HEALTH RESEARCH ABSTRACT SUBMISSIONS #22

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Title of Research *	Scatter fraction as a function of object size in Emission Tomography
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Introduction & Purpose *

Positron emission tomography (PET) and single photon emission tomography (SPECT) are two nuclear emission-imaging modalities that rely on the detection of high-energy photons emitted from minute amount of radiotracers administered to the subject. The majority of these photons are absorbed or scattered in the body, resulting in count losses or deviations from true detection distorting the accuracy of reconstructed images. In clinical emission tomography (ET), where scatter fraction(SF) ranges 30-60%, sophisticated correction methods are often required, employing additional x-ray CT or radionuclide transmission scans. Having proven their potential in both clinical and research areas, both PET and SPECT are being adapted for small animal imaging. However, despite the growing interest in small animal ET, little scientific information exists about the accuracy of these correction methods on smaller size objects, and what level of correction is required. Hence, the purpose of this work is to determine the role of scatter correction as a function of object size through realistic simulations. a function of object size through realistic simulations.

Experimental Design *

In emission tomography, Monte Carlo methods are often preferred instead of conducting real experiments due to the expensive instrument used in this field and time concerns. Unneccessary radiation dose and sacrificing small animals are also avoided with these methods.For these reasons we used Geant4 Application for emission tomography (GATE), a dedicated emission tomography software, to simulate the PET and SPECT scanners. Different sizes of MOBY (realistic mouse/rat model) and XCAT (realistic human model) are simulated and scatter fractions (scatter/ (true+counts) measured. In addition, we simulated cylindrical phantoms representing small animals and humans.

Results *	We found that for all mouse sizes and most rat sizes the scatter fraction (SF) was less than 20%. On the other hand, for even the smallest sizes of human studies SF was larger than 25%.
Conclusions *	Our results suggest that most small animal imaging can be performed without scatter correction or using simple methods. Human imaging, however, require additional transmission scan.

Created	
2 Apr 2010	**129.255.1.139**

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