

RADIOISOTOPE SCANNING FOR THE SPINAL CORD TUMOR

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ABSTRACT

Radioisotope scanning with ^{99m}Tc-pertechnetate or ⁶⁷Ga-citrate for the spinal cord tumors was reported. Six patients with spinal cord tumors including 2 ependymomas, 1 neurinoma, 1 metastatic medulloblastoma, 1 metastatic astrocytoma, and 1 metastatic pinealoma as well as 6 patients with non-neoplastic lesions were examined with this method. Two out of 6 cases with tumors showed positive scans and two equivocal scans. This new method is different from myeloscintigraphy and radioisotope angiography as already reported. It directly demonstrates tumor itself like brain scanning and is very useful as nontraumatic method for screening spinal cord lesions, especially in poor risk patient. The usefulness and limitation of this method are discussed.

INTRODUCTION

Brain scanning for intracranial lesions is now widely used as established diagnostic adjunct. Although the relative incidence of spinal cord tumors is much less than that of tumors of the brain, the diagnosis of spinal cord tumors with radioactive isotope would seem to be important in the practice of neurosurgery. Myeloscintigraphy has been reported as an important technique in the diagnosis of spinal cord lesions and abnormalities of cerebrospinal fluid circulation^{1,2}, but this is not the method for demonstrating the tumor itself. Radioisotope angiography was useful for demonstrating arteriovenous malformation of the spinal cord³, but not spinal cord tumor. Although visualization of spinal cord lesions by rectilinear scanning techniques had been usually without success,

Fazio *et al.* reported successful demonstration of spinal tumors with intravenously injected ^{99m}Tc-pertechnetate^{4,5}. This paper summarizes the results of rectilinear scanning for spinal cord tumors with some modification of the method and recently developed radioisotope.

MATERIALS AND METHODS

Radioisotopes used were either ^{99m}Tc-pertechnetate or ⁶⁷Ga citrate. Thirty minutes and 2 hr after injection of ^{99m}Tc-pertechnetate at a dose of 10-20 μ Ci/kg, rectilinear scan was performed as in the usual brain scan. The patient takes 300 mg of potassium perchlorate 1-2 hr before ^{99m}Tc administration. Lead plate 5 mm in thickness is placed on each side of the spine with the patient prone, leaving an unshielded space of 4-5 cm. Supports are placed under the abdomen to reduce the

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physiological lordosis making the field explored as flat as possible⁵). ⁶⁷Ga citrate at a dose of 2 mCi was injected 48 hr before scanning. The scan was made with the instrument with NaI (TI) crystal detector, 5 inches in diameter, and 85-hole collimator with an 11 cm focal length, which produces simultaneously a photoscan and a paper dot scan.

Six patients with spinal cord tumors, including 2 ependymomas, 1 neurinoma, 1 metastatic medulloblastoma, 1 metastatic astrocytoma grade 3, and 1 metastatic pinealoma (germinoma) were examined with this method. In addition, 6 patients with non-tumorous lesions were scanned (Table 1).

Table 1. Spinal Cord Scanning

Diagnosis	No. of cases
Ependymoma	2
Neurinoma	1
Dissemination of medulloblastoma	1
Dissemination of astrocytoma	1
Dissemination of pinealoma	1
Non-tumorous lesion	6
Total	12

RESULTS

Table 2 shows the results of scans. Patients with disseminated medulloblastoma to the spinal cord showed positive scan with ^{99m}Tc-pertechnetate. Scan with ⁶⁷Ga citrate in the patient with metastatic astrocytoma was positive.

Case 1. Three-year-old boy was admitted with chief complaint of headache, ataxia, and vomiting. Ventriculo-peritoneal shunt and suboccipital decompressive craniectomy with biopsy were done. Pathological diagnosis was medulloblastoma. Radiation at occipital region was followed. Four months later, lumbar pain and weakness of the left lower extremity were noted. Scanning of spinal cord with ^{99m}Tc-pertechnetate at a dose of 15 μ Ci/kg with oral administration of potassium perchlorate was performed in the manner stated above. Area of increased radioactivity measuring 3 \times 4 cm in diameter was noted at L1-2 level (Fig. 1). Radiation to the spinal column improved his complaints, but due to recurrent multiple metastatic lesions in the brain and spinal cord, he expired 1.5 years after the onset of the disease. Autopsy revealed widespread dissemination of the tumor along the subarachnoid space over the brain and spinal cord. Spinal nerves were also encased in thick layer of tumor.

Case 2. Twenty-four-year-old female with chief complaint of convulsion received removal of astrocytoma grade 3 from the right frontal lobe followed by chemotherapy and irradiation. Three years later, gait disturbance with weakness of left lower extremity and incontinence occurred. Lumbar puncture showed the initial pressure of 190 mmH₂O and xanthochromic cerebrospinal fluid with Froin's syndrome. Dis-

Table 2. Results of scanning for spinal cord tumor

Name	Age	Sex	Diagnosis	Isotope	Scan result
O. H.	47	F	Ependymoma	^{99m} Tc	Equivocal
S. K.	30	F	Ependymoma	^{99m} Tc	Negative
T. K.	35	M	Neurinoma	^{99m} Tc	Equivocal
M. H.	2	M	Medulloblastoma*	^{99m} Tc	Positive
O. K.	30	M	Pinealoma*	^{99m} Tc	Negative
I. M.	24	F	Astrocytoma*	^{99m} Tc ⁶⁷ Ga	Negative Positive

* Dissemination to the spinal cord

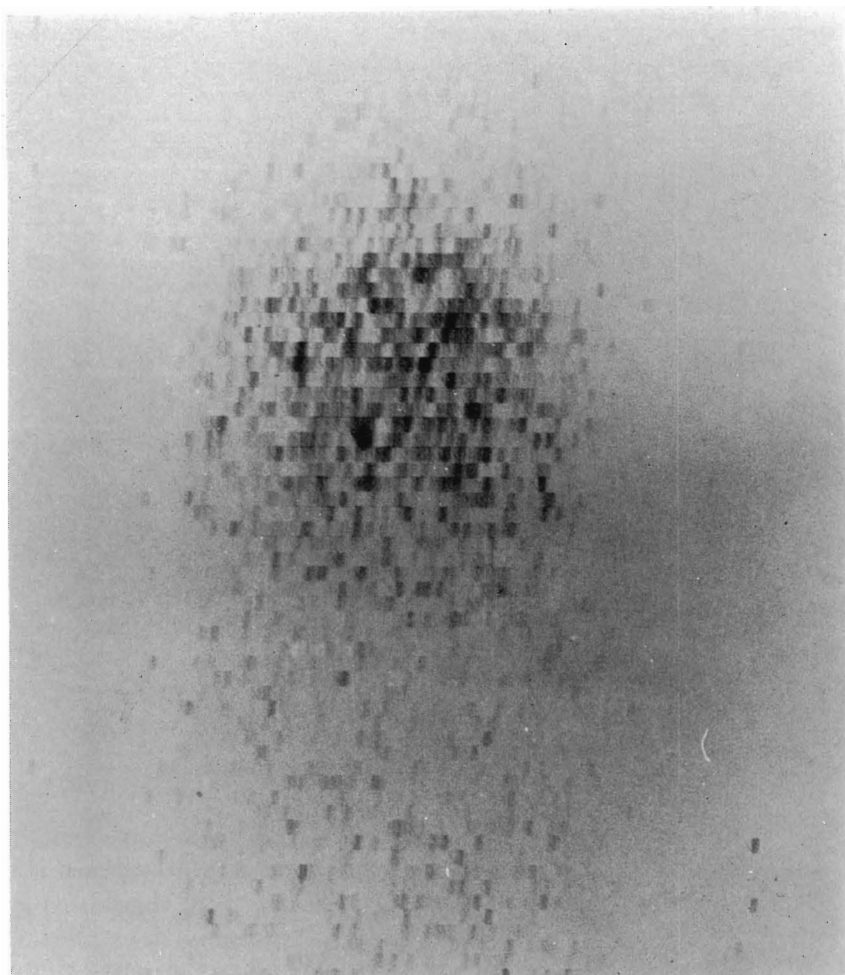


Fig. 1. Metastatic medulloblastoma from cerebellum. ^{99m}Tc scan showing area of increased radioactivity at L 1-2 level.

semination of tumor to the spinal cord was suspected. Although ^{99m}Tc scan of the spinal cord was initially negative, ^{67}Ga scan, 8 months later, revealed a large tumor at the cauda equina (Fig. 2).

One case with large intramedullary ependymoma occupying the whole thoracic level and one with neurinoma showed suspicious positive scans. Other cases with spinal cord tumor and non-neoplastic lesions were all negative.

DISCUSSION

Fazio *et al.* described a scan for tumor of the spine or of the spinal cord with intravenously injected ^{99m}Tc -pertechnetate^{4,5}. They demonstrated positive scan in a patient with vertebral metastatic tumor, epidural lesions of Hodgkin's diseases, medullary angioma, and meningioma. Positive spinal scans were obtained in lesions occupying the extramedullary space but not in intramedullary tumors. This technique

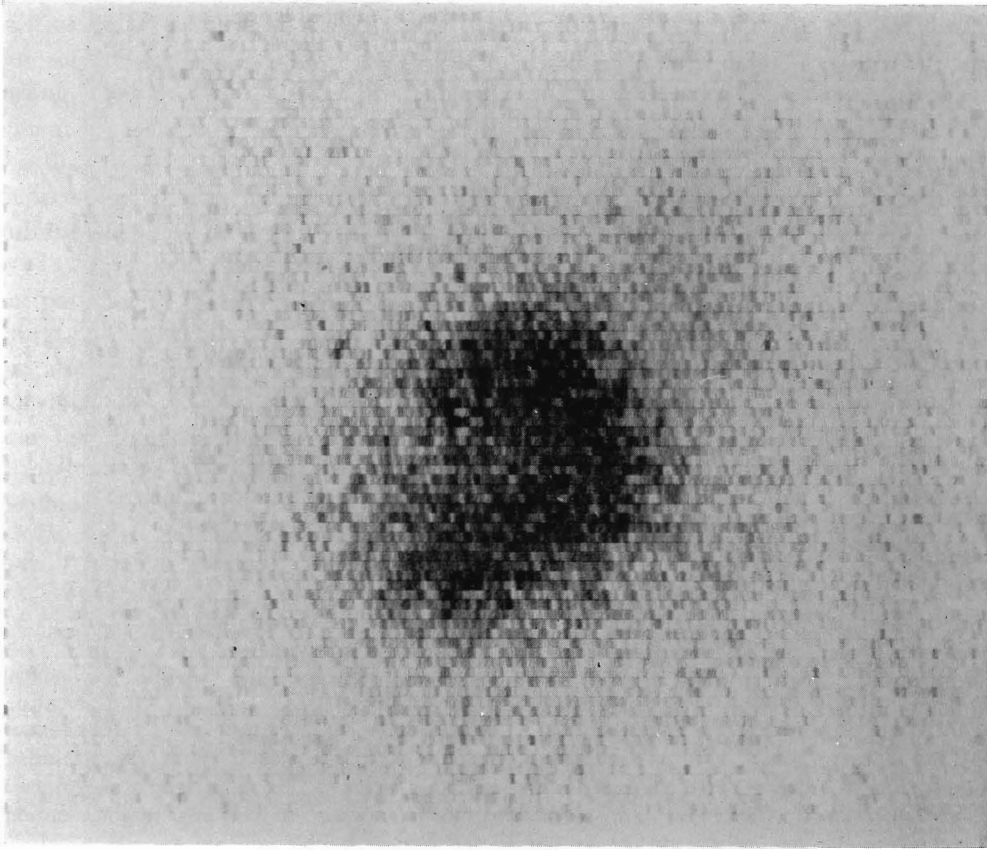


Fig. 2. Astrocytoma grade 3, metastatic to cauda equina. ^{67}Ga scan showing well delineated area of increased activity.

is different from myeloscintigraphy which is a scintigraphy of the spinal subarachnoid space¹). It is an important technique in the diagnosis of spinal cord lesions and abnormalities of cerebrospinal fluid circulation, such as malformation, inflammation (arachnoiditis), various stenoses, and various spinal tumors²), but this is not a method for demonstrating the tumor itself like brain scanning. Radioisotope angiography of the spinal cord was described by DiChiro³) in 1972. Although they suggested the possibility for demonstration of cord tumor by this method, positive image was obtained only in arteriovenous malformation at that time. In this method of injecting an isotope intravenously, pathologic

tissue may take it up more concentratedly than the surrounding tissue, much the same as in the brain tumor scanning. For a significant picture to be observed, however, it is necessary that the background activity recorded over the vertebral column is low, and the ratio of lesion to background must be significantly high⁵). This has been difficult because of the small size of the spinal cord compared with brain, and uptake of radioisotope by the surrounding tissues such as thick muscles, large vessels, thyroid gland, etc. Shielding of the paravertebral muscles reduces the background in the explored field in $^{99\text{m}}\text{Tc}$ scan⁵). In this respect, ^{67}Ga concentrates fairly selectively into the tumor, but not into vessels or muscles⁶).

^{67}Ga uptake of spine was hardly observed in our case 2.

To be positive in this method, following factors would seem to be critical.

1. Size of the tumor. So far positive scans were gained in only large tumors of at least over 3 cm in diameter. The limitation of tumor size for positive scan should be determined with further experience.

2. Site of the tumor. Extramedullary tumor showed positive scans. Only one case with intramedullary ependymoma showed an equivocal scan.

3. Selection of the radioisotope. $^{99\text{m}}\text{Tc}$ -pertechnetate was found to be useful for the scanning of spinal cord, but there remains the question of the ratio of lesion to background activity. ^{67}Ga citrate was selectively concentrated in tumor in case 2. However, we experienced only one case with this isotope, and further investigation with ^{67}Ga or other isotope should be made.

4. Nature of the lesion. In our two cases demonstrated above, brain scans showed a strongly positive focus revealing a primary tumor. Low grade astrocytoma or ependymoma may be difficult to demonstrate. In contrast, meningioma, neurinoma, malignant glioma, or metastatic carcinoma would have possibility of showing positive scans by this technique, because these tumors usually show strongly positive scans in the brain.

5. Masking of paravertebral regions by lead plate in $^{99\text{m}}\text{Tc}$ scan⁵⁾. This is useful for decreasing the background activity.

6. Focusing exactly on the level of spinal cord. In this respect, tomogram of scanning could be more beneficial. On the other hand, scintiscamera is less useful.

This technique seems especially valuable as a nontraumatic method for poor risk patients as well as for a screening procedure.

In our two cases stated above, patients were critically ill with metastasis and diagnostic procedure such as Pantopaque myelography was better to be avoided because of possible complications⁷⁾. In addition, direct visualization of tumor itself would give invaluable advantage for the treatment by neurosurgery.

Keeping these factors in mind, although there is limitation at this moment, the useful scope of scanning for spinal cord lesions may be widened especially with improved equipment and selection of a radioisotope.

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