

Attenuation correction of myocardial SPECT images with X-ray CT: Effects of registration errors between X-ray CT and SPECT

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Purpose: Attenuation correction with an X-ray CT image is a new method to correct attenuation on SPECT imaging, but the effect of the registration errors between CT and SPECT images is unclear. In this study, we investigated the effects of the registration errors on myocardial SPECT, analyzing data from a phantom and a human volunteer. **Methods:** Registerion (fusion) of the X-ray CT and SPECT images was done with standard packaged software in three dimensional fashion, by using linked transaxial, coronal and sagittal images. In the phantom study, an X-ray CT image was shifted 1 to 3 pixels on the x , y and z axes, and rotated 6 degrees clockwise. Attenuation correction maps generated from each misaligned X-ray CT image were used to reconstruct misaligned SPECT images of the phantom filled with ^{201}Tl . In a human volunteer, X-ray CT was acquired in different conditions (during inspiration vs. expiration). CT values were transferred to an attenuation constant by using straight lines; an attenuation constant of 0/cm in the air (CT value = $-1,000$ HU) and that of 0.150/cm in water (CT value = 0 HU). For comparison, attenuation correction with transmission CT (TCT) data and an external γ -ray source ($^{99\text{m}}\text{Tc}$) was also applied to reconstruct SPECT images. **Results:** Simulated breast attenuation with a breast attachment, and inferior wall attenuation were properly corrected by means of the attenuation correction map generated from X-ray CT. As pixel shift increased, deviation of the SPECT images increased in misaligned images in the phantom study. In the human study, SPECT images were affected by the scan conditions of the X-ray CT. **Conclusion:** Attenuation correction of myocardial SPECT with an X-ray CT image is a simple and potentially beneficial method for clinical use, but accurate registration of the X-ray CT to SPECT image is essential for satisfactory attenuation correction.

Key words: SPECT, X-ray CT, fusion image, misaligned images