Renal Cortical Imaging and the Detection of Renal Mass Lesions

Leonard et al. reported the usefulness of the Tc-99m glucoheptonate renal scintigram in detecting renal cortical mass lesions in comparison with the radiographic modalities, such as the excretory urography and renal angiography (1). Although in their discussion these authors described the usefulness of the radionuclide dynamic flow study to evaluate the vascularity of cortical mass lesions, further application of renal cortical scintigraphy should aid in the differentiation of renal space-occupying or mass lesions. We attempted to differentiate cortical vascular lesions from cortical cysts by combining early dynamic and late static images using Tc-99m dimercaptosuccinic acid (DMSA), instead of Tc-99m glucoheptonate (2).

For the past several years, Tc-99m DMSA has been used more frequently in Japan as a renal imaging agent. Since this radionuclide accumulates preferentially in the renal cortex, the late image provides a distinct cortical image, whereas the early image shows dynamic flow through the vascular pool in the renal cortex (3,4). After 2 mCi of Tc-99m DMSA were administered intravenously, early images were obtained after 20 to 50 sec and the late images after 2-3 hr. As shown in Fig. 1, in cases of renal cortical malignancy, such as renal-cell carcinoma, local Tc-99m DMSA uptake can be detected on the early image (left-hand arrow) and, because of the nonfunctioning cortical mass, an area of decreased activity should appear in the same area on the late image (right-hand arrow).

In the case of renal cystic lesions, the area of decreased activity was revealed in both early and late images with almost 100% diagnostically accuracy. In cases of renal-cell carcinoma and angiomylipoma, Tc-99m DMSA uptake was seen in the early image and the area of decreased activity was observed in the late image, indicating the diseased region. However, Tc-99m DMSA uptake was not seen in the early image in cases where a renal-cell carcinoma had advanced to the stage of necrosis. Occasionally when a highly vascular renal tumor had extended into the peripheric tissues, the tumor area could be overestimated on the early image.

It is almost impossible to diagnose renal-cell carcinoma using the radionuclide image alone. However, Tc-99m DMSA renal studies, with both early and late imaging, have proven to be a useful, noninvasive adjunct in the detection of malignant cortical lesions.

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References


Reply

Dr. Wolfstein is correct that our clinical experience with glucoheptonate is better than the reported statistics. We find ourselves in the camp claiming that all nuclear medicine studies can best be interpreted with full knowledge of the clinical information and other ancillary studies. To avoid the biases inherent in that view, however, our study was designed as a double-blind comparison. We hope our results will encourage the use of radionuclide scintigraphic procedures as a primary method for the evaluation of suspected renal mass lesions rather than being considered a substitute for the intravenous urography (IVU).

The majority of our reported patients were managed on the basis of the IVU report. Glucoheptonate was still investigational during the time of the study and it is only recently that the primary physicians have had confidence in the results. The six urograms that were not included were judged inadequate during the double-blind review. Although the radionuclide studies in these patients were all valid and useful, we decided not to include these patients because we were comparing results for adequate IVU and glucocheptonate scintigraphy. Including these patients would have improved the statistics but could be criticized since it would have been argued that the IVU should have been repeated. Including these patients would have decreased the IVU accuracy to approximately 70% without materially changing the glucoheptonate results. We do not have data on how many of the radionuclide studies were obtained because the primary physician felt the IVU was inadequate, rather than receiving the study as part of the investigational protocol.

While we appreciate Dr. Wolfstein's and Dr. Kawamura's comments on renal flow studies, we have found routine flow studies
at the time of injection to be useful in some cases, but misleading in others with lateral or anterior lesions. We have continued to obtain such data to evaluate equality of renal perfusion and the vascularity of posterior mass lesions, but for most patients who demonstrate a mass lesion with glucoheptonate scintigraphy, we perform a subsequent perfusion study with pertechnetate using the view and collimator that best demonstrate the lesion and its blood flow. The images demonstrated by Dr. Kawamura did not differ from those seen with glucoheptonate. We disagree with his inference that the early uptake reflects the cortical nature of the lesion. This same “early” uptake is seen with glucoheptonate and pertechnetate and is a reflection of the vascularity of the lesion rather than its site of origin.

Finally, our point regarding incidental findings and the IVU was in regard to lesions that would not demonstrate scintigraphic abnormalities. Certainly the radionuclide study may demonstrate certain incidental abnormalities, such as those mentioned by Dr. Wolfstein, but none of the patients in this report had additional findings on either study.

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Lung-Scan Abnormality in Pulmonary Artery Branch Stenosis

Pulmonary artery branch stenosis is characterized by narrowed segments of one or more of the peripheral branches of the pulmonary artery. It is believed to be a congenital condition whose clinical course varies, depending on the severity of frequently associated cardiac anomalies, although the stenosis itself may give rise to pulmonary hypertension and right-heart failure. The diagnosis is suspected on the basis of the auscultatory findings and is confirmed by pulmonary-artery pressure tracings and/or angiography. The clinical, hemodynamic, and radiographic features of pulmonary artery branch stenosis have been well described in the literature (1-4).

We report a case of this condition, documented by pulmonary angiography, in which lung scanning revealed multiple segmental perfusion defects with normal ventilation, thus mimicking pulmonary emboli. The scintigraphic abnormalities were unchanged 4 mo later.

A 30-year-old black woman experienced nonpleuritic chest pain associated with dyspnea. Physical examination was unremarkable except for a systolic precordial murmur, widely transmitted to the axillae, the right supraclavicular area, and the back. The intensity of the murmur increased on deep inspiration. Electrocardiogram was normal. Chest roentgenogram revealed prominence of the pulmonary outflow tract and slightly elevated left dome of the diaphragm. Arterial blood gases on ambient air were $P_{O_2}$ 94, $P_{CO_2}$ 35, and pH 7.43.

Perfusion lung scan with Tc-99m-labeled albumin microspheres revealed multiple defects—wedge-shaped, pleura-based and segmentally located—in both lung fields (Fig. 1). A xenon-133 study demonstrated good ventilation of both lungs, with delayed washout only from the left upper lung field.

A right-heart cardiac catheterization was performed, with selective pulmonary angiography. The pressures (mm Hg) were: right atrium 5, right ventricle 38/2, main pulmonary artery 32/17, and pulmonary artery wedge 7. The oxygen saturations were: right atrium 73.6% and pulmonary artery 69.5%. Pulmonary angiogram

FIG. 1. Perfusion lung scan shows multiple, wedge-shaped, pleura-based perfusion defects in both lung fields.

FIG. 2. Selective pulmonary angiogram. (A) Superior branch of right pulmonary artery reveals stenotic lesions in all of its three branches. (B) Inferior branch of right pulmonary artery shows stenotic lesion in inferior division itself. (C) Left pulmonary artery injection shows dilatation proximal to stenotic branches.