clinical signs of recurrence or metastasis, knowing that more sensitive means of early diagnosis are available.

Methods: We retrospectively selected women on the database of the PET center of the Bordet Institute. Only were selectionated patients with proven breast cancer who had undergone prior curative intent treatment; an asymptomatic elevation of the circulating tumor marker (CA15−3 and/or CEA); no known recurrent disease; and a follow-up for at least 12 months. PET(CT) images were assessed by 2 experienced nuclear medicine specialists. Both were blinded to the results of the other observer and to the medical recors of the patients. A pre-established patient-based classification was used. Finally, both investigators in consensus assessed the results.

Results: Twenty-four asymptomatic women were included. Previously performed diagnostic imaging revealed no evidence of tumour at all. Mean age was 61.1 years. Median CEA level was 10.0 ng/ml (reference >2.5 ng/mL) and median CA 15−3 level was 100.4 U/ml (reference >30.0 U/mL). Four patients presented elevated levels in both tumour markers. Ten patients presented only CEA elevated levels. The follow-up of 12 months after the date of the PET demonstrated a tumoral recurrence in thirteen patients (54.2%). PET(CT) was true positive in ten cases, false positive in one patient and false negative in three cases. The patient-based sensitivity and specificity of PET(CT) was 77% and 91% respectively. The negative predictive value was 77%; the positive predictive value was 91% and accuracy of 83%.

Conclusion: Our data demonstrates the usefulness of PET/CT in the follow-up of asymptomatic women suffering from breast cancer who have elevated levels of tumour markers, by providing an accurate method for detecting metastases and/or an alternative diagnostic for example a second primary. Nowadays, combined PET/CT seems to be the best imaging modality (all in one) detecting in a reliable way disease recurrence in the follow-up of women breast cancer.

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Accuracy of breast cancer detection with full-field digital mammography (FFDM) and integral computer-aided detection (CAD) correlated with breast density as assessed by a new automated volumetric breast density measurement system

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Background: To retrospectively assess the diagnostic performance of computer-aided detection (CAD) for full-field digital mammography (FFDM) in terms of sensitivity and specificity correlated with breast density as assessed by an automated breast density measurement system in histopathologically proven breast cancers and age-matched healthy controls.

Materials and Methods: 200 consecutive histopathologically proven breast cancers imaged with FFDM (Senographe DS or GE Essential, GE Healthcare) and 200 age-matched healthy controls identified from June 2005 through February 2009 were evaluated retrospectively using CAD (Hologic R2, version 8.3.17). Each case included a craniocaudal and mediolateral oblique view. Each cancer case was matched to one control case by date of birth, age at examination and laterality of mammogram used for density determination. In all cancer cases the malignant lesion was identifiable in at least one projection on radiologist review. A CAD mark was scored true-positive, if it correctly indicated a malignant lesion. All other CAD marks were considered false. CAD sensitivity and specificity were calculated and correlated with mammographic breast density (percentage of fibroglandular tissue) as assessed by an integral automated volumetric breast density measurement system (Hologic, Quantra).

Results: CAD correctly identified 157 of the 200 cancers, a sensitivity of 79%. Sensitivity was suggestively but non-significantly lower with increased density ($p = 0.09$). In those cancer cases with density at or below the median of 20%, sensitivity was 82%, compared to 75% in those with density above the median. The presence of one or more false CAD prompts was suggestively but not significantly more likely in controls than cases (87% vs 80%, $p = 0.06$). The number of false prompts was significantly higher in controls (average 3.6 vs 2.6, $p < 0.001$). False prompts were significantly less likely with higher density ($p = 0.008$). False prompts were present in 86% of cases and controls with density at or below the median, and in 81% of those with density above the median.

Conclusion: Increased breast density is significantly associated with higher specificity of CAD, and there is suggestive evidence that it is also associated with lower sensitivity. Radiologists should be aware that CAD is likely to be less sensitive in mammography screening of younger women with denser breast tissue.

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Quantitative multivoxel magnetic resonance spectroscopy in 13 breast lesions, a pilot study

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Background: The purpose of this study is to determine whether a new quantitative multivoxel Magnetic Resonance Spectroscopy (MRS) can differentiate benign from malignant breast lesions by measuring the highest choline concentration.

Materials and Methods: Twelve patients with 13 breast lesions (7 mammographic BIRADS-3 lesions and 6 mammographic BIRADS-4 lesions) underwent an MRI and MRS at 1.5 Tesla using a Magnetom Avanto system (Siemens, Erlangen). The multivoxel MRS technique used was 2D-chemical shift imaging (CSI) with point resolved spectroscopy (PRESS), first without suppression of the water and fat signals (repetition time (TR) 1500ms, echo time (TE) 30ms) to serve as a reference measurement, and subsequently with suppression of the water and fat signals (TR 1500ms, TE 135ms) to be able to detect choline. The choline concentrations were measured in 36 voxels of $0.5 \times 0.5 \times 1\,cm^3$.

Results: The highest choline concentrations for the seven mammographic BIRADS-3 lesions were found in 2 to 4 voxels: 0.05mM, 0.13mM, 0.13mM, 0.10mM, 0.15mM, 0.15mM and 0.23mM, respectively. The work-up of the last one (0.23mM) showed invasive ductal carcinoma, the other mammographic BIRADS-3 lesions showed no malignancy. The highest choline concentrations for six mammographic BIRADS-4 lesions were found in 4 to 6 voxels: 0.22mM, 0.41mM, 0.46mM, 0.25mM, 0.68mM and 0.10mM, respectively. The last lesion with 0.10mM highest choline concentration was not malignant. Pathology confirmed malignancy in all other mammographic BIRADS-4 lesions: 4 lesions were invasive ductal carcinomas and 1 lesion was a medullair carcinoma.

Conclusion: The new quantitative multivoxel MRS method can differentiate benign from malignant lesions by indicating that a breast lesion with a highest choline concentration exceeding 0.20mM is malignant.

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Comparison of synchrotron images of Paget's disease of the breast with their pathologic findings

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Background: Synchrotron radiation x-ray imaging has revealed its possibilities to evaluate various breast diseases non-invasively. Using a phase contrast technique, we received monochromated synchrotron images of Paget's disease of the breast tissue section. To figure out the relation with their optical microscopic features, we compared the synchrotron images of the Paget's disease with their histopathologic findings of the same stained section.

Material and Methods: An x-ray microscope was installed on 1B2 beamline of Pohang Light Source, a third generation synchrotron radiation facility with operating energy of 2.5 GeV in Pohang, Korea. The x-ray energy was set at 11.1 keV, and the x-ray beam was monochromatized by a W/B4C monochromator. Zernike phase-shifter was adapted for phase contrast x-ray microscopy. Formalin-fixed 5μm-thick breast tissue sample was attached onto the Kapton film, and positioned 25 m away from the beam source. The synchrotron image of the sample was converted into a visual image on the CsI(Tl) scintillation crystal, and this visual image was captured by a full frame CCD camera. After scanning, we put together these images one another to show the large area of the tissue section. For the comparative analysis with their synchrotron image, synchrotron-scanned breast tissue sections were stained, and the histopathologic findings of the samples were captured by the image analyzer. To identify the association of synchrotron image with its histopathologic findings, we compared them with each other. The magnifying power of this microscope was 100x.

Results: The monochromated x-ray microscopic images of Paget's disease of the breast tissue sections were obtained with a good contrast and high visibility by phase contrast technique. These images showed the large lacuna-shaped Paget cells within the epidermis of nipple. The Paget cells revealed large electron-dense nuclei and electron-lucent abundant

cytoplasm with more distinct cell outlines compared with their images in histologic section, and they were seen isolated or in clusters along the basal layer but often permeating the epidermis. The infiltration of inflammatory cells and profuse collagen strands were well recognized even in the low power synchrotron images, but the squamous epithelium of epidermis was not. The minute changes of each malignant cell showing the features of cancer tissue, such as cellular differentiation and nuclear grade, were also not identified well.

Conclusions: The x-ray microscopic images of Paget's disease of breast tissue sections by synchrotron radiation showed a good correspondence with the histopathologic findings of their stained tissue sections. Without staining of breast tissue section, the synchrotron image of Paget's disease revealed the characteristic Paget cells within the epidermis very well. Therefore, the synchrotron imaging of Paget's disease appears to have a great possibility for the clinical and research purposes in the future.

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Mammographic density decreases with age as assessed by an objective integral automated breast density measurement system

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Purpose: To assess the average decrease of percent mammographic density (PMD) of women routinely screened with full-field digital mammography (FFDM) in two consecutive screens as determined by an automated breast density measurement system.

Material and Methods: 338 women who underwent routine screening with FFDM were included in this retrospective study. 235 women were aged <50 (mean age 42 yo) and 103 >50 (mean 58 yo). Density of two consecutive screens spanning 1 to 4 years was measured separately on mediolateral oblique and craniocaudal images using an integral automated volumetric breast density measurement system (Hologic, Quantra). The volume of fibroglandular tissue, the total breast volume and the percentage of fibroglandular tissue were analyzed by Quantra. Right-left (R-L) correlation of Quantra measurement was assessed for both screens. To assess the relationship of density to age, we considered a single density measure at the second screen for each subject. Data were analyzed by linear regression to determine the decrease of PMD with age per year of age for all ages, the > and <50 group.

Results: There was an excellent R-L correlation of breast densities for all ages as assessed by Quantra ($p < 0.001$). Average PMD of the <50 group was 28.3% (SD = 18) at 1st screen and 27.1 (SD = 12.4) at 2nd screen. The single measure of density at 2nd screen significantly declined with age, −0.6% per year of age ($p = 0.02$). Average PMD of the >50 group was 23.7% (SD = 36.2) at 1st screen and 21.1 (SD = 21.6) at 2nd screen. Density at 2nd screen did not significantly decline with age, −0.5% per year of age ($p = 0.1$). In all ages combined there was a significant decline with age: 0.6% per year of age ($p < 0.001$).

Conclusion: An objective automated breast density measurement system confirms a significant decline of PMD with age per year of age of up to −0.6% especially in women aged 50 years and younger.

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Texture analysis applied to full field digital mammography: ability to discriminate between invasive ductal and invasive lobular breast cancer − preliminary results

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Background: To determine texture features of IDC and invasive lobular carcinoma ILC of the breast on full-field digital mammography (FFDM). To evaluate the ability of texture analysis to differentiate between those tumor types.

Materials and Methods: 23 IDC and 10 ILC imaged with FFDM were included in this study. For each lesion ROI was manually defined covering the lesion and 1 cm normal-appearing breast tissue around the lesion. Texture features derived from the grey-level histogram, the co-occurrence matrix, the run-length matrix, the absolute gradient, the autoregressive model, and the wavelet transform were calculated for the ROIs. Fisher coefficients were calculated to determine which texture features were best-suited for distinguishing between IDC and ILC. Based on the combination of those five texture features with the highest Fisher coefficients, lesion classification was performed, using LDA (linear discriminant analysis) and PCA (principal component analysis) classifiers. Classification accuracy was used as the primary outcome measure.

Results: The five texture features with the highest Fisher coefficients were all derived from the wavelet transform. Using LDA and PCA, classification accuracies of 78.8% (26 of 33 lesions) and 81.8% (27 of 33 lesions) were achieved, respectively.

Conclusions: Texture features best suited for discrimination between ILC and IDC are derived from the wavelet transform. Our preliminary data suggest that texture analysis of breast cancer cases imaged with FFDM allows a good degree of accuracy of discrimination between IDC and ILC.

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Prevalence of hyperplastic tissue changes in breast biopsy specimen obtained from MR-guided vacuum biopsy

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Background: Increased contrast uptake on breast MR imaging can serve as biomarker for epithelial proliferation. Epithelial proliferation, in turn, may be used as a marker for increased risk of subsequent breast cancer. Aim was to investigate the prevalence of hyperplastic tissue changes in breast biopsy specimen obtained from MR guided vacuum biopsy.

Material and Methods: Between 07–2008 and 10–2009, 175 MR guided vacuum biopsies were performed in 143 women for contrast enhancing lesions seen in breast MRI alone (i.e. without correlate in mammography or second look ultrasound). We investigated the prevalence of proliferative tissue lesions (severe usual or atypical hyperplasia, lobular hyperplasia, LCIS, papillomatosis, flat epithelial hyperplasia, complex sclerosing lesion, or lesions requiring immunehistochemical staining to rule out malignant degeneration) versus non-proliferative tissue changes.

Results: Of 175 cases, 122 proved to be benign. Among the benign lesions, a total 57 proved proliferative. This corresponds to a prevalence of proliferative changes of 47% (57/122).

Conclusion: Among women undergoing MR guided vacuum biopsy for benign tissue changes, a high fraction exhibits proliferative tissue changes. Further studies are needed to investigate whether these proliferative changes (and, thus, breast MR imaging findings) can be used to identify women at increased risk for breast cancer.

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Does radiopharmaceutical molecule size change number of sentinel lymph node in breast cancer patients?

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Background: Sentinel lymph node (SLN) biopsy became a standart procedure in early stage breast cancer in order to decrease unnecessary axillary dissection. Tc-99m labeled tincolloid (400–3000 nm) and nanocolloid (<100 nm) are two radiopharmaceuticals usually used in sentinel lymph node biopsy. Our aim is to find out whether any difference between these 2 molecules while sentinel lymph node biopsy

Material and Methods: A retrospective study was performed on breast cancer patients who underwent SLN biopsy between April 2002 and March 2008. Last 50 tincolloid used patients (Group 1) and first 50 nanocolloid used patients (Group 2) were selected in order to study. Clinicopathologic characteristics of tumor (size, type and grade), age of patients, the number of SLNs were recorded.

Results: Mean age of the patients for tincolloid group and nanocolloid group were 55.4 and 52.8 respectively ($p = 0.30$). According to the clinicopathologic characteristics there were no statistical difference between tincolloid group and nanocolloid group ($p > 0.05$). Mean number of SLN for Group 1 and 2 were 1.73 and 2.18 respectively ($p = 0.038$).

Conclusions: As regards the identification rates between tincolloid and nanocolloid group there was no statistically significant difference. On the other hand the number of sentinel lymph nodes are increased in the small molecule size group.