Assessment of new model-based iterative reconstruction kernels for the detectability of small hypervascular liver lesions: a phantom study

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Résumé

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Introduction: The purpose of this study was to evaluate the new kernels associated to Model Based Iterative Reconstruction (MBIR) for the detection of low contrast hepatic lesions based on a Non-PreWhitening matched filter with Eye filter (NPWE) model observer.

Methods: An image quality phantom (CATPHAN 600, The Phantom Laboratory, NY) was imaged on a Discovery CT750 HD scanner (GE Healthcare, Wisconsin) under variable

*Intervenant

tube current configurations (Noise Index (NI) ranged from 15 to 70). Images were reconstructed using filtered back projection (FBP), Adaptive Statistical Iterative Reconstruction (ASIR) 50% and MBIR associated to Standard, Noise Reduction (NR05, NR40) and Resolution Improvement (RP05, RP20) kernels. Noise Power Spectrum and Task based Modulation Transfer Function measurements were combined into a NPWE observer to assess the detectability index (d') for a clinical imaging task representative of the detection of small liver lesions (contrast of 20 HU and 11 mm diameter). The dose potential reduction of each MBIR kernel was evaluated regarding the protocol clinically used at our institution (NI 25, ASIR 50%).

Results: At comparable dose, the d' for MBIR Standard, NR05 and NR40 was higher than the one of FBP by 20%, 24% and 53%; and ASIR by 5%, 10% and 34% respectively. The d' for MBIR RP05 and RP20 wasn't improved compared to ASIR. In comparison to our routine protocol, MBIR Standard, NR05 and NR40 can lead to dose reductions of 15%, 22% and 56% respectively.

Conclusions: New MBIR NR05 and NR40 can offer further dose reduction than Standard kernel. Alternatively, at fixed dose, they can improve detectability of small hepatic lesions.

Mots-Clés: Computed Tomography, Image Quality, Dose, Iterative Reconstruction, Model Observer, Detectability