Schwannoma of S1-Dural Sleeve Was Resected While the Intact Nerve Fibers Were Preserved Using Microscope. Report of a Case with Early MRI Findings

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Abstract

In this report, we described a small schwannoma of the dural sleeve that is often difficult to differentiate this tumor from lumbar disc herniation, especially a sequestered hernia, or a discal cyst. Gadolinium-enhanced MR images were a useful preoperative examination for differentiating this lesion from other diseases. Microscopically, the intradural tumor was successfully removed. The dura mater of the S1-nerve root was opened microsurgically, allowing the nerve fibers involved by the tumor to be identified. The involved fibers were cut around the tumor, and the lesion was resected while the intact nerve fibers were preserved. Based on histological examination of the resected specimen, the tumor was diagnosed as a schwannoma with multilocular cystic degeneration. Microsurgery allowed the tumor to be removed with minimal impairment from cutting of nerve fibers in the nerve root.

Key Words

Schwannoma, Nerve root, Radiculopathy, Microsurgery
Introduction

The spinal nerve roots form part of the peripheral nervous system and run across the subarachnoid space. In general, the region extending from attachment of the nerve roots to the spinal cord and reaching the origin of the dural sleeve is called the cauda equina, and the region reaching down to the intervertebral foramen is termed the nerve roots in the dural sleeves. Schwannoma predominantly develops in the cauda equina and rarely affects the dural sleeve. Schwannoma of the dural sleeve initially manifests with pain and radiculopathy, and it is often difficult to differentiate from intervertebral disc herniation [1-4]. We recently treated a schwannoma of the S1 dural sleeve in a patient with symptoms of disc herniation. The details of this case are reported here together with some discussion of the relevant literatures.
Case Report

History and Examination. The patient was a 32-year-old man with lower back pain and sciatica of the right lower limb. There was nothing contributory in his family history or past history. The patient had suffered from back pain for about 1.5 years. A local clinic had diagnosed lumbar disc herniation and he had received conservative therapy with analgesics, but his symptoms did not improve. About 3 months previously, numbness of the lateral side of the right foot occurred without any specific cause. Since nocturnal pain became particularly severe, the patient presented to our hospital. At the initial examination, the patient had sciatica at 70 degrees during the straight leg raising test, and hypesthesia was noted in the S1 area. Both the patellar and Achilles tendon reflexes were normal, and there was no obvious reduction of muscle power.

Imaging. Lateral plain X-ray films of the lumbar spine showed mild narrowing of the L5/S1 disc space, but there was no foraminal expansion or bony changes. T1- and T2-weighted sagittal MR images showed a low intensity lesion and a high intensity lesion, respectively, inside the spinal canal at the L5/S1 disc level (Fig. 1A,C). After intravenous injection of gadolinium, T1-weighted images revealed enhancement of a mass that was adherent to the L5/S1 disc (Fig. 1B). An axial view showed enlargement of the right S1 nerve root compared with the left side. A low intensity area was noted on T1-weighted images (Fig. 1D), and the same area showed a high intensity on T2-weighted images (Fig. 1F). Enhanced MR images showed an enhanced region and a non-enhancing cystic region in the mass (Fig. 1E). Myelogram showed a defect of the right S1 nerve root in frontal images (Fig. 2A), while lateral views did not show posterior bulging of the L5/S1 disc (Fig. 2B). CT scanning after myelography clearly visualized the left S1 nerve root, which was enhanced by the contrast medium, but not the right S1 nerve root (Fig. 2C). Discogram of the L5/S1 disc showed no extravasation of contrast medium into the
epidural space (Fig. 2D). Radiculogram did not clearly visualize the tumor outline, but it reproduced pain and relief of pain was obtained after nerve root block at S1. Based on the above findings, the patient was diagnosed as having a tumor of the S1 dural sleeve.

Operation. Excision of the tumor was performed by microsurgery using a Casper retractor. Prominent swelling of the S1 dural sleeve was observed (Fig. 3A), but no disc herniation was seen. The dura mater over the nerve root was incised under the operating microscope, and a tumor about 1 cm in diameter and yellow-brown in color was exposed (Fig. 3B). The tumor was clearly demarcated, so the affected nerve fibers were cut around the mass to remove it and the intact nerve fibers were preserved.

Pathological Examinations. Histological examination of the resected tumor showed a mixture of abundant vessels and bundles of spindle-shaped cells in the lesion as well as multilocular cystic change in one area (Fig. 4A). On immunohistochemical examination, positive reactions for S-100 protein (Fig. 4B) and vimentin (Fig. 4C) were consistently evident in the tumor cells. Based on these findings, the tumor was diagnosed as a schwannoma.

Postoperative course. At 3 years postoperatively, the patient had no back pain or sciatica, and hypesthesia of the right foot was also improved.
Discussion

A Schwannoma was reported to account for 30 to 40% of all spinal cord tumors [5,6]. It is rare for schwannoma to develop in a nerve root at an extradural site, as well as for such a lesion to be detected at an early stage while it is still very small. Nayemouri et al. [7] mentioned nocturnal pain as a characteristic symptom of schwannoma affecting the dural sleeve and stated that pain decreases in the sitting position or while walking. Albert [3] and Lahat [4] reported that it was difficult to differentiate schwannoma of the dural sleeve from disc herniation by myelography and that contrast CT was more useful for making a preoperative diagnosis. This type of schwannoma morphologically resembles an hourglass tumor, and it corresponds to the foraminal and paravertebral type of hourglass tumor according to Eden’s classification [8]. Schwannoma in the dural sleeve has to be differentiated from disc herniation, discal cyst [9], arachnoidal cyst [10], ganglion cyst [11], synovial cyst [12], ganglioneuroma [13], meningioma [14], neurofibroma [15], angioma [15], giant cell tumor [15], metastatic carcinoma [10], radiculitis [16-18] and ganglionitis [19].

In this patient, the initial diagnosis was also lumbar disc herniation. The patient received long-term conservative therapy, but his symptoms did not improve and MR images strongly suggested the presence of a tumor located in the dural sleeve. In particular, enhanced MR images showed a low intensity region without enhancement at the site where a multilocular cyst was located and showed a high intensity area for the solid component, which corresponded to the histological findings on examination of the surgical specimen. Enhanced MR images thus clearly visualized the entire tumor contour and was useful for diagnosis of the lesion in this case. Schwannoma with cystic degeneration should be carefully differentiated from a sequestered hernia or a discal cyst which appears as a wrapped disc on enhanced MR images [20]. We therefore performed discography this patient and confirmed that there was no spreading of the contrast medium between the disc and mass to rule out the
above-mentioned conditions. Radiculogram was useful for preoperative diagnosis of the affected nerve root since reproducible pain and alleviation of the patient’s symptoms after nerve root block were observed at S1. During surgery for an advanced hourglass tumor, it is difficult to preserve the involved nerve root, and it is often necessary to resect the nerve root together with the tumor, so that neurological impairment occurs postoperatively [21]. In the present patient, however, the tumor could be detected at an early stage by MR images. The small intradural tumor was also successfully removed microsurgically with a small 25-mm skin incision and it was possible to preserve the uninvolved nerve fibers and minimize impairment due to cutting the fibers. Microsurgery is reported to be minimal invasive on the basis of clinical as well as biomechanical standpoints [22,23]. Thus, microsurgical excision of the small intradural tumor in the present case is considered to be the best surgical option for facilitating the early return to normal activities of daily living.
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References


Legends

Fig. 1 Preoperative MR imaging. A,D, Sagittal (A) and axial (D) T1-weighted MR images. B,E, Sagittal (B) and axial (E) T1-weighted MR images obtained after the intravenous administration of gadolinium. Arrow indicates site of enhancement area in the S1-nerve root. C,F, Sagittal (C) and axial (F) T2-weighted MR imaging.

Fig. 2 Preoperative imaging studies. A,B, Frontal (A) and lateral (B) myelogram. C, Computed tomographic scan reconstructed in the axial plane after myelography. D, Lateral discogram.

Fig. 3 Intraoperative findings. A, The S1-nerve root was apparently swelled. B, A tumor about 1 cm in diameter and yellow-brown in color (black arrow) was exposed after the dura mater (white arrows) was incised under operative microscope.

Fig. 4 Pathological findings. A, Antoni A and B area of a typical schwannoma (Hematoxylin-eosin, original magnification, X40), B,C, S-100 protein (B) and vimentin (C) immunoreactivity within the surgical material (original magnification, X200).