DEMONSTRATION OF SPINAL TUMORS WITH INTRAVENOUSLY INJECTED $^{99m}$Tc-PERTECHNETATE: A NEW DIAGNOSTIC TECHNIQUE

C. Fazio, A. Agnoli, G. L. Bava, L. Bozzao and C. Fieschi

University of Genova, Genova, Italy

For 12 spinal tumors recently observed in our department, we have used a new diagnostic procedure with intravenously injected radioisotopes ($^1$). This method is substantially different from the scan of the spinal canal after intrathecal injection of a gamma-emitting tracer. This new technique proved successful in all cases of vertebral, epidural and dural space-occupying lesions giving negative results in the two cases of intramedullary lesions of the present case material.

METHOD

A scan of the vertebral column is performed 30 min after intravenous administration of $^{99m}$Tc-per-technetate at a dose of 15 $\mu$Ci/kg as in the usual brain scan. A capsule of potassium perchlorate (600 mg) is ingested by the patient 2 hr before the administration of the isotope.

With the patient lying prone, lead foils 2 mm thick are placed on each side of the vertebral column, leaving an unshielded space of 4–5 cm. Supports are placed under the abdomen to reduce the physiological lordosis and make the field explored as flat as possible.

The scan is made with a photoscanner SELO DS 3$, (Società Elettronica Lombarda, Milano—Italia) with a 5-in. crystal and an 85-hole short-focus lead collimator. The scanning speed is 18 mm/sec. The entire procedure requires 30–45 min.

RESULTS

A spinal scan was recorded in 10 healthy subjects to establish the normal pattern. The potassium perchlorate blocks the uptake of the isotope by the thyroid gland, which otherwise appears very prominent at the lower cervical level. Once the thyroid is blocked, the background activity recorded over the entire vertebral column is rather low, with a constant slight prevalence between $D_t$ and $D_r$ (Fig. 1). We interpreted this as due to the activity in the descending aorta.

FIG. 1. Scan of spinal canal in normal subject after thyroid block with potassium perchlorate. Increase of radioactivity is present between $D_t$ and $D_r$, probably related to anatomical superimposition of descending aorta.

Received July 18, 1968; revision accepted Jan. 10, 1969. For reprints contact: C. Fieschi, Clinica delle Malattie Nervose e Mentali, Universita di Genova, Genova, Italy.
The results in patients include five vertebral metastatic tumors, three epidural lesions of Hodgkin's disease, one medullary angioma, one meningioma, one intramedullary ependymoma and one intramedullary abscess. The diagnosis was confirmed by oil myelography and in 11 cases by surgery or postmortem examination.

Positive spinal scans were obtained in the first 10 patients, all of whom had extramedullary space-occupying lesions (dural, epidural or vertebral). Furthermore, these patients had clear clinical signs of spinal cord compression and positive CSF and manometric findings. The positive scintigraphic findings consisted in a clear-cut area of increased concentration of the isotope, outlining the lesion as determined by myelography and subsequent direct examination (Figs. 2 and 3). In both cases with intramedullary tumors the scan of the spinal canal was normal.

**FIG. 2.** Hodgkin's disease with an extradural lesion at D₁—D₄ level as demonstrated by oil myelography. Scan of spinal canal shows well delineated area of increased radioactivity at D₁—D₄ level.

**DISCUSSION**

This technique of the spinal scan after intravenous injection of $^{99m}$Tc differs from the conventional isotopic method for diagnosing spinal blocks using scintillation myelography. In that technique the isotope (IHSA or $^{197}$Hg-Neohydrin) (2–4) is injected intrathecally, and the distribution of the isotope in the subarachnoid space is observed by a scan over the spinal canal performed after $\frac{1}{2}$–1 hr. In cases with partial or total blocks, the diffusion is slowed down or arrested at the level of the space-occupying lesion.

By injecting the isotope intravenously the pathological tissue may directly concentrate the tracer substance relative to surrounding tissues, much the same as in brain-tumor scanning. For a significant picture to be observed, however, it is necessary that the background activity recorded over the vertebral column be low, as indeed is observed in normal subjects, after block of the thyroid gland. On the other hand the ratio of lesion to background must be sufficiently high, and this is what we have observed in each of the 10 patients with vertebral, epidural or dural lesions.

The shielding of the paravertebral muscles and the choice of a focusing, 85-hole collimator, with focal distance of 8.6 cm and resolution of 1.1 cm, reduce the background in the explored field. The
geometrical efficiency of such a collimator decreases to 50% within a distance of 3.5 cm from the focus (Fig. 4).

Yet the remarkable visualization of the lesion in these patients is more than one would predict.

The size of the tumor is a limiting factor as is its location: in fact, in both cases of intraspinal expanding lesions of small size (ependymoma and abscess), the spinal scan was negative. Tumors that gave positive findings were located at dorsal and lumbar level and were large extraspinal masses. Eight of these cases had metastatic lesions (five were carcinoma, three had Hodkin's) and in four of these invasion and destruction of bone tissue was noted.

The type of lesion may also be critical although little information is available on the selective uptake of $^{99m}$Tc in tumor tissues. Admittedly, however, the present attempt is mainly empirical. At the moment the spinal scan seems valuable especially for defining the exact size and location of an expanding lesion whose presence is already obvious on clinical grounds. In this respect the spinal scan appears valuable as a nontraumatic preoperative method. This new technique might, however, prove useful also as a routine diagnostic tool after suitable case material is established.

SUMMARY

A new technique for radioisotope scanning of the spinal canal with intravenous $^{99m}$Tc is proposed. The method differs from myeloscintigraphy after intrathecal injection of tracer.

Results obtained in 10 normal, healthy subjects and in 10 patients with vertebral, epidural or dural lesions and in 2 cases with intramedullary tumors are reported.

While the lesions of the spinal canal were correctly diagnosed, the intramedullary tumors were missed. The new technique is valuable as a nontraumatic preoperative method and might prove useful also as a routine diagnostic tool.

REFERENCES


