nm/PRELIMINARY NOTE

RADIOISOTOPE ANGIOGRAPHY OF THE SPINAL CORD

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Radiographic angiography of the spinal cord is an established diagnostic procedure (*1*). For some time we have been intrigued by the possibility of exploring certain lesions of the spinal cord by radioisotope angiography.

Conventional static scintigraphy of structures located in the thoracolumbar section of the spinal canal is made difficult by the surrounding muscles and the neighboring aorta, vena cava, azygos vessels, and their branches. Radionuclide blood transit studies (*2*) and proper positioning of the patient may overcome these difficulties. A radioisotope angiographic technique applied in patients with arteriovenous malformations of the spinal cord as well as in normal controls is described in this article.

MATERIALS AND METHODS

The present report includes three patients harboring an arteriovenous malformation of the thoracolumbar spinal cord, a 9-year-old girl, a 19-year-old woman, and a 14-year-old boy. Prior to the radioisotope angiography, Pantopaque myelography had been carried out in two and selective arteriography of the spinal cord in all three patients. Surgery had been performed in two of the cases and an operation was eventually carried out also in the third patient who alone received two radioisotope angiograms, one pre- and one post-operative.

As normal controls, similar radioisotope angiograms of the thoracolumbar area have been carried out concomitantly with static brain imaging in many patients with suspected intracranial lesions but no indication of spinal cord pathology.

The patient is placed with the left flank (left posterior oblique position) against the detector surface of an Anger scintillation camera. The probe is located over the midtrunk region being certain that the spine is at the center of the detector. A bolus of 15 mCi of ^{99m}Tc-human serum albumin (1–2 ml) is injected in a left antecubital vein. The radiopharmaceutical ^{99m}Tc-serum albumin is to be preferred on theoretical grounds because it is known that the injected dose of this tracer remains in the intravascular compartment longer than the ^{99m}Tc-pertechnetate (*3,4*). We did, however, use in several of the normal controls $^{99m}TcO_4^-$ (15 mCi) with comparable results in the demonstration of the thoracoabdominal vascular structures. Serial 35-mm imaging is started when the evacuation of the radionuclide from the syringe is complete and exposures are obtained at 1-sec intervals. Eight rapid serial Polaroid views are also obtained.

RESULTS

The first area of activity visualized is the cardiac blood pool appearing within 3 sec after completion of the bolus injection, while the pulmonary blood flow becomes evident at 6 sec. The proximal portion of the abdominal aorta is seen at 7–9 sec while the entire aorta is visualized between 12 and 14 sec. Both kidneys appear almost simultaneously between 10 and 14 sec.

Arteriovenous malformations of the spinal cord were demonstrated by radioisotope angiography in all three cases of the present series. Visualization of the lesions commenced 8–10 sec after injection becoming detailed between 10 and 14 sec. In the left posterior oblique view aorta and left kidney were seen superimposed on the left side of the spine. Each patient's spinal cord vascular malformation was seen clearly projected between the right kidney and the aorta. No concentration of radionuclide was seen in the same area in the normal controls (Fig. 1).

Received Jan. 24, 1972; revision accepted Mar. 2, 1972.

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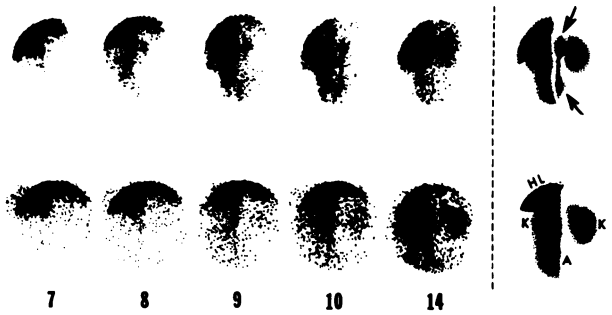

FIG. 1. Seven-, 8-, 9-, 10-, and 14-sec rapid flow, oblique, abdominal scintiphotograms in arteriovenous malformation of spinal cord (top) and normal control patient (bottom). In sketches at far right note arteriovenous malformation (top, arrows) and aorta, kidneys, and heart and lung pool (bottom: A, K, HL).

Scintiphotographic demonstration of the lesions corresponded well with the x-ray arteriographic visualization (Fig. 2). In the patient with both pre- and post-operative radioisotope angiograms the size of the lesion appeared smaller after surgery.

DISCUSSION

The arteriovenous malformations are the most obviously suitable spinal cord lesions for evaluating the diagnostic possibilities of an angiographic method. These lesions were in fact used as a sort of testing model during the introductory phase of the radiographic angiography of the spinal cord (*5*).

The combination of radioisotope transit studies and proper positioning of the patient has made possible the scintiphotographic demonstration of the three lesions in this series. In previous years we had been trying to visualize arteriovenous malformations and other lesions of the cord by rectilinear scanning techniques but without success.

The potential uses of radioisotope angiography of the spinal cord are considerable. At this time the main application is in cases in which, on the basis of the clinical findings and plain x-rays, a strong suspicion of an arteriovenous malformation of the cord is advanced. The standard management is to proceed with a Pantopaque myelography before a selective arteriographic study. We are always, however, somewhat hesitant to carry out a lumbar puncture and to inject Pantopaque in these patients, because severe complications may result due to the penetration of the needle in the pathological vessels. Even if a cisternal puncture is used for the introduction of the radiographic contrast medium, the irritating effect of Pantopaque cannot be disregarded (*6,7*). Circumvention of the possible hazards associated with myelography may be achieved by radioisotope angiography which can be used in lieu of myelography before the definitive roentgenographic

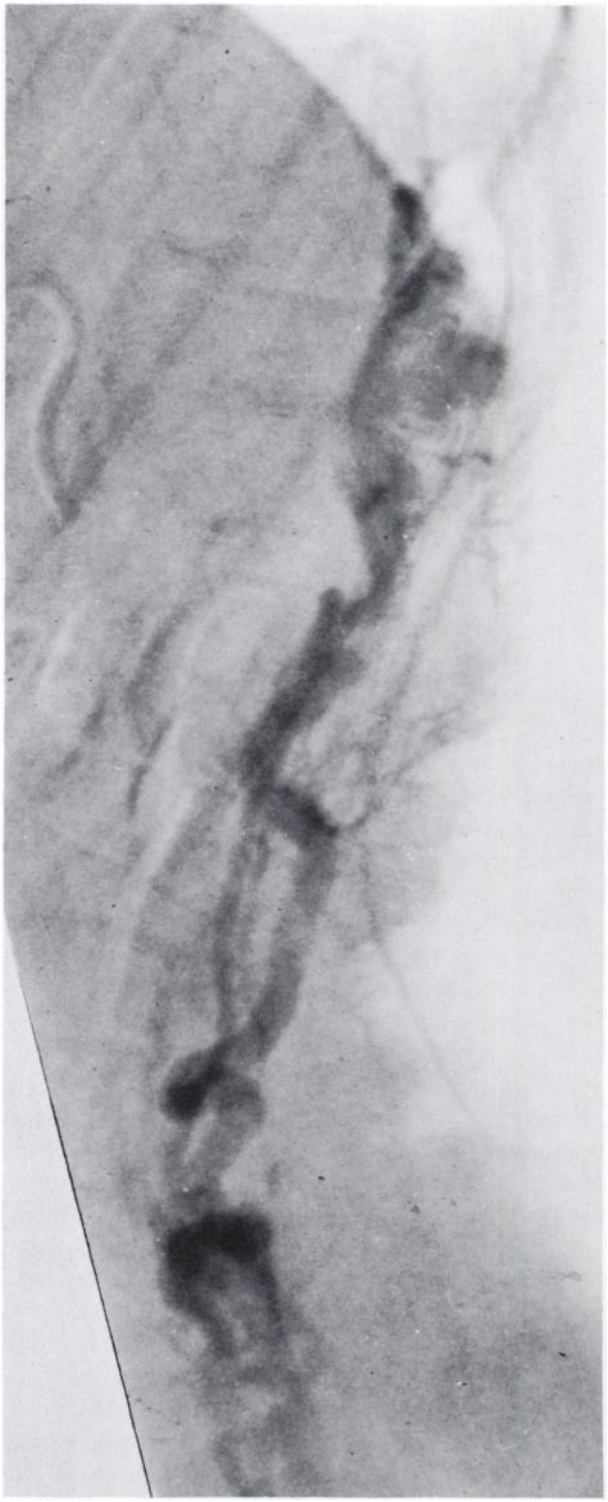

FIG. 2. Selective, subtracted, radiographic spinal cord arteriogram showing arteriovenous malformation in same patient as in Fig. 1, top.

arteriogram. One of the three cases in this series was never subjected to a myelography.

We may also foresee conditions in which radioisotope angiography could actually be more informative than x-ray arteriography. We are thinking of

those patients in whom large amounts of unremovable Pantopaque from previous myelograms remain entrapped among the pathological vessels of the malformation. In these instances the vascular radiologic study may be very difficult to interpret even if subtraction is used. Also, in some instances of arteriovenous malformation of the spinal cord complicated by bleeding or thrombosis (Foix-Alajouanine disease) x-ray angiographic visualization may not succeed (*8*). Here, the radioisotope uptake of the hemorrhagic and/or infarcted cord may be shown in the scintiphotograms.

Evaluation of radioisotope angiography of the spinal cord in the appraisal of lesions other than arteriovenous malformations, particularly cord tumors, as well as the extension of this type of examination to the high thoracic and cervical segments of the spinal cord are in progress.

SUMMARY

Three cases of arteriovenous malformation of the thoracolumbar spinal cord have been studied and clearly visualized by radioisotope angiography after intravenous injection of ^{99m}Tc-albumin.

This technique may be used as an alternative to Pantopaque myelography and as an adjunct to the radiographic selective arteriography of the spinal cord.

ACKNOWLEDGMENTS

The authors express their thanks for technical assistance received from Sybil J. Swann, Jeanne K. Honicker, and Camille L. Boyce, technicians in the Department of Nuclear Medicine, The Clinical Center, National Institutes of Health.

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