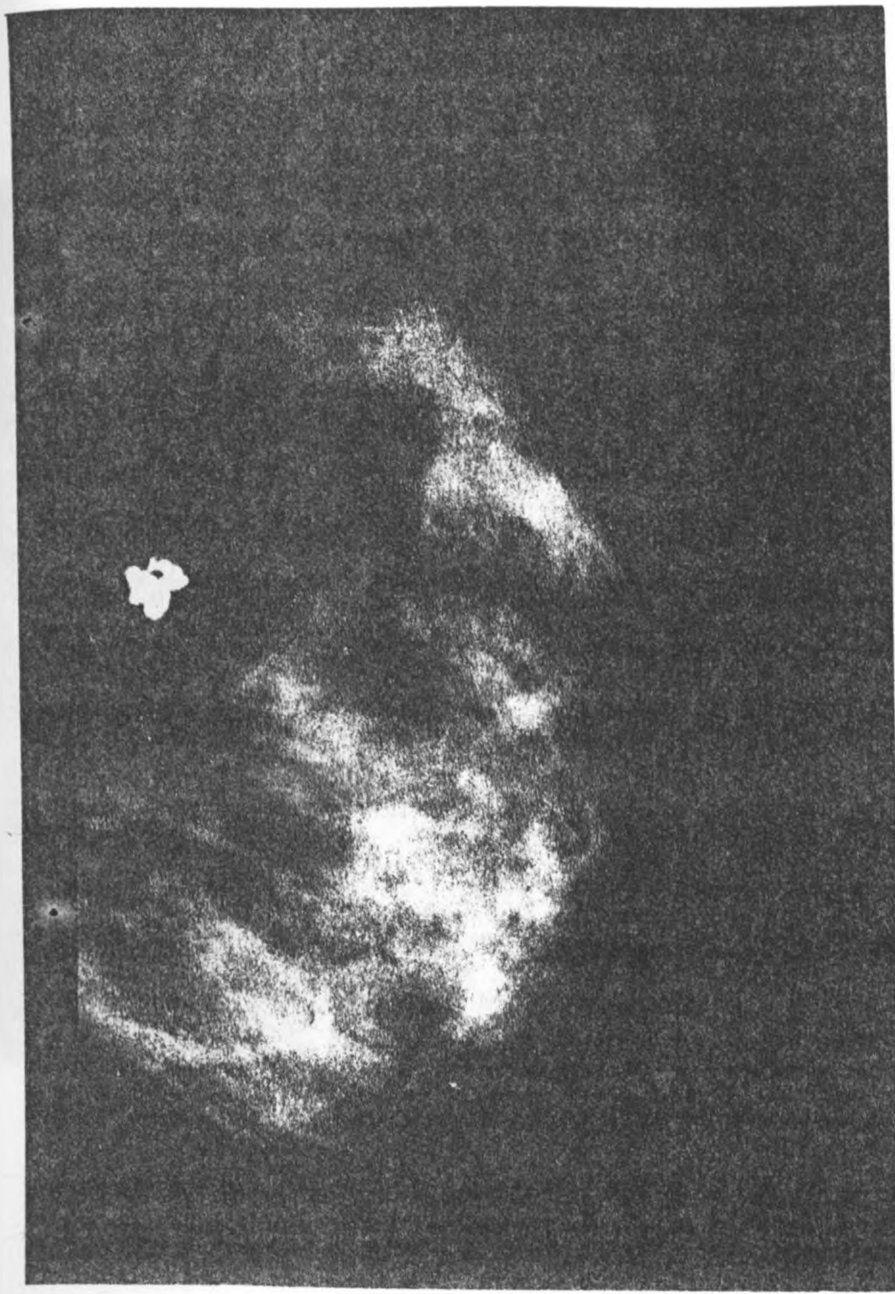


A 53 year old Indian patient who had a left mastectomy one year previously for carcinoma of the breast. She was on radiotherapy and came to the clinic to rule out metastasis in the right breast. She was a Para 11. Clinically she had skin thickening especially peri-areolar and oedema of the left arm.

Mammogram: Right breast shows gross diffuse skin thickening due to lymphoedema.

No malignant nodule is seen.

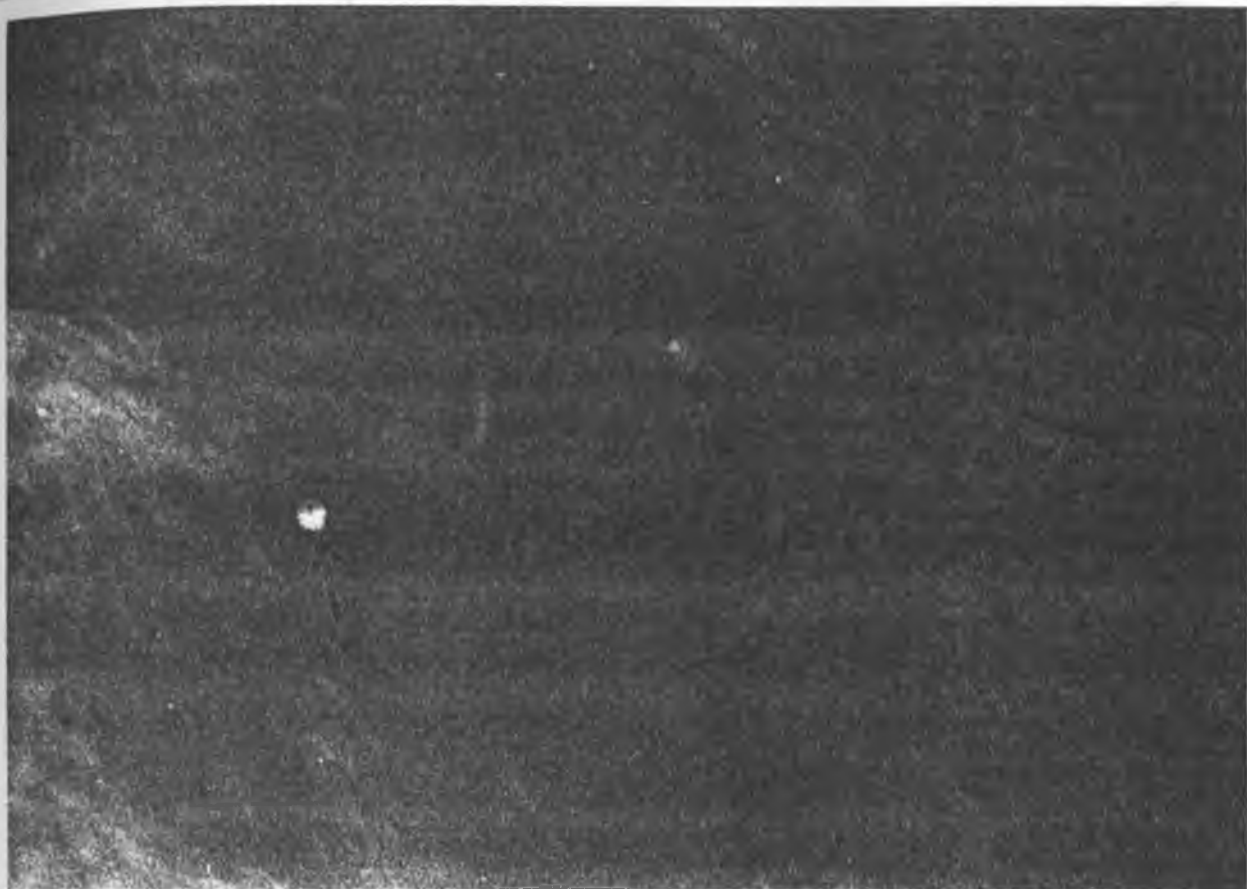
Conclusion: Lymphoedema.



A 42 year old Indian woman who visited the clinic for a check-up. She had a lumpectomy of the left breast 6 years previously which was found to be benign. She was a Para 3 and had not been on the contraceptive pill. Clinically the breasts appeared normal.

Mammogram: There is dense fibroadenosis with a "popcorn" shaped calcification posteriorly.

Conclusion: This is a typical calcified fibroadenoma (histologically proven).



An 82 year old white patient who presented with discomfort in both breasts for a period of 5 days. She was a Para 3. Clinically no definite mass was palpated.

Mammogram: The glandular parenchyma has been replaced by fibroadipose tissue. There is dense, benign duct calcification (arrows).

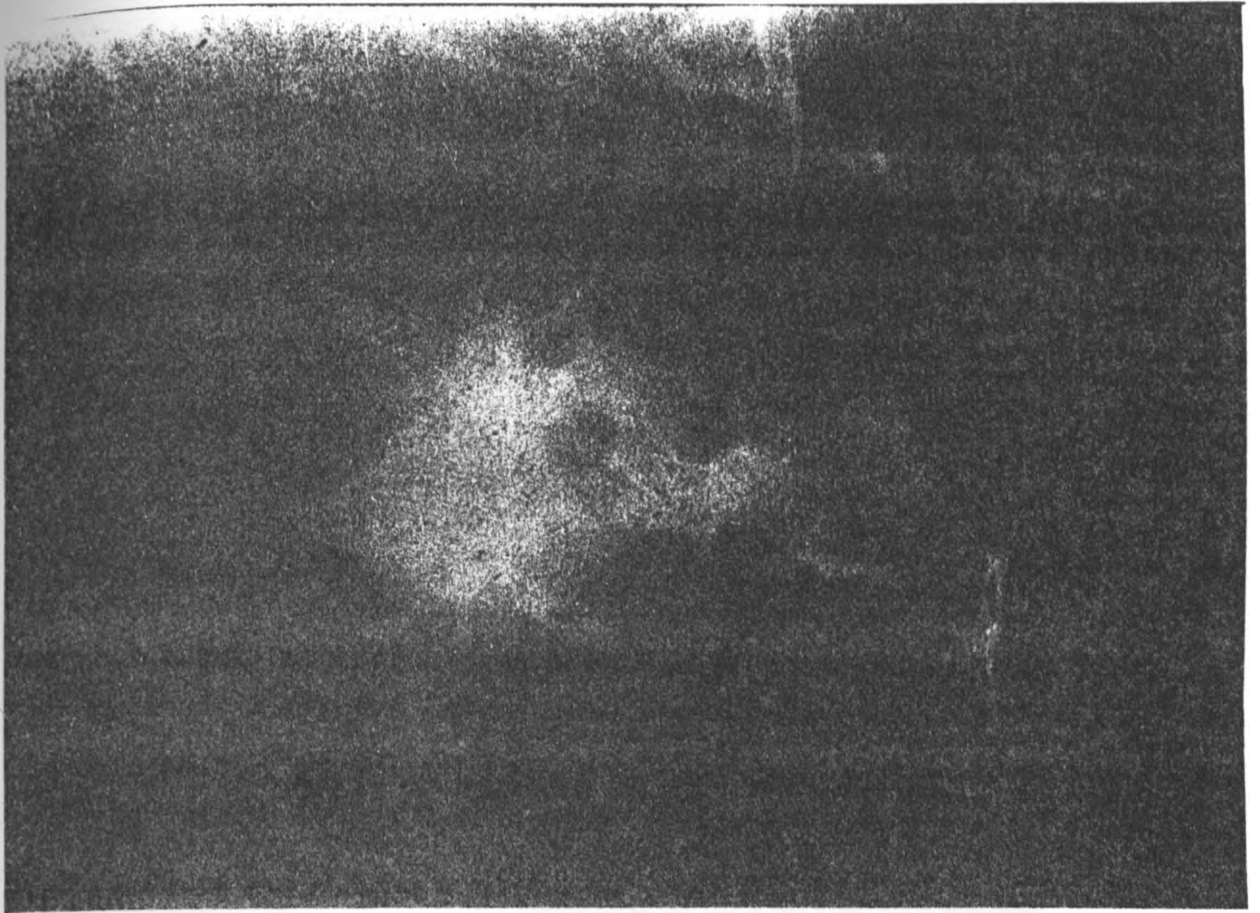
Conclusion: Involutional breast with benign calcification.



A 31 year old Indian woman who presented with a history of bloody nipple discharge from the left breast for 6 months. She was Para 2+2 and had been on the contraceptive pill for 9 years. Clinically the left breast was larger than the right, but no lump was palpable.

Mammogram: Three clusters of microcalcification with malignant features (dashes, dots and commas) are shown on this magnified oblique view.

Histology: Ductal Carcinoma.



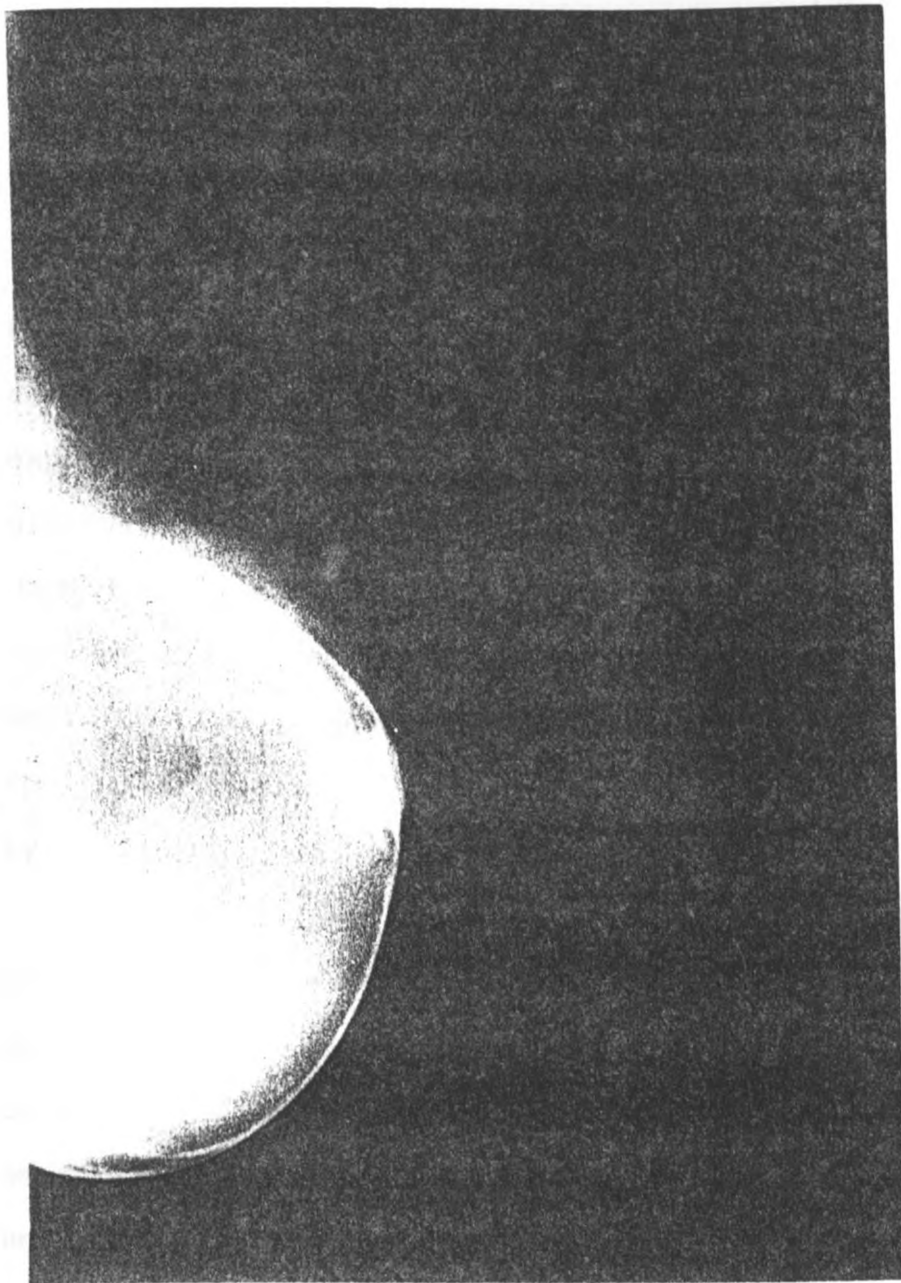
A 45 year old Indian patient who presented with a 2 year history of a lump in the right breast. She was a Para 5+1, had not been on the contraceptive pill and had breast fed each child for 2 years. Clinically a lump was palpable in the right lower hemisphere which was 2.5 cm x 2.5 cm and tender to touch. The lump was mobile and the overlying skin normal. No lymphadenopathy was noted.

Mammogram: This is a magnified image.

An opacity is seen with fimbriated margins, local hyper-vascularity and with associated trabecular destruction. The nipple is retracted. The lesion is sub-areolar and measures 1.5 cm x 1.5 cm.

Conclusion: Appearances are those of a Carcinoma.

P.S. - The black marks are artifacts.



A 36 year old white patient who visited the clinic for a check-up because of a family history of breast cancer (sister). She was Para 2+2, and had bilateral silicon mammaplasty two years previously for cosmetic reasons.

Mammogram: Demonstrates compressed glandular parenchyma in the upper hemisphere. The silicon implant is radiopaque and clearly outlined. It is possible to demonstrate an early malignancy in such a breast.

Conclusion: Breast Mammaplasty. No malignancy.

DISCUSSION

Mammography was not a common procedure until the 1960's when Egan demonstrated a high degree of accuracy in breast cancer diagnosis (14). Direct exposure film was used and the x-ray dose to the glandular tissue was relatively high. Screen-film mammography, which is performed with a high-detail intensifying screen in close contact with the single emulsion film as introduced in the mid 1970's, reduced the radiation dose. This has been repeatedly shown by various writers (8,36,37,39,42).

Increased speed films of these systems have permitted the use of a lower kVP, thus increasing contrast. The increased speed has also allowed use of an increased focal-spot to film distance and smaller focal spots, resulting in decreased geometric unsharpness. The high speed systems reduce exposure times and motional blurr. Because of these improvements in the mammographic image, and because of the lower x-ray dose with screen film technique, screening patients for breast cancer has become a viable reality.

Before discussing the results obtained during this study, it would be appropriate to give a

brief overview of the Mammographic machine. It has already been mentioned what its special features are, and the reasons for their incorporation are as follows:-

1. Optimum contrast in soft tissue examination is obtained with x-rays 0.6 to 0.9 A° wavelengths. Only a molybdenum anode can produce maximum concentration of x-rays in this particular range.
2. Inherent filtration is reduced to a minimum and any unwanted energy is cut-off by means of a molybdenum filter.
3. The most efficient KV valve is 20 to 40 kVP. This is achieved using 30 to 40 mA. Exposure times are selected manually using an adequate timer or by means of a phototimer (automatic).
4. By using a stationary anode with a small focal spot of 0.7 mm, geometrical unsharpness is minimal.

The use of rare earth screen-film combinations, further enhances the sharpness of the image.

It is worth noting the fact that the standard views being taken at the clinic were axial (or supero-inferior) and a modified lateral. It is not

possible to do a true oblique view as the tube cannot be tilted. An attempted oblique (modified lateral) is being done whereby the patient is made to sit at 45° to the cassette holder. Because the tube is fixed and can only be moved perpendicular to the cassette, this is the best compromise to a true oblique. Although much of the axillary tail is visualised, the anterior chest wall cannot always be included. Positioning the patient in this way also results in tension of the glandular component.

Supplimentary views include a true lateral axillary for the axillary tail. However, there is abundant literature written in favour of the true oblique view, and it is now internationally accepted so that all modern centres now routinely do only the axial and oblique views instead of the lateral. The oblique view is far superior to the modified lateral (29) because it allows visualization of the axillary tail and posterior breast tissue. The angle of the oblique view varies from 30° to 60° but is usually 45° .

Finally, with regard to radiography, other points should be noted. Firstly modern Mammographic machines have a special stiff compression device which is parallel to the film and made of translucent

plastic material so that the breast can be viewed through it. This attains optimal compression as compared to achieving compression by the use of the collimator cones.

Secondly it is almost routine elsewhere to use Grids. Scatter radiation significantly reduces subject contrast especially for thick dense breasts (3,4,46). The scatter radiation can be reduced by vigorous compression but there is a limitation. Both moving and stationary grids are now available which are particularly useful in dense breasts or large tender breasts that cannot be compressed. There is sufficient evidence to support the use of grids, in these patients (7,10,27,38).

Thirdly, the use of a phototimer is best avoided. The NCRP report No 85 (33) has highlighted various problems with its use and most centres are now using manual exposure time settings.

AGE DISTRIBUTION

Mammography was carried out on 1,744 patients aged between 9 and 86 years. Subsequently, the patients were grouped into three basic categories:-

Patients with Normal Mammograms	674
Patients with Benign disease	997
Patients with Malignancy of the Breast	<u>73</u>
	<u>1,744</u>

The above distribution is according to the mammographic reports.

The majority of patients seen had benign disease. Table/Graph I shows an interesting single peak age incidence for normal and benign patients while breast cancer patients have two peak age incidences. About 40% of normal patients and those with benign disease fall in the 31-40 years age group. Also the graph is "bell-shaped" for both categories.

However, breast cancer has two peak incidences, one between the ages of 31-40 and another between 51-60 years. In western countries, the peak incidences are later - ages 40-50 and 60-70 years.

In this study 85% of patients with breast cancer were between the ages of 30-60 years. This shows breast cancer to be a disease of the middle to elderly age groups.

ETHNIC AND GEOGRAPHIC DISTRIBUTION

Table 2 and 3 show the ethnic and geographic distribution respectively. A higher incidence of breast cancer is seen in the Asian population (these are Indian settlers from the Indian sub-continent). Benign disease does not appear to be significantly different. It is not within the scope of this study to analyse the reasons for this higher incidence, but it is of concern (similar data has been found with regard to Japanese settlers in the U.S.A.).

The geographic distribution, as expected shows that most patients seen at the clinic were from within Nairobi. Being the only Mammographic centre in East and Central Africa, about 7% of the patients were from outside Kenya. It is important to note that this is NOT the geographic distribution of breast disease but an indication of referral patterns of doctors.

INDICATION FOR REFERRAL

The commonest indication for referring a patient for mammography was pain and/or tenderness, as shown in Table 4. The other indications are shown

in this table, and all three categories have similar indications. However, it should be noted that about 20% of patients with breast cancer presented with skin symptoms or signs. As this is a relatively late sign in breast cancer, it demonstrates the rather late presentation of these patients to the clinic.

In a similar study, Nathan et al (32) did an evaluation of common indications for mammography at the Hammersmith Hospital in London. They found that the commonest indication was nodularity 34%, followed by solitary lump 20%, previous mastectomy 18%, mastodynia (Mastalgia) 10%, Nipple Discharge/Retraction 10% and only 8% presented due to other indications which included skin involvement in breast cancer. This shows that in Western countries the patients present earlier e.g. due to a mobile solitary lump or nodularity. The above breast clinic is also a referral centre and not a screening unit.

Our referral list does not include lumps. This is because many patients who complained of a lump in the breast were found to have nodular breasts. It was decided not to include these in the list because

the patients misinterpreted the meaning of the term "lump". Of those patients who did have a lump it was found that the ratio of lumps in the two breasts was about equal.

PARITY

Table 5 is drawn up to show the parity of patients seen at the clinic. Malignant disease appears to show a reverse percentage of patients with increasing parity. 30% of patients with malignant disease had a parity of 5 or more. This is not because higher parity predisposes to breast cancer. Table 1 shows that most patients with breast cancer are in the middle and older age groups. As a result, they are likely to have a higher parity. Normal patients and those with benign disease are of a younger age group and therefore, being still in their reproductive years are likely to bear more children. It was not possible to compare normal patients with those who had breast cancer in similar age groups. However, these findings are in keeping with world literature showing that parity has no predilictional value.

AGE AT FIRST PREGNANCY

There is no table given in the results because no correlations were found between benign or malignant breast disease and age at first pregnancy.

BREAST FEEDING

There has been a lot of controversy about the association of breast feeding with breast cancer. Although a higher proportion of patients with breast cancer were found to breast feed, (Table 6), this is probably because the majority of patients were older and in the past most women used to breast feed. The younger generation under western influence tends to breast feed less. In our study anyone who breast fed each child for at least three months continuously, was put in the "Yes" category.

ORAL CONTRACEPTION

As with breast feeding, there are contradictory reports on association between oral contraception and breast cancer. This study (Table 7) did not show any association. Only those patients who had taken oral contraception for at

least six months were categorised into "Yes".

FAMILY HISTORY

A positive family history of breast cancer in the mother of the patient or the immediate family of the mother was regarded as positive. No family history on the father's side of the family was considered. Table 7 shows the results obtained. In percentage terms, half as many patients with breast cancer had a positive family history of breast cancer as compared to normal patients. There is a well known higher incidence of breast cancer, worldwide, in patients with a positive family history.

LOCATION OF BREAST DISEASE

All patients with benign or malignant disease who had a lump that was seen on mammography are tabulated in Table 9. In the malignant group only patients with a clearly demarcated carcinoma are categorised into quadrants. Benign lumps include cysts, galactocoeles, fibroadenomas etc. All cancers which were retroareolar or those which were diffuse are classified under "All quadrants and retroareolar".

It is evident that most breast lesions, be they benign or malignant, occur in the upper outer quadrant.

Haegensen (23), in his data, found a similar distribution. This is shown and compared with the results from this study in Table 10.

In the breast, most of the glandular tissue is found centrally and laterally. Because virtually all breast cancers arise from the glandular tissue, results show that the upper outer quadrant is the commonest site as it contains the largest amount of glandular tissue. This further emphasises the importance of taking oblique films to include the axillary tail which lies in the upper outer quadrant.

Therefore the objective of mammography should be to visualize the glandular tissue with as much resolution and contrast as feasible within the constraints of desired low x-ray exposure. The 45° oblique view does just that.

Benign disease follows a similar pattern to malignant disease.

THE NORMAL MAMMOGRAM

From puberty up to the climacteric, one

encounters breasts with varying degrees of connective tissue oedema. The main requisite is normality of the matrix, which has to be well-balanced without fibrous plaques or marked preponderance to fibro-fatty involution. The "haziness" of the connective tissue varies with the fluid content. Similarly, normal breasts vary in overall density without basic alteration of the matrix.

Generally, young women have denser breasts which is due to a larger proportion of glandular tissue. With age as the breast involutes, there is greater fatty replacement and the density on mammogram reduces. However, it is not so clear cut as there are various factors that change the density, especially hormonal stimulation as seen in the glandular lactating mother. In patients who diet regularly (especially younger patients) the mammograms are particularly dense due to absence of fat and this can easily mask cancers. The size and shape also show a wide variation, some of which are hormone dependant.

An illustration is shown of pubertal breasts.

At puberty, there is sudden development of the connective tissue matrix with heavy congestion due to marked hormonal action giving increased vasculature and capillary permeability. Multiplication of epithelial buds occurs with this connective tissue accompaniment. The appearances are those of a small breast that is hazy, dense and cloudy. It can easily obscure a small mammary cancer.

The normal breast of young or adult women consists of well-balanced and orderly alternate opaque and clear areas. These are multiple chambers or roughly oval clear spaces surrounded by dome-shaped walls. The periphery shows greater density and is connected to the subcutaneous zone by triangular connective tissue prolongations called "Duret's Crests". These are lost in fibroadenotic breasts.

Post-menopausal breasts undergo a fibro-fatty involution and lose their density. These breasts are ideal for picking up pathology as there is no glandular dense masking effect as seen in younger breasts.

As mentioned, the breast mammogram shows alteration in lactating women and also during

the menstrual cycle.

BENIGN DISEASES SEEN ON MAMMOGRAPHY

All non-cancerous lesions are classified under the term benign mastopathies and all cancerous lesions under the term malignant mastopathies.

Diffuse benign mastopathies are further classified into various sub-groups. The nomenclature is still unsettled and confusing but for the sake of simplicity, all these are classified under FIBROCYSTIC MASTOPATHY. Included here are lesions normally described as FIBROADENOSIS, FIBROUS HYPERPLASIA, SNOW-STORM FIBROADENOSIS etc. On mammo-graphy, the main appearances of fibrocystic mastopathy are: increase in density, loss of the normal matrix architecture with confluencing homogenous density and disappearance of "DURET'S CRESTS". The changes may be widespread in the breast or localized clear rounded cysts may be visualized.

Besides these benign lesions specific localized lesions may be seen. These include:-

- Cysts - Rounded contoured density.
 Its density is always less than
 that of fibrous tissue and
 more than that of fat.

- Solid tumours - Fibroadenoma present as dense, homogenous, rather oval and often mamillated image with well defined outline. Sometimes it shows characteristic calcifications but more often there is no calcification. This is the solitary tumour of the young woman. It is usually grouped under fibrocystic mastopathy. Lipomas are also solid tumours and appear radioluscent, and rounded with a clear margin.

It is important to note that benign lesions are slow growing and normally have a luscent "halo" around them due to compression of fatty tissue. These are important differentiating factors from malignant lesions.

Various illustrations of benign lesions are included in the results. Under each one, there is a brief description of the lesion shown.

Table 11 shows a list of all the benign mastopathies as diagnosed on mammography. Fibrocystic mastopathy is the commonest representing 80%

of all cases.

89 patients had localized cysts without associated fibrous dense tissue as seen in fibrocystic mastopathy. 16 galactocoeles were shown, all in lactating breasts and 14 intraductal papillomas. The latter all presented with bleeding through the nipple. 49 patients had secretory disease - or benign duct ectasia.

Besides the above, various other benign diseases were seen. These include:

- Pagets Disease of the Breast
- Plasma cell mastitis
- Hypothyroid breasts
- Skin Boils
- Breast abscess
- Tuberculoma
- Haematoma
- Skin ulcer (benign)

As many examples as possible of those seen in the prospective study are shown among the illustrations.

AN OVERVIEW OF BREAST CANCER

Breast cancer is the commonest malignancy in western women (43). The 5-year survival rate has not altered in the past 25 years, despite all the apparent advances in treatment. Recent figures from the American Cancer Society (1) show an 87% 5-year survival when the cancer is localised to the breast but only a 47% 5-year survival when there is spread to the regional lymph nodes. Unfortunately, most breast cancers have already spread to lymph nodes by the time of clinical presentation (i.e. palpable lump).

Efforts have therefore been made towards the early detection of breast cancer, particularly at the subclinical stage in the hope of improving survival rates.

Many studies have been undertaken to show the advantages of screening patients in an effort to detect early cancer. Tabar et al, in 1985 in a carefully conducted study from Sweden demonstrated a 33% reduction in mortality in women of 50 years or older who had their breast cancer detected early by screening.

The advantages of early detection are twofold:-

- The earlier the detection of breast cancer

and the less the axillary node involvement, the greater the chances of treatment being successful.

- Reducing the disfigurement of treatment. The impact of a total mastectomy can be devastating to many women. Most tumours in screening series are under 2 cm in size, and a significant proportion are less than 1 cm, so that segmental resection or lumpectomy is feasible.

Various complex classifications of breast cancer have been advanced - most of which are related to surgical treatment. A brief classification suited to radiological detection is given below with the main mammographic features -The Breast(28):-

A. Epithelial tumours

The epitheliomas proliferate from the lactiferous ducts or their ramifications. Malignant epithelial hyperplasia is accompanied by secondary development of stroma. The amount of interstitial connective tissue is variable..

- (i) Intragalactophore epithelioma. Most important is Comedocarcinoma. This

is of particular interest to the radiologist. It is produced by endocanalicular proliferation of neoplastic cells which necrose forming pathological calcifications.

(ii) Infiltrating epitheliomas. This group includes 70% of breast cancers. There is varying amount of connective tissue producing streakiness. Only three types are of interest to the radiodiagnostician since they can be differentiated by mammography:-

- Advanced infiltrating epithelioma - often accompanied by a strong fibrous and inflammatory stromal reaction.
- Scirrhus Carcinoma - Very strong fibrous reaction with little inflammation.
- Colloid epithelioma - Marked mucous secretion in which detached tumour cells are seen to float.

It is important to note the problems attending the distinction between an acute inflammation and a cancer presenting the clinical picture of carcinomatous mastitis in which the radiological diagnosis

is very difficult since it resembles an abscess.

B. Mesenchymatous tumours or sarcomas

They are rare. Among sarcomas only the fibrosarcomas are seen.

C. Haemopathy deposits in the breast

Hodgkin's disease of the breast has been reported.

Photographs are included in the results to illustrate some of the findings in breast cancer.

ACCURACY OF MAMMOGRAPHIC DETECTION

An attempt was made to try and get a definitive diagnosis for every patient mammographed at the clinic. As previously mentioned, each referring doctor was contacted about their referrals. Unfortunately it was impossible to get a reliable feedback on every patient. Only the suspicious lumps were biopsied by referring doctors and some benign cysts aspirated. Almost all the patients diagnosed as malignant cases were biopsied and a good feedback was available regarding histological results. Some of the benign cases were also biopsied but a vast majority were managed conservatively following the mammography report. In the absence

of mammography, it is likely that many of the patients who presented with lumps would have been subjected to a biopsy. In these patients, who did not have a histological diagnosis, a follow-up was done for a minimum of six months. Any patients not followed up for at least this period of time could not be "labelled" with a diagnosis. Normal patients and those with benign disease whose condition did not deteriorate or showed no malignant change, were categorised on clinical grounds.

As a result, of the total 1,744 patients mammographed, only 483 could be "definitely" labelled with a diagnosis, within the constraints of acceptable accuracy. Table 12 shows the distribution of these 483 patients. There were 60 confirmed malignant cases all of which were histologically proven. Of these 57 had been correctly diagnosed on mammography so that there were 3 false negatives. These three had been diagnosed as benign cases. Of these one was a tuberculoma with calcification, and one was Pagets disease of the breast. The third was an intraductal carcinoma. There were also 5 false positives all of which were diagnosed mammographically

as suspicions of malignancy but were histologically shown to be benign.

Similarly Table 12 shows that there were 241 benign cases of which 233 were correctly diagnosed on Mammography. There were 10 false positives, of which, as mentioned above, 3 were malignant cases, the other 7 being normal. Eight patients with proven benign disease were not diagnosed correctly on mammography - five of them had been diagnosed as malignant and 3 as normals.

Of the 182 patients found to have no breast disease, there were 3 false positives all of which had histologically proven benign disease. There were 7 patients that had no breast pathology but had been diagnosed mammographically as having benign disease.

At this stage it is important to point out that the biopsied cases are being regarded as representatives of all the cases. Many patients could have been biopsied abroad with no follow-up available. However, the biopsied patients form a statistically large enough sample to arrive at conclusions without significant bias.

Table 13 compares the results in this study with those by other authors.

Egan (1964) (11) in a personal series of 3,818 consecutive mammograms encountered 728 breast cancers and correctly diagnosed malignancy in 97.1%. In 482 patients with benign breast disease he interpreted the mammograms of 44 as malignant, a false positive incidence of 9.1%. Clarke et al (9) assessing the reproducibility of Egan's Mammographic technique, reported the findings of 5 radiologists who correctly diagnosed 376 of 475 breast cancers (79.5%). In the latter series 106 out of 1095 benign breast lesions were regarded as malignant radiologically (9.6%). Friedman et al (18) reporting a combined study from 7 Philadelphia teaching hospitals, examined 3,882 patients by mammography. Of 233 patients with breast cancer, 159 (68%) were correctly diagnosed and 50 out of 543 patients with benign lesions (9.2%) were interpreted mammographically as cancers. In another combined study, Egan (1964) reported the results obtained by 38 radiologists who had received an intensive 5 day training course in mammographic technique and interpretation. In all 10,743 mammographic examinations were performed and 528 out of 602 breast cancers were correctly diagnosed (87.6%)

with 82 of 1,254 benign lesions interpreted as malignant (6.5%). In England, Stewart et al (1969) (40) correctly diagnosed 209 of 228 patients with breast cancer (92%) and James & Irvine (1969) (36) suspected or diagnosed malignancy in 50 of 55 patients with breast cancer (90%). In the latter paper, 46 benign lesions were reported. Two were thought to be malignant radiologically (4.3%) and in a further 9 the diagnosis was regarded as "equivocal".

Nathan et al (1971) (32) in their study at the Hammersmith hospital mammographed 892 patients. Subsequently, 84 patients were found to have breast cancer of which 74 had been diagnosed mammographically (88%). Histologically proven benign lesions were found in 145 patients and 14 of these had been diagnosed radiographically as malignant (9.7%).

The results of this present study at the Aga Khan Hospital, Nairobi are also listed in Table 13. Fifty seven of the 60 cancers were detected mammographically (95%) and only 5 of the 241 benign cases had been reported as malignant on mammograms (2%). This shows that the accuracy in picking up breast cancer on mammograms is in keeping

with other authors. However, the percentage of false positives was very low (2%) as compared to the other authors. The reasons for this are discussed after calculations of the sensitivity and specificity of the results. The following quotation is as appropriate for screening mammography as it is for diagnostic mammography:

"The value of a diagnostic test lies in its ability to detect patients with disease (its sensitivity) and to exclude patients without disease (its specificity). For tests with binary outcomes, these measures are fixed" (30). It is therefore assumed that the true-positive rate is a statistical approximation to test sensitivity and that the true-negative rate is a statistical approximation to test specificity.

Table 14 shows the interpretations from mammograms compared with the histologically confirmed diagnosis. Overall, the sensitivity was 95%, specificity 99%, positive predictive value 92% and negative predictive value 99%.

A number of studies (Table 15) have dealt specifically with the sensitivity and specificity of mammography in screening programmes.

Although the Aga Khan Hospital unit, is not a screening centre, the results of this study are compared with those above.

Chamberlain et al (5,6) reported improved sensitivity over time for first screen mammography in a study in which a false-positive was a decision by the radiologist to refer a woman for review who did not prove to have breast cancer. Gohagon (19) examined screening by mammography alone, based on rescreening as well as first screen data. Hicks et al (24) reported a sensitivity of 62% similar to Gohagon and Chamberlain et al, but their reported specificity was much lower, at 51%. Goin et al (20) looked at 38 consecutive incident breast cancer cases (those occurring after an initial screen) in one screening center and found sensitivity and specificity of 72%. However, in their study only 40 healthy control subjects were used so that in the sample read, there was already prior probability of 50% breast cancer which is not comparable with the screening situation.

Goldberg and Wittes (22) estimated the sensitivity of first screen mammography but reported specificity only for combined physical and mammographic screening which is not applicable.

Their model, which used the New York Health Insurance Plan data (34), probably gave unwarrantedly high false negatives. (If sensitivity is 29% as shown in Table 15, then the false negatives are 71%).

Moskowitz (31) reported a sensitivity of 72% and specificity of 96% for mammography in a screened population but gave no data for first screening.

Data from Tabar et al (41) suggest that on the basis of a 5% "call" rate at the radiologists initial reading of first screen mammograms, the Swedish screening programme had an estimated sensitivity and specificity of 95% and 96% respectively. However, since data have not been reported on blind review of second screen mammograms, it is not possible to determine sensitivity for the Swedish trial in the same way as the rest.

The Canadian National Breast Screening study (NBSS) report (2) by Banies C. J. et al reported sensitivity of 69% and specificity of 94% in a study involving 23,101 first screen mammograms. This is the most recent study and with such a large sample read, the results are indicative of most first screening centres in the West.

As Moskowitz (31) has pointed out, sensitivity and specificity are influenced by prior

probability of disease in the population. The prior probability of breast cancer at first screening is obviously greater than at second screening.

The present study was carried out at a referral clinic. Patients seen already had a higher prior probability of breast cancer as compared to the general population. Besides this, almost all the patients presented with symptoms which meant that the size of the neoplasm had already reached a significant level to cause symptoms.

All authors referred to in Tables 13 and 15 were reporting on cases seen at screening centres. Their probability of picking up cancer is lower and also, most cases diagnosed are at a very early subclinical stage. It becomes more difficult for the radiologist to diagnose a small ill defined carcinoma of the breast as compared to a larger, more frank, cancer. The identification of subclinical (malignant) lesions in symptomless women involves detection of malignancies less than 1 cm. in size. Symptoms usually set in once the tumour size is 2 cm. or greater.

The feed back from referring doctors was

rather deficient in detail. Most proven malignancies were recorded only as "Ca Breast" with no reference to the histological type. Nevertheless they were histologically proven cancers. From the mammogram reports, most cancers were 2 cm or more in size. As a result of this rather "easier" detection, the sensitivity of mammographic accuracy in this study are remarkably good, being the highest among all the authors in Table 15. However, the specificity, which is the ability of the test to exclude patients without disease was a staggering 99%. This cannot be attributable to late presentation of patients. Table 13 shows that only 2% of the total 241 benign cases had been wrongly diagnosed as malignant. This compares with an average of 8.1% for all the other authors. It is probable that because one is looking for very small lesions in a screening programme, there is a higher likelihood of picking up false positives in benign breasts - especially those with glandular hyperplasia and generalised fibroadenosis.

Nevertheless, the above results show that the accuracy of mammography reporting has been exceptionally good and that it has not been attained at the expense of a poor specificity.

POINTS TO PONDER

Certain parameters taken during this study were either unrelated to the goals of the study or proved statistically unfavourable to discuss. However, certain data produced interesting results and are briefly mentioned. An attempt had been made to record the blood groups for every patient seen at the clinic and to evaluate whether or not a correlation exists between Ca breast and certain blood groups. Unfortunately, less than half of the patients attending the clinic were sure of their blood groups.

Table 16 shows the distribution of blood groups in each category. These are compared with the distribution of blood groups in the Kenyan Population (35). The normal patients and those with benign disease have a similar distribution to the general population. However, a rather large percentage of patients with breast cancer were found to have Blood Group A. It is not within the scope of this study to go into details of this discrepancy in distribution but it is intended that further work in this field will be done.

Although not tabulated, no correlations were found between breast cancer and age at menarche or breast cancer and age at first pregnancy.

CONCLUSION

1. The age distribution pattern of patients with breast cancer shows that it tends to occur earlier in patients in this region as compared to Western countries. Two peak incidences were found (as in the West) and both were earlier than those reported in Western literature.
2. The ethnic distribution shows that breast cancer is more prevalent in Indian settlers of Asiatic origin, and surpasses that of the White Settler population.
3. Pain and/or tenderness appears to be the commonest complaint in patients with breast cancer and those with benign disease as well.
4. With reference to the referral symptoms and signs, it is apparent that patients present with breast cancer at a more advanced stage than in the west. A large proportion already had skin involvement which is a late feature.
5. Parity, age at first pregnancy, breast feeding and use of oral contraception were found to be of no predilictional value in breast cancer.

6. Patients with breast cancer reported a 50% higher positive family history on the maternal side as compared to others. This suggests a hereditary preponderance.
7. Most breast disease occurs in the upper outer quadrants where the majority of glandular tissue is located. These findings are similar to those of Haagensen (1971).
8. The radiological accuracy of Mammography in the detection of breast cancer was found to be high. It therefore has a very useful role to play in the early detection of breast cancer.
9. The specificity of the Mammographic reports is also remarkably high. This confirms that the facility is providing useful information to regional surgeons, without which all lumps would have to be biopsied to ascertain their nature.
10. The radiographic quality of the mammograms was good and achieved without increasing the radiation dosage to patients. Some recommendations are made, especially with regard to improvements in the mammography of dense or large breasts.

11. A high incidence of breast cancer was found in patients with Blood Group A. It is contemplated that further work will be done in this field.

SUMMARY

A retrospective and prospective study was carried out on 1,744 consecutive patients mammographed at the Aga Khan Hospital, Nairobi, between January 1981 and June 1987. All patients were interviewed with the intention of obtaining information regarding breast cancer risk-related parameters - which were subsequently analysed.

75% of the patients were from within Nairobi and the remaining from rest of Kenya and neighbouring countries. Mammographically 4% of patients were found to have breast cancer, 57% had benign breast disease and 39% were found to have detectable breast lesion.

Histologically proven breast cancer was found in 60 patients with peak age incidence of 31-40 years and 50-60 years. Although all ethnic groups were almost equally represented in the study sample, 49% of patients with breast cancer were Asian settlers of Indian origin.

Approximately 60% of breast lesions were located in the upper outer quadrant of the breast, and a larger percentage of patients with breast cancer had a positive family history as compared to the rest

- suggesting hereditary implications.

The radiography was found to be good and mammograms of good diagnostic quality. Some recommendations are made with regard to technique and improvements to the senograph itself.

Overall, the mammographic accuracy of breast cancer detection was as follows:-

Sensitivity 95%,

Specificity 99%,

Positive predictive value 92%,

Negative predictive value 99%.

RECOMMENDATIONS

With regard to radiography at the clinic:

Although the standards were high a few recommendations are listed below

1. A true oblique should be taken routinely in all patients. The advantages of this view are enumerated elsewhere, but because most lesions were found to occur in the upper outer quadrant, the use of this view is even further warranted.
2. An additional transparent compression device is recommended to achieve uniform compression.
3. The use of grids in larger and dense glandular breasts has been discussed. It is a very useful addition to the senograph.
4. All the exposures were taken using an automatic phototimer. It is preferable to use manual settings because they can be varied according to breast size and density.

It was noted, with concern, that very few patients (especially those in the high risk age groups) visited the clinic on their own accord.

In Western countries all women above the age of 40 are recommended to have yearly mammograms. This should be encouraged in our region and the onus

lies on doctors to increase patient awareness of the benefits of early detection of breast cancer.

The fact that breast cancer appears to affect a younger age group in our environment, further emphasises the need for screening patients for nonpalpable cancers.

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