

A study on attenuation correction using Tc-99m external TCT source in Tc-99m GSA liver SPECT

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Purpose: In attenuation correction of ECT images by transmission CT (TCT) with an external ^{99m}Tc γ -ray source, simultaneous TCT/ECT data acquisition is difficult, when the same radionuclide such as ^{99m}Tc -tetrofosmin or ^{99m}Tc -GSA is used as the tracer. In this case, TCT is usually acquired before administration of the tracer, and ECT is acquired separately after the tracer injection. However, mis-registration may occur between the TCT and ECT images, and the repetition of examinations add to the mental and physical stress of the patients. In this study, to eliminate this problem, we evaluated whether attenuation correction of ECT images can be achieved by acquiring TCT and ECT simultaneously, then acquiring ECT alone, and preparing an attenuation map by subtracting the latter from the former using ^{99m}Tc -GSA liver ECT. **Method:** The ECT system used was a three-head gamma camera equipped with one cardiac fan beam collimator and two parallel beam collimators. External γ -ray source for TCT of ^{99m}Tc was 740 MBq, and ECT of ^{99m}Tc -GSA was 185 MBq. First, pure TCT data were acquired for the original TCT-map, then, ECT/TCT data were acquired for the subtracted TCT-map, and finally, pure ECT data were acquired. The subtracted attenuation map was produced by subtracting the pure ECT image from the TCT/ECT image, and attenuation correction of the ECT image was done using both this subtracted TCT map and attenuation map from pure TCT. These two attenuation corrected images and non-corrected images were compared. Hot rods phantom, a liver phantom with a defect, and 10 patients were evaluated. **Results:** Attenuation corrected ECT values using the subtraction attenuation map showed an error of about 5% underestimation compared with ECT values of the images corrected by original attenuation map at the defect in the liver phantom. A good correlation of $y = 22.65 + 1.06x$, $r = 0.958$ was observed also in clinical evaluation. **Conclusion:** By means of the method proposed in this study, it is possible to perform simultaneous TCT/ECT data acquisition for attenuation correction using Tc-99m external source in Tc-99m GSA liver SPECT. Moreover, it is thought that this method decreases the mental and physical stress of the patients.

Key words: transmission computed tomography, ^{99m}Tc -GSA, subtraction attenuation map