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Initial experience of breast specific gamma imaging (BSGI) in Asia

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Breast-specific gamma imaging (BSGI) is a functional imaging modality with using a dedicated small field-of-view system designed to detect and localize lesions. Initial studies have reported sensitivity equaling that of magnetic resonance imaging, but with improved specificity. We reviewed our initial experience to evaluate the impact of this technology at our breast center in ASIA.

We performed a retrospective review of the initial data of patients underwent BSGI as part of the imaging work-up between November 2008 and July 2009. Mammography and ultrasonography were categorized according to BI-RADS criteria. BSGI was classified according to BSGI reading guideline by George Washington Univ. medical center. Patients with abnormal BSGI or ultrasonography were underwent biopsy.

A total of 715 patients underwent BSGI because of suspicious imaging, abnormal physical examination, foreign body implant, multiple lesions or high risk patient. BSGI was positive for 204 (28.5%) of the patients and negative for 511 (71.5%). Three patients with a new diagnosis of cancer obtained BSGI for further work-up. Sensitivity and specificity of BSGI were estimated 90% and 60% respectively. A positive predictive value (PPV) of 52% with a negative predictive value (NPV) of 92% was calculated. False-positive results in BSGI included fibroadenoma, intraductal papilloma, adenosis, phyllodes tumor, atypical ductal hyperplasia, and atypical lobular hyperplasia.

Breast-specific gamma imaging can be a useful additional diagnostic tool and detect the occult cancer in negative conventional studies. But, multiple heterogeneous patchy uptakes were complicated to evaluate of the breast lesion and high proliferative benign lesion could be revealed in false positive. Further studies will be needed to define the role of BSGI.

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The utility of real-time virtual sonography (RVS)-guided biopsy as the diagnostic procedure for incidental enhancing lesions on breast MRI

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Background: Incidental enhancing lesions (IELs) that were initially identified by breast magnetic resonance imaging (MRI), but not by conventional imaging, are found in 16−29% of patients upon performing breast MRI. Particularly, IELs found in separate quadrants from the index tumor are clinically important. It is often difficult to assess incidental enhancing lesions (IELs) on breast MRI. We recently have developed a real-time virtual sonography (RVS) system, in which a position tracking system is coordinated with a magnetic sensor. RVS can synchronize a sonography image and the MR image with multi-planar reconstruction (MPR) of the same section in real time. The aim of this study was to evaluate the utility of RVS-guided biopsy as the diagnostic procedure for IELs on breast MRI.

Materials and Methods: Between June 2006 and May 2007, 65 patients underwent breast MRI for staging of known breast cancer at our hospital. All patients were examined using mammography, sonography and breast MRI before their surgeries. MRI was obtained on a Magnetom 1.5 T imager, with the patient in the supine position using a flexible body surface coil. If a patient has any IELs on breast MRI, which were suspected of malignancy, she underwent RVS after a second-look sonography. If the lesion was identified by RVS, either core needle biopsy (14G) or vacuum-assisted needle biopsy (11G) was performed while using RVS as a guide. If the lesion were detected only on the virtual MR image, but not detected on the sonography image, excisional biopsy was performed after MRI information was marked onto body surface using the RVS system. Identification rates of IELs were compared between by a second-look sonography alone and by RVS. All IELs on breast MRI were correlated with pathologic findings.

Results: Of the 65 patients, a total of 23 IELs were found in 17 patients (26%). Of 23 IELs, 30% (7/23) of IELs could be identified by a second-look sonography alone, but 83% (19/23) of them were identified by RVS ($P = 0.001$). From these 19 IELs which were identified by RVS, we performed RVS-guided needle biopsy. From the rest of 4 IELs which were not identified by RVS, we performed excisional biopsy after MRI information was marked onto the body surface using RVS. The mean size of IELs was 6.6 mm. The median time required to perform the RVS-guided biopsy procedure was 35 minutes. RVS-guided biopsy procedures were successfully completed without important side effects in all patients. Histopathologically, malignant findings of invasive ductal carcinoma ($n = 7$) and ductal carcinoma in situ (DCIS) ($n = 5$) were obtained, whereas benign findings of fibrocystic disease ($n = 6$), fibroadenoma ($n = 2$), intraductal papilloma ($n = 1$), intramammary lymph node ($n = 1$) and hemangioma ($n = 1$) were obtained.

Conclusions: Our results suggest that the RVS system can correctly project enhanced MRI information onto a body surface, as we are checking sonographic morphology. RVS-guided biopsy of the breast is a conventional and effective method for the workup of IELs on breast MRI.

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Quantitative multivoxel magnetic resonance spectroscopy

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Background: To present a new quantitative multivoxel Magnetic Resonance Spectroscopy (MRS) method for the examination and metabolic mapping of pathology in the human breast.

Materials and Methods: One patient (53y) with an invasive ductal carcinoma of the left breast underwent MRS using a 1.5T Avanto MRI system. Multivoxel 2D-chemical shift imaging (CSI) with point resolved spectroscopy (PRESS) and a spatial resolution of 0.5x0.5x1 cm^3, was performed without suppression of the water and fat signals (repetition time (TR) 1500ms, echo time (TE) 30ms) to serve as a reference measurement and was repeated with suppression of the water and fat signals (TR 1500ms, TE 135ms) to be able to detect Choline (Cho). The number of peaks fitted included the chemical shift ranges restricted to 3.1−3.3 ppm for Cho, 4.5−5.0 ppm for water, and 1.0−1.5 ppm for the main resonance of fat (−CH2−). Using standardized postprocessing protocols, the raw data were processed automatically, allowing for operator-independent quantifications. The mean and the highest choline concentration were measured in 36 voxels of 0.25 cm^3 each.

Results: The unsuppressed CSI spectral map shows intense water (at 4.7 ppm) and minor fat peaks (at 1.3 ppm) for each voxel containing lesion. After application of water and fat suppression, tumour voxels showed an intense Cho peak at 3.23 ppm as compared with lack of signal in voxels containing adipose tissue. In 4 tumour voxels the mean concentration of Cho was 0.35 mM with a highest level of 0.51 mM.

Conclusion: Quantitative multivoxel MR spectroscopy can be well performed in a standard clinical setting with use of a regular 1.5 T MR scanner.

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Impact of pre-operative breast magnetic resonance imaging upon surgical management of breast carcinoma

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Background: The use of Magnetic resonance imaging (MRI) in determining the extent breast cancer has been advocated. The aim of this study was to evaluate the effect of pre-operative MRI on the surgical decision making in patients suffering from breast cancer.

Patients and Methods: In a period of 4 years (2005–2009) 82 patients diagnosed with breast cancer by the conventional clinical examination and mammography, were also subjected to breast MRI. The MRI study was performed using a 1.5-T Phillips Eclipse magnetic resonance scanner with a standard bilateral breast coil. Radiologic findings and clinicopathological data were evaluated.

Results: The mean age of patients was 50 years (30−70 years). In 16 patients (19.5%) additional lesion were identified which have not previously detected by conventional diagnostic modalities. All the new lesions identified at MRI were localized for biopsy. In 9 patients (56.25%) the biopsy revealed malignancy and in the rest 7 the lesions were benign. In eleven patients (13.4%) who were initially considered for breast conserving surgery, the surgical decision was shifted to mastectomy based upon MRI results revealing multicenter malignant lesions. MRI had a sensitivity of 100% and in comparison to with mammography the specificity was statistically significant higher (92.7% vs 74.7%, $p < 0.005$). The positive predictive value of MRI was 42.3%. The overall accuracy of MRI was higher but not statistically significant compared to mammography ($p = 0.0054$).

Conclusion: Breast MRI influences the surgical treatment options for patients with diagnosed breast carcinoma. MRI together with biopsy to the newly identified lesions seems to be the most accurate and safe method in surgical decision making in patients with breast cancer.