Case Report

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Traumatic Ventral Cord Herniation Presenting with Sexual Dysfunction: A Case Report and Review of Literature

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Abstract

Spinal cord herniation is a characteristic bulging from a defective arachnoid membrane and dura mater that is generally regarded as a rare neurosurgical case. Acknowledging that there are fewer than a hundred cases worldwide, this case report portrays a thirty-year-old male with diminished tactile, pinprick, and temperature sensation in the left lower and upper limbs consistent with Brown-Sequard syndrome presenting with a history of erectile dysfunction. This case report aims at raising awareness towards spinal cord herniations to better manage and treat this rare condition. As a treatment option, the patient underwent a surgical decompression using laminectomy to repair the dural defect with a synthetic dura mater below the level of T8. The implication of this case is to show that although ventral cord herniation associated with erectile dysfunction is a rare neurological case, it should be kept in the mind of physicians when faced with atypical cases of myelopathy that are not consistent with frequent etiologies. We show that such cases can be treated with surgical intervention, as it is imperative to patient treatment and recovery.

Keywords: Ventral cord; Herniation; Operative technique; Spinal cord surgery; Trauma

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Introduction

Wortzman first identified Spinal Cord Herniation (SCH) in a case report in 1974. SCH is the outward displacement of the spinal cord through a dural sac defect of the arachnoid membrane and the dura mater with the thoracic cord being the most affected region [1-4]. SCH remains a rare pathological entity encountered in the field of neurosurgery; however, it is a treatable spinal cord disease of unknown pathophysiology that is often missed as a diagnosis for paraplegia or neurological impairment [5,6]. The term Thoracic Anterior Cord Adhesion Syndrome (TASCS) is used in mild cases [7]. Whereas in advanced or severe cases, the spinal cord is protruded through a ventral dural defect where the bulge or the protrusion can sometimes reach centimeters through it.

Fewer than 100 cases have been reported in the literature, but the exact pathogenesis of SCH remains unknown. The literature contains several proposed theories in an attempt to explain the pathological mechanism of SCH. A study by Francis et al. claimed that it may be due to a congenital dural deficiency or related to a history of traumas [8]. Other authors have proposed an etiological basis related to pressure erosion of the dura, dural fistula, trans-dural disk herniation, spinal tumor or spinal arachnoid cysts dislocating the spinal cord [9], and duplication of the ventral dura [6,10-12]; as well as spontaneous or idiopathic, and iatrogenic

cases [2,13-16]. Nonetheless, traumatic spinal-cord herniation is poorly documented in the literature [8,17].

Typical MRI imaging investigations of the previously proposed etiologies demonstrate focal anterior ventral cord herniation between T2-T8 without intervening Cerebrospinal Fluid (CSF) and a dilated posterior CSF compartment similar to an arachnoid cyst [18-20]. In fact, an arachnoid cyst is ruled out as a probable cause in the presence of normal unobstructed CSF flow. Usually, arachnoid cysts tend to displace the nerve roots peripherally where it is best seen on a high-resolution T2-weighted imaging, making it a helpful tool in distinguishing a cyst from herniation [21]. When MRI results are inconclusive, a CT myelography is required as it shows unrestrained flow of contrast through the dural defect at the level of the herniation or a widened dorsal subarachnoid space [22]. Both imaging modalities led to the development of an idiopathic SCH classification system that contributed to decision-making in the management of SCH and the establishment of a prognosis. This classification includes several types: Type K (kink) where the imaging shows a kink to the ventral region, Type D (discontinuous) where the spinal cord is no longer evident at the herniated site, and Type P (protrusion), in which the subarachnoid space of the ventral spinal cord vanishes without a kink [4,23].

The neurological impairment of SCH most commonly appears between the ages of 22-71, with females being more commonly affected [1,24]. Patients with SCH present with progressive spastic paraparesis or Brown-Séquard syndrome, where the latter can also cause numbness, weakness in the legs, walking difficulty, as well as problems with bowel and bladder function [4,25-27].

There is no consensus on the surgical technique used to manage this condition as several have been reported in literature with the common aim of reducing the herniation and preventing recurrence [18,20]. As demonstrated by several studies, primary closure using sutures showed a high rate of post-surgical complications and thus yielded poor outcomes as opposed to the posterior approach whose main mechanism is the destruction of the dural defect and the use of a synthetic dural graft [28-30].

In this study, we report a case of a 30-year-old male who presented to Ain Wazein medical village, Lebanon, with sexual dysfunction and neurological impairment post trauma. The aim of this study is to raise the attention to such a rare condition in order to establish a better understanding of its mechanism and management.

Case Report: Presentation, Examination, & Follow-up

A 30-year-old young male presented with a history of progressive sexual dysfunction, burning sensation, and motor weakness in the left lower limb. Ten and a half years prior to presentation, the patient was admitted to a local hospital for trauma and underwent a Computer Tomography (CT) of the thoraco-lumbar spine. The result was negative, and he was discharged home with analgesics for back pain. However, his complaints persisted and three months prior to presentation, he experienced weakness and a loss of perception of temperature sensation in his left leg, especially while walking. Additionally, bladder and bowel functions were normal.

A neurological examination revealed Brown-Séquard syndrome below the level of T8. He had diminished tactile and pinprick sensation and reduced temperature sensation in the left lower extremity. His sense of position and vibration were bilaterally preserved, and reflexes were all brisk.

Following surgery, the patient regained sensation in his upper limbs and chest, in addition to an improvement in his erectile sexual dysfunction (Figure 1).

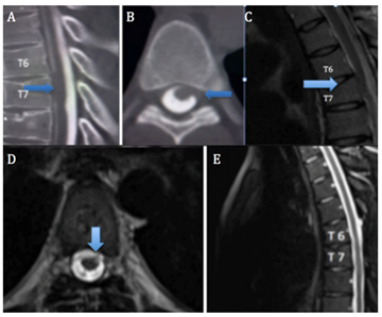

Figure 1 A,B) Preoperative CT myelography showing no contrast ventral to the spinal cord at T6–7. A) Sagittal image demonstrating contrast enhancement dorsal to the herniated spinal cord. B) An axial image demonstrating the ventral herniation at the level of the disc space. C) A sagittal T2-weighted image demonstrates a ventral spinal cord herniation at the level of T6-7. D,E) Postoperative MR imaging study of the thoracic spine demonstrating realignment of the spinal cord within the canal and restoration of CSF ventral to the spinal cord. .

Surgical Procedure

General anesthesia was administered to the patient in prone positioning with perioperative steroids and antibiotics. In addition, normotensive intraoperative blood pressure goals were reviewed with the anesthesia team. Prior to surgery, the patient was marked by injecting methyl at the level of the cord herniation with CT guidance. The anatomic levels were double checked prior to the skin incision with fluoroscopy and the posterior thoracic region was prepared with antiseptic solutions in the proper fashion.

Skin and dorsal fascia were opened in the midline and the paraspinal muscles were reflected from the spinous process and lamina. To better expose the spinal cord and identify the location of the displacement, a thoracic laminectomy and intraoperative ultrasound were performed, respectively. The dura was opened in the midline and secured with retractive sutures. Then, a careful microdissection of the arachnoid and generous freeing of the arachnoid adhesion from the upper and lower poles of the herniated spinal cord were conducted until a normal anatomical position was achieved.

Once a sufficient path around the cord at the level of the dural defect was achieved, a square piece of artificial dura was advanced circumferentially around the inner aspect of the dura, anterior to the cord (Figure 2). Double-checking at this stage is crucial to confirm an adequate reduction of the hernia and no

undue pressure or tension on the spinal cord at the level of the existing nerve roots. After achieving an adequate cord reduction, the dura and wound were closed in a routine fashion, including the use of a dural sealant.

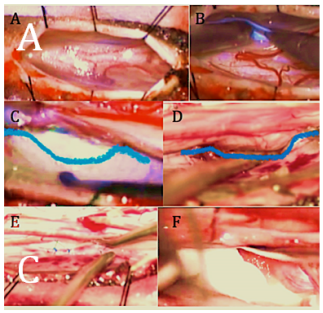

Figure 2 A) Dura opened post laminectomy. B) Careful retraction of the spinal cord and cutting the dentate ligament bilaterally to manipulate the spinal cord. C) Margin of the dura (blue line) of the spinal cord above the line and the dural edge below the line. D) Post release of the spinal cord ventrally from the dural defect. E) Suturing the floor of the dural defect with 6.0 nylon. F) Placement of DuraGen above the suture line.

Literature Review

PubMed and Medline libraries were searched using the term "ventral cord herniation". Case reports and literature reviews published between the years 2000-2021 were selected. The level of the herniation, cause, symptoms, surgical technique, and follow-up were extracted from every case (Table 1).

Results

Throughout the literature review, 51 articles describing spinal cord herniation between the years of 2000 and 2021 were retrieved and the cases are summarized in Table 1. The data shows that the thoracic region of the spinal cord is the most commonly affected area. Exceptions include 3 case reports involving the cervical regions C3, C4, C-5 and C-7 [56, 68, 71]. Most of the patients described in the articles presented with symptoms that could be described as Brown-Séquard. However, as shown in the table, the timeframe between the development of the very first symptoms and the time of presentation and surgery varied widely. It can also be noted that the patients' severity of symptoms also differed and ranged from mild to severe impairment. Sixty-one patients were described with 72% of them diagnosed with idiopathic spinal cord herniation, 20% with spinal cord herniation attributed to a previous spinal cord injury, and lastly, 5% with spinal cord herniation attributed to prior surgery involving the spinal cord. Ninety percent of the patients underwent surgical intervention with laminectomy, while a few cases were followed clinically. Upon follow-up, most of the patients' symptoms improved post-operatively, whereas a few cases reported worsening of the symptoms or no change at all [4,32,33,36,37,40,43,60,61,65,67]

Discussion

Several conditions might lead to the rare onset of a spinal cord herniation such as dural and arachnoid membrane defects or rupture of the cord adhesions from their surrounding meninges.

Table 1: A Review of literature of the last 21 years. MEP: Motor Evoked Power; SEP: Sensory Evoked Power; JOA: Japanese Orthopedic Association Score; N/A: Not Applicable; LL: Lower limb; UL: Upper Limb; RLL: Right Lower Limb; LLL: Left Lower Limb; PTP: Prior to Presentation.

Year	Author	Age/ sex	Localization	1st appearance of symptoms	Symptoms	Cause	Management	Surgical technique	Post-operation outcome
2000	Ewald et al (31)	51/F	T6	2 years PTP	Brown-Séquard syndrome	Idiopathic	Surgery	T6 laminectomy	Improvement of neurological symptoms
2001	Eguchi et al(32)	49/F	T4-T5	10 years PTP	Left lower limb weakness	Idiopathic	Surgery	T4-T5 laminectomy	Formation of a compressive arachnoid cyst and worsening of the symptoms
2001	Miyaguchi et al(9)	54/F	T3-T4	2 years PTP	Brown-Séquard syndrome	Idiopathic	Surgery	T3-T4 laminectomy	Gradual improvement in strength
2001	Pereira et al(33)	55/M	T2-T3	4 years PTP	Left lower limb weakness	Idiopathic	Surgery	T2-T3 laminectomy	Uneventful
2001	Aizawa et al(34)	44/M	T8-T9	5 years PTP	Left lower limb numbness	Idiopathic	Surgery	T8-T9 laminectomy	Muscle power recovered 1-year /post-op
2001	Aizawa et al(34)	60/F	T4-T5	3 years PTP	Brown-Séquard syndrome	Idiopathic	Surgery	T3-T6 hemilaminectomy	Motor power improved/ sensory showed no improvement
2001	Aizawa et al(34)	59/F	T4-T5	20 years PTP	Left lower limb weakness	Idiopathic	Surgery	T3-T6 laminectomy	Motor power improved/ sensory showed no improvement
2001	Berbel et al(35)	56/M	N/A	N/A	Brown-Séquard syndrome	Idiopathic	Surgery	Laminectomy	Mild improvement
2001	Adams et al(36)	56/M	T7	6 months PTP	Brown-Séquard syndrome	Trauma	None	N/A	Progression of the herniation and increase of the weakness

2003	Nakagawa et al(37)	77/F	T6-T7	9 years PTP	Urinary incontinence and weakness in LL	Trauma	Surgery	T6-T8 laminectomy	Aggravation of the symptoms 2 months post-op
2003	Nakagawa et al(37)	77/F	T6-T7	9 years PTP	Recurrence of symptoms	Trauma	Surgery	T6-t8 laminectomy	Symptoms improved 1 year postop
2003	Sagiuchi et al(38)	48/M	T7-T8	20 years PTP	Gait difficulties	Idiopathic	Surgery	T7-T8 Laminectomy	Improvement in motor and sensory functions
2004	Najjar et al(39)	32/M	T8-T9	11 years PTP	Brown-Séquard syndrome	Idiopathic	Surgery	T9-T9 laminectomy	Regained normal gait
2004	Rivas et al(40)	49/M	T6-T7	N/A	Brown-Séquard syndrome	Idiopathic	Surgery	T6-T7 laminectomy	Motor power improved/ sensory showed no improvement
2004	Spissu et al(24)	56/F	T7	14 months PTP	Brown-Séquard syndrome	Trauma	Surgery	Lysing of adhesion and relocating the spinal cord to its anatomical position	Uneventful (motor power improved/sensory showed no improvement)
2004	Maruichi et al(41)	53/M	T4-T5	N/A	Numbness and pain of the RLL	Idiopathic	Surgery	T3-T5 laminectomy	N/A
2004	Aquilina et al(42)	37/F	T4	N/A	N/A	Idiopathic	Surgery	Surgical exploration and reduction	Significant improvement
2005	Ferre et al(43)	70/M	T10-T11	28 months PTP	Slowly progressive gait deterioration	Idiopathic	Surgery	T10-T11 laminectomy	Rapid improvement for both sensory and motor
2005	Ferre et al(43)	75/F	T5-T6	1-year PTP	Brown-Séquard syndrome	Trauma	Surgery	T5-T6 laminectomy	No significant change in the neurological status
2005	Ferre et al(43)	48/F	T5-T6	4 years PTP	Paresthesia LLL	Idiopathic	Medical management	N/A	Stable with symptomatic improvement
2006	Darbar et al(44)	41/M	T5	3 years PTP	Brown-Séquard syndrome	Trauma	Surgery	T4–T6 laminectomy	Improvement of gait and bladder control
2006	Darbar et al(44)	63/F	T6-T8	15 years PTP	Brown-Séquard syndrome	Trauma	Surgery	Repair of the Dural defect and untethering of the cord	Resolution of urinary symptoms, and partial amelioration in the RLL
2006	Darbar et al(44)	34/F	T7-T8	3 years PTP	Brown-Séquard syndrome	Idiopathic	Surgery	T7-T8 Laminectomy	Paraparesis improved after surgery.
2006	Morley et al(45)	28/F	T5-T6	2 years PTP	RLL weakness and difficulty walking.	Idiopathic	Surgery	Cord reduced and the defect repaired with a synthetic graft.	Motor weakness improves, sensory deficit persisted
2006	Inoue et al(46)	71/F	T2-T3	N/A	Brown-Séquard syndrome	Idiopathic	Surgery	T1-T3 laminectomy	Slight neurological improvement
2006	Saito et al(47)	57/M	T2-T3		Brown-Séquard syndrome	Idiopathic	Surgery	Repair of the Dural defect	Improvement of the patient symptoms
2006	Bandai et al(48)	63/F	T2-T3	5 years PTP	Slowly progressive gait deterioration	Idiopathic	Surgery	T2-T3 laminoplasty	No improvement
2008	Alkan et al(49)	36/M	T5-T6	9 years PTP	Bilateral paraparesis, lumbar pain, urinary incontinence, and erectile dysfunction	Idiopathic	Conserva-tive management	N/A	Na -stable neurologically
2008	Ghostine et al(50)	47/F	T6-7	3 years PTP	Low back pain, progressive myelopathy, right proximal LLL deficit, sensory deficit, and pathologic reflexes.	Idiopathic	Surgery	Laminoplasty and intradural exploration	Improvement

2008	Selviaridis et al(15)	51/M	T2-T3	2 years PTP	Progressive weakness and sensory disturbances in the RLL and left paresthesia	Idiopathic	Surgery	T2–T3 laminectomy and reduction of the herniated cord after adhesiolysis from the arachnoid cyst	Follow up at 2 years post: cured, returned to normal state. Recurrence of herniation 10 years post-op
2008	Senturk et al(51)	38/F	T4	6 months PTP	Chest pain radiating through to the back at the T4 dermatome bilaterally.	Idiopathic	Non-operative	N/A	N/A
2009	Sasani et al(52)	45/F	T-8	2 years PTP	Brown-Séquard syndrome below the level of T8	Idiopathic	Surgery	Laminectomy at T8	Improvement
2011	Nakamura et al(53)			Duration of disease:	Brown Séquard,Brown Séquard,Brown Séquard paraplegia Brown-Séquard Brown-Séquard paraplegia, paraplegia,Brown Séquard,Brown Séquard,Brown Séquard,Brown Séquard,Brown Séquard paraplegia	Idiopathic	Surgery	N/A	Recovery (%): 57,43,43,0,50, 50,22,50,40,40,17,67,67,67, 60,25 JOA score increased in 15 post-op out of 16 patients
				5 years,					
		43 N/A,	T4,	3 years,					
		39 N/A,	T3,	4 years,					
		54 N/A,	T4,	10 years,					
		71 N/A,	T4,	5 years,					
		49 N/A,	T4,	5 years,					
		47 N/A,	T5,	16 years,					
		78 N/A,	T4,	2 years,					
		56 N/A,	T6,	3 years,					
		47 N/A,	T3,	1 year,					
		46 N/A,	T4,	8 years,					
		68 N/A,	T7,	3 years,					
		67 N/A,	T4,	1 year,					
		42 N/A,	T3,	0.5 years,					
		53 N/A,	T5,	3 years,					
		60 N/A,	T5,	3 years					
		68 N/A	T3						
2011	Liu et al(54)	56/M	T-11, T-12	18 months PTP	Progressive difficulty in walking and numbness in both lower limbs	Idiopathic	Patient refused operation	N/A	N/A
2012	Akutsu et al(55)	50/M 66/F 83/F	T6-T7, T4-T5, T5-T6	60 months 120 months 120 months	Brown-séquard, brown-séquard, paraparesis	Idiopathic	Surgery	Laminectomy at the level of herniation	Recovery rate: 50%, 38%, 12.5% JOA post-op score increased in all 3 patients

2013	Summers et al(6)	66/M 51/F 81/M	T5 T7 T3-T5	18-year history 3-year history of back pain 10 days	Upper thoracic spine pain Thoracic back pain Progressive bilateral LL weakness and generalized numbness in his thorax and LLs.	Idiopathic	Conserva-tive manage-ment	N/A	N/A - 1st case: stable neurologically at 4 months post presentation 2nd case: stable neurologically at 4 years post presentation 3rd case: stable neurologically at 3 months after presentation
2013	Moriyama et al(56)	51/M	C-7	10 years PTP	Progressive paraparesis and urinary disturbance	Post-operative (spinal tumor)	Surgery	Adhesiolysis at the spinal cord and the Dural defect and then duroplasty of the Dural defect	Improvement
2013	Krishnan et al(57)	50/F	T6-T7	3 years PTP	Slowly progressive gait difficulties	N/A	Surgery	Laminectomy, reduction of the cord with micromanipulation and then duroplasty	Improvement
2014	Berg-Johnsen et al(4)	44.6/F	T4/5	3 years	Paraparesis sensory level	Idiopathic	Surgery	Laminectomy or laminoplasty	Improved
		63.9/F	T5/6	5 years	Brown-Séquard				No change
		75.5/M	T4/5	4 years	Paraparesis sensory level				Improved (transient)
		58.3/F	T4/5	3 years	Brown-Séquard bladder dysfunction				Improved (slightly)
		57.1/F	T4	6 years	Brown-Séquard bladder dysfunction				Improved
		42.0/F	T6/7	2 years	Brown-Séquard bladder dysfunction				No change
		60.0/F	T7/8	10 years					Improved
2014	Yamamot-o et al(58)	60/F	T5-T6	15 years PTP	Brown-séquard	Idiopathic	Surgery	Laminectomy and right-sided partial pediculectomy of the t5 and t6 vertebrae was performed	At 2 years follow up, the patient had no recurrence of symptoms, no instability, and no back pain.

2014	De Souza et al(59)	66/F	T-4	7 years PTP	Back pain	Idiopathic	Surgery	Laminectomy with reduction of the hernia and ventral Dural repair	Improved
2017	Lui et al(60)	62/M	T-2/T-3	2 years PTP	LLL deficit, hypersensitivity, hypertonia, and gait abnormality	Idiopathic	Surgery	T-2/T-3 laminectomy with Dural patch and dentate ligament hitch stitches	Hyperesthesia remained
2017	Lui et al(60)	42/F	T-5/T-6	10 years PTP	Progressive motor deterioration, pain around the rib cage, spastic gait	Idiopathic	Surgery	T-5/T-6 laminectomy with Dural patch and dentate ligament hitch stitches	Improved
2017	Ronald et al(61)	52/M	T-4/T-5	10 years PTP	Sensory deficit, motor deficit, paresthesia in the LLL	Traumatic injury	Surgery	T-4/T-5 laminectomy	LLL improved RLL unchanged
2017	Ronald et al(61)	58/F	T-8	1-year PTP	Temperature changes, motor deficit, and hyperpathia in LLL.	Idiopathic	Surgery	T-7/T-8 laminectomy	Unchanged
2017	Delgado-Lopez et al(62)	33/F	T-7/T-8	20 months PTP	Brown-séquard	Idiopathic	Surgery	T-7/t-8 laminectomy and closure of the Dural defect with titanium micro staples	Recovered
2017	Shimizu et al(63)	33/M	T-5/T-6	6 months PTP	Progressive gait disturbances	Idiopathic	Surgery	T-5/T-6 laminectomy	Motor deficit improved; sensory deficit persisted
2018	Ghali et al(64)	66/F	T-5/T-6	3 years PTP	Progressive leg spasticity and urinary incontinence	Idiopathic	Surgery	Laminectomy	Improved
2018	Bartels et al(65)	24/M	T-4	N/A	Left sided Brown-Sequard Syndrome	Develop-mental disorder	Surgery	Spinal cord untethering	The patient recovered without deficit
2019	Tyagi et al(5)	72/M	T-4/T-5	35 years PTP	Progressive stiffness and weakness of his LLs. JOA 4 of 11.	Idiopathic	Surgery	T3-T5 laminectomy, midline durotomy, reduction of cord dislocation then ventral Dural patch placement.	1 year follow-up JOA 4 of 11
2019	Tyagi et al(5)	31/F	T-3/T-4	4 years PTP	Upper back pain, decreased temperature sensations on the LLL with stiffness and weakness.	Idiopathic	Surgery	T3-T4 laminectomy with partial left facetectomy. Durotomy, then spinal cord was reduced. Duroplasty ventrally	Improved motor power with mild deficit. JOA 10 of 11.
2019	Herring et al(66)	72/F	T-8/T-9	1-year PTP	Brown-séquard	Idiopathic	Surgery	T-8/T-9 laminectomy	Neurological symptoms improved without complications
2019	Neale et al(67)	61/F	T-4	4 years PTP	Brown-séquard	Idiopathic	Surgery	T-3/T-4 laminectomy	Worsened
2020	Lunes et al(28)	55/F	T-4/T-5	3 years PTP	Back pain, LLL weakness, urinary incontinence	Idiopathic	Surgery	Surgical decompression	Partial improvement

2020	Finneran et al(68)	49/M	C-5	1-year PTP	Neck pain, headache, paresthesia in the ULs	Iatrogenic (C5 corpect-omy)	Surgery	C4-C6 vertebral corpectomy, reduction and anatomic realignment of the spinal cord, then C3-C7 reconstruction and fusion	Motor and sensory power restored in all 4 limbs 3 months after.
2020	Bakhshes-hian et al(3)	60s/M	T-4	N/A	Sensory deficit in RLL, weakness and spasticity in LLL. Gait instability.	Idiopathic	Surgery	A T3-T4 laminectomy, left-sided facetectomy, and left-sided T4 pediculectomy, spinal cord reduction	Neurological symptoms improved, residual LLL weakness
2020	Randhaw-a et al(11)	50/M	T-2	N/A	Progressive myelopathy	Idiopathic	Surgery	Laminectomy	Improved
2020	Aljuboori et al(69)	35/F	T-4	1-year PTP	LLs weakness and numbness	Idiopathic	Surgery	N/A	Improved
2020	Regensb-urger et al(70)	51/M	T-2/T-3	2004: right trunk pain 2012: spastic deficit of the RLL	2012 progressive spastic paresis of RLL associated with Babinski sign	Idiopathic	Surgery	Laminectomy	MEP unchanged. SEP slightly improved
2021	Diaz et al(71)	38/M	C-3/C-4	N/A	Progressive cervical myelopathy	Iatrogenic (schwan-oma resection)	Surgery	C1-C5 laminectomy	Sensory and motor improvement
2021	Teng et al(72)	48/F	T-3/T-4	6 months PTP	Progressive non-radiating thoracic back pain associated with migraines. RLL weakness.	Idiopathic	Surgery	T-3/T-4 laminectomy	LLL weakness post-op improved later. Mild RLL deficit persisted.
2021	Wilson et al(73)	48/F	T-7/T-8	3 years PTP	Cerebral palsy, worsening myelopathy, gait ataxia	Traumatic	Surgery	T-7/T-8 laminectomy	Improved

After Wortzman et al. [1] described the first incarcerated SCH in 1974, several cases have been reported and classified into subclasses of varying etiologies generating this condition. The main etiologies described in the literature are congenital, iatrogenic, idiopathic, and post-traumatic [2,7-9,27,74]. Idiopathic spinal cord herniation is the most common and well-defined entity occurring predominantly in the thoracic cord. This class is frequently associated with calcified disc fragments which, in theory, may have caused dural fragilization and microtears. The thoracic localization of SCH might be attributed to the length and weight carried by the thoracic spine [7,74] because it has a smaller diameter when compared to the cervical or lumbar spine and more room inside the dural sac surrounding it, making its mobilization, and kinking easier. Iatrogenic herniation, where dural and meningeal envelopes are weakened by traumatic surgical manipulation, have been reported secondary to a failure in a C1–C2 fixation (wiring), as well as surgeries performed for cervical stenosis that are complicated post-op by pseudomeningocele [75-77]. Post-traumatic herniation has been noted secondary to a nerve root avulsion, penetrating injury to the dura, and vertebral fractures. The following work will discuss traumatic spinal herniation cases that are usually not as well documented in the literature as others [8,17,78–81].

Most of the case reports reviewed in the literature have demonstrated progressive neurological deficits developing years after the initial injury. This was particularly seen in our case where the trauma occurred 10.5 years prior to presentation, suggesting a progressive mechanism of cord herniation. This mechanism is attributed to the contact between the defective part of the dura and the epidural space which generate adhesions with the cord. This, in turn, causes a shift of the cord placement in the dural sac towards the defect, leaving empty space filled with Cerebrospinal Fluid(CSF)that is sometimes mistaken to be an arachnoid cyst[26]. Subsequently, cord adhesions with the meninges occur, the denticulate ligament is loosened, and CSF pulsations progressively squeeze a segment of the cord through the defect [7,14,15]. This could possibly explain the progressive aggravation of the symptoms in our patient's case, where his condition worsened three months before arriving at our institution.

The most common presentation of idiopathic spinal cord herniation is Brown-Sequard syndrome [26]. This may be due to the fact that dural defects in SCH cases are mainly anterior and antero-lateral, and that the part of the cord that is suffering from the compression, the kinking or the vascular compromise is limited to a lateralized hemi section of the cord at that level. Although this is found in idiopathic SCH, it was also found in our patient's case of post traumatic SCH. Most of these cases in literature were found to have caused diffuse myelopathy or unilateral pyramidal symptoms as the most common presenting symptoms. Myelopathy or myeloradiculopathy can also be seen in iatrogenic herniation [81]. In our case report, the patient was mainly suffering from progressive sexual dysfunction, burning sensation in the left lower limb, as well as motor weakness.

MRI is the gold standard investigation for diagnosing SCH with typical features demonstrated on both axial and sagittal images. Sagittal images demonstrate expansion of the dorsal subarachnoid space, and a ventrally displaced spinal cord with anterior C- or S-shaped angulation. On axial images, there is antero-lateral displacement of the cord with loss of the normal intervening CSF signal [7,19]. These features were classically seen in our case.

Conclusion

Ventral cord herniation is a complex disease, in which the spinal cord herniates through defective meninges. Its pathophysiology is complex and has multiple etiologies. Although rare, it should be taken into consideration when confronted with atypical cases of myelopathy with neurological deficits that does not pertain to the classic pathologies.

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