14:00 - 15:30 Room C

Breast

SS 702
Breast: diffusion-weighted MR imaging (DWI)

Moderators:
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B-0615 14:00

Is there a systematic bias of apparent diffusion coefficient (ADC) measurements of the breast if measured on different workstations? An inter- and intra-reader agreement study

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Purpose: Apparent Diffusion Coefficient (ADC) values obtained by Diffusion Weighted Imaging (DWI) are increasingly used for breast lesion differentiation and monitoring of neoadjuvant therapy response in breast cancer. The purpose of our study was to evaluate ADC measurements of breast lesions on different computer platforms workstations by different readers in order to address subjective reader and objective post-processing influences on ADC measurement reproducibility.
Methods and Materials: Forty-one patients with 41 biopsy-proven breast lesions were included in this prospective IRB approved study. MRI examination was performed at 1.5 T using an Echo Planar Imaging DWI sequence (TR 7100 ms, TE 84 ms) with b-values of 0 and 1000 s/mm2. Two radiologists (R1, R2) with experience in breast imaging reviewed the images in separate sessions and measured the ADC for each lesion using 3 different softwares: MRI workstation (MRI-WS), PACS workstation (P-WS) and a commercially available DICOM viewer (O-WS). Agreement between WS and readers was evaluated using Intraclass Correlation Coefficient (ICC) and Bland-Altman plots.
Results: Thirty malignant, 2 high-risk and 9 benign mass-like lesions were analyzed. Agreement between WS and readers was very good (ICC R1=0.926; ICC R2=0.976). Inter-reader agreement was high for all three WS (ICC MRI-WS=0.738; ICC P-WS=0.659; ICC O-WS=0.702). Using Bland-Altman plots, no systematic differences were identified between readers and workstations. Limits of agreement ranged between a minimum of 33.9%/-38.9% and a maximum of 38.1%/-46.2%.
Conclusion: ADC measurements show a high reproducibility as measured by inter- and intraobserver agreement and are independent from the software platform used.

B-0616 14:08

Diffusion-weighted imaging with background body signal suppression (DWIBS) imaging of breast lesions before and after gadolinium injection

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Purpose: To assess whether contrast material injection (CMI) significantly affects DWIBS imaging.
Methods and Materials: 200 patients were prospectively evaluated by MRI with STIR, TSE-T2, pre-CMI DWIBS, contrast enhanced THRIVE-T1 and post-CMI DWIBS sequences. Pre and post-CMI DWIBS were analyzed searching for the presence of breast lesions and calculating the ADC value. ADC values of $\leq 1.44 \times 10^{-3}$ mm²/s were considered suspicious for malignancy. This analysis was then compared with the histological findings. Sensitivity, specificity, diagnostic accuracy (DA), positive predictive value (PPV) and negative (NPV) were calculated for both sequences and represented by ROC analysis. Pre and post-CMI ADC values were compared by using the paired t test.
Results: In 150/200 (59%) patients, pre and post-CMI DWIBS indicated the presence of breast lesions, 53 (35%) with ADC values of > 1.44 and 97 (65%) with ADC ≤ 1.44. Both pre-CMI and post-DWIBS sequences obtained sensitivity, specificity, DA, PPV and NPV values of 97%, 83%, 89%, 79% and 98%, respectively. The mean ADC value of benign lesions was $1.831 \pm 0.18 \times 10^{-3}$ mm²/s before and $1.828 \pm 0.18 \times 10^{-3}$ mm²/s after CMI. The mean ADC value of the malignant lesions was $1.146 \pm 0.16 \times 10^{-3}$ mm²/s before and $1.144 \pm 0.16 \times 10^{-3}$ mm²/s after CMI. No significant difference was found between pre and post CMI ADC values (p > 0.05).
Conclusion: DWIBS is not influenced by CMI. Breast MR protocol could be modified by placing DWIBS after dynamic contrast enhanced sequences in order to maximize patient cooperation and preserve the diagnostic accuracy.

B-0617 14:16

The influence of size and position of the region of interest on the apparent diffusion coefficient values in discriminating between benign and malignant breast lesions in diffusion weighted imaging

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Purpose: To determine the influence of size and position of the region of interest (ROI)in DWI of breast lesions on the ADC values in discriminating benign from malignant lesions.
Methods and Materials: Sixty-four patients with 72 breast lesions (52 malignant; 20 benign) underwent breast DWI. ADCs were calculated for b-value pairs: 0-1000, 0-800, 0-500, 0-200 and 0-50s/mm2. In each lesion 4 oval ROIs were drawn. ROI1 encompassed as much of the lesion as possible, ROI2 (0.5 cm2) was located in the middle of the lesion and ROI3 (0.5 cm2) and ROI4 (1.0 cm2) were selections within the lesion yielding the lowest ADC. ROC analysis was used to quantify the diagnostic accuracy of the ROI methods with the different b-value pairs. An independent sample t-test was used for malignant lesions and Mann-Whitney U test for all and benign lesions to determine statistical significance.
Results: Benign and malignant lesions significantly differed for b-value pair≥ 0-200s/mm2 (p < 0.001). A significant difference between ROI3 and ROI4 for malignant lesions (p=0.005) was observed with higher accuracy for ROI3 (0.943 versus 0.932, respectively). The ADC outcomes of b-values 0-1000 and 0-800s/mm2 met higher specificity than the lower b-value pairs: 70-75% for ROI1 and ROI3 when choosing a sensitivity and negative predictive value of 100%. The AUC was highest for ROI3 using b-values 0-1000 and 0-800s/mm2 (0.965 and 0.964, respectively).
Conclusion: The highest accuracy in discriminating between benign and malignant breast lesions is for a small ROI yielding the lowest ADC with b-values 0-1000 and 0-800s/mm².

B-0618 14:24

Sensitivity of dynamic contrast-enhanced and diffusion-weighted MRI in the detection of ductal carcinoma in situ and correlation with nuclear grade

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Purpose: This study aims to investigate the sensitivity of breast MRI in the detection of ductal carcinoma in situ (DCIS) associated with microcalcifications on the mammogram, and to assess whether the combined evaluation of dynamic contrast-enhanced (DCE) MRI and diffusion-weighted imaging (DWI) can be helpful in predicting DCIS grade.
Methods and Materials: Sixty-eight DCIS lesions (32 high-grade, 24 intermediate-grade, 12 low-grade) in 63 women who underwent preoperative breast MRI with both DCE-MRI and DWI were retrospectively reviewed. DCE imaging was classified as negative or positive on the basis of enhancement absence or presence (including all kinetic patterns). DWI was classified as negative or positive on the basis of both hyperintensity and apparent diffusion coefficient (cut-off value of 1.4x10-3 mm2/sec). Sensitivity of MRI in the detection of DCIS was calculated. DCE-MRI and DWI findings were correlated to the DCIS grade.
Results: Detection sensitivities of DCIS were 75% for DCE-MRI, 58.8% for DWI and 77.9% for combined DCE-MRI and DWI. DCE-MRI and DWI detection of DCIS increased significantly with increasing nuclear grade (p=0.032 and p=0.029 respectively). The simultaneous positivity or negativity of both DCE-MRI and DWI was significantly correlated with DCIS grading (p=0.028): negative findings in both DCE-MRI and DWI (n=15) were associated with low-grade DCIS; positive findings in both DCE-MRI and DWI (n=38) were associated with high-grade DCIS. Discordant DCE-MRI and DWI findings (n=15) were inconclusive.
Conclusion: Breast MRI may help identifying DCIS lesions, particularly high-grade DCIS. Simultaneous negative or positive DCE-MRI and DWI findings are useful to predict DCIS grade.

B-0619 14:32

Traffic light labelling of the apparent diffusion coefficient improves specificity of breast MRI

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Purpose: To assess whether traffic light labeled Apparent Diffusion Coefficient (ADC) values can be integrated with contrast enhanced MRI (CE-MRI) to improve the specificity of breast MRI in enhancing lesions.
Methods and Materials: Retrospective analysis of a consecutive series of patients referred to breast MRI at 1.5 T for further workup of mammographical/sonographical lesions classified as Breast Imaging Reporting And Data System (BI-RADS) 3-5. Reading results of CE-MRI (according to EUSOMA recommendations) were dichotomized into 1 (BI-RADS 4&5, suspicious) or 0 (BI-RADS 2&3, benign). Lesion´s ADC values (in *10-