

The pathophysiology, classification, treatment, and prognosis of a spontaneous thoracic spinal cord herniation: A case study with literature review

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Abstract

Background: Spinal cord herniation was first described in 1974. It generally occurs in middle-aged adults in the thoracic spine. Symptoms typically include back pain and progressive paraparesis characterized by Brown-Séquard syndrome. Surgical reduction of the hernia improves the attendant symptoms and signs, even in patients with longstanding deficits.

Case Description: A 66-year-old female with back pain for 7 years, accompanied by paresthesias and a progressive paraparesis, underwent a thoracic MRI which documented a ventral spinal cord herniation at the T4 level. Following a laminectomy, with reduction of the hernia and ventral dural repair, the patient improved.

Conclusion: Herniation of the thoracic cord, documented on MR, may produce symptomatic paraparesis which may resolve following laminectomy with ventral dural repair.

Key Words: Laminectomy, magnetic resonance imaging, microsurgery, neurosurgical procedures, spinal cord diseases

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INTRODUCTION

Idiopathic spinal cord herniation (ISCH), most commonly found in the thoracic spine, was first described in 1974.^[12] On thoracic MR studies, the spinal cord is typically pushed through a ventral defect/tear in the dura.^[10] The ISCH is commonly found in middle-aged adult females and is characterized by progressive lower extremity sensorimotor deficit, or Brown-Séquard syndrome.^[7,10,11] Although as yet there is no clear explanation of the etiology/pathology of this lesion, the

surgical management is relatively straightforward and consists of reduction of the herniated spinal cord with ventral dural repair. Of interest, patients go on to improve even with longstanding preoperative deficits.^[10] The case reported here is a 66-year-old female with a T4 ISCH, and a literature review of the topic is also provided.

CASE REPORT

A 66-year-old female farm worker presented with 7 years of progressive back pain and impaired motor and sphincter

function. On neurological examination, she exhibited a sensory level at T4 with a spastic paraparesis and bilateral (right greater than left) muscle atrophy.^[1] The MR revealed a ventral dural gap at the T4 level [Figure 1a-c]. She underwent a T4 laminectomy at which time the ventral dural gap was repaired (e.g. ventral dura mater defect repaired utilizing a 5-0 prolene suture to attach a muscle/fascia patch to the surrounding healthy dura mater) and the cord was reduced [Figure 2a] at surgery. The herniated cord appeared “violaceous/pale” in color and was hardened [Figure 2b]. Postoperatively, the patient showed improvement in muscle strength in the lower limbs, allowing her to walk with assistance (with a cane or walker).

DISCUSSION

Clinical and diagnostic studies

Utilizing MRI, ISCH has been increasingly recognized. In one series, it was reported to occur in 0.08% of cases.^[6,7] It typically occurs in middle-aged females (range 22-71 years of age) versus males.^[1,7,9,10,11] It most commonly presents as a Brown-Séquard syndrome or a non-focal deficit.^[1,6,9] Although postoperative improvement is commonly reported, the more severe the preoperative deficit, the worse is the prognosis (e.g. 80% of the cases with spastic paraparesis regain motor function).^[1,4,8,9]

Pathophysiology

Spontaneous ventral cord herniation usually involves the mid-thoracic spine, where the cord is naturally anteriorly situated due to the natural kyphosis.^[5] This facilitates ventral cord herniation through an anterior/anteromedial dural defect that may have resulted from a ventral disc protrusion (causing weakness of dural fibers), an

arachnoid cyst (pushing the cord to an anterior sleeve), or other ventral lesions.^[1,3,4,5]

One author^[8] suggested that two factors account for these lesions. They include an anterior dural defect leading to an extradural arachnoid cyst (congenital), or pseudomeningocele (iatrogenic), and the concave defect situated on the site of the spinal curvature (dorsally in the cervical spine and ventrolaterally or ventrally in the thoracic spine).

Other etiologies of spinal cord herniation

There are also multiple other etiological theories as to why ventral thoracic cord herniations occur. The predominant one is that the ventral position/adherence of the thoracic cord leads to compression and extrusion through ventral dural defects attributable to cardiac, pulmonary, and/or CSF pulsations.^[1,2,6] Other theories include chronic inflammation, lytic substances, and inflammatory conditions.

Value of MR in diagnosing spinal cord herniation

Although MRI is the most accurate tool for diagnosing spinal cord herniation, myelo-CT studies also prove useful.^[9] They typically show thinning of the spinal cord and adherence to the anterior spinal canal. T2-weighted images can further directly demonstrate an anterior dural “gap.”

Classification of sagittal and axial MR types of cord herniation

Sagittal MR: In the sagittal plane, three types of thoracic MR cord herniations are identified: Type K shows an obvious ventral spinal kink; Type D, the discontinuous type, is characterized by the spinal cord completely disappearing

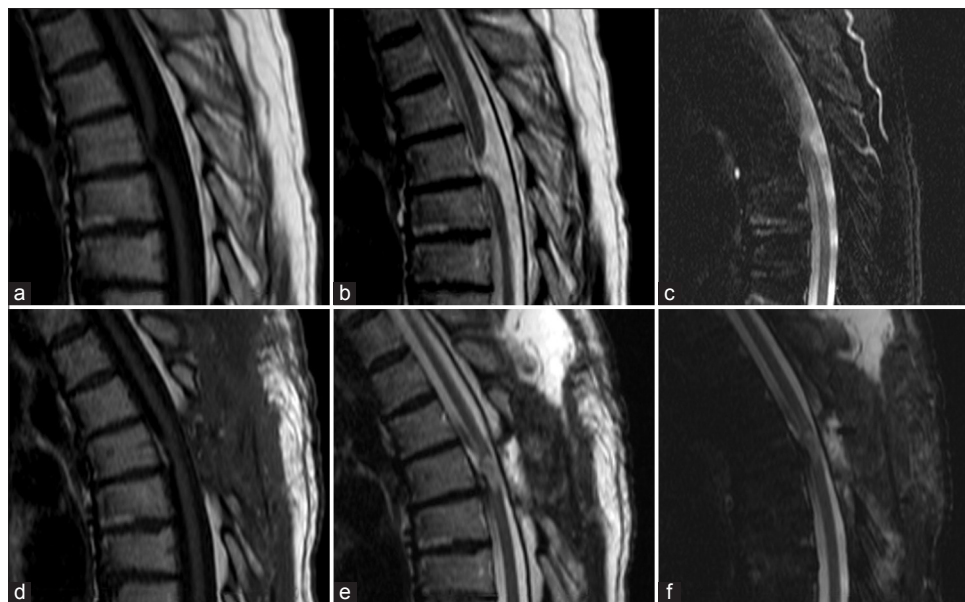


Figure 1: Magnetic resonance of the dorsal spine [sagittal acquisition – (a and d) T1-weighted images; (b and e) T2-weighted images; (c and f) SPIR (Selective partial inversion recover) T2-weighted images] demonstrating the spinal cord herniation (a-c) and the radiological result following surgical treatment (d-f)

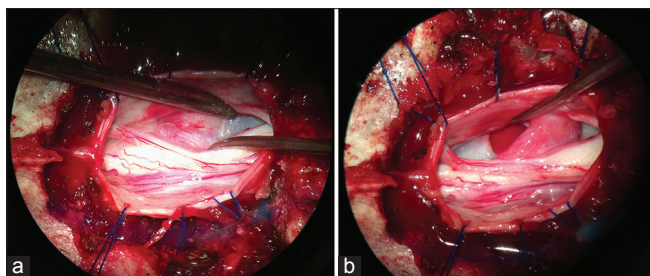


Figure 2: Intraoperative photograph. (a) Here, the herniated spinal cord content is demonstrated (instrument tip to the right). (b) The dural defect (indicated by the instrument), the reduced spinal cord area, and the tapering of the spinal cord at the herniation level are shown

at the herniation site; and Type P is the protrusion type wherein the anterior subarachnoid space ventral to the thoracic cord disappears, almost without a focal “kink.”^[7]

Axial MR: Using axial images, the location of cord herniations is classified as central (Type C) and lateral (Type L) types. Furthermore, the laterality of the herniated spinal cord is classified based on its correspondence (same; Type S) or non-correspondence (opposite; Type O) with the location of the herniation.^[7]

Surgery and outcome

Surgery for ISCH is appropriate when a progressive and/or severe neurological deficit occurs.^[9] At first, reduction and repair of the dural defect through thoracotomy and partial corpectomy was described; however, this involved prolonged recovery for most patients.^[12] Most authors, therefore, prefer a laminectomy or laminoplasty often accompanied by looking for and repair of an attendant arachnoid cyst.^[5,6,8] In this case, a laminectomy at T4 with the resection of the dentate ligament permitted gentle rotation of the spinal cord and its reduction through the ventral dural defect that was then repaired with prolene 5-0 sutures.

Prognosis is better if the preoperative deficit is limited.^[1,4,8,9] Nevertheless, when the neurological symptoms are already very serious, with paraplegia and

spasticity,^[1,9] as in our case, significant improvement is not likely to occur.

CONCLUSION

Patients who present with slowly progressive paraparesis or Brown-Séquard syndrome may suffer from a ventral thoracic spinal cord herniation (ISCH). Surgical decompression, utilizing a laminectomy or laminoplasty, may allow for reduction of the cord herniation while facilitating ventral dural repair.

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