

Purpose: To compare denoising performance between the Prior Image Constrained Compressed Sensing (PICCS) method and a commercially available technique, Adaptive Statistical Iterative Reconstruction (ASiR).

Methods: Pediatric abdominal CT data sets were acquired using a GE VCT scanner and retrospectively analyzed in this study. ASiR was applied to the FBP reconstructed images to reduce noise. Similarly, the PICCS reconstruction method was also applied to the same data set to reduce noise. To enable PICCS reconstruction, each FBP-reconstructed image was forward-projected to generate a fully-sampled synthesized projection data set; additionally, it was low-pass filtered to generate a low-noise prior image. The forward-projected data and the low-pass filtered image were fed into the PICCS reconstruction method to generate a high spatial resolution and low noise image. Nine ROIs (two were in fat, four in soft tissue, three were in air) were used to measure the standard deviation of the noise. The difference images between the FBP image and the PICCS/ASiR images were calculated for visually evaluating the edge degradation.

Results: PICCS reduced the noise standard deviation roughly by a factor of 2 for all the measured ROIs. 80% ASiR could achieve a similar noise reduction factor for fat and soft tissues. The noise in air regions in ASiR images was not reduced. Residual anatomical structures were observed in the difference images between FBP and 80% ASiR, while they were barely observable in the difference images between FBP and PICCS.

Conclusions: PICCS can be used to reduce the noise by a factor of 2 in pediatric CT while preserving the edges. With the same noise reduction factor, PICCS can better preserve edges than ASiR. The noise reduction of ASiR is selective: it does not work in air regions, while the noise reduction of PICCS is uniform.