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Iatrogenic spinal cord herniation. A rare clinical entity and review of literature with 16 cases

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ABSTRACT

Introduction: Spinal cord herniation occurs idiopathically or is due to defective or weakened dura mater resulting from iatrogenic or traumatic lesions. Although there have been many reports of idiopathic cases, there are few reports of postoperative iatrogenic spinal cord herniation. The authors describe a rare case of postoperative spinal cord herniation in the cervical spine, with an extensive analysis of reported cases

Materials and methods: This article reports a documented case of postoperative spinal cord herniation. The case description is followed by an analysis of the literature.

Results: A 67-year-old woman who had cervical laminectomy 3 weeks before for cervical laminectomy, presented with neck pain and torticollis after coughing. The MRI findings showed a cervical medulla herniation with cerebrospinal fluid (CSF) leakage. The patient underwent surgery to reduce the herniation and duroplasty with subsequent complete resolution of symptoms. Over the previous 50 years (1973–2023), 16 post-operative spinal cord herniation cases were reported. The mean patient age was 43.3 years (range 15–67 years). There was a male predominance (80%). The mean onset period after surgery was 292 weeks (range, 1 week to 728 weeks). Clinical symptomatology was polymorphic with non-specific signs.

Conclusion: Iatrogenic spinal cord herniation is an extremely rare occurrence after spine surgery. The diagnosis must be evoked in case of any neurological degradation after surgery of the cervical spine, thoracic spine or thoracolumbar junction. The surgical management gives satisfactory clinical results.

INTRODUCTION

Spinal cord herniation occurs idiopathically or is due to defective or weakened dura mater resulting from iatrogenic or traumatic lesions. Although there have been many reports of idiopathic cases, there are few reports of postoperative iatrogenic spinal cord herniation (10).

The authors describe a rare case of postoperative spinal cord herniation in the cervical spine, with an extensive analysis of reported cases focusing on pathogenesis, therapeutic management and outcome.

Keywords

iatrogenic spinal cord
herniation,
spinal compression,
spinal cord surgery



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METHOD

This article reports a documented case of postoperative spinal cord herniation. The case description is followed by an analysis of the literature. An extensive review of the literature of the previous 50 years (1973–2023) was performed on PubMed, Google Scholar and EMBASE, using the following keywords: iatrogenic spinal cord herniation, postoperative spinal cord herniation. The review covered documented spinal cord herniation in cervical, thoracic and thoraco-lumbar junction region. Articles in languages other than English or French and articles unavailable in the databases weren't included.

RESULTS

For our study, we included 13 patients, ages varied from 28-70, 4 patients were female while the remaining 9 were male. 11 patients were classified as Fisher grade 2; 1 patient as Grade 3 and 1 patient as Grade 4. 8 patients were classified as WFNS grade 1, 4 patients as grade 2 and 1 patient as grade 3.

CASE REPORT

A 67-year-old woman who had undergone a cervical laminectomy three weeks earlier for cervical myelopathy suffered neck pain and stiff neck after coughing.



Image 1. Cervical MRI obtained three weeks after a cervical laminectomy showing a spinal cord herniation.

Clinical examination of this patient revealed a 4/5 limb motor deficit with a vivacity of osteostendinous reflexes. Magnetic resonance imaging (MRI) revealed a cervical spinal cord herniation at the level C2-C3 with leakage of cerebrospinal fluid (Image 1).

The patient underwent surgery to reduce the herniation. The intraoperative morphology of the dural defect was a 2 cm one with no adhesion of the spinal cord. After the reduction of the herniation, the dura mater defect was closed indirectly using a dural patch.

The patient recovered completely from his motor deficit a week after surgery with a full resolution of all other signs (Image 2).



Image 2. Post operative MRI showing the resolution of the spinal cord herniation.

REVIEW OF LITERATURE

Over the previous 50 years (1973–2023), 16 post operative spinal cord herniation cases were reported (Table1). The mean patient age was 43.3 years (range, 15–67 years). There was a male predominance (80%). Mean onset period after surgery was 292 weeks (range, 1 week to 728 weeks). The Clinical symptomatology was polymorphic with non-specific signs. The most frequent location was the cervical spine (73.30%). The most repair technique of dural defect was duraplasty with dural patch in 12 case (75%) and direct suture of the dura mater in 4 cases (25%). Almost all patients (86,67%) improved neurologically after surgery.

Table 1. Data of 16 post-operative spinal cord herniation in the literature

Author	Age and sex	Level of herniation	Previous surgery	Onset period after surgery	Symptoms	Operative repair technique	Operative result
Cobb et al. 1973	39M	C5-C6	Laminectomy	03 Years	Motor and sensory dysfunction in both upper and lower limbs	Duraplasty	Improvement
Burres et al. 1978	41M	C2	C3-6 posterior decompression (Laminectomy)	18 Years	Motor and sensory dysfunction in left arm function	Duraplasty	Improvement
Dunn et al 1987	33M	C1-C2	C1-2 wire fixation for odontoid fracture	2 weeks	Numbness and weakness in the left hand and leg	Duraplasty	Improvement
Hosono et al 1995	45M	C2-C3	Laminectomy	14 Years	Gait disturbance and clumsiness of the right fingers	fibrin glue	Improvement
Belen et al 2009	22M	C1-C2	FMD with C1 laminectomy for Chiari malformation	07 Years	Worsened hand function in both upper extremities and gait disturbance	Duraplasty	Improvement
Moriyama et al. 2013	51M	C7	Spinal tumor	10 Years	Gait disturbance and urinary incontinence	Duraplasty	Improvement
Zakaria et al. 2013	57M	TH12-L1	Intramedullary cyst resection	8 weeks	Gait disturbance, and numbness of both lower legs	Direct closure of dura	No Improvement
Iencean et al. 2014	51M	C2-C3	Ependymoma resection	5 years	Spastic tetraparesis with impossibility of in standing and walking	Duraplasty	No Improvement
Abd et al 2015	56M	C2-C3	Neurofibroma	05 years	Neck pain and progressive weakness of the right upper limb	Duraplasty	Improvement
Seung-Jae Hyun 2016	51F	T2	Laminectomy for OPLL	01 week	paraparesis (motor grade 2-3)	Duroplasty	Improvement
Hiroaki Nakashima 2020	55M	C4-C5	cervical laminoplasty	08 Years	gait disturbance, paralysis of lower limbs (muscle manual testing, 2-4/5)	Duraplasty	Improvement
Hiroaki Nakashima 2020	60M	C2-C3	Laminectomy for OPLL	03 MONTHS	worsening lower leg numbness with gait disturbance	Duraplasty	Improvement
Hiroaki Nakashima 2020	47F	TH11-TH12	durotomy for resection of a spinal cord tumor	02 MONTHS	left leg numbness	Duraplasty	Improvement
Axumawi Gebreyohanes 2022	15F	T10	Thoracic laminectomy	03 months	reduced lower limbs power and thoraco-lumbar dermal hypoaesthesia	Duraplasty	improvement
Ayesha Arshad 2022	16M	T11-T12	resection of thoracic ependymoma	06 months	weakness in lower limb	Duraplasty	improvement
present case 2023	67F	C3-C4	Cervical laminectomy	03 weeks	neck pain and stiff neck and tetraparesis	Duraplasty	Improvement

DISCUSSION

Spinal cord herniation is described in the literature as a rare cause of spinal cord dysfunction (4,6,11,19). It can commonly be classified into spontaneous, idiopathic, iatrogenic, and posttraumatic. Spontaneous and idiopathic presentations have been described more commonly in the literature (11)

and herniation due to a traumatically acquired dural defect is the least reported cause (4,11).

The causes of Cervical iatrogenic spinal cord herniation were hypothesized as weakness of the dura mater, cervical lordosis, and physiological damage to the spinal cord that gradually resulted in extrusion of the cord into a pseudomeningocele

through a defect of the dura mater (3,9,10,16).

Anatomically, the spinal cord is not strictly located in the center of the dural sheath. In the cervical spine, it is located more dorsally, whereas in the thoracic spine it is more ventral. The spinal cord also has a certain mobility. During flexion movements, it moves in a craniocaudal direction and during extension, it moves in an anteroposterior direction, as revealed by magnetic resonance imaging studies (1).

Spinal cord herniation is a rather rare phenomenon whose occurrence requires the presence of two hypothetical phenomena presented by Kumar and Onhishi (5,12). First, there must be a dural breach leading to a pseudomeningocele and second, this breach must be located in the concave curvature of the dural sheath (dorsally for the cervical spine and ventrally for the thoracic spine).

In case of a breach that goes unnoticed, a pseudomeningocele is formed with the spinal cord abutting the breach. Then the pulsations of the CSF push the spinal cord further into the pre-existing cyst, causing a herniation of the spinal cord. The dynamic anteroposterior movement of the spinal cord and the flow of CSF into and out of the dural defect with each heartbeat and respiratory movement have been observed intraoperatively (2).

Clinically, approximately two-thirds of reported cases of thoracic spinal cord herniation presented with the Brown-Séquard syndrome, and one-third with symmetrical spastic paraparesis. Isolated sensory deficits and sphincter dysfunctions are less common (15,18).

In the case of cervical spinal cord herniation in general, the clinical manifestation is polymorphic; consisting of a sensory and motor deficit of the limbs and walking disorders (Table1). In our presented case, the motor deficit of the limbs was associated with neck pain and Torticollis.

In current practice, MRI is the investigation of choice; three dimensional sequences/volume data and thin slice images can be acquired to aid data reconstruction. These may also be of use in surgical planning. In certain cases, computed tomographic myelography can be an aid in establishing the diagnosis of spinal cord herniation or in differentiating pseudomeningoceles from arachnoid cysts or arachnoid bands (13). Once the diagnosis of this rare complication is made, it must be treated surgically.

The goals of the surgical treatment are to reduce the herniation, return the spinal cord to its normal position, and prevent recurrence. Removal of the pseudomeningocele and release of the cord under the microscope are necessary if it is adhering to the dural margin. After reduction of the herniation in the subarachnoid space, the dural defect is repaired using different techniques that have been described (14). The most common technique is to repair the dural defect with using either an autologous graft that can be made of Fascia lata, muscular tissue, or an artificial dural made of dural patch (7,8,14,17). In that presented case, we used fascia lata to perform the duraplasty.

Previous reports showed neurological improvement after surgery for spinal cord herniation in the majority of cases (10). In that present case, The patient recovered completely from his motor deficit one month after surgery with a full resolution of all other signs.

CONCLUSION

Iatrogenic spinal cord herniation is an extremely rare occurrence after spine surgery. The diagnosis must be evoked in case of any neurological degradation after surgery of the cervical spine, thoracic spine or thoraco-lumbar junction. The surgical management that consists of a reduction of the spinal cord herniation hernia associated with a repair of the dural defect gives satisfactory clinical results.

REFERENCES

1. Funck M, Schneider B, Igloffstein J, et al. [Transesophageal ultrasonography of the spinal canal]. *Dtsch Med Wochenschr* 1946 1989 ; 114 : 529-533.
2. Goodman SJ, Gregorius FK. Cervical pseudomeningocele after laminectomy as a cause of progressive myelopathy. *Bull Los Angeles Neurol Soc* 1974 ; 39 : 121-127.
3. Hosono N, Yonenobu K, Ono K. Postoperative cervical pseudomeningocele with herniation of the spinal cord. *Spine* 1995 ; 20 : 2147-2150.
4. Khattar NK, Donovan AM, Oxford BG, et al. Traumatic Ventral Cervical Spinal Cord Herniation: A Case Report. *Cureus* 2019 ; 11 : e4070.
5. Kumar R, Taha J, Greiner AL. Herniation of the spinal cord: Case report. *J Neurosurg* 1995 ; 82 : 131-136.
6. Le TC, Grunch BH, Karikari IO, et al. Dorsal thoracic spinal cord herniation: report of an unusual case and review of the literature. *Spine J* 2012 ; 12 : e9-e12.
7. Masuzawa H. Spinal cord herniation into a congenital extradural arachnoid cyst causing Brown-Séquard syndrome. *J Neurosurg* 1981 ; 55.

8. Miyaguchi M, Nakamura H, Shakudo M, et al. Idiopathic Spinal Cord Herniation Associated With Intervertebral Disc Extrusion: A Case Report and Review of the Literature. *Spine* 2001 ; 26 : 1090–1094.
9. Moriyama T, Tachibana T, Maruo K, et al. Postoperative spinal cord herniation with pseudomeningocele in the cervical spine: a case report. *Spine J* 2013 ; 13 : e43–e45.
10. Nakashima H, Ishikawa Y, Kato F, et al. Postoperative iatrogenic spinal cord herniation: three case reports with a literature review. *Nagoya J Med Sci* 2020 ; 82 : 383–389.
11. Ogbu I, Eltoukhy M, Tzerakis N. Duroplasty in iatrogenic dorsal spinal cord herniation: illustrative case. *J Neurosurg Case Lessons* 2021 ; 2.
12. Ohnishi Y-I, Iwatsuki K, Yoshimura K, et al. Incarcerated herniation of the cervical spinal cord after laminectomy for an ossification of the yellow ligament. *Eur Spine J Off Publ Eur Spine Soc Eur Spinal Deform Soc Eur Sect Cerv Spine Res Soc* 2010 ; 19 : 140–143.
13. Patel J, Stewart J, Biswas S, et al. Spinal Cord Herniation into a Pseudomeningocele—A Delayed Presentation following a Traumatic Cervical Root Avulsion Injury. *Indian J Radiol Imaging* 2023 ; 33 : 264–266.
14. Sarigul B, Ogrenci A, Dalbayrak S. Surgical management of idiopathic thoracic ventral spinal cord herniation: a case report. *Egypt J Neurosurg* 2023 ; 38 : 12.
15. Shin JH, Krishnaney AA. Idiopathic ventral spinal cord herniation: a rare presentation of tethered cord. *Neurosurg Focus* 2010 ; 29 : E10.
16. Watters MR, Stears JC, Osborn AG, et al. Transdural spinal cord herniation: imaging and clinical spectra. *AJNR Am J Neuroradiol* 1998 ; 19 : 1337–1344.
17. White BD, Firth JL. Anterior spinal hernia: an increasingly recognised cause of thoracic cord dysfunction. *J Neurol Neurosurg Psychiatry* 1994 ; 57 : 1433–1435.
18. Yang C, Lin G, Zhang J, et al. Case Report: Idiopathic Spinal Cord Herniation: An Overlooked and Frequently Misdiagnosed Entity. *Front Surg* 2022 ; 9.
19. Zakaria R, Ellenbogen JR, Grewal IS, et al. Posterior spinal cord herniation: a novel occurrence following surgery for an intramedullary cyst at the thoracolumbar junction. *Eur Spine J* 2013 ; 22 : 399–403.