ORIGINAL ARTICLE

Diagnostic accuracy of Sonomamography in carcinoma breast using biopsy as the gold standard in pre-operative cases

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Abstract

Objective: To determine the diagnostic accuracy of sonomammography in carcinoma breast using biopsy as the gold standard in pre-operative cases.

Material and Methods: A cross sectional study involving 114 participants took place in a tertiary care government hospital in Karachi, Pakistan. The selected patients were those referred for mammography who were reported as Breast Imaging-Reporting and Data System (BI-RADS) Category IV and V (suspected case of breast carcinoma and biopsy advised for confirmation). Ultrasound examinations were then correlated and final result obtained after biopsy.

Results: Ultrasound detected carcinoma in 38 (33.3%) cases true positive cases was 32 and true negative cases were 68. Sensitivity, specificity, PPV, NPV were 80%, 91.9%, 84.2%, 89.5% and 93% respectively. Mammography detected carcinoma in 38 (33.3%). True positive cases were 33 and true negative were 60. Sensitivity, specificity, PPV, NPV and accuracy were 82.5%, 81.1%, 70.2%, 89.6% and 93.9% respectively. The diagnostic accuracy of combination of US and mammography was 99.1%. Sensitivity, specificity, PPV, NPV was 97.5%, 91.9%, 86.7% and 98.6% respectively.

Conclusion: Whole breast ultrasound or mammography does not possess enough diagnostic value when evaluating breast carcinoma. However, if used in adjunct, they complement each other to improve diagnoses significantly.

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Introduction:

Carcinoma of the breast is the malignant tumor originating from the breast tissue, broadly speaking it is divided anatomically into ductal and lobular carcinoma, originating from the ducts and lobules, respectively.[1] As it stands currently it is considered a major health burden, not only in the western countries but worldwide.[2] Despite the high diagnostic accuracy of core needle biopsy and vacuum assisted needle biopsy, thousands of the over 1.6 million women who undergo breast biopsy annually in the United States receive false negative diagnoses, allowing cancer progression and increasing mortality.[3]

We acknowledge the importance of many widely understood risk factors for breast cancer including: primary genetic mutations, reproductive history, and lifestyle factors such as weight gain, alcohol consumption and lack of physical exercise,[4-5] Yet we begin with an understanding that in total, these factors do not address a considerable portion of the risk for the disease.[4-5] A substantial body of scientific evidence indicates that exposures to common chemicals and radiation, singly and in combination, also contribute to the increasingly high incidence of breast cancer observed over the past several decades.[4]

Keeping in mind all these risk factors the frequency of breast cancer mortality continues to rise in the under-developed countries, making up 33.5% of all cancers in women.[6] Breast cancer survival rates vary greatly worldwide,

ranging from 80% or over in North America, to below 40%[2] in low-income countries. Possible reason for this difference in the development of screening and awareness programs provided by the health authorities in developed countries, in comparison to under-developed countries. These programs have led to earlier detection of disease thus making curative treatment more likely.[7]

Two modalities of radiological techniques are utilized in the diagnosis of breast cancer: ultra sound and mammography.

Mammography specifically aims to demonstrate both micro-calcifications and larger areas of tissue having much lower intrinsic contrast than would be imaged in general radiography.[8] Mammographic studies can be tailored to differentiate surgical scar in the treated breast from malignancy by using special views with magnification in addition to the routine views.[9] On the other hand, breast sonography has been conventionally used to differentiate cysts from solid masses. It is also used to evaluate specific abnormalities detected in clinical examination or mammography and for guidance in interventional procedures.[8-10]

The sensitivity of ultrasound for malignant breast masses is 67% and the specificity is 92.4%.[10] Compared to that of mammography which has a sensitivity of 79%. The combination of US and mammography is significantly better.[9,11]

The rationale of this study emphasizes on evaluating the radiological features of carcinoma breast as visualized on mammogram and then their correlation with ultrasound. Most studies have focused on sono-mammography in patient in dense breast or breast lumps so far, and not on carcinoma breast per se. Hence, the purpose of study is to assess the diagnostic value of whole-breast ultrasound as an adjunctive technique to mammography and to determine whether ultrasound should be routinely used in the pre-operative assessment of patients with suspected breast cancer.

Materials and Methods:

This cross-sectional study took place at Department of radiology, Civil Hospital Karachi, for a total duration of six months (1st October 2015 to 31st March 2016). Sample size was calculated to be 114 (prevalenhlce of carcinoma breast taken 33.5%,[10] sensitivity 67%, specificity 92.4%[13] from literature review, with a confidence level of 95% and desired precision 15%).

Inclusion criteria included, all female patients referred to the department for mammography who were reported suspected case of breast carcinoma and biopsy advised for confirmation, only pre-operative patients were selected.

Exclusion criteria comprised of unwilling patients, those patients with breast lumps and benign lesions on biopsy, post-operative patients (mastectomy done), patients with metastatic deposits in the breast and male patients were excluded from the study.

Informed verbal consent was taken from the patients after explaining the purpose of the study, the necessity of the procedure and the associated radiation hazards involved. After the adequate selection of the patients, they were subjected to mammography. Mammograms were obtained and interpreted in accordance with current German Radiological Practice Guidelines. Diagnoses were coded according to the Breast Imaging -Reporting and Data System (BI-RADS). The primary radiology feature was noted and any associated features were also documented. At the radiologic review, the radiologists were unaware of the pathologic prognostic features of the tumor or a patient survival.

Ultrasound examination of the same breast was performed, the features of both modalities were then correlated and final result obtained after biopsy.

Data was analyzed in statistical software SPSS-21, mean, standard deviation and percentage were computed for age and duration of disease while frequency and percentage were computed for marital status, breast feeding history. The

sensitivity, specificity, PPV, NPV and accuracy of the ultrasound and mammography were computed for breast carcinoma against gold standard of biopsy.

Results:
A total of 114 patients with Breast Imaging-Reporting and Data System (BI-RADS) categories IV and V (Suspicious and highly suspicious of malignancy and biopsy advised) were included in this study. Majority of the patients were above 30 years of age and the average age of the patients was 46.4 ± 8.2 years whereas the duration of disease was 2.5 ± 1.34 months. Out of 114 cases, 92% were married and 8% were unmarried.

Nipple discharge was the commonest clinical presentation of the carcinoma that was observed in 28.9% cases followed by skin changes 22.8%, Axillary lymph node involvement was 16.7% and nipple retraction was observed in 10.5% cases. The location of the tumor was mostly in the upper/outer quadrant i.e. 45 cases, 22 cases in upper/inner quadrant and 30 cases in more than one quadrant. Breast carcinoma was confirmed in 35.1% (40/114) cases by biopsy.

On ultrasound the tumor mostly presented as a hypoechoic or heterogenous echogenicity mass with posterior acoustic shadowing in 105-patients hyperechoic foci representing calcifications were seen in 26 patients. While ultrasound detected carcinoma in 38 (33.3%) cases in which true positive cases was 32 and true negative cases were 68. Sensitivity, specificity, PPV, NPV and accuracy of ultrasound was 80%, 91.9%, 84.2%, 89.5% and 93% respectively.

Similarly mammography was detected carcinoma in 38 (33.3%) cases in which true positive cases 33 and true negative cases was 60. Sensitivity, specificity, PPV, PV and accuracy of mammography was 82.5%, 81.1%, 70.2%, 89.6% and 93.9% respectively.

The diagnostic accuracy of combination of US and mammography was 99.1% similarly sensitivity, specificity, PPV, NPV was 97.5%, 91.9%, 86.7% and 98.6% respectively.

Discussion:
The aim of the study was to see the specific features of ultrasound and mammogram in the patients who were labeled BI-RADS Category IV and V whom biopsy was advised to confirm the diagnosis of carcinoma. The results were then correlated to the radiological findings in both modalities.

Ultrasound as compared to mammogram is a non-invasive, readily available, low cost and highly informative radiological modality. Due to its wide range of qualities it is one of the standard radiological investigations in patients of breast cancer.[12] The role of ultrasonography in breast imaging is a subject of ongoing discussion. Sonography is generally accepted as the method of choice for the differentiation of cysts from solid masses and for guidance in interventional procedures.[12] Malignant disease on ultrasound appears as hypoechoic lesions with irregular poorly defined margins, shadowing and vertical orientation. Interesting enough lesions that are non-palpable and occult on mammography can be detected on ultrasound, one of the only cases when ultrasound is preferred to mammography in screening. However a normal sonogram does not exclude breast cancer, especially in the early stages.[13] New advances in ultrasonography like pulse Doppler, CFM have further augmented the capability of ultrasound in the diagnosis and management of breast cancer. In addition to the evaluation of the lesion, ultrasound guided FNAC and core needle biopsy can be done to assess the multicentricity of the disease which allows for a more accurate pre-operative diagnosis. Hence, it helps the surgeon decide which surgical procedure is most appropriate for a given lesion.[13]

We have shown initial clinical feasibility of an US/radiography fusion prototype with good localisation and evaluation of region of interest. The combined examination was well tolerated. The simultaneous evaluation with mammography and US imaging may be able to improve detection.[14]

Mammograms can detect small non-palpable

lesions; it shows the extent and location of the tumors, architectural distortion, micro-calcifications, skin and nipple changes and lymphadenopathy. It also detects the multi-centricity of the tumor. Some cases however, are mammographically occult, especially in dense breast and post-operative cases. The margin of the lesions seen on mammography can be used to predict the histologic grade. A circumscribed margin is associated with a favourable histologic grade, whereas an indistinct margin is more commonly associated with the mixed type of lesion.[13]

After detailed evaluation of mammography and sonographic findings, it was established that in 85% cases there was an agreement of findings in both the modalities. Considering individual modalities, it was found that neither radiological modality was 100% diagnostic and false negative exist, but the false negative rates were much higher in ultrasound as compared to mammographic studies.

Studies performed to evaluate sonography as a screening modality alone have failed to establish its efficacy,[14,15] and it has been concluded that sonography should not used as the primary screening tool in lieu of mammogram. However, the use of sonography as an adjuvant to mammography increase accuracy by upto 7.4%.[16]

Conclusion:
To conclude ultrasound is an important complimentary breast imaging modality, especially when carcinoma is suspected in young age, in dense breast and post-operative cases. However the technique currently possesses neither the threshold sensitivity nor the requisite accuracy to that of mammogram alone. The simultaneous evaluation with mammography and ultrasound imaging improve detection and reduce examiner related variability.

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Role and contribution of authors:
Dr. Mohammed Aqil, initial write up, data acquisition, manuscript preparation, conceived, concept design, definition of intellectual content and literature search.

Dr. Uzma Azmatullah, did write up, data acquisition and manuscript preparation.

Dr. Shua Nasir, did write up, data acquisition and manuscript preparation, literature search.

Prof. Ateeque Ahmed Khan, did literature search and critically review manuscript, did also final layout and data entry of the article.

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