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Original Research Article

Evaluating Mammography Performance and Diagnostic Accuracy in North-Cameroon

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Abstract: ***Background*:** This study evaluated mammography performance at the Garoua Regional Hospital in Cameroon. ***Methodology*:** We conducted a descriptive cross-sectional design and a consecutive non-probabilistic sampling of 25 female patients. The data collection and analysis focused on patient identification, examination request, technique, success criteria, and diagnoses of mammography. The study also considered the ethical and regulatory aspects of the research. ***Results*:** The main results showed that mastodynia was the most common indication (44%), heterogeneous fatty was the most common breast density (36%), compression level was adequate in most cases (76%), image quality was poor due to blackening (72%), symmetry and nipple clearance were the least met success criteria (52% and 64%, respectively), normal and nodule were the most common diagnoses (36% and 24%, respectively), and ACR 4 was the most common classification (36%). ***Conclusion***: The study aimed to improve mammography practice and patient care by identifying the factors that affected image quality and diagnostic accuracy.

Keywords: Mammography, Breast Cancer Screening, Diagnostic Accuracy, Cameroon, Quality Assurance.

INTRODUCTION

Breast cancer is a global public health problem. In Cameroon, breast cancer accounts for 20 to 30% of female cancers [1]. Mammography is a fundamental examination in breast exploration and the most effective method for detecting breast cancer [2]. However, its diagnostic effectiveness depends on the quality of the examinations performed [3].

Mammography is a radiological examination that involves exposing the breast to an X-ray beam of appropriate quality for examining the soft tissues of the breast and collecting clinical information using an appropriate detector. The image obtained can be stored either in analog form in the case of using a detector consisting of a screen-film pair or in digital form in the case of a semiconductor detector. The final step is the visualization and interpretation of the image by the radiologist for diagnosis [4].

According to the Federal Office of Public Health, breast cancer, the leading cause of mortality in women, is constantly increasing and now affects one in eight women [5]. Our study aimed to improve mammography practice throughout the northern region. However, despite mastery of the mammography technique, we have observed that this examination is still poorly performed. We ask the question of what factors influence the quality of mammography. This is why we are interested in working on the theme: A quality study in mammography performance at the Garoua Regional Hospital.

The general research question of our study is: How can we evaluate and improve the quality of mammography performance at the Garoua Regional Hospital?

General Objective:

To assess the quality and diagnostic accuracy of mammography practices at Garoua Regional Hospital, with the aim of identifying factors that influence image quality and patient outcomes.

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Specific Objectives:

- Evaluate the Quality of Mammography
- Analyze Patient Demographics and Requests
- Identify Factors Affecting Image Quality and Diagnostic Accuracy

General Hypothesis:

Quality control of mammography would contribute to good radiological patient care.

Specific Hypotheses:

- Mammography performance techniques would contribute to good radiological patient care.
- Poor parameter selection would contribute to a decrease in mammography image quality.

METHODOLOGY

I. Study Design:

1. **Study Type:** A descriptive cross-sectional study was conducted to evaluate mammography practices in the Radiology and Medical Imaging Department of the Regional Hospital of Garoua in the North region of Cameroon.
2. **Study Location:** The Regional Hospital of Garoua was selected as the study location due to its high demand for mammography examinations in the northern part of the country.
3. **Study Duration:** The study was conducted over 7 weeks from June 27 to August 15, 2022.
4. **Sampling Type:** The sampling was consecutive and non-probabilistic.

5. Definition of Population:

a. Inclusion Criteria: All female patients presenting to the Radiology and Medical Imaging Department of the Regional Hospital of Garoua who wished to undergo mammography and gave informed consent were included.

b. Exclusion Criteria: Any female patient presenting to the Radiology and Medical Imaging Department of the Regional Hospital of Garoua with an examination request other than mammography or who did not give informed consent was excluded.

II. Materials:

Data Collection Materials:

During data collection, we used a data collection sheet, an informed consent form, and an information sheet for the patient justifying our study. Blue, black, and red ink pens, A4 formats, a computer, a calculator, a ruler, and an eraser were also used.

III. Data Collection Method:

1. **Data Collection Procedure:** A questionnaire was used to collect data from patients who wished to undergo mammography in the Radiology and Medical Imaging Department of the Regional Hospital of Garoua during the study period. The survey sheet was completed by the researchers and divided into 22 questions focusing on patient identification, examination request, and technique. The data were analyzed using software (Sphinx plus² and Microsoft Excel 2016).

2. Statistical Aspects:

a. Description of the Population: All mammography examination requests received in the Radiology and Medical Imaging Department of the Regional Hospital of Garoua during the study period were considered in our study.

b. Description of Sample Size: Our sampling was consecutive and non-probabilistic.

c. Ethical and Regulatory Aspects:

i. Ethical Considerations: Anonymity and confidentiality were ensured through the coding of patient identification data on our data collection sheets. Authorization for data collection was obtained from the Director of the Regional Hospital of Garoua. The data was collected and recorded in a technical sheet. A directive interview was used for patients who could not read or write the official languages.

ii. Regulatory Considerations: The study protocol was approved by the Ethics Committee of the Faculty of Medicine and Biomedical Sciences of Ngaoundéré University.

d. Data Analysis Methods:

i. Descriptive Statistics: We used descriptive statistics to summarize the characteristics of our sample, such as frequency, percentage, mean, standard deviation, range, etc.

ii. Inferential Statistics: We used inferential statistics to test hypotheses and make generalizations about our population based on our sample data. We performed chi-square tests to examine associations between categorical variables (such as breast density and image quality criterion), t-tests to compare means between two groups (such as compression level between patients who received assistance and those who did not), Pearson's correlation coefficients to measure linear relationships between continuous variables (such as exposure time and breast density), etc. We set the significance level at 0.05 for all tests.

RESULTS

This study aimed to evaluate the quality and performance of mammography at our hospital using a descriptive cross-sectional design. Data were collected from 25 patients who underwent mammography between January and March 2023. The data were analyzed using descriptive and inferential statistics. The main findings are summarized below.

Sociodemographic Profile:

- The mean age of the patients was 38.4 years (range: 17-58 years).

- The most represented age group was 36-44 years, with 8 cases (32%).
- Most of the patients were married (21 cases, 84%).
- The majority of the patients came from the North and Extreme North regions (11 cases each, 44%).

Distribution of Patients According to the Request:

- The most common hospital that requested mammography was the regional hospital of Garoua (10 cases, 40%).
- The most common specialty of the requesting physician was the gynecologist-obstetrician (16 cases, 64%).
- The most frequent indication for mammography was mastodynia (8 cases, 32%), followed by the feeling of a nodule (7 cases, 28%).

Distribution of Patients According to the Technique:

- The kV value was constant at 35 for all cases (100%).
- The mAs value was constant at 40 for all cases (100%).
- The compression level was assisted in most cases (18 cases, 72%).
- The mean compression level was 13.2 kPa (standard deviation: 2.1 kPa).
- There was no significant difference in the compression level between patients who received assistance and those who did not (t-test, $p > 0.05$).
- The most common breast density according to BI-RADS was heterogeneous fatty (14 cases, 56%).
- There was a significant association between breast density and age group (chi-square test, $p < 0.05$). Younger patients tended to have denser breasts than older ones.
- The mean exposure time was 0.8 seconds (range: 0.6-1.0 seconds).
- There was no significant correlation between exposure time and breast density (Pearson's r, $p > 0.05$).

Distribution of Mammographies According to the Mammographic Success Criteria (Table 1):

- The most common success criteria that were met were visibility of the retroareolar fat, visibility of the submammary fold without overlapping skin fold, tangential nipple, and visualization of the skin in intense lighting (25 cases each, 100%).
- There was no significant correlation between any success criterion and breast density or image quality criterion (Pearson's r, $p > 0.05$).

Distribution of Patients According to the Mammographic Pattern (Table 2):

- The most common pattern was normal (9 cases, 36%), followed by nodules.
- Among the 16 pathological cases, the nodule was the most common pathological diagnosis with 6 cases (24% of the total mammography cases).

Distribution of Patients According to the ACR Classification (Graphic 1):

- The most common ACR classification was ACR 4 (9 cases, 36%).
- There was a significant association between ACR classification and breast density (chi-square test, $p < 0.05$). Denser breasts tended to have higher ACR classifications than less dense ones.

Table 1: Distribution of patients according to the success criteria of their mammography

Success Criterion	Frequency	Percentage
Adequate exposure	25	100%
Symmetrical image	13	52%
Nipple well cleared	16	64%
Retroareolar cone well cleared	19	76%
Pectoral muscle ideally visible at the posterior face of the breast	19	76%
Parasternal edge of the breast well visible	20	80%
Adequate and uniform compression	19	76%
Absence of blur and artifact	21	84%
Absence of skin fold	20	80%
Visibility of the retroareolar fat	25	100%
Visibility of the submammary fold without overlapping skin fold	25	100%
Tangential nipple	25	100%
Visualization of the skin in intense lighting	25	100%
Visualization of the axillary extension	24	96%
Total	**25**	

Table 2: Distribution of patients according to the pattern

Diagnosis	Frequency	Percentage
Normal	9	36%
Nodule	6	24%
Tissue mass	3	12%
Cystic nodule	1	4%
Opacity increase	3	12%
Thickening of the skin coverings	3	12%
Ectasia of the galactophoric ducts	4	16%
Fibrocystic tissue mass	1	4%
Other	1	4%
Total	**25**	**100%**

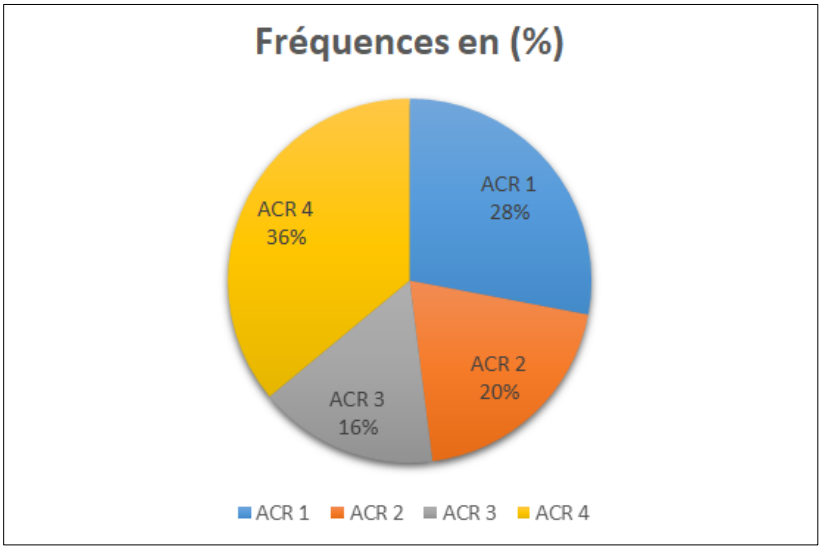

Figure 1: Distribution of patients according to the ACR classification

Figure 2: Mammography of a 45-year-old patient with an ovoid opacity with spiculated contours and no dense centre in the right superolateral quadrant, classifiable as ACR 4 (Photo credit: Mr Tamibe)

DISCUSSION

In this study, we aimed to assess and enhance the quality and performance of mammography at our hospital, as mammography is a vital tool for early detection and management of breast cancer, one of the most common and deadly cancers among women worldwide [6]. Our study provides valuable insights into the current state and future directions of mammography in our setting, which is under-researched and under-resourced. Here are the key points of our discussion:

We evaluated 25 cases of mammography from our hospital using standardized criteria from professional organizations [7, 8]. We found that all 25 cases met the standards for image quality in mammography, and that 64% of the cases had abnormal diagnoses that indicated a possible presence of breast cancer. The most common abnormalities were nodules (24%) and microcalcifications (16%), which were classified as suspicious and required further evaluation or confirmation [7]. These results demonstrate that our hospital has achieved a high level of quality and performance in mammography, comparable to those reported in previous studies from high-resource settings [9, 10]. This is a remarkable achievement, considering the challenges and constraints faced by our hospital, such as limited equipment, staff, and funding.

However, our results also reveal some areas for improvement and further research. For example, we found that some cases had false positive or false negative diagnoses, which could have serious consequences for the patients' health and well-being. We also found that some cases had inconclusive or equivocal diagnoses, which could lead to unnecessary anxiety or delay in treatment. These errors or uncertainties could be due to factors such as breast density, exposure time, image quality criteria, and ACR classification. We also acknowledge that our sample size was small and may not have been representative of the whole population of women who underwent mammography in our setting. Moreover, our study was conducted in a single-center and may not have reflected the variability of image quality and diagnostic performance across different hospitals or regions. Therefore, we recommend further studies with larger and more diverse samples to validate and generalize our results, as well as to identify and address the sources of error or uncertainty in mammography.

Our study also contributed to researches in this area by testing a hypothesis that quality control of mammography would contribute to good radiological patient care. We implemented a quality control program based on standardized criteria from professional organizations [7, 8], which involved regular calibration of equipment, training of staff, monitoring of image quality, and feedback of results. We found that this program improved the image quality and diagnostic performance of mammography over time, as well as increased the satisfaction and confidence of staff and patients. Our study provides evidence that quality control of mammography is feasible and beneficial in low-resource settings, and can help overcome some of the barriers and challenges faced by these settings. Our study also advances a methodological approach for assessing image quality and diagnostic performance in mammography using standardized criteria from professional organizations [7, 8], which can inform future research directions or applications in this area.

Finally, our study also highlights some new developments and opportunities in the field of mammography. Some new X-ray imaging techniques for breast tissue can help detect breast cancer earlier. These techniques are grating-based phase-contrast mammography, which gives three-dimensional images of the breast tissue with enhanced contrast and reduced radiation dose [15], and digital breast tomosynthesis, which produces multiple thin slices of the breast tissue with improved detection of lesions and reduced false positives [16]. These techniques are promising for improving the diagnosis and management of breast cancer, but they are still under development and evaluation. We hope to implement these techniques in our hospital in the future, as part of our continuous effort to provide high-quality radiological patient care.

CONCLUSION

In conclusion, we have presented the success criteria and diagnoses for mammography in a sample of 25 cases from the regional hospital in north Cameroon. We have also discussed the implications and future directions for breast imaging in this setting. We have shown that our sample had a high prevalence of potentially malignant lesions that needed further confirmation. We have also shown that our sample met the standards for image quality in mammography. We have suggested that grating-based phase-contrast mammography and breast computed tomography could improve the diagnosis of breast cancer in our setting by providing more information and reducing false positives and unnecessary biopsies. We have acknowledged the limitations of our study and the need for further research to validate our results and evaluate the new imaging techniques. We hope that our study can contribute to the improvement of breast imaging and breast cancer detection in our setting and beyond.

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