Coexistence of two different intraspinal tumors
Case report and review of the literature

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The occurrence of multiple neoplasms in the central nervous system is well documented. In von Recklinghausen's disease, patients frequently present with multiple neurofibromas and/or meningiomas at different sites within the spinal axis. However, the presence of multiple, histologically different spinal tumors in the absence of von Recklinghausen's disease is extremely rare.

The authors describe a patient with progressive paraparesis in whom an extradural, malignant lesion and a separate benign, intradural tumor of the thoracic spine were found. The histological diagnosis of the intradural tumor was a pigmented schwannoma.

On review of the literature, the authors found nine additional cases of coexisting, histologically different tumors of the spine. The majority of these tumors occurred in the thoracic spine and, not unexpectedly, intradural meningiomas and schwannomas prevailed. Except for the presumed same mesenchymal cell origin of neurinomas and meningiomas, no explanation for the coexisting, different spinal tumors could be determined.

Key Words * coexisting spinal tumor * multiple neoplasm * spinal meningioma * spinal neurinoma * neurofibromatosis Type 1

The presence of two histologically different tumors in the central nervous system (CNS) is uncommon. Most of the reports on coexistence of histologically different tumors refer to their presence in the head and rarely in the spine.

We report on a patient in whom an extradural, malignant lesion of the thoracic spine and a separate, benign intradural tumor were discovered.

CASE REPORT

History. This 72-year-old man presented to an outlying hospital with a several months' history of severe low-back and progressive bilateral leg pain, which was more severe in the left leg. Approximately 3
months earlier, he had begun to experience impotence and, shortly thereafter, urinary incontinence and difficulty with bowel control. He developed increasing weakness of both lower extremities; he subsequently fell and thereafter was unable to walk. His pain became excruciating, especially below the knees anteriorly. He presented to the emergency room with acute urinary retention.

His past medical history was significant for asthma and hypertension, which were well controlled with medications.

**Examination.** On physical examination, the patient weighed 150.5 pounds. There was tenderness on palpation over the spinous processes in the thoracolumbar junction region.

Abnormal findings on neurological examination included knee jerks 1+ bilaterally and both ankle jerks absent. Motor strength in the lower extremities was 2-3/5 bilaterally; the paresis was worse distally. He experienced decreased sensation to all sensory modalities below the level of the groin on both sides. Rectal tone was diminished, but an anal wink was present. There was urinary retention.

We obtained plain x-ray films of his spine that revealed marked degenerative changes in the thoracic and lumbar spine and a pathological compression fracture of the T-12 vertebral body (Fig. 1). Subsequent computerized tomography (Fig. 2 upper left and right) and magnetic resonance (MR) imaging (Fig. 2 lower left and right) of the thoracic spine confirmed the compression deformity involving the T-12 vertebral body, with soft-tissue expansion that extended posteriorly into the spinal canal. We also noted extensive tumor expansion into the left paravertebral space as well as involvement of the neural arch with infiltration of the left pedicle. The extradural tumor markedly constricted the spinal canal. On spinal MR imaging of the spine, a second, well-defined, intradural lesion at the T10-11 level was visualized, which enhanced after the administration of gadolinium and appeared to be separate from the extradural mass at T-12 (Fig. 2 lower right).
Fig. 1. Plain x-ray films, anteroposterior (upper) and lateral (lower) views, obtained in the thoracolumbar spine demonstrating a compression fracture of T-12 vertebral body with destruction of bony elements.
Fig. 2. Imaging studies. Upper Left and Right: Computerized tomographic scans of T-12 demonstrating a partial destruction of vertebral body and involvement of left pedicle. Soft-tissue extension laterally and compromise of spinal canal posteriorly can be seen. Lower Left and Right: Axial (lower left) and sagittal (lower right) T₁-weighted MR images of thoracic spine, with gadolinium enhancement, revealing expansile and destructive tumor of T-12 vertebral body with involvement of left pedicle and neural arch. There is almost complete obliteration of spinal canal at this level. An enhancing, intradural tumor involving spinal cord at T10-11 is demonstrated, but there is no connection with destructive lesion at T-12.

External beam radiotherapy was immediately begun, and analysis of a CT-guided needle biopsy sample that was obtained of the T-12 lesion suggested a poorly differentiated carcinoma.

On the basis of the MR imaging findings, the patient underwent surgery 12 days after admission. After performing a T10-12 laminectomy, the epidural tumor and most of the destroyed T-12 vertebral body and left pedicle were removed. The discolored dura at T-10 was then opened and a distinct, black nodule, which was situated in an intradural-extramedullary position, was excised. We completed the surgery by performing a posterior fusion from T10-L2 by using a Texas Scottish Rite Hospital instrumentation and iliac bone graft.

**Postoperative Course.** The patient's immediate postoperative course was complicated by an acute upper gastrointestinal bleed and hyponatremia. Six weeks postoperatively, he was transferred to a rehabilitation
Intensive pre- and postoperative metastatic workups failed to demonstrate a primary carcinoma. There was also no clinical evidence found of neurofibromatosis (NF).

The pathological findings were as follows: 1) epidural tumor: metastatic adenocarcinoma of unknown origin (Fig. 3 upper left and right; and 2) intradural tumor: pigmented schwannoma (Fig. 3 lower left and right).

Fig. 3. Photomicrographs. Upper Left: Photomicrograph showing eosinophilic necrotic debris containing remnants of partially devitalized bony trabeculae. Focally scattered within the fibrous matrix are small aggregates of poorly defined tumor cells Original magnification X 20. Upper Right: Photomicrograph revealing large tumor cells with abundant, finely granular, eosinophilic cytoplasm. The nuclei show a vesicular round appearance with slight variation in size and shape. Original magnification X 100. The diagnosis was focal metastatic, poorly differentiated adenocarcinoma. Lower Left: Photomicrograph showing pigmented spindle-cell tumor comprised of compact, elongated cells with indistinct cell margins. Pigmented melanin-containing cells (arrows) are frequently arranged in palisades and intersected by thick-walled hyalinized vessels. Original magnification X 20. Lower Right: Photomicrograph demonstrating that the cells are noticeably hyperchromatic with rather abundant, tapered eosinophilic cytoplasm. No mitotic figures are identified. Original magnification X 100. The diagnosis was pigmented schwannoma. All photomicrographs were stained with H & E.

The patient improved postoperatively but gradually deteriorated and died 2 years later. Unfortunately, no postmortem examination was performed.

DISCUSSION
Various multiple neoplasms can occur in the CNS. Multicentric meningiomas and their association with neurilemomas among other diverse neoplasms are well known. Multiple tumors may also occur along the dura, the upper spinal nerve roots, and the cauda equina.

There are well-documented reports on meningiomas coexisting with gliomas, sarcomas, oligodendrogliomas, and mixed pituitary adenomas in the brain.[13] Occasionally, the association of neurofibroma with a glioma is found. In reviewing the literature through 1960, Elam and McLaurin,[5] found 18 recorded cases of intracranial gliomas associated with meningiomas.

Multiple meningiomas have been reported to occur in 8% of the cases of intracranial meningiomas, but the real incidence may be closer to 16%. The occurrence of multiple meningiomas in separate neuraxial compartments is a much rarer condition, and only 11 histologically confirmed cases have been reported.[26] Hereditary components or multicentricity may be factors in the pathogenesis of multiple meningiomas and could explain those cases in which lesions are found simultaneously in both intracranial and spinal compartments.

**Multiple Tumors Associated With Neurofibromatosis**

Neurofibromatosis (NF) is the most commonly inherited disorder affecting the CNS. It is usually classified as NF1 (peripheral NF); NF2 (central NF); and NF3 (the mixed form).[6,16,22] Whereas NF1 is caused by defects in the chromosome 17 gene, the NF2 gene is in chromosome 22.[4,16] The basic biological feature is a widespread tendency for multiple tissues to undergo malignant transformation. These autosomal dominant neurocutaneous syndromes are associated with multiple tumors of the CNS, including neurofibromas, schwannomas, meningiomas and intracranial gliomas.[20]

In an article by Ilgren, et al.,[11] they reported 98 gliomas in 87 patients with NF. Rodriguez and Berthrong[27] reviewed the literature for cases of NF with multiple tumors located intracranially, intraspinally, or in various combinations, and they found a high incidence of acoustic neuromas (occurring bi- or unilaterally), meningiomas, and glial tumors. Syringomyelia was present in 20%. They concluded that if multiple meningiomas are associated with one or more acoustic neuromas, NF is almost certainly present. Sakaida, et al.[29] have reported two cases of NF in which multiple brain and spinal tumors were histologically different.

Mautner, et al.[19,20] have emphasized that bilateral vestibular schwannomas are the hallmark of NF2. They conducted neuroimaging studies in their patients and found a high incidence of vestibular schwannomas, spinal tumors, meningiomas, and trigeminal schwannomas. By obtaining imaging studies of the whole spine, they found that spinal tumors were more common in patients with NF2 than previously reported and that tumors of the spine and other cranial nerves were nearly as common as vestibular schwannomas. Multiple tumors were present in 56% of their patients. Also of interest was the finding of multiple, asymptomatic spinal lesions in patients who presented with a single, symptomatic spinal tumor.

Spinal cord involvement in NF is typically from extramedullary growth of spinal nerve root tumors. In contrast, intramedullary spinal cord tumors are represented in only scattered single reports. Nishiura, et al.[22] reported the case of a 16-year-old girl who harbored three different types of spinal tumor at distant regions: ependymoma, schwannoma, and meningioma. They and others[7,10,28] stated that the incidence of multiple spinal tumors, mainly neurinoma and meningioma, was only 1 to 4% of all cases. Multiple ependymomas are rare in patients with NF, and their presence also raises the question of...
possible extension or metastases.

In a report by Lee, et al., patients with NF represented 2.5% of all patients with intramedullary spinal cord tumors. They noted a tendency for spinal cord ependymomas to occur in patients with NF2 and for astrocytomas to occur in those with NF1. Nakasu, et al., have described two cases of rare subependymoma in the cervical spinal cord associated with stigmata of NF. Lindboe and Nordan reported another unique combination of neuropathological findings consisting of multiple neurilemomas of the cauda equina, lateral sclerosis, and a cavernous hemangioma of the lower thoracic spinal cord.

**Spinal Tumors Without Evidence of Neurofibromatosis**

Multiple primary tumors of the spinal cord and its meninges are rare and are most frequently accidental findings at autopsy. In Lichtenstein's study of 100 cases of glioma of the spinal cord, only two cases of multiple tumors were encountered: one ependymoma and one neurinoma.

The incidence of spinal intradural meningiomas in patients with epidural meningiomas is quite high. Multiple spinal meningiomas at the same spinal cord level have also been reported. Weil, et al., have reported such a case in which an extradural spinal meningioma with a separate intradural meningioma were present at the same cord level. The extradural tumor was a fibrous meningioma, whereas the intradural tumor was syncytial. The likelihood that multiple meningiomas would appear near each other is defined as the effect of regional multicentricity.

The occurrence of spinal meningiomas and neurinomas without clinical signs of NF is very rare. These tumors represent approximately 50% of all spinal tumors and are therefore relatively common. Their simultaneous occurrence can probably be coincidental. Such a case was described by Dorizzi, et al., in which a 70-year-old woman harbored a cervical schwannoma and a dorsal meningioma. These authors found four other cases in the literature. Of these cases, the one reported by Camp was considered a probable case of NF because an association was determined between a meningioma and two neurofibromas.

A common pathogenetic mechanism related to aberrations of chromosome 22, like the loss of a tumor-suppressor gene, can be used to explain why meningiomas, which are mesodermal tumors, occur in association with neurinomas, which are neuroectodermal tumors. It has also been postulated that meningioma and neurinoma cells derive from the same mesenchymal cell. Therefore, the occurrence of meningioma in association with a neurinoma could be attributed to a common origin of the Schwann cells and of the meningocytes.

Kasantikul and Netsky have described eight cases of intracranial and peripheral neoplasms composed of mixed neurilemoma and hemangioma, three of which were found in the spinal cord or peripheral nerve. The authors postulated that the occurrence of meningioma may be related to angiogenetic or to developmental factors as in rare cases of vascular meningiomas. On the basis of the embryology of blood vessels, the authors suggested that vascular elements can arise from mesenchyme of both neural crest and lateral plate mesoderm. The combination of neurilemoma and angioma, or neurilemoma and other mesenchymal tumors, such as lipoma, rhabdomyoma, or meningioma, could therefore be explained on the basis that they originate from ectomesenchyme.

Multiple hemangioblastomas of the spinal cord are not unusual. In addition a mixed paraganglioma and glioma occurring in the conus medullaris and cauda equina and, similarly, the presence of an astrocytoma of the cervical spinal cord and hemangioblastoma of the brainstem have been
Shen and Lee have described a woman who harbored a spinal intradural meningioma that occurred with an intramedullary ependymoma. The latter was also associated with a syringomyelic cavity without evidence of NF. These authors reported the simultaneous occurrence of multiple spinal tumors in the same patient to be at a rate between 1 to 4% of all spinal tumors.

Neurilemoma and ependymoma are the most common tumors of the cauda equina, according to a report by Heuschling, et al. The concomitant presence of these tumors, which are composed of different cell types, is extremely rare in the absence of NF. The authors reported that these tumors occurred at the cauda equina level, and they postulated that the neurilemoma may have developed in response to the microtrauma and irritation produced by the ependymoma. Sciolla, et al., have described a patient in whom the diagnoses of a neurilemoma and ependymoma were separated by a 26-year interval.

Lechevalier et al. reported the case of an epidural cavernoma that was associated with a vertebral angioma at the thoracic level, and Pasquier, et al. described a patient in whom a "collar-stud tumor" was composed of combined neurilemoma and hemangioma elements with mediastinal and intraspinal locations.

Lange and associates have reported on the coexisting presence of a common benign tumor of the spine (osteoblastoma) and a rare tumor of the bone (hemangioendothelioma) demonstrated in the posterior elements of two separate vertebrae (T-10 and T-12). They considered the appearance of these two lesions in the spine to be unusual and unique. Hockley described another extraordinary case of a breast carcinoma metastasized to a spinal meningioma 6 years following treatment. There was no bony evidence of metastatic disease. The meningioma was located in the C-2 area, and the adjacent dura was infiltrated by tumor. This occurrence was considered coincidental.

In Tables 1 and 2 a summary is provided of the case reports found in the literature on the coexistence of different spinal tumors in the absence of NF. Men and women were equally represented. More than half of the tumors were located in the thoracic spine, where our patient's two historically different tumors were also found. The second most frequent site was the cervical spine. Because benign tumors of the spine in general are frequently located in the intradural-extramedullary space, it is therefore not surprising that 12 of the tumors were located in that space and were histologically represented as meningiomas and schwannomas/neurinomas. This was followed by four tumors of vascular origin. In only one other report in addition to ours was there a patient harboring a metastatic lesion.
CONCLUSIONS

The presence of two or three biologically different tumors within the spinal canal in the absence of NF is rare. Unless the clinician is cognizant of the possibility of diverse spinal tumors, one of the lesions may be missed in the treatment. Clinical or roentgenographic suspicion of coexisting lesions in the spine requires further careful and detailed studies for proper surgical planning and successful outcomes. Although the coexistence of neuroinoma and meningioma in the spine can be explained by their origin from the same mesenchymal cell, presently there is no explanation for or correlation between the

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**TABLE 1**

<table>
<thead>
<tr>
<th>Authors &amp; Year</th>
<th>Age (yrs), Sex</th>
<th>Spinal Level</th>
<th>Location &amp; Tumor Type</th>
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<tbody>
<tr>
<td>Hockley, 1975</td>
<td>72, F</td>
<td>C-2, C-2</td>
<td>intradural meningioma, intradural metastatic carcinoma (breast)</td>
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<td>Lechevalier, et al, 1979</td>
<td>27, M</td>
<td>T-8, T-8</td>
<td>vertebral angioma, extradural cavernoma</td>
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<td>Lange, et al, 1986</td>
<td>19, M</td>
<td>T-10, T-12</td>
<td>vertebral hemangioblastoma, vertebral osteoblastoma</td>
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<tr>
<td>Araszkiewicz, et al, 1988</td>
<td>22, F</td>
<td>T8-9, L2</td>
<td>intradural menigioma, intradural neurinoma</td>
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<tr>
<td>Olveira-Rabiela &amp; Duran-Padilla, 1988</td>
<td>20, M</td>
<td>medulla, C3-6</td>
<td>intramedullary hemangioblastoma, intramedullary astrocytoma</td>
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<tr>
<td>Pagni, 1989</td>
<td>46, F</td>
<td>T-10, T-11</td>
<td>intradural menigioma, intradural neurinoma</td>
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<td>Dorizzi, et al, 1992</td>
<td>70, F</td>
<td>C-7, T2-3</td>
<td>intradural schwannoma, intradural menigioma</td>
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<tr>
<td>Shen &amp; Lee, 1992</td>
<td>67, F</td>
<td>C6-7, T12-L1</td>
<td>intramedullary ependymoma, intradural menigioma</td>
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<tr>
<td>Present case, 1999</td>
<td>72, M</td>
<td>T10-11, T-12</td>
<td>intradural schwannoma, pigmented, extradural metastatic adenocarcinoma</td>
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**TABLE 2**

<table>
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<tr>
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<tr>
<td>Location</td>
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<tr>
<td>intradural</td>
<td>12</td>
</tr>
<tr>
<td>intramedullary</td>
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<tr>
<td>Tumor type</td>
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<tr>
<td>schwannoma</td>
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<tr>
<td>metastatic</td>
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</table>
simultaneous existence of different spinal tumors other than simple coincidence. Their occurrence, however, is exceedingly rare.

References


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