

accuracy for excluding or demonstrating the presence and location of an abdominal or pelvic abscess by ultrasound is 96%. Unlike the gallium examination, the results of ultrasound examination are immediately available to the surgeon, and an abscess cavity can frequently be drained before the diagnosis could have been made with gallium. Nevertheless, in our experience, the combination of gallium and ultrasound examination provides the highest accuracy.

In conclusion, it appears that our experience with the grey-scale ultrasound technique and the hepatobiliary system has led us to conclusions rather different from those of Dr. Sanders' about its clinical use in the diagnosis and management of patients at this institution. We believe that our experience is more characteristic of the potential of the method than that indicated by Dr. Sanders.

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#### Reply

We are glad that Drs. Taylor and Rosenfeld have commented on our recent article in the *Journal of Nuclear Medicine* because it gives us an opportunity to emphasize the importance of technique.

Performance of a diagnostic ultrasound examination requires considerably greater technical skill—and possibly more interpretive skill—than a comparable nuclear medicine examination. Although the two techniques give results of roughly comparable diagnostic accuracy, the radioactive approach, requiring less skill, is therefore preferred.

Standards of technical skill and interpretation for diagnostic ultrasound vary throughout the country, and in our article we attempted to give a consensus of the feelings at the better centers in the U.S.A. of the value of diagnostic ultrasound in abdominal disease. In several areas, the claims made by the Yale ultrasound group differ from those reported from other major centers. Although the grosser examples of diffuse liver disease can be diagnosed by a high-quality sonographer, in our view a difficult and subjective judgment on the internal sonographic texture of the liver

is required. Borderline cases are hard to call, and time-gain compensation and output power variations may make a dense echo pattern invalid. Since in a scintigram the spleen shows increased uptake in early diffuse liver disease, we believe early detection is simpler by radionuclide techniques.

With regard to focal liver disease, it is inevitable that some peripheral liver lesions will be missed by sonography. In those patients in whom the liver is high in the abdomen or surrounded by ribs, some parts of the liver are inaccessible to current ultrasonic scanning techniques. We therefore persist in our belief that the liver scan is a more accurate method of detecting peripheral liver lesions.

However, several centers now report slightly greater accuracy for ultrasound in the overall detection of focal liver lesions. We now feel that all individuals suspected of having focal liver disease should have both a scintigram and an ultrasound examination, since each can detect lesions missed by the other. The scintigram should precede the ultrasonic examination so that defects found on the liver image can be characterized by the ultrasound examination. In our experience, liver abscesses may be surrounded by a zone of increased or decreased echoes.

It is over a year since we completed our manuscript for the *Journal of Nuclear Medicine*, and since this is a rapidly moving field, some of our conclusions have become outdated. We now agree with Drs. Taylor and Rosenfeld that ultrasound is highly accurate in the detection of obstruction of the common bile duct, and have ourselves achieved similar results: a 95% accuracy rate. It remains true, however, that a decision as to whether the bile ducts are obstructed is dependent on actual distention of the ducts. Therefore, obstruction that is recent in origin and has not yet caused duct dilatation may be difficult or impossible to detect by ultrasound.

When an abscess is intravisceral, i.e., within the spleen, liver, etc., it is easily detected by ultrasound. More difficulty is encountered with abscesses in the mesentery, where gas, barium, bandages, incisions, and ribs may all render ultrasound useless, and loops of fluid-filled bowel may be confused with an abscess (1). In our view, gallium is the preferred first screening technique in fever of unknown origin if there are no localizing signs and the patient's condition is such that a decision can be deferred for 48 to 72 hr. The sonogram is used to look at areas of suspicion found with gallium. An additional value of the gallium scan is that it will detect extra-abdominal inflammatory foci.

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#### Unbinding of Tc-99m by Iodinated Antiseptics

All of the radiopharmaceutical kits used in our institution are prepared "in house" by our nuclear pharmacist, using the same formulation as two neighboring hospitals. These two others have never had any problems of poor labeling with our common procedure. We have had numerous sporadic occurrences of excessive free technetium activity with our Tc-99m-labeled sulfur colloid.

Initial chromatographic analysis after preparation of the colloid showed good labeling, but subsequent patient studies showed excessive blood-pool activity and occasional evidence of free pertechnetate later in the day.

After several fruitless searches, the problem was eventually traced to the antiseptic that we used to sterilize the tops of our vials. The other hospitals used 70% alcohol, whereas we used a preparation of iodine complexed with polyvinylpyrrolidone\*. Other similar products are Betadine† and Bridine‡. The antiseptic action of povidone-iodine solutions is due to the available iodine present in the complex, which yields nascent oxygen in aqueous solutions.

After the usual preparation of the sulphur colloid, we normally had 0–3% free technetium, but in the presence of Providine this increased to between 10–100% free.

We found that only a small amount of Providine need enter the vial to inhibit labeling or release previously bound technetium. When the vial is swabbed, a small puddle often remains on the septum so that some Providine enters with the needle. If the Providine is allowed to dry completely on the septum, no problem occurs, since then it is not sucked into the evacuated vial.

Many antiseptics, particularly iodinated ones, are good oxidizing agents. These may oxidize the compound, releasing technetium and degrading the radiopharmaceutical. It is important that precautions be taken so that no antiseptic contaminates the radiopharmaceutical.

We think that this is an important consideration if any institution has a problem with poor labeling or instability of radiopharmaceutical kits.

We now sterilize the tops of vials with alcohol, and have had no problems with radiopharmaceutical instability.

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#### FOOTNOTES

\* Providine, Rougier Inc., Montreal, Canada.

† The Purdue Frederick Co. Ltd. (Canada), Toronto, Canada.

‡ Allen & Hanburys, Toronto, Canada.

### Pulmonary Radioactive Microemboli following Radionuclide Venography

Radionuclide venography is a study frequently used to diagnose deep venous thrombosis in the lower extremities. This technique has generally been considered free from complications. We report a problem with this procedure that is apparently rare.

A 48-year-old male, who had received a gunshot wound to his left thigh approximately 30 yr previously, was seen for varicosities and stasis ulceration of that leg. Contrast venography using 250 cc. of 25% diatrizoate sodium was technically unsatisfactory. One hour later a radionuclide venogram of the left lower extremity was performed using 3 mCi Tc-99m MAA.

Radioactivity was seen only in the superficial veins of this limb (Fig. 1A). Tagging of clot in the calf veins was noted at the end of the procedure (Fig. 1B). In view of the apparent deep venous thrombosis, an eight-view pulmonary perfusion series was performed, but it revealed no perfusion defects.

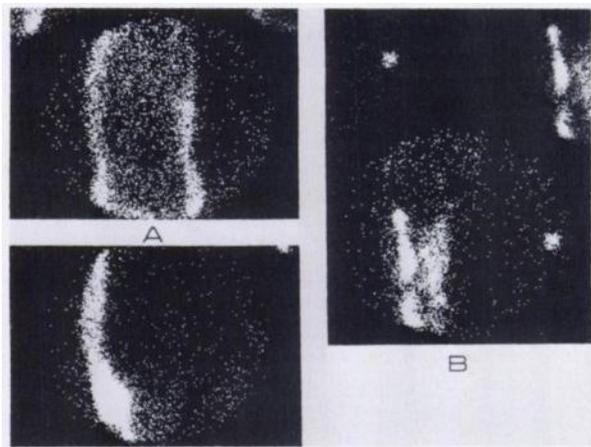


FIG. 1. Radionuclide venogram of the left lower extremity. Activity is seen to be limited to superficial veins of this extremity in both thigh and calf (A). Later imaging of calf shows tagging of clot in expected position of deep venous system (B).

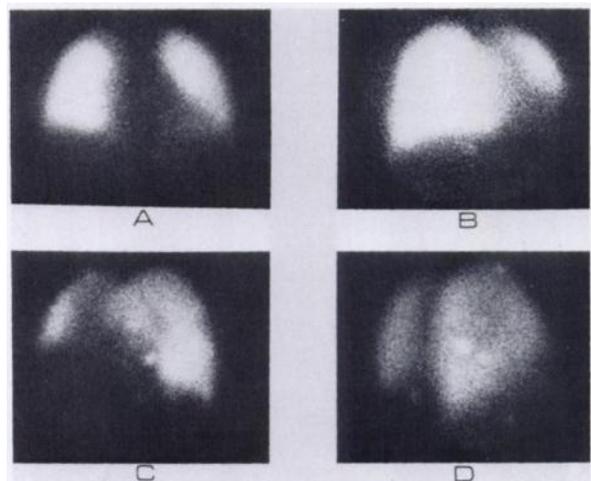


FIG. 2. Immediate pulmonary perfusion scintigrams, those shown being the first, third, fifth, and eighth. (A) = ant., (B) = RAO, (C) = LAO, and (D) = RPO. Series shows increasing radioactive emboli. Note peripheral arrangement, suggesting subpleural locations.

After the normal anterior scintigram (which was done first), however, "hot spots" were seen to appear on subsequent scintigrams, increasing in number between the earliest and later images (Fig. 2). These emboli were subpleural, suggesting that they were quite small. The patient had no complaints during or after the study. His post-scan chest roentgenogram was normal, and he remained asymptomatic.

There has been one other report in the literature of intercurrent radioactive embolization. This occurred during lung scanning during upper-extremity venous disease (1). In neither this case nor our own was this phenomenon felt to be the result of improper technique during injection of the radionuclide. The same procedure and material have been used in over 100 other radionuclide venograms, and subsequent perfusion images have not produced these findings.

Experience with the "hot clot" phenomenon resulting from the mixing of MAA with blood drawn into the syringe has been reported (2). Preston and Greenlaw (3) offer,