Dacryocystography: Incompatibility of the "Reversed Pinhole Insert" in Some Collimator Designs

To the Editor: Magnification techniques are usually required for dacryocystography because of the small size of the structures being imaged. Pinhole collimators fitted with inserts having apertures as small as 1 mm have been recommended (*1–3*). With many pinhole collimator designs, the aperture in the insert is recessed several centimeters, which interferes with positioning of the patient's eye close to the opening (Fig. 1). To facilitate close positioning of the

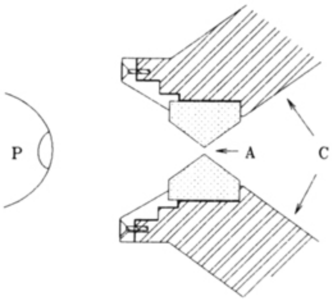

FIG. 1. Cross-section of the pinhole collimator with insert in the standard position. P is position of the patient's eye; A is insert aperture; and C is collimator base.

patient, Chaudhuri (*4*) recommended a modification of the standard position in which the insert in the collimator is reversed (Fig. 2). He reported excellent

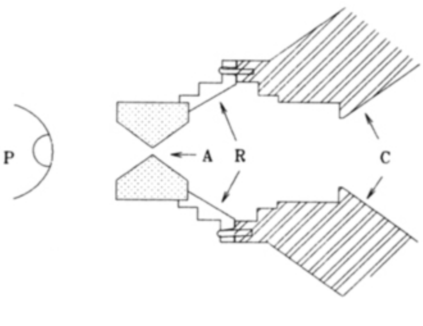

FIG. 2. Cross-section of the pinhole collimator with insert in the reversed position. P is position of patient's eye; A is insert aperture; R is aluminum ring; and C is collimator base. This position allows the patient's eye to be positioned closer to the pinhole aperture.

magnification and easier positioning with this arrangement. Reversal of the pinhole collimator insert for dacryocystography may produce confusing artifacts.

We recently employed a scintillation camera* for dacryocystography and attempted to utilize this reversed configuration of the insert. Prior to studying the patient, test images were obtained to evaluate the performance of this arrangement and to determine the field of view in the reversed position. An initial image of a four-quadrant bar phantom with the collimator insert reversed failed to resolve any of the bars and had a relatively cold central spot (Fig. 3). Using a flat-

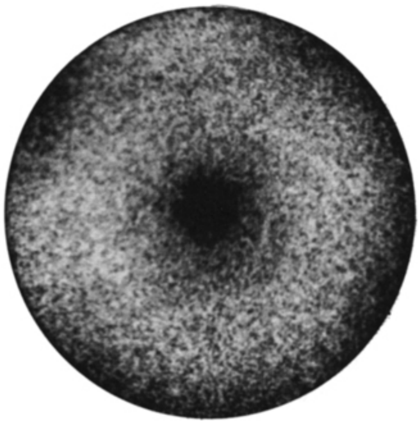

FIG. 3. The collimator insert in the reversed position failed to resolve a four-quadrant bar phantom using a flood source.

field flood source without the bar phantom, images were made with the pinhole insert in the normal configuration and in the reversed position. While the normal configuration produced the expected image (Fig. 4A), the reversed position yielded an image with a "cold" center surrounded by a "hot" band (Fig. 4B). Computer enhancement of the images showed relatively little activity within the cold spot.

The pinhole insert is made from titanium while the housing holding it in place is made from aluminum. In the standard configuration, the aluminum ring is attached to the lead housing of the

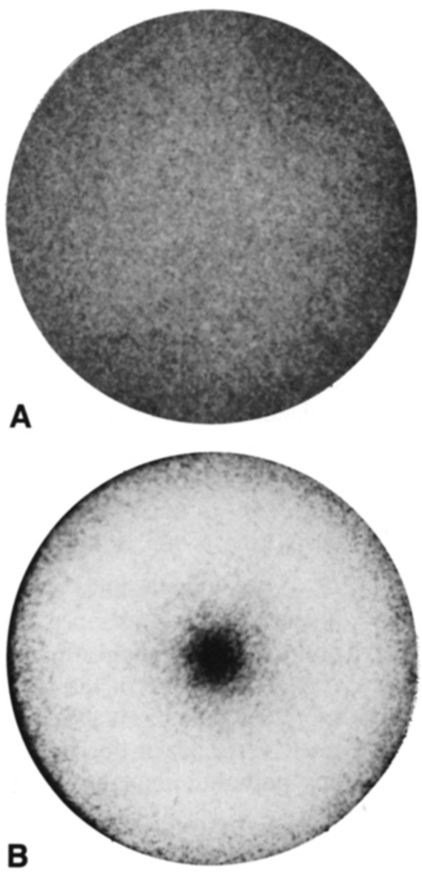

FIG. 4. (A) Image of a flood source with the collimator insert in the standard position. (B) Flood source image with the insert in the reversed position.

collimator base that provides shielding for the detector. Thus, all counts seen by the detector pass through the pinhole insert aperture. In the modified (reversed) position, there is no lead to provide additional shielding for the aluminum ring. This allows penetration by the 140 keV ^{99m}Tc photons and results in most of the detected counts coming through the unshielded aluminum. The central titanium insert is an effective attenuator, and the counts through the small pinhole are so few that they are overwhelmed by the counts coming through the ring. A "hot" donut with a relatively cold center is the result.

Obviously, this would not be satisfactory for imaging and emphasizes the need to perform appropriate tests whenever an attempt is made to use equipment in a modified manner or in a configuration different from the manufacturer's original intent. Investigators wishing to employ Chaudhuri's reversed insert position (*4*) for dacryocystography should make certain that their collimator design will allow this modification without introducing confusing artifacts. Equipment modification should be studied with appropriate quality control measures before being used for patient studies.

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Note

* Picker 411 Dyna Camera, Highland Heights, OH.

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