AbstractID: 9913 Title: SPECT/CT Instrumentation and Clinical Applications

Hybrid SPECT/CT is rapidly becoming a mainstream imaging modality, with the recent commercial introduction of systems that incorporate state-of-the-art multi-slice, diagnostic CT scanners. The ability to acquire contemporaneous, electromechanically registered dual-modality scans has created a new paradigm for SPECT imaging. The first generation, single-slice hybrid scanner produced acceptable attenuation coefficient (mu) maps for SPECT attenuation correction, however the quality of its anatomical overlay CT for SPECT/CT fusion imaging was limited. The CT integrated into the latest generation of hybrid systems is a fully-functional diagnostic scanner. In addition to generating high-quality mu maps, these systems can produce diagnostic image quality CT scans with variable scan parameters (speed, collimation, pitch, mA, slice thickness and FOV), that are capable of greatly improving both the localization and specificity of abnormalities detected on the corresponding SPECT scan. In some cases, these systems are also capable of performing billable diagnostic CT scans with contrast enhancement.

The widest use of SPECT/CT is currently in oncology, with applications including: tumor localization, staging and response to treatment; pre-surgical mapping (e.g., parathyroid adenomas, sentinel lymph nodes); differentiation of skeletal metastases from other disease processes; functional image-based radiation therapy treatment planning (e.g., lung perfusion); and quantitative SPECT/CT-based internal radionuclide therapy dosimetry/treatment planning. Cardiac SPECT/CT is currently focused primarily on improved attenuation correction of SPECT myocardial perfusion images; although the newest, 16-to-64-slice integrated scanners offer the potential for contemporaneous CT cardiac imaging (e.g., coronary angiography, calcium scoring). SPECT/CT is also being utilized for imaging bone and other non-malignant diseases.

This lecture will review the underlying physics of SPECT/CT imaging, present several examples of the clinical application of SPECT/CT, and provide an overview of the currently available SPECT/CT scanner types and models.

Educational Objectives:

1. To understand the underlying physical principles of SPECT/CT image acquisition, processing and reconstruction
2. To understand current and future clinical applications of SPECT/CT imaging
3. To become familiar with the various commercially-available SPECT/CT product offerings