

CLINICAL EVALUATION OF THE WIDE BEAM RECONSTRUCTION METHOD: ULTRA HIGH-RESOLUTION BONE SPECT

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Objective: This study evaluates the diagnostic benefits of a novel reconstruction method, the Wide Beam Reconstruction (WBR™), for bone SPECT applications.

Methods: The WBR™ technology (UltraSPECT Ltd.) is based on an accurate physical description of the emission detection process and on its reconstruction, utilizing iterative optimization methods with no post-filtering applied. This technology is designed to simultaneously suppress noise and improve image resolution by eliminating the line spread function limitations from the system resolution. Additional fine tuning is done per application (e.g. the optimization for bone scans is different than that of cardiac applications.) 60 patients from three medical centers referred for bone SPECT imaging were included in this study. Data were acquired following the routine hospital imaging protocol. Each set of bone SPECT projection data was reconstructed twice: first using the native protocol (FBP or OSEM) and then the WBR™ High-Resolution reconstruction method. The patient's information was removed and a blind reading was done on each reconstruction method. For each reading a questionnaire was completed in which the reader was asked to evaluate on a 1-100 scale the (1) clarity of bone uptake, (2) bone to soft tissue ratio, (3) overall image quality, and (4) confidence of interpretation.

Results: Overall mean score was 69 for OSEM and FBP reconstructions combined, and 84 for WBR™ (median 70 vs. 84 respectively). In 59 patients (98%), the overall score of the WBR, per patient was higher than the score of the native reconstruction method. In 54 (90%) patients the bone to tissue ratio was higher for the WBR™. In none of the evaluated parameters has the WBR™ scored less than the native method. The magnitude of improvement with WBR™ was inversely proportional to the image quality scores of the native images ($R = -0.86$). A Wilcoxon signed-rank test ($p < 0.001$) confirmed the significance of the difference between the two sets of results.

Conclusions: Images reconstructed using the WBR™ method yielded significant improvement over conventional methods in subjectively scored image quality and clarity for bone SPECT applications, and elevated the physicians' confidence level. Improvement in image quality with WBR™ was greatest when the quality of images with FBP or OSEM was poor.