Hepatic Scintiangiography: The Technical Side of the Story

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Different techniques to obtain the most accurate and reliable method of proper patient positioning for hepatic scintiangiograms were investigated by this clinic. Neither the sole use of a lead-strip marker, palpation, nor percussion of the liver demonstrated enough accuracy for the proper patient positioning necessary to achieve a diagnostic liver flow study. Our experience, however, shows that the use of a flood tank for transmission scanning and a lead-strip rib marker for body landmark identification provides accurate, proper patient positioning.

The liver scan has long been used in nuclear medicine to evaluate liver size, shape, and position, as well as to delineate focal and nonfocal liver defects. However, since a routine liver scan cannot be used to establish whether a defect is vascular or avascular, further evaluations on the part of the clinician are necessary to determine the etiology of the abnormality.

One method previously employed was the radiopaque hepatic angiogram, which demonstrated superb clarity and unique specificity. This study proved complicated and invasive, however, requiring selective and even subselective catherization on the part of the radiologist. Because it possessed some degree of morbidity, it was not readily accepted by either patients or physicians as a routine study to obtain definitive information concerning blood flow to the liver.

An alternative to the radiographic hepatic angiogram is the hepatic scintiangiogram employed by DeNardo et al. (*1*) for evaluating hepatic blood flow and increasing specificity in the diagnosis of space-occupying lesions of the liver.

In normal patients (Fig. 1), radioactivity within the hepatic bed is greatly reduced during the arterial phase and increased during the venous phase (*1*), since 75–80% of the hepatic blood flow is supplied by the portal vein with the rest supplied by the hepatic artery. In patients with hepatic neoplasms, however, early arterialization or tumor stain is seen at the site of the lesion (Fig. 2).

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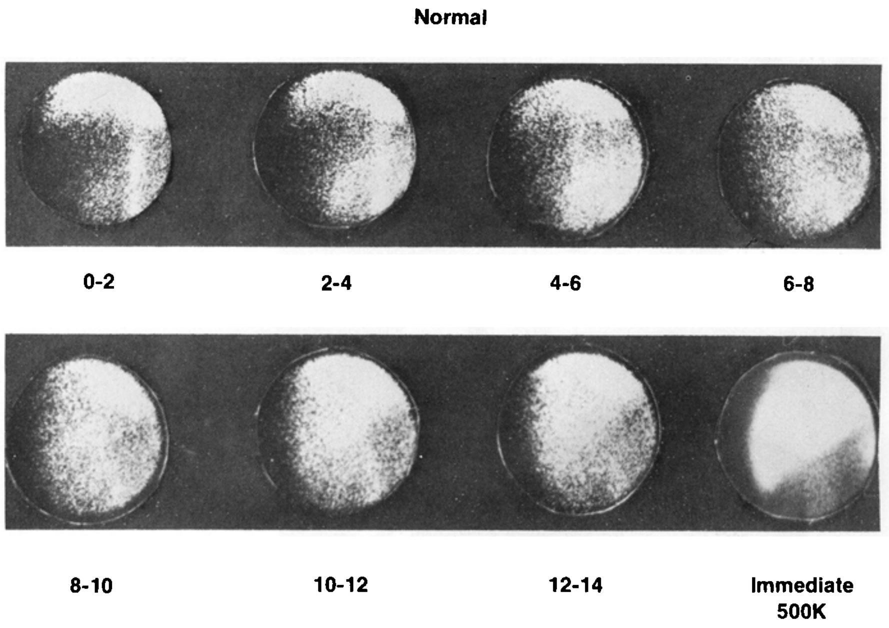

FIG. 1. Normal hepatic scintiangiogram.

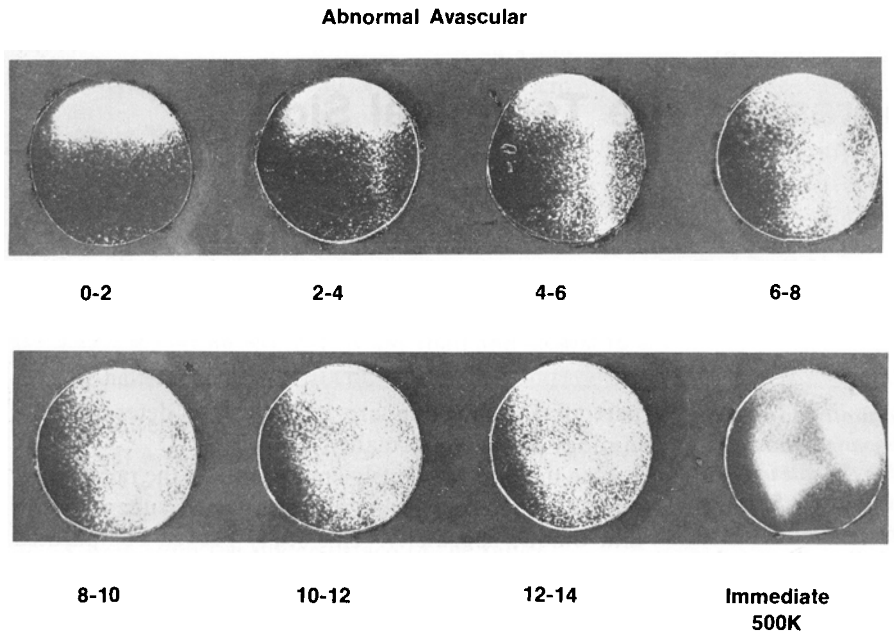

FIG. 2. Serial images of an abnormal avascular liver defect.

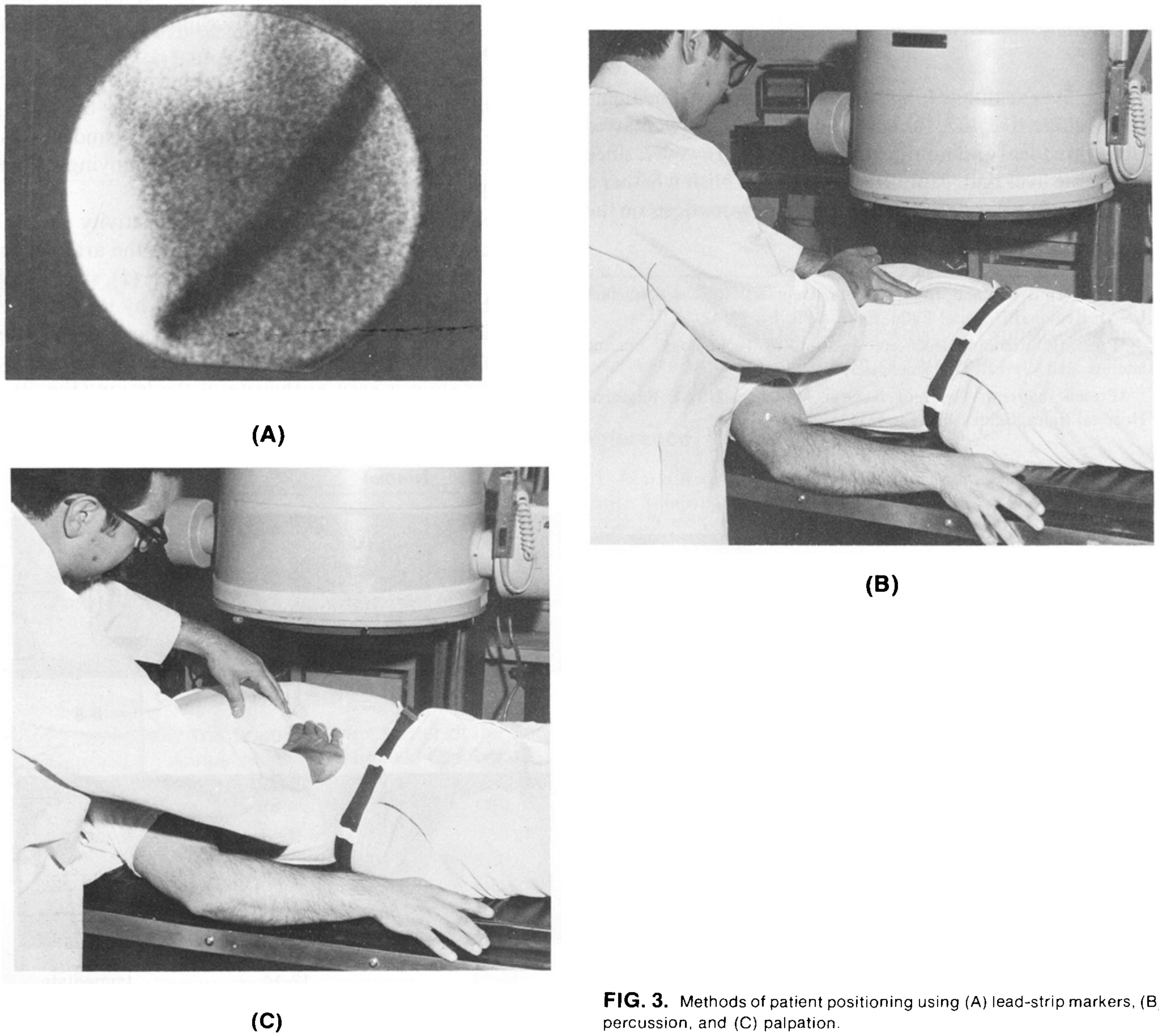

FIG. 3. Methods of patient positioning using (A) lead-strip markers, (B) percussion, and (C) palpation.

By taking rapid, serial scintiphotos after a bolus intravenous injection of Tc-99m sulfur colloid, additional information can be obtained. This requires a procedure to reduce the amount of patient information lost due to malpositioning.

Materials and Methods

Originally, the clinic at Wilford Hall employed three methods of patient-to-detector alignment (Fig. 3): lead-strip rib marker, percussion, and palpation. These methods proved to be inadequate, however, often necessitating the rescheduling and redosing of a patient to obtain the required information. In order to reduce these errors in positioning, we used a standard flood tank with 5-10 mCi $^{99m}TcO_4$ as a transmission source. This drastically reduced errors in positioning the patients by displaying anatomical landmarks without making an injection (Fig. 4).

The patient is placed in the anterior-supine position on a radiolucent imaging table. The right upper quadrant is aligned to the detector, and the transmission source is placed on a small table directly between the patient and detector. Using the persistence oscilloscope, we relied on the anatomical structures of cardiac shadow, right hemidiaphragm, and right outer surface to ensure correct position (Fig. 4). Once the proper position was obtained, the transmission source was removed and a 10-mCi Tc-99m sulfur colloid bolus was injected into the antecubital vein.

Serial images (Fig. 1) using standard Polaroid and Nikon 35-mm cameras with motor drive were taken at one frame every 2 sec for 1 min. An immediate 500k static image for positioning was then obtained. After the scintiangiogram was performed, a routine seven-view liver scan was completed.

Discussion

Because an exposed source was used in establishing the proper patient alignment, other factors had to be identified and included in this study. Radiation exposure to the patient and technologist had to be considered and was found to be less than 1 mR/hr (*2*). This was verified through the close scrutiny of film badges and pocket dosimeters. Set-up time was reduced as technologists became more proficient. Use of a standard radiographic portable film storage bin for holding the transmission source reduced the exposure to both patient and technologist.

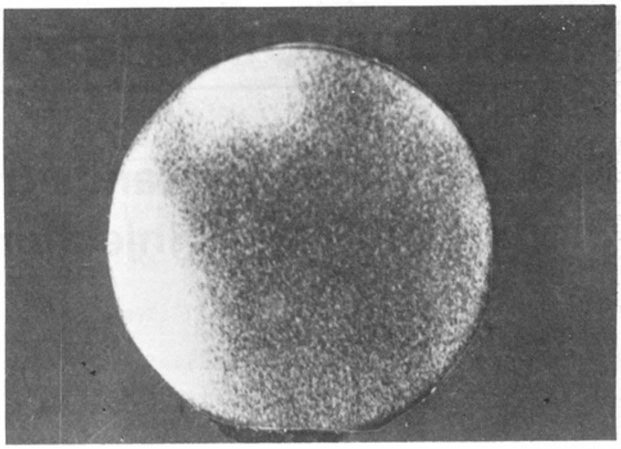

FIG. 4. Transmission scan without lead marker. Graphic display of the anatomical structures as seen on the persistence scope.

Results

Of the original 202 consecutive case studies routinely performed using this method, only two studies had to be repeated because of malpositioning. This constitutes 99% accuracy and is a definite improvement over the other methods used.

References

1. DeNardo G, Stadalnik R, DeNardo S, et al: Hepatic Scintiangiographic patterns. *Radiology* 111: 135-144, 1974.

2. Trott G, Stacey AJ, Ellis RE, et al: The dosimetry of selective procedures using x-rays and radioactive substances. *AEC Symp Ser* 20: 244, 1972