TECHNICAL NOTE

Imaging I-125 with a Scintillation Camera

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The 27–35 keV radiations from I-125 are generally considered to be well below the useful energy range of Anger cameras. However, we report for the first time the successful employment of an unmodified Ohio-Nuclear Model 120 mobile camera to image I-125. When the high-voltage and window-width controls are both set to maximum, the composite I-125 spectral peak is almost entirely included in the lower-energy portion of the analyzer window. Although tests demonstrate spatial resolution somewhat inferior to that obtained with Tc-99m, we show clinically satisfactory images of I-125-labeled fibrinogen in deep-vein thromboses of the leg. Ohio-Nuclear Models 410 and 420 and a General Electric Maxicamera II, tested elsewhere all provide sufficient gain to center the spectral peak in the analyzer window. Other camera models not currently capable of imaging I-125 could be made to do so by simple modifications.

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The useful energy range of the Anger camera is generally considered to be about 70–700 keV. At lower energies the intrinsic resolution is adversely affected by random variations in the number of electrons released in the photomultiplier tubes. This energy limitation is assumed to rule out the imaging of the 27–35 keV radiation from I-125 (*1*).

However, we report for the first time the successful imaging of I-125 with a scintillation camera*. When the controls for the high-voltage supply and for the width of the pulse-height analyzer are both set to maximum, the composite spectral peak from the I-125 radiations appears in the multichannel analyzer display at the left-hand side of the window (Fig. 1).

As expected, the spatial resolution is somewhat inferior to that measured with Tc-99m. We have compared the resolution from I-125 and Tc-99m sources, contained in capillary tubes, using a high-sensitivity collimator and 2 cm of scattering material. The values for the full width at half maximum are 1.16 and 0.77 cm, respectively. The corresponding modulation transfer functions are shown in Fig. 2.

After the above investigations were performed, a related report by Taylor et al. (*2*) appeared, in which the same

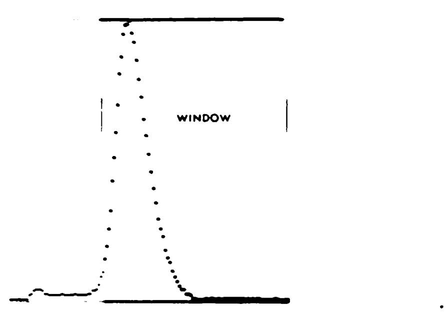

FIG. 1. Iodine-125 spectrum displayed with multichannel analyzer of an Ohio-Nuclear Model 120 scintillation camera. High-voltage supply and window-width controls are both set to maximum in order to bring the photopeak into the window.

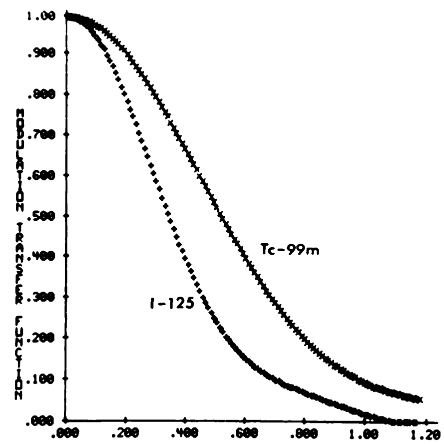

FIG. 2. Comparison of modulation transfer functions from I-125 and Tc-99m sources. Sources contained in capillary tubes were imaged through high-sensitivity collimator and 2 cm of Masonite.

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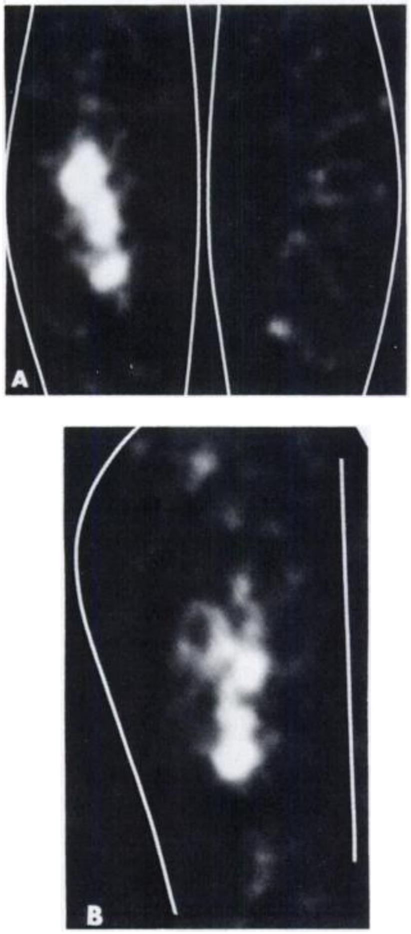

FIG. 3. Images made 4 days after injection of 160 μCi I-125-labeled fibrinogen, demonstrating deep-vein thrombosis of left calf. Acquisition time was 10 min per view through high-sensitivity collimator. (A) Posterior view of both calves. (B) Medial view of left calf. Measurement at this site with an external probe showed a 68% increase in counting rate over that of right leg.

camera model but with the collimator removed, was used as a highly sensitive monitoring device for I-125 contamination.

Iodine-125 imaging with the scintillation camera appears to be useful for the display of labeled fibrinogen contained in deep-vein thrombosis of the leg (Figs. 3 and 4). The signal-to-background ratio is poor because of the small dose administered and because of the very wide analyzer window required to include the spectral peak. The images shown in Fig. 3 have been processed by background subtraction and a 9-point smooth. Those in Fig. 4 used raw data and show the rather high background. Despite the present performance deficiencies of the camera with I-125, the images of deep-vein thrombosis appear to provide considerably more detailed information than is obtainable by the conventional external counting procedure. Our application, however, awaits further study.

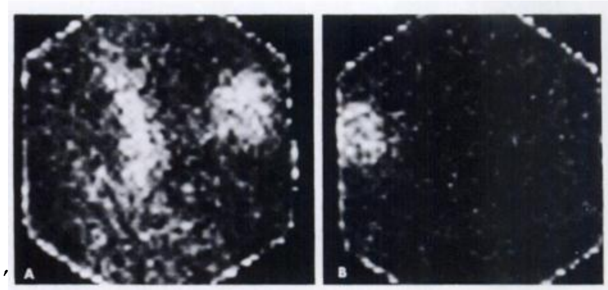

FIG. 4. Anterior I-125 fibrinogen images of both hips, showing (A) thrombosis in right groin, with normal bladder activity; and (B) no abnormal activity in left hip outside the bladder. These unprocessed images demonstrate rather high background resulting from small administered dose and use of wide analyzer window.

More recently we have investigated elsewhere the I-125 response of a number of other camera models and have demonstrated successful performance with the Ohio-Nuclear 410, 420, and with the General Electric Maxicamera II, all of which have sufficient gain to center the spectral peak in the analyzer window. The current models, with 37 photomultiplier tubes of improved efficiency, are not nearly as limited in low-energy performance as earlier cameras. If a clinical need is established for I-125 imaging, the manufacturers of cameras not currently capable of imaging I-125 can easily provide this feature by extending the range of the high-voltage supply or increasing the gain of the preamplifiers.

FOOTNOTE

* Ohio-Nuclear Model 120.

ACKNOWLEDGMENT

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2. Taylor A, Verba JW, Alazraki NP, et al: Monitoring of I-125 Contamination Using a Portable Scintillation Camera. *J Nucl Med* 19: 431–432, 1978