

EVALUATION OF WIDE BEAM RECONSTRUCTION OF HALF TIME BONE SPECTS IN CHILDREN

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Objectives: Reducing acquisition time or decreasing the injected dose while maintaining diagnostic accuracy are desirable objectives in nuclear medicine, particularly in pediatric scintigraphy. Wide Beam Reconstruction (WBR™ UltraSPECT) is a resolution recovery algorithm that improves resolution of SPECT and planar images. Preliminary reports in adults suggest that WBR enabled reduction of bone SPECT acquisition time to about half of the typical scan time without sacrificing lesion detectability. This study evaluates the quality of clinical images of half time (HT) pediatric bone SPECTs in comparison to full time (FT) SPECTs.

Methods: Tc-99m MDP SPECTs of the spine of 65 children aged 5 months-16.7 years (mean age 9.8 years) were analyzed. The original 120 projections of the full time raw data were reconstructed using FBP and OSEM algorithms (FT-FBP and FT-OSEM). WBR was applied on half time raw data (HT-WBR) that was obtained by discarding every other projection resulting in 60 projections and half of the original counts. 50 normal SPECT studies were used to assess the perceived image resolution by counting the number of vertebral bodies and spinous processes that were distinctly visible on sagittal SPECT slices on the FT-FBP, FT-OSEM and HT-WBR reconstructions. 15 abnormal SPECT studies with 25 focal lesions (identified in the FT-FBP reconstruction) were used to evaluate lesion uptake intensity (LUI) in all 3 reconstructions. LUI was defined as the ratio between average pixel counts in a lesion and a normal reference region of interest. The Wilcoxon's signed rank test was used to compare the results.

Results: Mean, standard deviation (\pm) and median counts of vertebral bodies were 5.36, ± 1.75 and 5.5 respectively for HT-WBR, 4.30, ± 1.91 and 4 for FT-FBP and 4.38, ± 1.65 and 4 for FT-OSEM. The higher number of vertebral bodies counted in HT-WBR was statistically significant compared to FT-FBP ($p < 0.001$) and FT-OSEM ($p < 0.001$). Mean, standard deviation and median counts of spinous processes were 6.68, ± 2.12 and 7 respectively for HT-WBR, 5.88, ± 2.49 and 6 for FT-FBP and 5.98, ± 2.33 and 6 for FT-OSEM. The higher counts in HT-WBR were statistically significant compared to FT-FBP ($p = 0.0006$) and FT-OSEM ($p = 0.0007$). All 25 lesions recorded on FT SPECT were visible on HT-WBR images. LUI was significantly higher on HT-WBR images (mean: 2.42, ± 1.46 , median: 1.95) than on FT-FBP (mean: 2.06, ± 1.03 , median: 1.76) $p = 0.003$ and on FT-OSEM (mean: 2.34 ± 1.39 , median: 1.81) $p = 0.04$.

Conclusions: Wide Beam Reconstruction of simulated half time bone SPECTs of the spine in children produced images that were superior to standard full time reconstructions in the perceived spatial resolution of normal elements as well as in the intensity of uptake in lesions.