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Original Research Article

The Comparative Analysis between MRI and Mammography in Screening of Breast Cancer

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Abstract

Introduction: The screening of breast cancer is aimed at reducing the incidence and mortality rate due to breast cancer, by early diagnosis. Breast cancer is one of the most serious health issues. Traditional approaches for screening breast cancer have been called into question in recent studies. Breast cancer is still diagnosed primarily through mammography. Novel imaging modalities, such as positron emission mammography, are currently being tested but they are far from being applicable in screening. Recently, Magnetic Resonance Imaging or MRI has been in debate as it is found that its sensitivity and efficiency is significant in screening breast cancer.

Aims and Objectives: To find out the efficiency of MRI and Mammography to be used as screening method in breast cancer.

Materials and Methods: This prospective study was conducted in our hospital with 50 patients susceptible of breast cancer. All the patients received mammography, MRI and biopsy. The biopsy was done for confirmation of their breast cancer. The findings of MRI and mammography were assessed according to the Breast Imaging Reporting and Data System (BI-RADS) classification. The statistical analysis was conducted to compare the efficiency of MRI and Mammography as screening method.

Results: The study has shown that for early scores (0 to 2), the efficiency of MRI is more than Mammography ($P<0.05$) and there is no significant difference between their screening ability at advanced stage (scores of 3 to 5).

Conclusion: The study has concluded that both the modalities (mammography and MRI) are effective in advanced stage while MRI is more efficient in earlier stages of breast cancer.

Keywords: MRI, Mammography, Screening, Birads, Breast Cancer

Background

The screening of breast cancer is aimed at reducing the incidence and mortality rate due to breast cancer, by early diagnosis. The magnetic resonance imaging technique, mammography, ultrasound, and digital breast tomosynthesis are used for screening for breast cancer in many countries including United States. Mammography screening can be effectively used for early diagnosis and starting the required management at early stage so that the advanced stage can be prevented. Mammography has long been the gold standard for screening. However, there are currently a variety of supplementary imaging methods

accessible. Some are just better anatomic delineation, whereas others include containing physiology. A third category (molecular imaging) is solely for physiologic purposes. A review of relevant randomized controlled trials, research, and meta-analyses that influenced the development of guidelines for screening is included. In the end, five major medical organizations developed the current screening standards in the United States. As there is a lack of consensus on the guidelines it reflects a continuing debate regarding the best time and manner for women to get screened for breast cancer. The Imaging Reports of the breast and Data System vocabulary is explained for mammography screening, which matches to suggested clinical care [1,2,3].

In the United States, breast cancer is one of the most serious health issues. Traditional approaches for screening breast cancer have been called into question in recent studies. Although many studies have demonstrated that breast self-examination does not enhance cancer-specific or all-cause mortality, it is nevertheless widely recommended as a noninvasive screening method. Patients who wish to self-examine should be instructed on proper follow-up and technique. It's impossible to say how much the clinical examination of breasts contributes to early detection, but studies suggest that sensitivity is greatly reliant on the amount of time it takes to perform the exam [2,4]. Up to 10% of tumors are undetectable on mammography but visible on clinical examination of the breast. Mammography is recommended for women over 40 who are in good health by the US Preventive Services Task Force, however, clinicians should keep in mind that there is low sensitivity in younger women. In younger women and those with dense breasts, digital mammography is slightly more sensitive, although there are no outcome studies. Despite showing potential as an instrument for screening in some high-risk women, magnetic resonance imaging is suggested at present for general examination due to high rates of false-positive and cost. in women older than 30 years who are at high risk, the American Cancer Society advises yearly magnetic resonance imaging as a supplement to screening mammography [4]

Breast cancer is still diagnosed primarily through mammography. Breast cancer mortality can be reduced by mammographic screening. Magnetic resonance imaging and ultrasonic are the most common imaging procedures and are also used to describe lesions in the breast, and breast cancer stage, and help in planning surgery. However mammography has been proved to reduce the mortality rate due to breast cancer in the overall population, and additional imaging studies were shown to be effective for screening patients with a high risk of having breast cancer. Newer technologies may increase the specificity and sensitivity of breast cancer detection and screening in the future. The question isn't whether a mammogram is effective, but rather if the percentage of false positives and negatives can be lowered. The optimum screening of the candidate, the optimal modality of imaging for breast cancer screening, and the decrease in the mortality rate of breast cancer will all be discussed in this review [5,6].

Screening for breast cancer is a complicated and, more recently, contentious subject. clinical, self-examinations, and mammograms are all examples of traditional screening. Novel imaging modalities, such as positron emission mammography, are currently being tested in the clinic in the hopes of boosting screening sensitivity for breast cancer. Furthermore, the introduction of biochemical techniques that use minimally invasive sampling is promising [7].

Material and Methods

This prospective study was conducted b\w

August 2021 to March 2022. The patients who attended our hospital, aged between 30 years to 60 years, had clinical features of breast cancer, cooperated with the institute's study and diagnostic protocols, were included. The patients who were suscepted to be carrier of BRCA1 or BRCA2 mutation, confirmed history of breast cancer, patients with claustrophobia, patients who had metallic implantations, reduced or compromised creatinine clearance, were all excluded. After applying inclusion and exclusion criteria, the study considered 50 patients.

The patients who have been included in this study, attended the outpatient department of our hospital. These included patients had been following our screening protocol. The patients needed to give consent. All the patients received mammography, MRI and biopsy. The biopsy was done for confirmation of their breast cancer. The surveillance was done by experienced radiologists every 6 months. The patients underwent mammography in craniocaudal view and gadolinium contrast breast MRI as per standard guidelines. Both the imaging was done between Day 5 and Day 15th of menstrual cycle of each patient. The findings of MRI and mammography were assessed according to the Breast Imaging Reporting and Data System (BI-RADS) classification [7,9]. In cases where both MRI and mammography was found to be negative while PBE was marked as suspicious, then, further investigations were carried out on those patients.

Statistics analysis

The study has conducted statistical analysis using SPSS 25 and Excel software. The descriptive data is expressed in mean±standard deviation while the number of patients have been expressed in absolute number and percentage. The effective analysis, the study has used Chi Square test in SPSS.

Results

The study has recorded detailed history of the patients including menopausal status, history of hormonal contraception, usage of Hormone Replacement Therapy (HRT), history of Oophorectomy.

Table 1

Characteristics	Value	Percentage (%)
Mean age	49.25±14.38	
Status of menopause		
Premenopausal	25	50
Perimenopausal	15	30
Postmenopausal	10	20
Use of hormonal contraception		
Never	11	22
Past	31	62
Present	8	16
Whether used Hormone Replacement Therapy (HRT)		
Never	36	72
Past	8	16
Present	6	12
Underwent Oophorectomy in the past		
No	32	64
Yes	18	36

The study determined the BIRADS scoring (0 to 5) against each modality (mammography and MRI) and also recorded the finding of biopsy which has confirmed the number of patients in each of the BIRADS score.

Table 2

BIRADS classification	Mammography	MRI	Confirmed positive by biopsy	*P*-value
0	0	6	9	0.000
1	3	9	11	0.02
2	7	12	12	0.036
3	7	7	7	>0.05
4	3	2	2	>0.05
5	0	2	1	>0.05

The study has shown that for early scores (0 to 2), the efficiency of MRI is more than Mammography ($P<0.05$) and there is no significant difference between their screening ability at advanced stage (scores of 3 to 5). The study also found that the Positive Predictive Value (PPV) of mammography was 47.61% while for MRI, it was found to be 90.47%. The diagnostic efficiency was compared between mammography and MRI, which have shown that there is a significant difference specially in the early stage. The sensitivity and specificity of mammography was found to be 75% and 92%, respectively. While the sensitivity and specificity of MRI was found to be 95% and 85%, respectively.

Discussion

Screening for breast cancer in community practices and randomized controlled studies may differ. New screening methods are being developed. Meta-analyses, systemically biased reviews, community-based screening of breast cancer studies, and guidelines were assessed in English articles on randomized controlled trials which assess the effectiveness of screening of breast cancer. Newer screening techniques were also evaluated in the research. Mammography screening is recommended for women the age of above 39 years and up by all major medical organizations in the United States.

After a follow-up of 15 years, the mortality rate of breast cancer is decreased by screening with mammograms at around 30% in women in the age group of 49 to 70, and a slight reduction in women in the age group of 39 to 50. In our study, the age of females that was considered to be eligible was between 30 and 50 years old, which was found to be the most common age group that is susceptible to breast cancer [8]. Nearly 96% of the women with some abnormalities are not diagnosed with breast cancer after screening with a mammogram, however, it varies with the age of the women and the radiologist who is evaluating the mammogram. Studies show that there is no statistical difference between the mammogram and the screen film, although the influence of the results of the mammogram was not known. A study stated that the detection of the cancer was improved by computer-based detection techniques, but other large studies found no such improvements [9]. MRI has the potential to detect cancers missed by mammography, however, the reported sensitivity of screening clinical breast examinations is lower in the community (30% to 35%) than in randomized trials (about 55%). This has been found in our current study, specially in early stages of the disease. Though the breast examination was clinically it does not help in decreasing the mortality rate but it shows false-positive results due to a high number of biopsies of the breast. For screening breast cancer, MRIs and ultrasounds are being studied in high-risk women, but are not recommended for the general public. In high-risk women, magnetic resonance imaging has shown to be significantly more sensitive than mammography, but less specific. A lower mortality rate has not been proven to be a result of magnetic resonance imaging.

Screening should be discussed with each woman in a balanced manner, taking into account the potential benefits and risks [8,9,10].

A study aimed at comparing the ultrasound, mammogram, and magnetic resonance imaging in diagnosing breast cancer (less than 2 cm), as well as to assess the advantage of presurgical MRI of the breast after traditional imaging methods for small breast cancer. A total of 476 patients diagnosed with breast cancer were studied in this observational retrospective study. We looked over the medical records, analyzed the preoperative Ultrasound, mammogram, and magnetic resonance imaging reports, and classified the findings as benign (BI-RADS 1-3) or malignant (BI-RADS 1-4). (BI-RADS 4 or 5). The pathologic examination of the specimen served as the criteria standard for detection. Various approaches were compared using the McNemar test. Individuals with a poor density of the breast(84.5 percent vs 65.8%, P.001) had significantly higher MG sensitivity than someone with great breast density (84 percent vs 65%, P.002). US was highly sensitive than a mammogram (P.002), and the combination of ultrasound and mammogram was more sensitive than either MG or US alone (P.002). The inclusion of MRI in the MG and US combination increased the responsiveness yield (from 93 percent to 98 percent; P =.002) but did not enhance the mastectomy incidence (from 49 percent to 50 percent; P =.178). In individuals with minor breast cancer, especially those with dense breasts, MG has low diagnostic sensitivity. When it comes to spotting risks of cancer besides the density of breasts the US outperforms MG [11,12].

As MRI is the sensitive method used for screening breast cancer it is used effectively in women who are at high risk of developing cancer. A study was conducted to compare the effectiveness of the cost of mammograms versus MRI. As the predictive accuracy of MRI screening improves, the model implies that MRI screening is becoming more expensive for patients with higher-risk profiles. A probabilistic assessment was also carried out to test the sustainability of the results in the basic scenario. When the willingness-to-pay threshold approaches $130,000/QALY, the net health advantages of MRI screening over mammography improve, but it is still not cost-effective for this population [13].

The goal of this study was to compare the specificity and sensitivity of three breast cancer early detection methods: tomosynthesis, mammography, and magnetic resonance imaging compared with histopathology, as well as the intra - personal variation between modalities. We looked at 60 lesions o breasts that were found using 3 distinct diagnostic modalities which are then confirmed by histology. All three diagnostic modalities were interpreted by a single expert radiologist. 30 of the breast tumors were cancerous, while the remaining 27 were benign. Tomosynthesis, mammography, and MRI had a sensitivity of 100 percent, 73 percent, and 93percent, respectively, whereas specificity was 46.4 percent, 60.7 percent, and 75 percent. Breast tomosynthesis outperformed both breast MRI and computerized mammography in terms of overall diagnostic benefit, according to ROC curve analysis. There was a statistical difference between computerized mammography and tomosynthesis (p0.002), but not between breast tomosynthesis and breast MRI (p = 0.21) [14].

There are studies in the past which compared the efficiency of MRI and mammography by analyzing the breast lesions and histopathologic characters. Past studies also analyzed contrast enhanced MRI scans and also conventional MRI scans. Both approaches used a five-point scale to classify all lesions as benign and malignant, and the findings were

compared to histology. These studies have shown that MRI and conventional mammograms have little to none significance in screening ability of breast cancer. When the findings of the two approaches were combined, the sensitivity for breast cancer diagnosis climbed to 96%, but the specificity fell to 54%. Contrast-enhanced dynamic MRI was much more specific and sensitive than conventional mammography in detecting cancer in this subgroup of patients, which included only those referred for excisional biopsy. While combining the two approaches improves sensitivity slightly, it drastically reduces specificity [15].

Conclusion

The study has concluded that both the modalities (mammography and MRI) are effective in advanced stage while MRI is more efficient in earlier stages of breast cancer. Further, the study has concluded that MRI is significantly efficient in screening of breast cancer at earlier stages as compared to mammography. The study pointed out that there is a need to conduct more studies with larger sample size and with varied population. The screening of the breast cancer should be supported by different modalities and the need to search for a efficient modality is always a need of the hour.

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