AbstractID: 2559 Title: Introduction to dual-modality imaging and SPECT/CT

Over the past decade, dual-modality imaging has emerged as a diagnostic technique which combines structural and functional information with the goal of improving the assessment and management of patients with heart disease, cancer, and other disorders. Prototype dual-modality systems developed by early investigators were designed to perform both x-ray and radionuclide imaging simultaneously with a single detector array, an approach proved to be very challenging and ultimately impractical. Now, both SPECT/CT and PET/CT systems are available for clinical use that integrate separate radionuclide and x-ray imaging subsystems with a common gantry, computer system, and patient table. The direct combination of radionuclide and x-ray imaging with dual-modality systems thereby facilitates fusion of functional and structural image data. In addition, patient-specific *a priori* information from CT can be incorporated into tomographic algorithms used to reconstruct the radionuclide data with corrections for photon attenuation and other physical perturbations, to improve both the visual quality and the quantitative accuracy of the radionuclide data. PET/CT now has significant clinical role in facilitating structural/functional correlation and attenuation correction, primarily of ^{18}F-fluorodeoxyglocuse imaging of patients with cancer. Similarly, SPECT/CT can perform attenuation correction and structural/functional imaging using single-photon diagnostic agents for cancer and heart disease, including those that use gamma-ray emitting radiopharmaceuticals for radionuclide cancer therapy. These applications are enabled through the design and implementation of both the hardware and the software for dual-modality imaging, and provide unique capabilities and important clinical data which can not be achieved easily when structural or functional imaging is performed in isolation.

The author acknowledges research support from Gamma Medica Incorporated (Northridge CA), General Electric Healthcare (Waukesha WI and Haifa Israel), Radiation Monitoring Devices (Watertown MA), the UC Discovery Grant Program (Oakland CA), the UC Campus Laboratory Collaboration Program (Berkeley CA), the Department of Defense, the Department of Energy, and the National Institutes of Health.

Educational Objectives

1. To understand the design and clinical goals of dual-modality imaging systems, including both SPECT/CT and PET/CT
2. To understand how implementation of dual-modality imaging improves both the visual quality and the quantitative accuracy of radionuclide data