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Visual grading evaluation in abdominal Computed Tomography

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Abstract (Doctoral thesis)

Aim

The aim of this doctoral thesis was to evaluate the dose reduction potential of two different classes of iterative reconstruction (IR) algorithms Sinogram affirmed iterative reconstruction (SAFIRE) and Advanced modeled iterative reconstruction (ADMIRE) in low-dose and standard-dose abdominal CT, and to explore the diagnostic value of low-dose abdominal CT.

Materials and Methods

Visual grading experiments were performed with pair-wise comparison of images in the same patient at different tube loads reconstructed with filtered back projection to evaluate the IR algorithms SAFIRE and ADMIRE at different strengths with variation in slice thickness. To explore the diagnostic value a low-dose abdominal CT, an absolute assessment of image quality and pathology was performed by comparing the three phases of a CT Urography. For all four studies, the anonymized images were displayed in random order for a group of radiologists who used European image quality criteria (adapted specifically for the four studies) to assess the image quality. The responses from the reviewer assessment were analyzed statistically with Visual Grading Regression (VGR).

Results

In a low-dose abdominal CT using SAFIRE strength 1, the estimated potential dose reduction was 5-9%. In a standard dose CT using ADMIRE strengths 3 and 5; a dose reduction of 30-50% was possible when compared to filtered back projection (FBP). Significant better image quality was obtained for slice thicknesses of 2mm and 3mm compared to 1 mm with potential dose reductions between 24 and 41%. However, clinical utility of the highest algorithm strength was limited to certain criteria. Visualisation of renal anatomy was as expected in favour of the post-contrast phases when compared to the native phase. Assessment of pathology showed no significant differences between the three phases.

Conclusion

IR algorithms, SAFIRE and ADMIRE, due to their denoising properties, improve image quality in abdominal CT and allow for some dose reductions. A low-dose series seems to be sufficient as a first-line modality in certain patient groups.