

Purpose:

Evaluate the potential of phased attenuation correction in respiration correlated PET/CT.

Method and Materials:

Respiration correlated scans were made on a Siemens Biograph PET/CT scanner which was modified to make an extremely low pitch CT scan and list mode PET scan possible. After collection of the raw CT, list mode PET data, and the respiration signal via a pressure load cell, PET/CT images were binned into ten phases of the respiration with help of in-house built software. Attenuation correction was next performed for each phase.

Experiments were performed with a lollipop phantom. The sphere at the end of the rod was filled with approximately 20MBq FDG. For the first experiment a sphere with a diameter of 3.3cm was used. The second experiment was performed with a large sphere with a diameter of 3.7cm in which a second smaller sphere of 2.2cm was situated. The inner sphere was filled with water or air in order to simulate a tumor with a necrotic core. The sphere movement had an amplitude of 5.0cm, and a frequency of 0.3Hz.

Results:

Both CT and PET images of the ten phases in the first experiment show well-defined spheres in all orthogonal directions. In phased PET images corrected with the phased CT data, the sphere has a clearer outline as compared to images that were corrected with uncorrelated CT data.

The images of the second experiment indicate that phased attenuation correction also results in a better detection of inhomogeneous structures.

Conclusion:

In this phantom study we have shown that phased attenuation correction after respiration correlation of CT and PET is feasible.

Application of phased attenuation correction reduces motion artifacts and improves image quality. In future research the feasibility of phased attenuation correction in PET/CT for lung cancer patients will be examined.