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A Small Field of View Camera for Hybrid Gamma and Optical Imaging

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The development of compact low profile detectors has allowed the production of small field of view, hand held imaging devices for use at the patient bedside and in operating theatres. The combination of an optical and a gamma-ray camera, in a co-aligned configuration, offers high spatial resolution multi-modality imaging giving a superimposed scintigraphic and optical image. This innovative introduction of hybrid imaging offers new possibilities for assisting surgeons in localizing the site of uptake in procedures such as sentinel node detection.

Materials and Methods:

We have developed a compact hybrid gamma-optical camera of weight approximately 1kg, consisting of a 600 μm thick CsI(Tl) columnar scintillator coupled to an electron multiplying CCD. A tungsten collimator with a 0.5mm diameter pinhole produces a 40x40mm nominal field of view (FOV) and alignment with an optical camera provides the same FOV as the gamma camera for image superimposition.

Images are recorded simultaneously and presented in a fused co-aligned display of the two modalities. Performance characteristics including sensitivity, spatial resolution and count rate response, have been measured based on protocols adapted for use with high-resolution small FOV systems.

Results:

The characteristics of the hybrid camera compared favourably with other portable gamma cameras currently available. Spatial resolution $<1\text{mm}$ was recorded with system sensitivity of up to 214cps/MBq. A simulated node 2mm in diameter containing 2MBq $^{99\text{m}}\text{Tc}$ was detectable (signal-to-noise ratio 25) situated 10mm from a simulated injection site 8mm in diameter with an activity of 32MBq at a source-to-camera distance of 55mm. The new hybrid system is being clinically evaluated and initial results from imaging patient volunteers are very encouraging.

Conclusion:

The anatomical context provided by the optical camera aids the physical localisation of radiopharmaceutical uptake in patients. The compact size and fused display makes the system ideal for surgical use, where optical information can aid localisation of sites of uptake, such as in sentinel node detection. Initial patient images show the utility of the system and encourages us to carry out further evaluation in the surgical theatre setting.

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