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Radiology

COMPARISON OF DIGITAL MAMMOGRAPHY AND DIGITAL BREAST TOMOSYNTHESIS FOR EVALUATION OF BREAST TUMOURS WITH HISTOPATHOLOGICAL CORRELATION

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ABSTRACT **AIM:** To compare the histopathological grading of breast tumors detected with digital breast tomosynthesis(DBT) to those found with digital mammography(DM). **MATERIALS ANS METHODS:** The study was conducted in the department of Radiodiagnosis, Gauhati Medical College and Hospital, Guwahati, from January 2021 to January 2022. A sample of 100 women with signs and symptoms of breast disease were evaluated based on inclusion and exclusion criteria. **RESULTS AND DISCUSSION:** DM and DBT were performed and the findings were recorded. During statistical analysis BIRADS category allotted in DM and DBT was compared in benign and malignant tumors and final results were formulated in tables and graphs. The findings we obtained in our study were compared with the results of previous research works. **CONCLUSION:** DBT is a promising imaging technique that has higher sensitivity and specificity than DM for the diagnosis and characterization of various breast disorders.

KEYWORDS : Breast cancer, Digital breast tomosynthesis, Digital mammography, Histopathology

INTRODUCTION

History of mammography can be approximately subdivided into three time period: The Age of Pioneers where the work of Salomon and their colleagues was highlighted; The Age of Technical Progress highlights the names of Wolfe, Gould, and their co-workers; The Modern Era displays the work of Ostrum, Becker, and their associates(1). Mammography's ultimate success as the gold standard for breast cancer screening would not have been possible without the passionate idealism, scientific acumen, and keen vision of those who first developed it.

Mammography a radiological imaging procedure that uses x-rays to see breast tissue. It is an essential tool that assists in early breast cancer diagnosis and hence greatly lowers mortality from breast cancer. The recommended screening frequency for women with an average risk of breast cancer varies among professional groups and governmental organizations, despite the fact that mammography is widely acknowledged for this purpose. For example, starting at age 40, the American College of Radiology and the National Comprehensive Cancer Network (NCCN) advised average-risk women to undergo annual screening mammography(2). The American Cancer Society suggests annual mammography screening for women between the ages of 45 and 54 and, if necessary, annual screening for those between the ages of 40 and 44(3). According to recommendations from the American Cancer Society, women can switch to biennial screening at age 55, while they also have the option to remain with annual screening if they wish. In a similar manner, the American College of Obstetricians and Gynecologists advise women to start receiving annual or biennial screening mammograms at the age of 40 and to begin screening no later than age 50, with consideration for biennial screening after age 55(4). For average-risk women between the ages of 50 and 74, the U.S. Preventive Services Task Force advises biennial screening mammography(5).

DBT has quickly gained recognition for routine breast cancer screening. DBT images are acquired as the x-ray tube travels across a limited arc above the breast and multiple low-dose x-ray exposures are obtained. The motion of the tube, the length of the arc, and the time it takes to obtain a complete set of projection images— reconstructed into thin image slices spaced at 0.5–1.0 mm(6). The addition of DBT has been shown to increase the cancer detection rate when it is used in conjunction with conventional DM. There remains limited data on the biology of the additional cancers detected with the use of DBT in regards to the pathologic type, histologic grade and lymph node status at time of diagnosis. The additional information obtained from the DBT acquisition decreases the confounding effect of overlapping tissue, allowing for improved lesion detection, characterization, and localization(7).

MATERIALS AND METHOD

The aim of my study is to compare the histopathological grading of breast tumours detected with DBT to those found with DM.

PATIENTS:-

The study was conducted in the department of Radiology, Gauhati Medical College and Hospital, from January 2021 to January 2022. A sample of 100 women with signs and symptoms of breast disease were evaluated. Women aged between 11-80 years of age with signs and symptoms of breast disease from whom written and informed consent has been taken for inclusion in the study. Women who refused to give consent for participation in the study, with history of mastectomy or breast augmentation, pregnant and lactating women are excluded from the study.

DM AND DBT IMAGE ACQUISITION:- Fujifilm AMULET Innovality Digital Mammography and Digital Breast Tomosynthesis Machine acquires and generates full DM and DBT. It is used for both screening and diagnosis of breast by acquiring craniocaudal and mediolateral oblique projections during the same breast compression. The x-ray tube moves approximately 1 degree for each image in a 15 arc (-7.5 to +7.5) above the compressed breast during DBT image acquisition. It acquires 15 images in approximately in 4 second time duration. DM and DBT images were reviewed on dedicated workstations with high-resolution display monitors to determine the presence or absence of any abnormal findings. The DM views were evaluated first, then the images obtained by DBT were reviewed. For interpretation as cross-sectional slices of the breast, these recorded projection images are rebuilt, with each slice typically being 1 mm thick.

DM AND DBT IMAGE AND TISSUE ANALYSIS:- After reading the characteristics of the lesions of both DM and DBT images, each lesion is assigned a ACR BIRADS category. The ACR BI-RADS category of each lesion, of each diagnostic method, was compared with the HPE findings. The final diagnosis was established by histopathological analysis of core biopsies, vacuum-assisted stereotactic biopsy, or surgical excision of the specimen. Histopathological analysis was done at the Department of Pathology.

METHODOLOGY:- 100 women with signs and symptoms of breast

disease referred were evaluated based on inclusion and exclusion criteria. Written and informed consent taken and patients were enrolled in the study. DM and DBT for each patient done on Fujifilm AMULET Innovality Digital Mammography and Digital Breast Tomosynthesis Machine. In patients with bilateral or multiple lesions the lesion with highest grade was considered. Findings were recorded in structured format for both the procedures. BIRADS scores assigned to each patient for both the procedures separately. Biopsy taken for HPE. Findings of both DM and DBT were analyzed and were subjected to standard statistical analysis. BIRADS score for both the procedures were compared to the HPE result and logical conclusions were drawn.

REPRESENTATIVE IMAGE:-

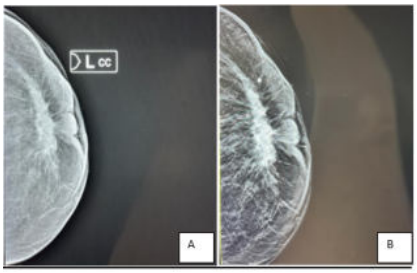
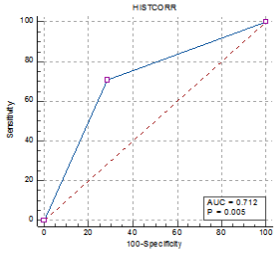


Image 6: Mammography (A) and Tomosynthesis (B) images showing an ill-well defined lesion in mammary zone of left breast in subareolar region with nipple retraction. The margins in images B is better delineated than image A with evidence of a microcalcification. On HPE, it was diagnosed as ILC.

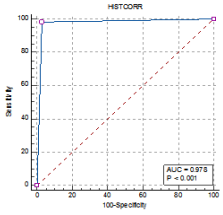
RESULTS-:

In our study the age of the patients ranged between 11(minimum) to 80 (maximum) years of age. Mean age and standard deviation for our study is 42.52 ± 11.24. Maximum number of patients came in the category of age group 41-50 years and the least number of patients were in the extremes of age, in the age group 11-20 years as well as 61 years and above.

Using DM and DBT, we evaluated imaging features of 100 breast lesions and compared them to histopathology findings. The dataset consisted of 65 malignancies and 35 benign breast lesions. The most common malignant lesion was Infiltrating ductal carcinoma and most common benign lesion was fibroadenoma.



Graph showing accuracy of mammography in detecting malignant tumours.



Graph showing accuracy of tomosynthesis in detecting malignant tumours.

	MAMMOGRAPHY	TOMOSYNTHESIS
AREA UNDER THE ROC CURVE (AUC)	0.712	0.978
STANDARD ERROR A	0.0756	0.0186
95% CONFIDENCE INTERVAL B	0.613 TO 0.798	0.927 TO 0.997
SIGNIFICANCE LEVEL P (AREA=0.5)	0.0051	<0.0001
ASSOCIATED CRITERION	>0	>0
SENSITIVITY	70.93	98.46
SPECIFICITY	71.43	97.14
NPV	68.63	88.42
PPV	69.23	96.53

DISCUSSION:-

This study was undertaken to determine the sensitivity, specificity and diagnostic accuracy of DBT and DM in evaluation of the breast tumours. Coming to the final statistical analysis of the results of our study, we determined the sensitivity and specificity of the findings of DM and DBT, and then performed statistical correlation with HPE findings using receiver operating curve (ROC) analysis. Cohen's Kappa test was then used to compare diagnostic accuracy. It was found that DM has a significantly lower sensitivity (70.9%) and specificity(71.4%) than DBT in diagnosing malignant breast lesions. The sensitivity of DBT was 98.4% in this study, meaning that DBT detected almost all the malignant tumors. This factor alone is a significant indication of the superiority of DBT over DM. Furthermore, ROC curve analysis showed an overall diagnostic advantage of DBT over DM, clearly seen when comparing ROC curves for the two analyzed diagnostic methods. Lesions were easier to distinguish on DBT, and the analysis of other features like margins, shape, calcifications, and asymmetry were also more precise. In several cases, superimposed breast tissue caused false-positive findings on mammography that were later reported as normal breast tissue on DBT. The increased sensitivity and specificity in this study are due to improved image quality in DBT over DM in terms of spatial and contrast resolutions. Additionally breast compression, which serves to achieve immobilization and to further reduce the radiation dose by reducing breast thickness, was used.

CONCLUSION:-

In conclusion, DBT is a promising imaging technique that has higher sensitivity and specificity than DM for the diagnosis and characterization of various breast disorders, particularly in young females and those with dense breasts. As a result, fewer instances are recalled, there are fewer negative biopsies, and it is easier to detect breast cancer and other breast lesions that aren't visible with traditional DM. The clinical accuracy of DM is increased with DBT by improving sensitivity and specificity, perhaps due to the enhanced quality and visibility of the image. These facts might be of tremendous interest to medical facilities because it influences their choice of upgrading DBT not just for diagnosis but also for screening.

CONFLICT OF INTEREST:- No conflict of interest to declare.
FINANCIAL DISCLOSURE:- The study has received no financial support.

ABBREVIATIONS :-

DM : Digital mammography ; DBT : Digital breast Tomosynthesis ; ROC : Receiver operating curve; HPE : Histopathological correlation

REFERENCES:-

1. Gold RH. The evolution of mammography. RadiolClin North Am. 1992 Jan 1;30(1):1–19.
2. Monticciolo DL, Newell MS, Hendrick RE, Helvie MA, Moy L, Monsees B, Kopans DB, Eby PR, Sickles EA. Breast cancer screening for average-risk women: recommendations from the ACR commission on breast imaging. Journal of the American College of Radiology. 2017 Sep 1;14(9):1137-43.
3. Oeffinger KC, Fontham ET, Etzioni R, Herzig A, Michaelson JS, Shih YC, Walter LC, Church TR, Flowers CR, LaMonte SJ, Wolf AM, DeSantis C, Lortet-Tieulent J, Andrews K, Manassaram-Baptiste D, Saslow D, Smith RA, Brawley OW, Wender R; American Cancer Society. Breast Cancer Screening for Women at Average Risk: 2015 Guideline Update From the American Cancer Society. JAMA. 2015 Oct 20;314(15):1599-614.
4. American College of Obstetricians and Gynecologists. Breast cancer risk assessment and screening in average-risk women. Practice bulletin. 2017(179):2019-1.
5. Siu AL, US Preventive Services Task Force. Screening for breast cancer: US Preventive Services Task Force recommendation statement. Annals of internal medicine. 2016 Feb 16;164(4):279-96.
6. Hooley RJ, Durand MA, Philpotts LE. Advances in Digital Breast Tomosynthesis. American Journal of Roentgenology. 2017 Feb;208(2):256–66.
7. Chong A, Weinstein SP, McDonald ES, Conant EF. Digital Breast Tomosynthesis: Concepts and Clinical Practice. Radiology. 2019 Jul;292(1):1–14.