Optimisation of the Astonish 2.0 algorithm by SPECT/CT.

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Introduction.

The new Astonish 2.0 reconstruction algorithm based on 3D-OSEM (ordered subset expectation maximization) techniques gives gamma cameras PET-like resolution of 4.5 mm. To investigate the effect of this algorithm, image contrast, signal-to-noise ration and SPECT spatial reconstructed resolution using this algorithm was tested using NEMA2001 procedure and results were compared with filtered back projection (FBP) and OSEM algorithms. The aim of this work was to compare the performance of Astonish reconstruction in terms of resolution and contrast with standard reconstruction algorithms, to determine the optimal parameters to be used in clinical work and to compare our results with manufacturer's specifications.

Material and Methods.

SPECT acquisition of 3 point sources was made according to NEMA-2001 (128 angles, min. 20kcnts) with different collimators, VXHR, LEGP, MEGP and HEHR, and with 99mTc, 111In and 131I. Astonish reconstruction (Philips Medical Systems, Eindhoven, NL) and standard algorithms (FBP and OSEM) were applied to these data sets using different parameters for the reconstruction. The central, axial and peripheral resolutions were plotted for Astonish reconstruction according to the product of iterations and subsets in order to determine the optimal parameters regarding resolution and CPU time. Image contrast and signal-to-noise ratio were assessed by using a Jaszczak phantom filled 99mTc with VXHR and LEGP collimators and with different background to objects ratio. Images with hot spheres were reconstructed with and without attenuation correction.

Results.

For Astonish algorithm the optimal parameters for iterations and subsets were a product of 64 for all measurements. Because of the relative CPU time necessary for reconstruction process, optimal parameters were determined as 2 iterations and 32 subsets or 4 iterations and16 subsets.
The SPECT resolution (FWHM) for 2 iterations and 32 subsets (reconstructed image matrix size128x128) with Astonish algorithm was found to be 4.6 mm at the centre of SPECT field of view using VXHR collimations, 5 mm for LEGP,5 mm for MEGP and 8 mm for HEHR, respectively. Resolutions were 11 mm, 13 mm, 14 mm and 15 mm and 10 mm, 12 mm, 14.mm and 14 mm for FPB and OSEM with VXHR, LEGP, MEGP and HEHR collimators, respectively.
As for the resolution results, the contrast increase until a product iterations subsets of 64 and then decrease or do no more increase significantly. The same observations were made for the signal-to-noise ratio.

Discussion.

Astonish reconstruction algorithm significantly improved resolution of SPECT compared with standard reconstruction algorithms like FPB and OSEM. Astonish reconstruction should be used with iterations and subsets as a product of 64 as these parameters were found to result in an optimal resolution. Our findings were comparable with published manufacturer's specifications.