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T Yoshiura, D A Shrier, W H Pilcher and A Rubio

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# Cervical Spinal Meningioma with Unusual MR Contrast Enhancement

Takashi Yoshiura, David A. Shrier, Webster H. Pilcher, and Ana Rubio

**Summary:** A 16-year-old girl had progressive neck pain and weakness in the left hand. MR images showed a dumbbell-shaped spinal tumor with a prominently enhancing intradural component and a minimally enhancing extradural component. Pathologic examination revealed a meningioma with an intradural transitional component and an extradural syncytial component. The tumor showed no significant cystic change or necrosis.

Meningioma is a common extramedullary spinal tumor affecting primarily middle-aged women. At MR imaging, the tumor typically appears isointense with spinal cord on T1- and T2-weighted sequences, with homogeneous contrast enhancement (1). We report a case of spinal meningioma in a 16-year-old girl that showed a very unusual pattern of MR contrast enhancement; namely, a diffuse, prominently enhancing intradural component and a minimally enhancing extradural component.

## Case Report

A 16-year-old girl had a 3-month history of neck pain radiating into her left shoulder and weakness in her left upper extremity. Neurologic examination revealed slight loss of power of the left biceps and triceps muscles. The patient had four café au lait spots, on the neck, left tibia, and buttocks. She had had resection of fibromas from her left wrist at the age of 5 and from her right hand at the age of 13. The family history was remarkable for a sister who also had café au lait spots. From the findings and history, neurofibromatosis type 1 was suspected, but the criteria for this disorder were not fulfilled (2). Chromosomal analysis was not performed.

CT and MR imaging were performed to rule out spinal lesions. A noncontrast CT scan of the cervical spine showed a dumbbell-shaped mass of soft-tissue density with calcification at the level of C2–C4 extending through a widened left C2–C3 neural foramen (Fig 1A). MR imaging revealed that the tumor consisted of intra- and extradural components. The signal intensity of the tumor was equal to or slightly lower than that of spinal cord on both T1- and T2-weighted images (Fig 1B and C). Intravenous administration of contrast material resulted in homogeneous enhancement of the intradural component on T1-weighted images, while only minimal enhancement was seen in the extradural component (Fig 1D and E). Minimal dural enhancement was noted adjacent to the dural attachment.

The preoperative differential diagnosis included meningioma and nerve sheath tumor. The isointense signal on T2-weighted MR images relative to spinal cord favored meningioma; however, the patient's age and the dumbbell shape of the tumor were suggestive of nerve sheath tumor. No abnormality was seen on MR images of the thoracic and lumbar spine. MR images of the head showed no signs of neurofibromatosis type 1.

At surgery, the intradural component extended from C2 through C4 on the left, markedly compressing the spinal cord to the right. The tumor had a cauliflowerlike appearance and was somewhat adherent to the anterolateral dura, consistent with meningioma. The tumor appeared to penetrate the dura at the area where the C3 nerve root passed. Laminectomies of C1 through C4 were performed, and a near total resection of both the intra- and extradural portions of the mass was accomplished.

Histologic examinations of the intra- and extradural components were performed separately. The intradural component was composed predominantly of transitional meningioma with minimal microscopic foci of cystic degeneration (Fig 1F). Spotty calcification was also seen (Fig 1F). The extradural component consisted of syncytial meningioma (Fig 1G). No microcystic change or other signs of degeneration were seen, and calcification was not observed. There was no significant difference in vascularity between the intra- and extradural components.

After surgery, the patient was discharged with no significant neurologic deficit. Follow-up studies have shown no tumor recurrence for 8 months.

## Discussion

Meningioma is the second most common tumor of the spine, accounting for approximately 25% of such masses (3). There is a strong female preponderance (80%), and the peak period of occurrence is in the fifth and sixth decades (3, 4). The most common location is the thoracic spine, followed by the cervical spine; meningiomas in the lumbosacral spine are rare (3–5). The majority of spinal meningiomas (approximately 90%) are intradural, with only about 5% extradural and the other 5% both intra- and extradural (3). The most common symptoms are local and/or radicular pain, weakness of the limbs, and paresthesia (4, 5). Surgical removal is the treatment of choice in most cases, and recurrence is uncommon (3–5).

On CT scans, spinal meningiomas usually appear as

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From the Departments of Radiology (T.Y., D.A.S.), Neurosurgery (W.H.P.), and Pathology (A.R.), University of Rochester, NY.

Address reprint requests to Takashi Yoshiura, MD, PhD, Department of Radiology, University of Rochester, 601 Elmwood Ave, Box 648, Rochester, NY 14642.

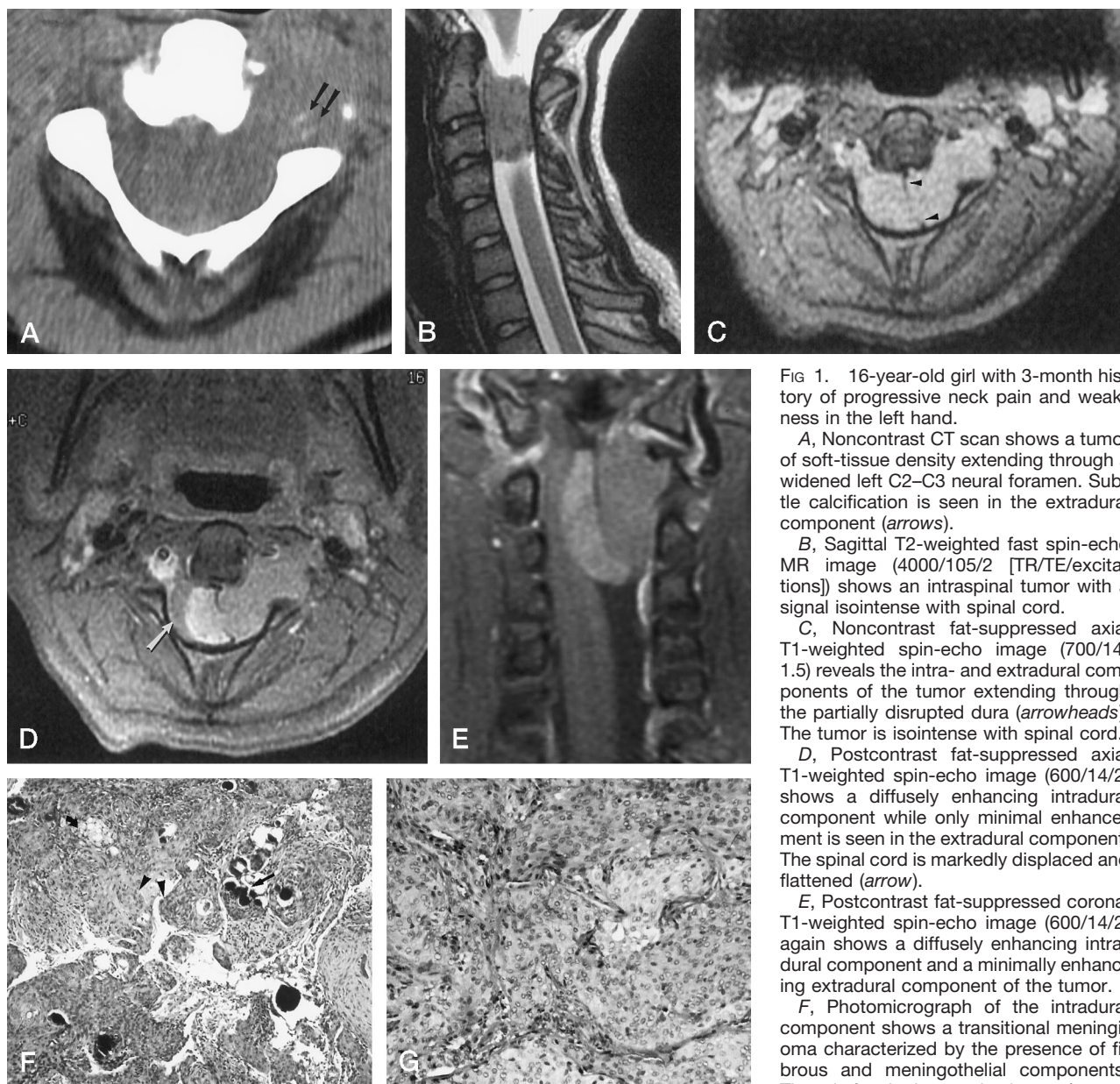


FIG 1. 16-year-old girl with 3-month history of progressive neck pain and weakness in the left hand.

A, Noncontrast CT scan shows a tumor of soft-tissue density extending through a widened left C2-C3 neural foramen. Subtle calcification is seen in the extradural component (arrows).

B, Sagittal T2-weighted fast spin-echo MR image (4000/105/2 [TR/TE/excitations]) shows an intraspinal tumor with a signal isointense with spinal cord.

C, Noncontrast fat-suppressed axial T1-weighted spin-echo image (700/14/1.5) reveals the intra- and extradural components of the tumor extending through the partially disrupted dura (arrowheads). The tumor is isointense with spinal cord.

D, Postcontrast fat-suppressed axial T1-weighted spin-echo image (600/14/2) shows a diffusely enhancing intradural component while only minimal enhancement is seen in the extradural component. The spinal cord is markedly displaced and flattened (arrow).

E, Postcontrast fat-suppressed coronal T1-weighted spin-echo image (600/14/2) again shows a diffusely enhancing intradural component and a minimally enhancing extradural component of the tumor.

F, Photomicrograph of the intradural component shows a transitional meningioma characterized by the presence of fibrous and meningeothelial components. There is focal microcystic change (curved

arrow), poorly formed whorls (arrowheads), psammoma bodies (straight arrow), and other calcific deposits (H and E, original magnification

×100).

G, Photomicrograph of the extradural component shows predominantly syncytial meningioma. Cells are arranged in lobules separated by fibrovascular septa (H and E, original magnification ×200).

extramedullary tumors with a higher density than spinal cord. Although calcification of the tumor has reportedly been seen on plain radiographs in only 0.6% of cases (3), the exact rate of calcification on CT scans has not been described. Changes in surrounding bones are considered to be uncommon. The primary tool for radiologic diagnosis of spinal meningioma is MR imaging. MR characteristics of spinal meningiomas share many similarities with those of intracranial meningiomas. Spinal meningiomas typically are isointense relative to spinal cord on both T1- and T2-weighted images (1). They often have a broad-based attachment to the dura. Postcontrast T1-weighted images usually show moderate and homogeneous en-

hancement (1). Abnormal enhancement of the adjacent dura is seen in some cases (1, 6).

Our case differed from typical spinal meningiomas in several respects. First, onset at the age of 16 is unusual. In one large series, only 1.7% of all patients were under the age of 20 years (3). Spinal meningiomas in children and adolescents raise the possibility of underlying neurofibromatosis type 2 (7, 8). In contrast, neurofibromatosis type 1, which was suspected in our patient, has no established relationship with spinal meningioma. Extension through the neural foramina is also considered to be relatively rare in meningioma (1), although the exact prevalence has not been reported.

The most striking finding in our case was the remarkably different degree of contrast enhancement between the intra- and extradural components of the tumor on postcontrast T1-weighted MR images. To our knowledge, this contrast enhancement pattern has not previously been described for meningiomas or for any other spinal tumor. Inhomogeneous enhancement of meningiomas on CT and MR studies has been reported in association with cyst formation, necrosis, or hemorrhage (9, 10). In these cases, the tumor sometimes shows a ringlike pattern of enhancement and may mimic intracranial glioma (10). A cystic spinal meningioma with a ringlike enhancement pattern has also been reported (11). Dense calcification may also cause inhomogeneous enhancement on MR images (1). Sintini et al (12) reported a case of a tuberculum sellae meningioma with no enhancement on MR images, but the mechanism for the lack of enhancement was not discussed.

In our case, only subtle focal calcification was seen on CT scans, and it is unlikely that the minimally enhancing extradural component resulted from this calcification. Pathologic examination revealed different types of meningioma (transitional and syncytial) in the intra- and extradural components; however, there is no known association between MR contrast enhancement pattern and histologic type. Microcystic changes, which might explain decreased enhancement on MR images, was minimal and was seen only in the enhancing intradural component. Shrier et al (13) reported a lack of contrast enhancement within a spinal tumor secondary to acute infarction. In our case, no evidence of infarction or necrosis was found in the pathologic specimen of the extradural component. The most likely explanation for the greater contrast enhancement in the intradural component is the richer blood supply to this component, which is surrounded by the vascular arachnoid membrane;

however, a difference in vascularity was not proved histologically.

## Conclusion

The spinal meningioma seen in our patient represents a case of a highly unusual pattern of enhancement, consisting of a homogeneously enhancing intradural component and a minimally enhancing extradural component.

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