



Performance of a hybrid gamma-optical camera for improved utility in diagnostic imaging

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Hybrid Compact Gamma Camera

The Hybrid Compact Gamma Camera (HCGC) is a new portable gamma camera with a small field of view developed in Space Research Centre, University of Leicester [1], Figure 1. This gamma camera offers high spatial resolution (approximately 1 mm) by using a pinhole collimator.

The complete system combines optical and gamma-ray cameras, in a co-aligned configuration, offering high spatial resolution scintigraphic imaging fused with anatomical information from an optical image. Figure 2. The technology has the potential to be operated as a hand-held camera during intraoperative procedures such as sentinel node detection.

Simulation of lymphatic imaging

Lymphoscintigraphy is a nuclear medicine imaging procedure used to assess the lymphatic system. The common indications of lymphoscintigraphy are to assess regional lymphatic drainage and for sentinel lymph node mapping/biopsy, for example in breast cancer and malignant melanoma.

This work describes the characteristics of the camera and initial images of simulated lymphatic vessels using a 0.55 mm diameter cannula filled with ^{99m}Tc solution.

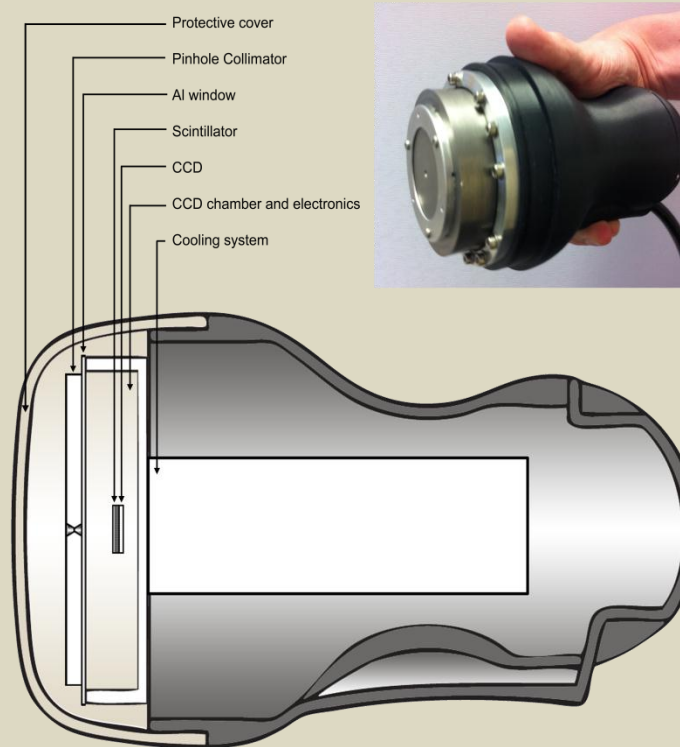


Figure 1. Main: schematic of compact gamma camera (CGC). Inset: image of CGC with protective cover to show pinhole collimator. Image taken from (Bugby, S.L., 2014)

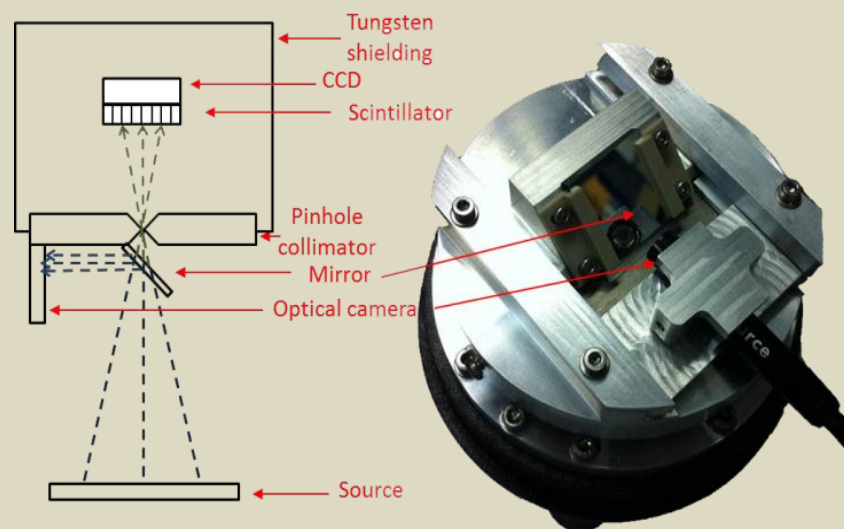


Figure 2. Schematic of hybrid compact gamma camera (HCGC).

Results

The characteristics of the HCGC have been found to compare favourably with other portable cameras designed for intraoperative use [2]. Spatial resolution of less than 1mm was recorded with a system sensitivity of up to 214cps/MBq. Figure 3 shows optical and gamma images of a ^{99m}Tc filled cannula. The fused images show good alignment of the two modalities allowing accurate localization of activity.

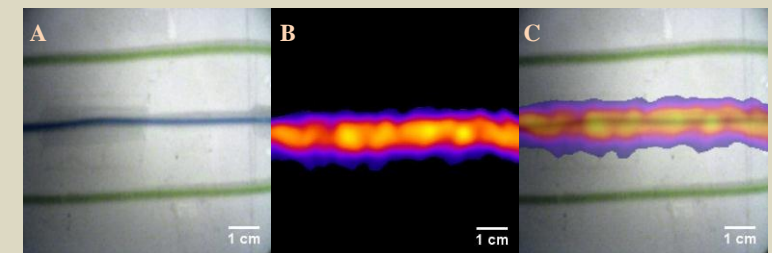


Figure 3. Optical and gamma images acquired by the HCGC. A cannula was used to mimic a lymphatic vessel. The middle cannula was filled with ^{99m}Tc mixed with blue dye, the upper and lower one filled with green dye only. (A) optical image, (B) gamma image and (C) fused gamma optical images.

Conclusion

The performance characteristics of a hybrid camera have been described and initial images demonstrate that it is well suited for intraoperative imaging. The anatomical context provided by the optical camera aids the physical localization of radiopharmaceutical uptake. These studies encourage us to carry out further evaluation in preparation for its use in a surgical theatre setting.

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References

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2. Bugby, S.L., et al., Characterisation of a high resolution small field of view portable gamma camera. Phys Med, 2014. 30(3): p. 331-9.