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THE AUTHORS' REPLY

We have read with keen interest the impressive studies of Braunstein, et al (*1,2*) about the problems concerning brain death. We do agree that it would be of great value to have a method for routine clinical use by which it could be possible to obtain objective criteria of impaired cerebral perfusion.

We admit that it is inconvenient to bring the patient from the ICU to the isotope department. These patients, however, are few in our hospital, and the transport has not offered any difficulties and no complications have occurred. These drawbacks, however, have not influenced our choice of method.

We have had a different intention than Braunstein, et al when deciding which type of technique is preferable in these cases. In some European countries there is a tendency to insist upon x-ray angiography as a form of legal proof of the absence of cerebral circulation at brain death. The x-ray examination is rather time consuming and requires a lot of personnel. Therefore we have looked for another method of examination which is easy to perform, not so time consuming, and yet reliable. We believe that we have found such a method in the isotope angiography we have described (*3*).

The important difference between the portable probe technique and our method is that the latter makes it possible to visualize the morphologic changes of impaired cerebral circulation by means of sequential pictures as well as by time–activity curves.

On the scintiphotos from the examination of the circulation we have been able to check that the radionuclide has been properly injected. By this method it is also possible to detect local vascular changes, for instance, arterial embolic lesions with impaired circulation or dislocation of intracranial arteries owing to expanding masses.

The question concerning the distribution of the activity in the external and the internal carotid artery is contradictory. We believe that the time–activity curves obtained by the method used by Braunstein, et al are the sum of the intra- and extracranial activity at maintained cerebral circulation even though the extracranial activity may be low compared with the intracranial. For that reason we feel entitled to state that "it is impossible to decide whether the detected activity comes from the vessels in or outside the brain." Of prime importance, however, is that this holds true in impaired intracerebral circulation, "intermediate type," according to Braunstein, et al (*2*).

The discussion about the discrimination of the depressed and prolonged transit curve and the extracerebral curve is interesting. Braunstein, et al admit that it may be difficult to separate the intracranial from the extracranial activity.

This fundamental problem concerning the level of the intracranial pressure at which the intracranial circulation is totally hindered is relevant for every kind of measuring or visualization of the cerebral circulation including x-ray angiography. Further investigation of this problem is necessary.

The last question deals with angioscintigraphy of patients in deep coma due to drug intoxication with prolonged total abolishment of the EEG with subsequent recovery. We have not examined any such patient and thus we cannot give any answer to the question. The patient in our paper (*3*) had "a highly abnormal EEG, being sometimes flat, almost isoelectrically silent for periods of 10 sec."

SVERKER NORDLANDER
PER-ERIK WIKLUND
PER-ERIK ÅSARD
Danderyd Hospital, Danderyd
Sweden

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RADIONUCLIDE VENOGRAPHY

It always has been my feeling that radionuclide venography is a highly recommended procedure for a patient with clinical evidence of pulmonary embolism because of its simplicity and usefulness. It was delightful, therefore, to read the article by Henkin, et al (*1*). In our series of radionuclide venographies, we have some findings that are not described in their rather extensive studies. An example is the visualization of the popliteal veins for more than 30 min after the injection of ^{99m}Tc-HAM. At an early stage of the study when radionuclide activity was confirmed in the femoral vein, tourniquets were removed from both ankles. The early dynamic scintiphotogram showed a slight decrease in the blood flow through the right iliac vein (Fig. 1A). As the camera field was moved over the thigh, the femoral and saphenous veins appeared to be normal in both sides except for a delayed flow (Fig. 1B).

However, images of the popliteal veins obtained at a later stage were grossly abnormal showing retention of the radionuclide and development of collateral flow (arrows, Fig. 1C). In this particular case, markedly delayed clearance or hangup of the radionuclide in the popliteal veins was visualized up to 30 min after the injection.

Rosenthall has described visualization of trapped ^{99m}Tc-human albumin macroaggregates at the region of thrombi, 7 min after the injection (*2*). It is apparent that a search for areas of delayed radionuclide clearance in the lower leg is a recommended practice, particularly when radionuclide venography over the pelvis and thigh is negative.

In view of the significant increase in field size, I prefer to use a 140-keV diverging-hole collimator despite considerable loss in sensitivity. With a dose of 1 mCi or more of ^{99m}Tc-HAM in each leg, the lower sensitivity of the diverging-hole collimator has never been a problem in our venography series.

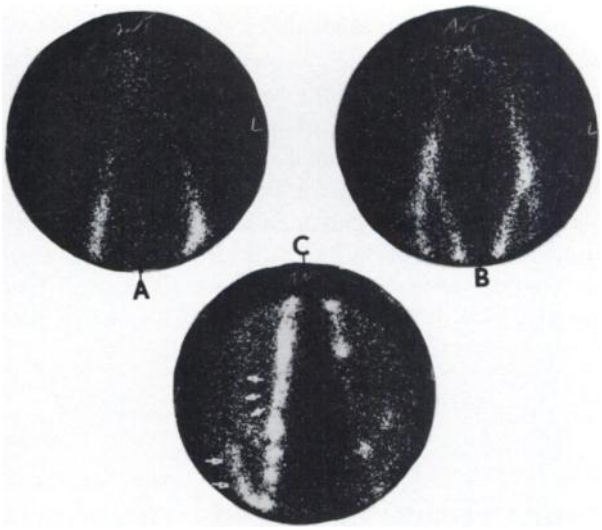

FIG. 1. Radionuclide venogram obtained from Pho/Gamma HP camera with 140-keV diverging-hole collimator. Two millicuries of ^{99m}Tc-HAM were injected into dorsal vein of each foot. (A) Scintiphotogram of both iliac veins recorded 20 sec after injection. (B) Scintiphotogram of femoral and saphenous veins in both legs recorded about 1 min after injection. (C) Images of right and left popliteal veins recorded 25 min after injection.

U. YUN RYO
Michael Reese Hospital and Medical Center
Chicago, Illinois

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THE AUTHORS' REPLY

We are encouraged to see that other institutions are adopting what we have found to be an excellent technique for the evaluation of deep venous thrombosis (DVT) of the lower extremities.

Different institutions may employ slightly different methodology in performing radionuclide venograms. It would appear that the method employed by Dr. Ryo resembles that of McDonald (*1*) more than the method we described (*2*).

We have, however, made observations similar to