

# Evaluation of Hybrid-type Iterative Reconstruction using 3D-consolidated Signal to Noise Ratio in Computed Tomography

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## 【purpose】

Numerous reports have investigated the image quality of iterative reconstruction (IR) and hybrid-IR. Most reports based on the noise power spectrum in the axial plane (NPSax) and the modulation transfer function (MTF) have concluded that the image quality of IR and hybrid-IR was superior to that of filtered back-projection (FBP). However, the slice sensitivity profile (SSP) may be significantly thickened at a low contrast-to-noise ratio (CNR). This SSP difference is often neglected in comparisons and may therefore skewer results. We combine SSP and the longitudinal noise power spectrum (NPSz) with in-plane MTF and NPSax. We test this consolidated method by applying it to the evaluation of the Adaptive Iterative Dose Reduction 3D (AIDR-3D) which is a type of hybrid-IR.

## 【method】

A hypothetical filter H, which equalizes the SSP of FBP to that of AIDR-3D, was determined from SSPs measured at sufficiently low-CNR. Coefficient Kz, which is a noise variance reduction factor attainable by filter H, was obtained from the measured NPSz of FBP. Instead of a simple  $SNR(f)$ , which is a ratio of axial  $MTF(f)$  and the square root of  $NPSax(f)$ , we defined the z-corrected  $SNR(f)$  whereby  $NPSax(f)$  is replaced by  $NPSax(f)/Kz$ . The appropriate  $SNR(f)$  of AIDR-3D is obtained when SSP is corrected to be equivalent to that of FBP. We measured MTF using a tilted-wire method and SSP using a thin plastic sheet, both at sufficiently low-CNR conditions. The NPSax and NPSz were obtained using the three-dimensional Fourier transformation of the noise images. Water-filled phantoms (18 cm diameter) were used for each case and were helically scanned with a pitch of 0.89. The Collimation width and reconstruction slice thickness were both 0.5 mm. Slice interval was 0.1 mm.

## 【result】

When based on ordinary  $SNR(f)$ , AIDR-3D was significantly superior to FBP. However, the z-corrected  $SNR(f)$  showed that AIDR-3D was no better than FBP. Conventional in-plane image quality assessment may overvalue IR and hybrid-IR. For fair evaluation, the differences associated with low-contrast SSP and longitudinal NPSz, must be considered.