Poster #: 17

Title of Abstract: How Do Iterative Reconstruction Algorithms Affect Spatial Resolution?

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Modality: CT

Organ System: Multi

Intro: The use of various filters and reconstruction algorithms have increased dramatically related to the processing of CT data; this evaluation examines the effect that filtered back-projection (FBP), adaptive statistical iterative reconstruction (ASiR) and model based iterative reconstruction (MBIR) have on spatial resolution.

Purpose: To measure the modulation transfer function (MTF) of images reconstructed with filtered back-projection (FBP), adaptive statistical iterative reconstruction (ASiR), and model based (MBIR) iterative reconstruction algorithms and determine their effects on

Methods Used: Catphan 600 CTP401 module was inserted into a fat-equivalent oval ring to approximate an adult body shape and size. Phantom images were acquired on a GE HD750 CT scanner using typical patient scan parameters: 120 kVp, 0.8 s rotation time, 40 mm beam width, large Scan-Field-of View (SFOV), 2.5 mm thickness, 0.516, 0.984 and 1.375 pitch factors, with varying mAs to achieve 1, 2, 5 and 11 mGy CTDIvol values. The images were reconstructed using the Standard algorithm with FBP; 20%, 40% and 70% ASiR; and MBIR. The cylindrical air target (high-contrast sensitometry sample region) was selected to measure MTFs of reconstructed images. A 14 mm line ROI, traversing half the target and an equal amount of surrounding material, was used to define the edge spread function (ESF). The line spread function (LSF) and MTF were then calculated.

Results of Abstract: MTF analysis revealed the superior performance of MBIR at higher spatial frequencies, across all dose levels and pitch factors investigated. At 1 mGy, MTF values for FBP (0.66), ASIR 70% (0.61), MBIR (0.63) at 5 lp/cm and FBP (0.17), ASIR 70% (0.18), MBIR (0.23) at 10 lp/cm, showed MBIR improvement at high spatial frequencies. For 5 mGy, MTF values for FBP (0.67), ASIR 70% (0.74), MBIR (0.72) at 5 lp/cm and FBP (0.14), ASIR 70% (0.25), MBIR (0.30) at 10 lp/cm, further demonstrate the improved performance of MBIR with increasing dose. Increasing the percent contribution of ASiR algorithms, improved MTF compared to FBP and only the very lowest dose level reduced the MTF of ASiR reconstructed images. FBP resolution was insensitive to both dose and pitch, whereas only MBIR increased MTF with larger pitch factors at higher spatial frequencies.

Discussion: Our results further demonstrate the improved performance of MBIR with increasing dose. Increasing the percent contribution of ASiR algorithms improved MTF compared to FBP and only the very lowest dose level reduced the MTF of ASiR reconstructed images. FBP resolution was insensitive to both dose and pitch, whereas only MBIR increased MTF with larger pitch factors at higher spatial frequencies.

Scientific and/or Clinical Significance? Although MBIR exhibited better spatial resolution characteristics than ASiR or FBP, MBIR was more sensitive to lower dose, which is the context in which MBIR is usually clinically applied.

Relationship to existing work To further elucidate MBIR technology and its proper clinical use.

N/A