A review of low dose CT in SPECT-CT: system capability and dosimetry

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Hybrid SPECT-CT systems available on the market can produce varying quality CT images. Some units have restricted options in terms of the acquisition parameters, whereas some units produce equivalent quality images to diagnostic CT scanners.

As well as impacting on the clinical value of these images, the capability of the unit also impacts upon the added patient dose.

This talk will consider the main parameters that have an impact on patient dose and image quality.

Photon Fluence

mA is one of the most important parameters to consider in CT. It has a linear relationship to dose, it affects the contrast resolution, as well as the signal to noise ratio (SNR).
Rotation time of the tube also has a direct relationship to dose, increasing rotation time will increase the dose linearly. (McNitt-Gray, 2002)

kVp

The kVp chosen will affect the linear attenuation coefficients of the tissues. In diagnostic CT 120kV is routinely used. There is a current trend to reduce the kV to 80-100 kV, which reduces dose and improves contrast resolution, but decreases SNR. (Huda, Ogden, & Khorasani, 2008)
However, in hybrid imaging 140 kVp is used causing reduced inherent tissue contrast resolution.

Slice Thickness

The slice thickness used effects the spatial resolution in the Z-axis, an increased slice thickness means poorer resolution, whereas using a thinner slice would mean having to increase the mA to maintain the same SNR impacting on dose. (Bongartz G, 2004)

Pitch

Increasing pitch decreases dose, and also decreases the Z-axis resolution due to the partial volume effect.

Matrix Size

Matrix size directly affects the spatial resolution of the image, a larger matrix size would also need a higher mAs to improve the SNR. (Romans, 2011)

Scanner Geometry

Due to the inverse square law, the scanner geometry affects image quality and noise, therefore it is not recommended to transfer the same scanning parameters to units with different scanner geometries (Kalra, et al., 2004).

References & recommended further reading

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