ORIGINAL ARTICLE

Annals of Nuclear Medicine Vol. 14, No. 4, 271–277, 2000

Phantom study of fusion image of CT and SPECT with body-contour generated from external Compton scatter sources

Kazuyoshi SUGA, Naofumi MATSUNAGA, Yasuhiko KAWAKAMI and Mataichi FURUKAWA

Department of Radiology, Yamaguchi University School of Medicine

Purpose: A phantom study was conducted to evaluate the feasibility of body contour definition with Compton scatter photons from extemal sources of technetium-99m pertechnetate (Tc-99m) to create a fusion image of CT and SPECT images.
Methods: External sources of 1 mCi (37 MBq) Tc-99m were placed on each collimator, and body-contour SPECT images were obtained with an energy window of 100 keV ± 25% for detecting 90° and 180° Compton scatter photons of Tc-99m from the body surface in water-filled cylindrical and hexagonal phantoms, and in a chest phantom with a Tc-99m-avid simulated lung nodule and multimethod surface markers. In the chest phantom, each transaxial SPECT slices was registered with the corresponding CT slice by using image-matching soft ware. A summation of the registered images yielded a three-dimensional (3-D) fusion image of this phantom.
Results: This method clearly visualized the body contour on all the SPECT slices in all the phantoms except for the complex hexagonal phantom. There was no significant difference between the known and SPECT-measured diameters of the cylindrical phantom. The fit of CT and SPECT images of the chest phantom was achieved with a mean alignment error of 5% in visual inspection, which was improved to 0.2% after correction of the magnification of the SPECT images according to the resultant dimensional differences. The 3-D fusion image of this phantom effectively visualized the anatomic location of the lung nodule and surface markers.
Conclusion: This simple method effectively provided boundary information on the cold phantoms. Although further improvements in the registration technique with CT images are desirable, the body-contour SPECT image obtained by this method has the potential for accurately creating a 3-D fusion image with CT images, and is a feasible way of anticipating the anatomical localization of a target tissue.

Key words: SPECT, image fusion, Compton scattered photons, body-contour definition