Complementary Role of Ultrasound And Mammography in The Diagnosis of Breast Cancer

Medical Science

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ABSTRACT

Introduction: The global incidence and mortality of breast cancer have increased steadily in the past decades, and breast cancer is recognized as an important health problem for women. Mammography and ultrasound are commonly used anatomic imaging procedures to detect breast cancer, but they have several limitations.

Material & Methods: Patients with a personal history of breast cancer were excluded from this study. One hundred twenty women who met the study criteria were enrolled. All had undergone mammography and ultrasound to evaluate the breast lesion or lesions. Biopsy was performed when considered clinically necessary, and biopsy results were used as the reference standard.

Results: Fifteen of the 17 lesions (88.2%) were in patients with heterogeneously or extremely dense breasts. Two breast lesions were identified in nondense breasts: One was classified as invasive ductal carcinoma measuring 0.2 cm and one as DCIS without microcalcifications measuring 0.8 cm. Seven of the 17 breast lesions had microcalcifications identified by mammography but were interpreted as indeterminate or benign.

Conclusions: Hence it was concluded that Interpretation of Ultrasound had better specificity than mammography. It is a simple approach that can be integrated into clinical practice without additional imaging or radiation.

Introduction

Breast cancer is the leading cause of cancer in females between the ages of 15 and 54, and the second leading cause of death in United States' women.Although, the death rate from this disease is decreasing in the United States, the worldwide incidence of breast cancer continues to climb.[1] The mortality reduction achieved in the United States and the world can be attributed to several radiologic advances in diagnostic imaging.[2]

The global incidence and mortality of breast cancer have increased steadily in the past decades, and breast cancer is recognized as an important health problem for women.[3] Mammography and ultrasound are commonly used anatomic imaging procedures to detect breast cancer, but they have several limitations. The sensitivity of mammography for breast cancer detection decreases substantially if the breast parenchyma is dense. In addition, falsepositive diagnoses based on mammography result in many benign findings at biopsy.[4]

Breast cancer is cancer that develops from breast tissue.[1] Signs of breast cancer may include a lump in the breast, a change in breast shape, dimpling of the skin, fluid coming from the nipple, or a red scaly patch of skin. In those with distant spread of the disease, there may be bone pain, swollen lymph nodes, shortness of breath, or yellow skin.[5]

Risk factors for developing breast cancer include: female sex, obesity, lack of physical exercise, drinking alcohol, hormone replacement therapy during menopause, ionizing radiation, early age at first menstruation, having children late or not at all, older age, and family history. About 5–10% of cases are due to genes inherited from a person's parents,[6] including BRCA1 and BRCA2among others. Breast cancer most commonly develops in cells from the lining of milk ducts and the lobules that supply the ducts with milk. Cancers developing from the ducts are known as ductal carcinomas, while those developing from lobules are known as lobular carcinomas.[7]

Ultrasound is being used today to supplement traditional mammography when suspicious lesions are noted on mammograms. It can be used to differentiate a cyst from solid mass and can pinpoint solid masses that have characteristics of malignant lesions.[8, 9]

Cysts imaged with ultrasound appear as well defined, echo-free areas in the breast. These areas have well-defined walls and are round or oval in shape. There is normally posterior acoustic enhancement. In addition, Doppler ultrasound can be used to check for vascularity of the lesion. Cysts are always avascular. Peart documented that ultrasound can detect cysts as small as one to two mm with 100% specificity. Cysts that do not demonstrate the above characteristics are biopsied.[10]

Ultrasound images of malignant masses demonstrate breast lesions with internal echoes. They have an irregular shape with poorly defined, spiculated margins. Often times they are connected to ducts in the breast and may contain calcifications.[8]

The first digital mammography system was approved in the year 2000. The National Institute of Health, in response to the poor sensitivity and specificity of film/screen radiography, supported the research and development behind digital efforts. This has resulted in several advantages. For instance, digital images can be more easily stored and retrieved than film/screen radiographs.[11] Digital images also have superior contrast resolution, meaning they allow the radiologist to distinguish between subtle shades of gray. Computer software programs, known as computer aided diagnosis can be applied to images to help the radiologist be more productive and improve the accuracy of readings. In addition, three-dimensional (3D) image reconstruction as well as dual-energy and contrast subtraction techniques can be applied to images to yield more diagnostic information without additional radiation to the patient. Due to post-processing features to adjust image contrast and density, the radiologist can manipulate and change the appearance of images without additional projections. This in turn, results in lower radiation doses to patients.In this study, we investigated whether the interpretation between the mammography and ultrasound in the diagnosis of breast cancer.

MATERIAL & METHOD

This retrospective study was approved by our institutional review board; patient consent was not required. The records of patients who had at least one of the following indications were reviewed: clinical findings such as a palpable breast lesion, breast pain, or bloody nipple discharge; indeterminate or suspicious mammography or ultrasound findings; or high risk of breast

cancer. Patients with a personal history of breast cancer were excluded from this study. One hundred twenty women who met the study criteria were enrolled. All had undergone mammography and ultrasound to evaluate the breast lesion or lesions. Biopsy was performed when considered clinically necessary, and biopsy results were used as the reference standard. If the biopsy result was inconclusive, another biopsy was performed 3 months later. When a biopsy result was not obtained, the clinical follow-up results at least 1 year were used as the reference standard. The results were classified as malignant or benign.

Mammography and ultrasound were performed as part of the clinical evaluation of the patients. The mammography and ultrasound studies were interpreted by one experienced radiologist unaware of the pathology results. Assessments for mammography and ultrasound were classified as either negative (BI-RADS categories 0–3) or positive (BI-RADS categories 4 and 5).

Statistical Analysis

The significance of differences in the sensitivities and specificities of mammography, and ultrasound was identified using the McNemar test. Statistics software (PASW, version 17.0, SPSS) for Microsoft Windows was used for the analyses, and p values less than 0.05 were considered significant.

Results

The clinical characteristics of the 120 women and the pathologic results of the malignant lesions are summarized in Table 1. Biopsy results were available for 90 lesions, and the other 30 lesions underwent clinical follow-up. Overall, 50 lesions were found to be malignant and 70 were found to be benign. We also evaluated 50 malignant breast lesions with available sizes, 15 of which were 1 cm or smaller. There were 17 malignant breast lesions that were mammographically negative but sonographically positive. The mean size of the 17 lesions was 1.5 ± 1.8 cm. Fifteen of the 17 lesions (88.2%) were in patients with heterogeneously or extremely dense breasts. Two breast lesions were identified in nondense breasts: One was classified as invasive ductal carcinoma measuring 0.2 cm and one as DCIS without microcalcifications measuring 0.8 cm. Seven of the 17 breast lesions (two DCIS and five invasive ductal carcinomas) had microcalcifications identified by mammography but were interpreted as indeterminate or benign (BI-RADS categories 0–3).

Discussion:

The diagnostic sonography in the breast has been investigated for at least 30 years. Sonography did not detect any proven cancers that were missed by mammography. Mammography was found superior in detecting 97% of the 64 pathologically confirmed cancers, while sonography can only seek 58% of them.[12] Mammography detected more than 90% in all cancer categories, including those amenable to cure, but the value for sonography is only 48% (40% of the non-palpable malignancies and 8% of the cancers smaller than 1 cm that did not yet spread to axillary lymph nodes).[13] Tumor size and axillary lymph node status are the most important prognostic indicators for breast cancer, and the mammography done far outperformed sonography in detecting the smallest cancers and those that did not yet spread to axillary nodes. A major factor limiting the ability of sonography for non-palpable breast cancers seems to be its inability to image the micro-calcifications (individual particles 0.2–0.5 mm).[12] Mammography-positive sonography-negative cancers usually are small, non-palpable, and have not yet spread to axillary lymph nodes, whereas very rare sonography-positive mammography negative cancers are always detectable by physical examination and more likely to have metastasized. Therefore, upgrading to state-of-the-art mammography is preferred to improving the cancer detection ability rather than purchasing an US system.[12, 14]

The role of sonography in breast diagnosis is an ongoing investigation. US is a widely accepted method for discriminating cysts from solid masses and guiding interventional procedures. Sensitivities and accuracy of the US in the discrimination between benign and malignant breast nodules are not high enough to reply on, and its value in comparison or addition to mammography is still in debate.[15, 16]

There are several limitations of the current study. First, patient selection bias may have unduly influenced the determined sensitivities of mammography, and ultrasound. Most of the included patients had suspicious or indeterminate mammography or ultrasound findings or an abnormal clinical finding. This bias may have decreased the sensitivity of mammogram and increased the sensitivity of ultrasound. In addition, most patients had dense breast tissues, which may explain the low sensitivity of mammography in our study. Second, histologic confirmation was not acquired in all cases because we had to rely on a limited period of clinical follow-up observations in a proportion of cases. Validation of breast lesions by conventional imaging methods and serial followup may cause imprecise identification of malignant breast lesions. However, because all patients were followed for more than 1 year, it is unlikely that the conclusions of the current study would have differed significantly with further follow-up. Third, and most important, the results in this study were obtained by retrospective review and should be considered as preliminary findings. We used an uptake ratio of 1.5 as the threshold to differentiate benign from malignant breast lesions based on an ROC curve analysis of our data.

These studies should include evaluations of the extent of known disease, detection of locoregional recurrence, comparison of the diagnostic accuracies, and effects of BSGI and other breast imaging modalities on patient management. Hence it was concluded that Interpretation of Mammography had better specificity than Ultrasound. It is a simple approach that can be integrated into clinical practice without additional imaging or radiation.

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