Artefacts In Mammography: A Three year experience in a new teaching hospital. Pictorial Essay

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Citation

Abstract
In radiology, an artefact is a substance or structure not naturally present in living tissue, but of which an authentic image appears in a radiograph1. The accuracy of interpretation of a mammography image depends mainly on the quality of the radiographs. A good quality image has greater sensitivity and specificity. The presence of artefacts on a mammogram could obscure abnormalities or create false images, which will lead to misinterpretations. Therefore the radiologist has to be familiar with the various types of artefacts which could be encountered while reporting.

This study reviewed artefacts seen in mammography in the Lagos State University Teaching Hospital, Lagos, Nigeria in a period of three years, with a view to reducing misdiagnosis.

INTRODUCTION
The role of the technologists in film processing cannot be overemphasised, as their inability to recognise artefacts so as to effect immediate amendments will militate against the production of good quality images which is a prerequisite for accurate interpretation.

Artefacts cause the degradation of film quality and image artefacts would allow for rejection of the images2,3,4. Artefacts may be caused by the patient, equipment, the act of processing and the processor itself. Some may be clearly obvious while others cause false images. Interpretation of images are marred on the long run and misinterpretation results in misdiagnosis which ultimately lead to undesired consequences.

We demonstrate the variety of artefacts encountered on reviewing mammograms done in our centre in the last three years.

MATERIALS AND METHODS
All mammograms of patients sent to the radiology department of LASUTH from August 2003 to August 2006 for diagnostic and screening mammography were reviewed with particular attention to the variety of artefacts seen. At least two views were taken, the cephalocaudal and mediolateral views, using a Melody Villa Systemi Medicali stereotactic biopsy mammography machine. Where necessary a spot compression view was also done. Viewing boxes were well lit and magnifying glasses were employed. All films suspected to have artefacts were retaken to confirm their presence or otherwise. The various types of artefacts were classified depending on their origin and documented.

RESULTS AND DISCUSSION
The artefacts were classified by origin into those due to the patient, due to technician and bad dark room habits, film processing, the processor and to the equipment itself.

PATIENT RELATED ARTEFACTS
Artefacts could result from patients themselves, ranging from misinformation when they were scheduled for the examination, as in wearing deodorant or talc powder and lotion which should be avoided, movement during the examination, articles on their body overlying the breast during the examination, such as hair, jewellery, hand, clothing, chin, and even the other breast Fig 1,2,3,4.
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Figure 1
Figure 1: A cephalocaudal view showing a patient related artefacts caused by overlap of an object (fingers) in the lower medial quadrant of the breast.

Figure 2
Figure 2: A cephalocaudal view of the right breast showing a clothe artefact with roller artefact overlapping the upper inner quadrant of the breast.
Figure 3
Figure 3: A mediolateral view showing the raised arms as an artefact in the upper medial quadrant and a scratch artefact

Figure 4
Figure 4: A mediolateral view showing the patient's chin as an overlying artefact in the upper medial quadrant and an artefact over the anterior margin of the breast.

Most artefacts caused by superimposed objects are readily identified and are easily corrected by repeating the exposure after first making sure that the overlapping object is safely out of the path of the x-ray beam.

ARTEFACTS DUE TO TECHNICIANS AND DARKROOM RELATED ARTEFACTS

Some of the artefacts were attributed to use of nail polish and hand lotions by the technician and faulty techniques by radiographers, such as choosing poor exposure factors or loading the film upside down.

Dark room artefacts encountered were due to darkroom faults, such as dirty intensifying screens, faulty or careless loading of films into cassettes, worn out cassette locks, bad dark room habits and cleanliness, poor chemical quality or mixing, use of cell phones and light leaks in the dark room.

The processing techniques are also an important factor in eliminating artefacts.

Initially, manual processing was the only mode of processing available in the department and the artefacts
peculiar to this mode of processing is shown in Fig. 5.

**Figure 5**

Figure 5: Mediolateral view of the left breast showing artefact due to manual processing and poor chemical admixture. The punctate opacity above and behind the nipple is grain or dust artefact.

Improper developer fixation causes incomplete film fixing which leads to fading and brownish discoloration of the film, Fig 6.

This problem may be caused by loss of circulation in the fixer tank, under replenished or improperly mixed fixer, or low fixer temperature. Dust or grain artefacts (Fig 7), were the commonest seen artefacts on mammograms in our study as was found by other authors.
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Figure 7
Figure 7: Mediolateral view of the breast showing dust artefacts giving minus density particles on the film

These simulate calcifications. They are due to dust particles on the intensifying screen which prevent light from the intensifying screen from reaching the film. It is avoided by daily and weekly cleaning of the intensifying screen. Grain artefacts could also be as a result of sand particles in the water used in processing the films. The predominance of this type of artefact in our study is probably due to our source of water supply which is from the bore hole and is quite sandy.

Technologists should also not wear nail polish or hand lotion, as these produce dust particles.

Figure 8
Figure 8: shows a bizarre artefact which usually occurs if film is loaded into a cassette before it dries. It is therefore recommended that the cassette should be air dried for at least 30 minutes before loading and wiped with a screen cleaning material and lint-free material to avoid minus density or pick-off artifacts.
Figure 10: Mediolateral view showing fingernail prints. Fingerprints left after exposure show as a plus density (black) while those left before exposure will give a minus density (white).

Clumping of silver halide granules can also occur if the dryer is too hot and water droplets form during the drying process. It is recommended that the dryer temperature be set as low as possible while still producing films that are sufficiently dry when they exit the processor.

Washing the hands to rid them of grease and lotion prior to film handling and not allowing food and beverages in the darkroom help prevent fingerprint artefacts. Pressure artefacts can be caused by touching the film with the fingernails or fingertips or by improperly storing film boxes lying flat rather than standing on end. Fingernail marks are seen as plus-density or dark curvilinear artefacts, Fig 9.

Figure 11: A cephalocaudal view showing under penetration due to improper loading of film.

Fingertip pressure artefacts appear as minus-density oval artefacts that may be mistaken for a nodular lesion if seen on only one view. If repeated, neither artefacts should be present on the image.

Loading films upside down or loading double film will cause underexposure (Fig 10).
Mobile phones should not be used in the dark room as the light they show may cause film fog.

**EQUIPMENT RELATED ARTEFACT**

Some artefacts were due to faulty equipments such as poor compression, faults due to bad processor (mainly as a result of defects in the rollers). These types of artefacts were rarely seen in our study, most likely because these equipments were new. The processor related artefacts is usually due to worn out, uneven or erratic rotating rollers, excessive build up of developer on rollers or excessive roller pressure, as seen in Fig 11a and b.
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Figure 14
Figure 12: Mediolateral view showing an artefact due to running films too close together through the processor.

Adequate processor cleaning, chemical replenishing and proper processor adjustment helps prevent this. Artefacts may also be due to running films very closely through the processor, (Fig 12) causing them to overlap and stick together, potentially ruining both film.

Figure 15
Figure 13: Metallic artefacts due to compression equipment on a spot compression view

The compression component of the equipment is seen as a metallic artefact, Fig 13.

{image:15}

CONCLUSION
In this series, most artefacts were found to be mainly as a result of careless darkroom habits, processor and processing faults. The source of water used in the dark room was from the bore hole which might contain sand particles that could account for the grain artefacts. Artefacts due to the equipment were virtually non-existent, probably because the machine was new. This study has helped to emphasize the importance of ensuring excellent quality control at all times so that good quality mammograms are produced.

Most artefacts are readily recognized and do not pose any diagnostic difficulties. Others may give impressions of false lesions or mask true lesions. Radiologists and radiographers should be familiar with the variety of artefacts and how they can be avoided. Majority of mammographic artefacts can be eliminated by taking into cognizance, cleanliness in the darkroom, careful film handling, frequent planned maintenance of the processor and replenishment of chemicals, daily quality assurance checks and meticulous patient positioning during mammography procedures.

References
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