التصوير الطبي

Medical Imaging

LECTURE NINE

Emission Computed Tomography

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Introduction

Single photon emission computed tomography (SPECT) has been widely used in nuclear medicine for several decades. Since the late 1980s and early 1990s SPECT images have been combined with x-ray computed tomography (CT) to provide complimentary information of anatomy and function for improved diagnostic outcomes. Image registration emerged to bring SPECT and CT into a combined SPECT/CT imaging modality. Despite the success of these approaches, difficulties exist with the co-registration process; differing spatial resolutions, differing respiratory state / cardiac cycle and differing abdominal contents from examinations being performed at different times of the day. Hardware innovations, hybrid SPECT/CT, were developed to address co-registration software limitations. Acquisition of both SPECT and CT images can be made within a few seconds of one another. Since the first commercial system became available in 1999, which used low x-ray outputs with low quality CT images, SPECT/CT have evolved to utilise higher output diagnostic standard CT scanners such as 64 slice CT systems. The improved capability and diagnostic quality CT images has been accompanied by widespread clinical use and demand. The ability to accurately locate the functional information seen from SPECT has an incremental benefit over the SPECT and CT images alone. Clinical examples are provided to highlight these combined strengths. SPECT/CT is one example of the 'blurring' of traditional boundaries between radiology and nuclear medicine. An understanding of the technical and clinical aspects of SPECT/CT can provide improved clinical outcomes for the benefit of the patient and of the professional development of medical radiation scientists. Single photon emission computed tomography (SPECT) is a nuclear medicine tomographic imaging technique that involves positioning the camera head at multiple angles around the body accumulating 180°or 360° of data at specific angular intervals, generally 2–6 degrees depending on the structure. The principle of data collection (Figure 1) and reconstruction is common with other tomographic techniques such as positron emission tomography (PET) and computed tomography (CT); traditionally, using filtered back projection with the more recent emergence of iterative reconstruction methods.