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Segmented attenuation correction for myocardial SPECT

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Purpose: One of the main factors contributing to the accuracy of attenuation correction for SPECT imaging using transmission computed tomography (TCT) with an external gamma-ray source is the radionuclide count. To reduce deterioration of TCT images due to inadequate radionuclide counts, a correction method, segmented attenuation correction (SAC), in which TCT data are transformed into several components (segments) such as water, lungs and spine, providing a satisfactory attenuation correction map with less counts, has been developed. The purpose of this study was to examine the usefulness of SAC for myocardial SPECT with attenuation correction. ***Methods:*** A myocardial phantom filled with Tc-99m was scanned with a triple headed SPECT system, equipped with one cardiac fan beam collimator for TCT and two parallel hole collimators for ECT. As an external gamma-ray source for TCT, 740 MBq of Tc-99m was also used. Since Tc-99m was also used for ECT, the TCT and ECT data were acquired separately. To make radionuclide counts, the TCT data were acquired in the sequential repetition mode, in which a 3-min-rotation was repeated 7 times followed by a 10-min-rotation 4 times (a total of 61 minutes). The TCT data were reconstructed by adding some of these rotations to make TCT maps with various radionuclide counts. Three types of SAC were used: (a) 1-segment SAC in which the body structure was regarded as water, (b) 2-segment SAC, in which the body structure was regarded as water and lungs, and (c) 3-segment SAC, in which the body structure was regarded as water, lungs and spine. We compared corrected images obtained with non-segmentation methods, and with 1- to 3-segment SACs. We also investigated the influence of radionuclide counts of TCT (3, 6, 9, 12, 15, 18, 21, 31, 41, 51, 61 min acquisition) on the accuracy of the attenuation correction. ***Results:*** Either 1-segment or 2-segment SAC was sufficient to correct the attenuation. When non-segmentation TCT attenuation methods were used, rotations of at least 31 minutes were required to obtain sufficiently large counts for TCT. When the 3-segment SAC was used, the minimal acquisition time for a satisfactory TCT map was 7 min. ***Conclusion:*** The 3-segment SAC was effective for attenuation correction, requiring fewer counts (about 1/5 of the value for non-segmentation TCT), or less radiation for TCT.

Key words: transmission computed tomography, emission computed tomography, segmented attenuation correction, myocardial SPECT