RESEARCH ARTICLE

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Comparison of Breast Magnetic Resonance Imaging and Mammography Findings in Detecting Ductal Carcinoma *in situ* in Preoperative Evaluation

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Abstract

Objectives: Breast cancer is the most common type of cancer in women, imaging methods have an important role in diagnosis and treatment. Ductal carcinoma *in situ* (DCIS) accounts for approximately 30% of new breast cancer diagnoses. It was aimed to retrospectively compare the sensitivities of breast magnetic resonance imaging (MRI) and mammography (MG) in detecting lesions in DCIS patients and predicting pathological subgroups of the lesion in the preoperative period.

Methods: Preoperative MRI and MG examinations of 150 lesions diagnosed with DCIS, with an average age of 59 years, were evaluated retrospectively. In our study, the sensitivities of MRI and MG were evaluated by comparing them with pathological dimensions. In addition, lesions were divided into pathological subgroups and sensitivity comparisons were made between imaging methods.

Results: Of the 150 DCIS lesions, 30 (20%) were found solely with MG screening, 15 (10%) were found solely with MRI examination, and the remaining 105 (70%) patients had both MG and MRI detection. While the average size of DCIS was 1.55 cm in 135 mammograms, it was 2.10 cm in 120 MRI examinations. It was statistically significantly lower in MG ($p<0.05$). Compared to the histopathological size of 105 cases in which lesions were found to be common in both examinations, the accuracy of MRI and MG was 0.64 and 0.58, respectively. Data finds MRI more sensitive in detecting DCIS ($p<0.05$). Pathological examinations revealed high-grade DCIS in 35 patients (23%) and low- and intermediate-grade DCIS in 115 patients (77%). In the sensitivity comparison between pathological subgroups, no significant statistical difference was found between the two imaging methods ($p>0.05$).

Conclusion: MRI detects a slightly larger size than MG, it has a higher sensitivity in detecting DCIS in younger patient groups.

Keywords: Ductal carcinoma *in situ*, DCIS, magnetic resonance imaging, MRI, mammography

Introduction

Ductal carcinoma *in situ* (DCIS) is a preinvasive or noninvasive breast cancer characterized by the proliferation of ductal epithelial cells confined to the terminal ductal lobular unit.[1] DCIS accounts for approximately 30% of new breast cancer diagnoses.[2] DCIS is a highly varied set of lesions distinguished by genetic and molecular abnormalities, histopathologic characteristics, and biologic indicators, as well as a varying risk of development to invasive disease. Some DCIS lesions will develop into an aggressive invasive malignancy.[3]

It is known that the incidence of invasive cancer in previous separation DCIS is approximately 40%.[4] It may also expand 20% of all breast cancers.[5] Therefore, determining the localization and distribution of DCIS before the operation is very important in approaching the patient. Mammography (MG) is regarded as the primary approach for detecting microcalcifications in radiological treatment.[6] However, MG has relative limitations in detecting DCIS and assessing tumor size, as foci of noncalcified DCIS cannot be demonstrated in dense breasts, and it can sometimes be difficult to distinguish calcifications associated with benign histology from malignant calcifications. Failure to appropriately establish the mass boundaries in patients may result in relapse and recurrent treatments.[7]

The research has demonstrated that evaluating mass dimensions preoperatively with a magnetic resonance imaging (MRI) examination is highly beneficial. The same is true for people with DCIS, which has been shown to be more effective than MG. However, there is no standardized preoperative technique using MRI in DCIS patients.[7-10]

The aim of this study is to investigate the efficacy of pre-operative breast MRI in assessing DCIS size in contrast to histopathological size, as well as to compare the accuracy of MRI and MG.

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Methods

The Institutional Review Board approved this retrospective study. The retrospective nature of the decision precluded informed consent.

For this study, ethics committee approval numbered 938/2021 dated 22.12.2021 was received from Ankara Training and Research Hospital Clinical Research Ethics Committee.

The reports of patients who underwent breast MRI in our hospital were retrospectively reviewed using the hospital information management system. Among these patients, those diagnosed with breast cancer were examined, and those diagnosed with DCIS were included in the study. During the specified period, 150 patients were diagnosed with DCIS, forming the study population.

For all patients over, MG exams were conducted using the conventional craniocaudal and mediolateral-oblique projections (Figure 1).

All patients underwent MRI after conventional examinations to ensure that there were no disruptions in treatment (Figure 2). A 1.5 T whole body imaging equipment (Signa Excite, GE Healthcare, Milwaukee, WI, USA) was used to perform the MRI exams. Using a four-channel breast coil, the patient's breast was hung during the prone scan. With fat suppression, transverse and sagittal plane MRIs were acquired. Pre-contrast sagittal acquisitions were carried out with a T2-weighted fast spin-echo sequence, and pre-contrast transverse acquisitions were carried out using a T1-weighted fast spin-echo sequence and transverse T2-weighted fast spin echo short tau inversion recovery (STIR) imaging. Echo array suppressing fat deposits. Pre- and post-contrast sagittal dynamic imaging, 3D multiphase, VIBRANT (flip angle 10°; minimum 2.4 msec echo duration; maximum 14.0 msec echo time).

Biopsy was recommended for all cases for definitive diagnosis and treatment planning of the patients. Biopsy examination was performed with sonography in 105 of 150 patients, while 45 patients were marked with a stereotaxic wire and mammography.

The fourth edition of the MG and MRI breast imaging reporting and data system (BI-RADS) categories was followed by a radiologist with seven years of expertise in breast imaging to assess the characteristics. In the MG examination, the presence of masses, microcalcifications, and parenchymal distortions were noted. In the examination, the shape, contour, density and microcalcification morphology of the lesion were evaluated. In breast MRI examination, parenchymal background contrast enhancement of fibroglandular tissues and the mass structure of the lesions were determined in the morphology of the lesions. The contrast enhancement pattern and distribution of those that did not have a mass structure were noted.

DCIS was categorized based on nuclear grade (high, intermediate, and low). Microinvasion is the term used to describe the unfocused spread of cancer cells into neighboring tissues via the basement barrier.

Statistical Analysis

The study data was analyzed using IBM Statistical Package for the Social Sciences (SPSS) Inc., Chicago, IL's SPSS for Windows 20. The normal distribution of the data was confirmed by the Kolmogorov-Smirnov test. For numerical data that is regularly distributed, the mean and standard deviation are shown. When displaying data that does not follow a normal distribution, the median is utilized. Both the Mann-Whitney U test and the Student's t-test were used to compare numerical variables between groups. Statistically significant value of $p<0.05$ was used.

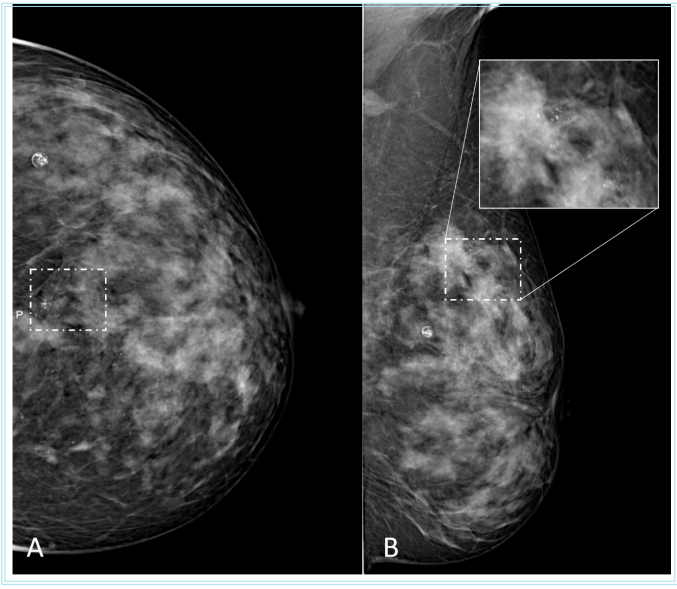

Figure 1. Mammography images of a 63-year-old female patient diagnosed with ductal carcinoma *in situ* (DCIS). A) In the craniocaudal view, pleomorphic calcifications clustered in the central area (rectangle) are observed. B) In the mediolateral oblique view, pleomorphic calcifications clustered in the upper zone (rectangle) are observed. The core biopsy from the defined area confirmed a diagnosis consistent with DCIS

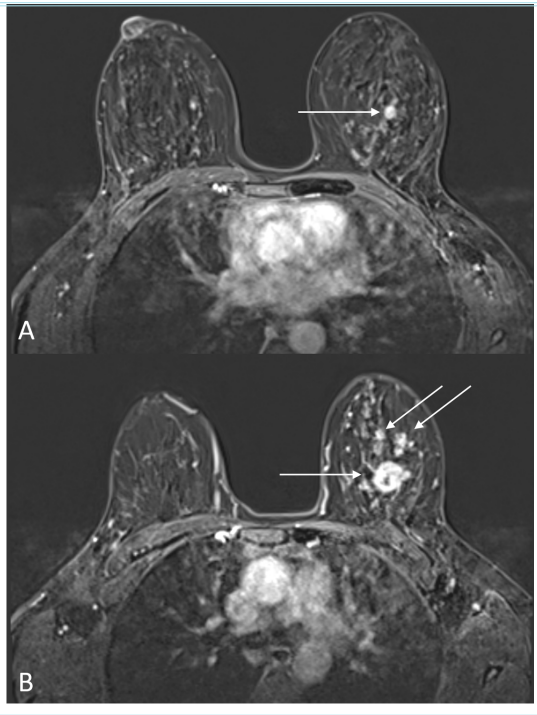

Figure 2. Contrast-enhanced breast magnetic resonance imaging images of a 63-year-old female patient diagnosed with ductal carcinoma *in situ* (DCIS). A) A subcentimetric enhancing solid lesion in the central area of the left breast is observed (arrow). B) In more superior sections, larger and multifocal enhancing lesions are observed in the same patient (arrows). The pathological results of these lesions were consistent with DCIS.

Results

Of the 150 DCIS lesions, 30 (20%) were found solely with MG screening, 15 (10%) were found solely with MRI examination, and the remaining 105 (70%) patients had both MG and MRI detection (10%, 20%, and 70%, respectively).

In the MG examination of 150 patients, type D pattern was observed in 15 (10%) patients, type C pattern was observed in 50 (33.3%) patients, type B pattern was observed in 50 (33.3%) patients, and type A pattern was observed in 35 (23.3%) patients. In the MG examination, there was a mass appearance in 25 (16%) of 150 patients, only microcalcification in 95 (63%), microcalcification along with the mass in 10 (7%) patients, and only parenchymal distortion in the remaining 20 (5%) patients.

Lesions could be visualized in a total of 120 (80%) MRI examinations. While contrast enhancement without mass effect was observed in 110 (73.3%) patients, MRI examination was observed as false negative in 10 (6.7%) patients.

While the average size of DCIS was 1.55 cm in 135 mammograms, it was 2.1 cm in 120 MRI examinations. It was statistically significantly lower in MG ($p< 0.05$).

In the pathological examinations, high-grade DCIS was observed in 35 (23%) patients, and low- and intermediate-grade DCIS was observed in 115 (77%) patients. There was no microinvasion in 135 (90%) of the patients. Seventy-four (49%) of the lesions were observed in the right breast and 76 (51%) were observed in the left breast.

Compared to the histopathological size of 105 cases in which lesions were found to be common in both examinations, the accuracy of MRI and MG was 0.64 and 0.58, respectively. MRI showed better accuracy than MG for younger patients. The current situation was found to be significant in terms of accuracy in the MRI examination ($p<0.05$). While no significant difference was observed in tumor nuclear staging in any group, it was slightly closer to significance in the middle group ($p=0.06$).

Discussion

In our study, we investigated the sensitivities of DCIS lesions in MG and MRI examinations. In our study, lesions were detected in MG examination in 135 (90%) patients and in MRI examination in 120 (80%) patients. In this case, unlike the study conducted by Kuhl et al.[11], MG examination was found to be more sensitive in detecting DCIS. However, in our study, while stereotaxic marking was used to guide pathological diagnosis, breast MRI vacuum biopsy method was not used. This may indicate that MG is falsely more sensitive.

In our study, microcalcification was detected in 63% of the lesions, while MRI contrast enhancement causing mass effect was observed in 73%. While the appearance showed a similar correlation with the literature in terms of microcalcification, the microcalcification rate was observed to be lower.[12,13] In our study, MG examination revealed a mass rate of 16%, microcalcification with a mass rate of 7%, and parenchymal distortion rate of 13%. These rates are higher than those in the literature.[14,15] In MRI examination, the contrast enhancement rate of the lesions was similar to the literature.[16,17]

Since DCIS is the early stages of the malignant process, tumor size may change the treatment process. In our study, MG was able to detect smaller lesions (2.1 cm versus 1.55 cm). When we look at the literature, we found that the average size of the lesions detected in MG examination was lower in the study by Kim et al.[18], similar to our study. This situation was evaluated due to the ability to detect calcification in MG examination of small lesions.

It is shown in the literature that MRI has a higher accuracy rate in detecting the lesion and showing its pathological extent.[11] In our study, the relationship between post-pathology size and detectable MRI and MG sizes was consistent with the literature.[19]

When the current sources in the literature were evaluated in comparison with the study by Proulx et al.[7], the number of lesions in our study was almost twice as high (150 lesions versus 79 lesions). Compared to the study of Proulx et al.[7], our MRI and MG lesion detectability rates were similar. However, contrary to the study conducted by Proulx et al.[7], in our study, the p values regarding MRI sensitivity in tumors diagnosed as middle-stage pathologically were not significant, although they were low. The current situation may be due to the lack of homogeneous distribution of the patient group in our study. As it is known, MRI examination is sensitive in the diagnosis of DCIS at early ages due to the low sensitivity of MG in the young group. For this purpose, the cut-off value can be determined in future studies in DCIS screening according to age.

Study Limitations

There are several limitations in our study. First, although our patient population was higher than in the literature, it was performed in a single center and evaluated retrospectively. Secondly, since subgroups for the patient population were not performed, the sensitivity of our study according to age was low. Thirdly, a single radiologist evaluated the examinations. This may have caused bias in the results. Fourth, since there is no MRI vacuum biopsy technique in our center, this may have affected the results.

Conclusion

Although MRI detects a slightly larger size than MG, it has a higher sensitivity in detecting DCIS in younger patient groups.

Ethics

Ethics Committee Approval: For this study, ethics committee approval numbered 938/2021 dated 22.12.2021 was received from Ankara Training and Research Hospital Clinical Research Ethics Committee.

Informed Consent: Since the study was a retrospective study, informed consent was not required by the ethics committee.

Financial Disclosure: The author declared that this study received no financial support.

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