

## IDEAL ASSIST (Automated Spine Survey Iterative Scan Technique): Metastasis Detection

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### BACKGROUND AND PURPOSE:

Multi-parametric MRI of the entire spine is technologist-dependent, time consuming, and often limited by inhomogeneous fat suppression. We prospectively tested a recently developed technique<sup>(1)</sup> in breast cancer patients to provide rapid automated total spine MRI metastasis screening with improved tissue contrast through optimized fat-water separation.

### METHODS:

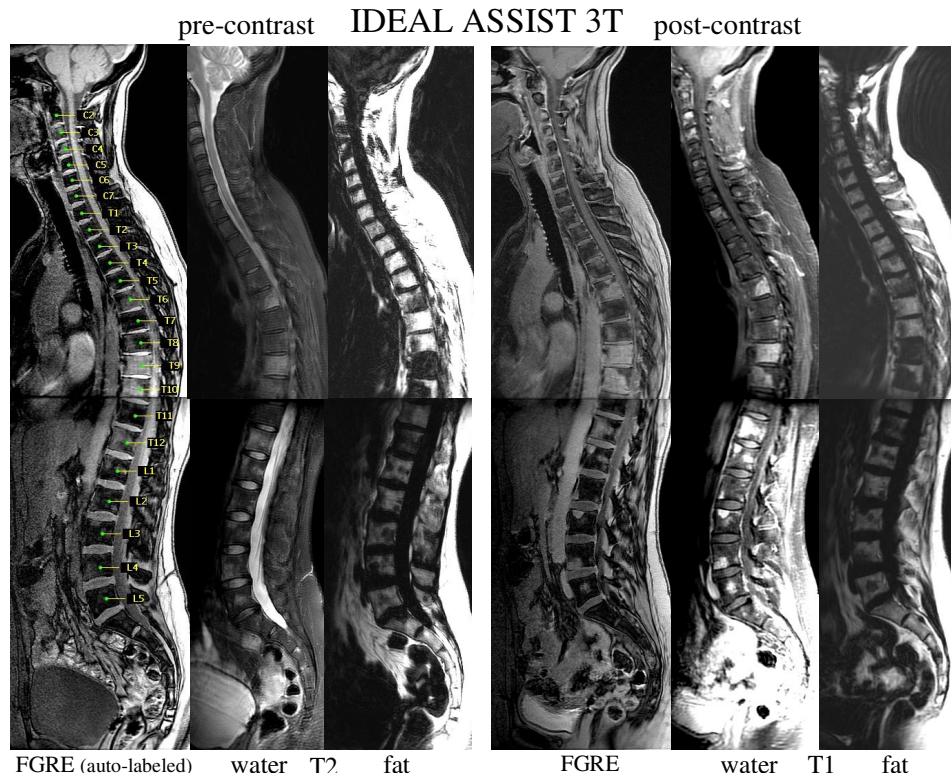
The entire spine was auto-imaged in two contiguous 35 cm FOV sagittal stations (4mm skip 1mm), utilizing out-of-phase FGRE (TR/TE =57/1.4 ms, flip angle =30, BW=±62.5 kHz, 512 x 352 matrix, 11 slices, 21 sec breath hold) and T1 (TR/TE=700/12.3 ms, ETL= 3, BW=±31.2 KHz, 320 x 256 matrix, anterior sat, 11 slices, scan time =4:04 min) and/or T2 weighted (TR/TE=2150/ 60.9 ms, ETL= 9, BW ±35.7 KHz, 512 x 320 matrix, FC, anterior sat, 13 slices, scan time=4:31 min) FSE IDEAL (Iterative Decomposition of Water and Fat with Echo Asymmetric and Least-squares Estimation) sequencing.<sup>(2)</sup> 22 subjects, median (range) age of 53 (37, 91) with known breast cancer were prospectively studied at 3.0 T; 2 received follow-up IDEAL ASSIST (Automated Spine Survey Iterative Scan Technique)<sup>(3)</sup> exams. Seven subjects received contrast, as part of a concurrent clinical MRI exam. (Fig 1) 15/22 subjects underwent PET-CT in a median (range) interval of 16 (2, 45) days before/after MRI. MRIs were independently evaluated for metastasis by two blinded neuroradiologists and run through ASSIST analysis software for automated vertebral numbering; discordant readings were re-evaluated by two raters together to reach MRI consensus. PET-CTs were evaluated by a third blinded radiologist with fellowship training in PET-CT. Final diagnosis of each case was based upon consensus of the three raters using all available imaging and clinical information, including conventional MRI, bone scans, PET, and CT exams performed before and after the investigational exam and biopsy reports; and was considered the reference standard.

### RESULTS:

Spinal metastases were identified in eight (8/24 or 33.3%) cases using the reference standard, with 6 (6/24 or 25%) cases showing metastases in more than one level. MRI correctly identified 7 metastasis positive cases and 13 metastasis negative cases with a sensitivity of 87.5% and a specificity of 81.3% respectively. Among 15 cases with PET-CT scans, the PET-CT correctly identified 2 out of 4 metastasis cases, with a sensitivity of 50% and 9 out of 11 non metastasis with a specificity of 81.8%. Two MRI raters agreed on a total of 22 out of 24 cases, with a Kappa statistics ± standard error (SE) of 0.82 ± 0.12, suggesting an outstanding inter-rater agreement. Among the 15 case subset, PET-CT and MRI were concordant on 12 cases, with a Kappa statistics ± SE of 0.53 ± 0.24, suggesting a moderate agreement between these two imaging modalities. FSE IDEAL provided uniform fat and water separation throughout the entire 70 cm FOV in all 24 studies. FGRE ASSIST afforded subminute submillimeter in-plane resolution of the entire spine with high contrast between discs and vertebrae at 3.0T. Marrow signal abnormalities could be particularly well characterized with IDEAL derived images.

### CONCLUSION:

IDEAL ASSIST is a promising MRI technique for metastasis surveillance; affording a rapid automated high resolution, high contrast survey of the entire spine with optimized tissue characterization.



**Figure 1:** Midline sagittal images from pre and post-contrast IDEAL ASSIST, total acquisition time = 18:34 sec. 37 y.o. with breast metastases detected at all vertebral levels by both MRI raters.

### REFERENCES:

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