CASE REPORT

Spinal cord injury without radiographic abnormalities caused by rotation-stretching injury manifesting as Brown-Sequard syndrome: a case report

Wentao Zhong, Mengyang Pu, Yu Zhang, Peng Zhang, Yixin Shen

Abstract

Spinal cord injury without radiographic abnormality (SCIWORA) is a term that denotes clinical symptoms of traumatic myelopathy without radiographic or computed tomographic features of vertebral fracture or instability. However, SCIWORA in adults is very rare, especially that involving the thoracic spine.

We describe the case of a 38-year-old man who complained of weakness in the right lower extremity for two hours. The injury occurred due to rapid spinal cord rotation-stretching. The patient was diagnosed with SCIWORA at the T4 level, manifesting as Brown-Sequard syndrome (BBS). Finally, he was able to walk independently without assistance after two-month treatment.

SCIWORA due to spinal cord rotation-stretching injury, manifesting as BSS, is a very rare mechanism of injury. When X-ray and CT scans rule out the diagnosis of spinal fractures, SCIWORA should be suspected. We recommend that clinicians should have a comprehensive and systematic understanding of this disease to greatly reduce misdiagnosis and improve the level of treatment.

Keywords: SCIWORA, Brown-Sequard syndrome, Spinal Cord Injury.

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Introduction

Spinal cord injury without radiographic abnormality (SCIWORA) is described as acute traumatic myelopathy with clinical symptoms but without fracture, dislocation, or instability on plain radiographs and computed tomography (CT).[1] SCIWORA is more common in children with cervical spinal cord injury due to increased cervical mobility. However, adult SCIWORAs are mostly high-energy injuries, usually associated with vertebral fractures or instability, which is a rare condition occurring due to decreased flexibility of the spine in adults. In most cases, SCIWORA occurs as a result of hyperextension or hyperflexion force. Magnetic resonance imaging (MRI) is the most effective assessment of spinal cord injury, which can manifest as oedema and haemorrhage of the spinal cord.[2]

Brown-Sequard syndrome (BSS) was first described in the 1800s. The classical syndrome is the consequence of a hemisection of the spinal cord with ipsilateral paralysis and loss of proprioceptive and vibratory sensation on the same side and loss of pain and temperature sensation on the contralateral side.[3] Aetiological reports suggest mostly spinal cord puncture injury, intraspinal extramedullary tumour, and iatrogenic injury.

SCIWORA manifesting as BSS due to the rotation-stretching injury is rare and may lead to misdiagnosis. Here, we report a case of SCIWORA manifesting as BSS due to the rotation-stretching injury, which is rare and may lead to misdiagnosis. Therefore, clinicians should have a comprehensive and systematic understanding of this type of injury to make correct diagnoses and treatments for patients.

Case Report

In February 2022, a 38-year-old male patient was admitted to the emergency department of Second Affiliated Hospital of Soochow University, Jiangsu, China, with complaints of back pain and weakness in his right lower extremity for two hours. The clothing of the patient's upper extremity had been accidentally caught in the autorotation machine two hours prior. The high-speed rotating machine caused the patient to be momentarily subjected to enormous torsional forces, resulting in rotation-stretching injury of the spinal cord. Neurological examination revealed evidence of right-sided BSS (monoparesis of the right lower extremity and loss of ipsilateral touch, hypoalgesia and thermohypesthesia below the level of the left nipple).

X-ray and CT scans did not reveal obvious spinal fracture or dislocation (Figure 1). In view of the clinical symptoms of the patient's neurological injury, an urgent MRI

Department of Orthopaedics, The Second Affiliated Hospital of Soochow University, Suzhou, China.
Correspondence: Yixin Shen. Email: 972679925@qq.com
ORCID ID. 0009-0000-1745-703X

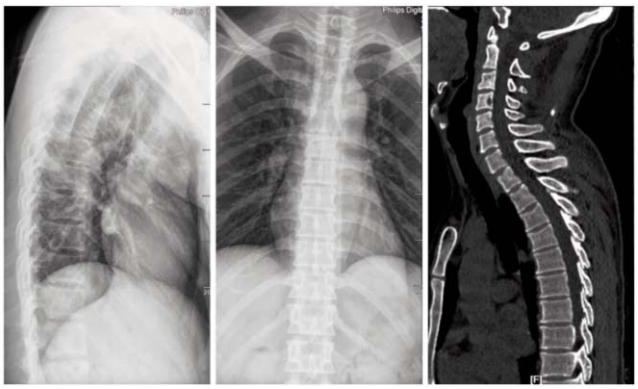

Figure-1: No fracture or dislocation was found on X-ray and CT of the thoracic spine.

Figure-2: （A）Sagittal MRI showed no abnormal signal change on admission; (B) MRI of the patient's thoracic spine was re-examined on day three after injury, suggesting local spinal cord signal changes at T1-T4 (white arrows).

examination was performed, though no changes in the spinal cord signal were observed (Figure 2(A). Therefore, the patient was diagnosed with an incomplete spinal cord injury at the T4 level manifesting as BSS. The patient's cervical spine was immobilised with a cervical collar, methylprednisolone 30 mg/kg was administered for 15 minutes, which was then maintained at 5.4 mg/kg/h for the next 23 hours. It was noted that the patient's right lower extremity muscle strength improved from grade 0 to grade 1 after two days.

On the third day after the injury, the MRI of the patient's thoracic spine was reviewed, indicating local spinal cord oedema at T2-T4.(Figure 2 (B). In the next two weeks, the patient continued to receive symptomatic treatment, such as pain relief and neurotrophy. The patient's right lower extremity muscle strength recovered to grade 2, and the left lower extremity pain and temperature sensation improved slightly compared with admission after two weeks. The patient was further treated in the rehabilitation department. At two-month follow-up, the patient's right lower extremity muscle strength had recovered to grade 4, the left lower extremity pain and temperature sensation were significantly improved, and he was able to walk independently without assistance.

Discussion

SCIWORA was first proposed by Pang and Wilberger in a series of 24 children with traumatic myelopathy.[1] It is used to define clinical symptoms of traumatic myelopathy without radiographic abnormalities (X-ray and CT). SCIWORA has been reported to account for approximately 6% to 19% of all paediatric spinal cord injuries, while the prevalence in adults is as low as 0.08% to 15%,[4] and occurs mostly in the cervical spine. Cases of thoracolumbar involvement are rare, mainly due to different anatomical and biomechanical features of the cervical spine in children.[5] Therefore, the rarity of SCIWORA in the adult population presents a diagnostic challenge for clinicians.

According to reports, injury factors in SCIWORA include sports injuries, motor vehicle crashes, falls, and abuse.[6] In adult patients with SCIWORA, the most common mechanism of injury appear to be a fall. Zou et al[7] reported that the main causes of SCIWORA were falls (38%) and traffic accidents (38%). Its pathological process includes spinal cord traction injury due to hyperflexion, extrinsic SCI caused by hyperextension, and parenchymal SCI caused by oedema or vascular injury. The case of a young woman has been reported who fell and hit her head on the ground first in the left lateral flexion position, and her symptoms manifested as BSS.[8] In our case, the patient's clothing was caught in a rapid autorotation machine, causing the body to rotate axially. This powerful twisting force caused the thoracic spinal cord to be rotation-stretched rather than stretching along the long axis of the spinal cord. Due to this particular mechanism of injury the patient presented with BSS. The patient lost left pain sensation and fine touch, which represented damage to the right spinothalamic and dorsal column; he also had right lower extremity weakness due to damage to the corticospinal tract.

MRI may show delayed manifestations and mislead clinical diagnosis, although it has good diagnostic value for SCIWORA. Schellenberg et al[9] reported the case of an 18-year-old male who was involved in a car accident while driving with seatbelt on. Although the patient presented with paraplegia, his initial plain radiograph, CT, and spinal MRI were normal. Repeated MRI scans five days after injury showed evidence of spinal cord oedema at the T3-T4 levels. Similarly, the patient in this case, despite having no specific findings on the initial MRI, had abnormalities observed on a reviewed MRI two days later. This delayed presentation may be due to a series of secondary inflammatory responses, oedema, and ischaemia, leading

to further spinal cord parenchymal damage.

The prognosis of incomplete SCIWORA often makes the patients and their families very anxious, mainly due to the difficulty of diagnosis and the need for surgical treatment. A two-year follow-up study of 22 SCIWORA patients by Chen et al[10] observed that in the nonsurgical treatment group, more than 60% of the patients recovered from grade 1～2 to grade 3 or above, but the neurological function of the surgical treatment group recovered faster. The prognosis of SCIWORA depends on the initial neurological deficit and the degree of MRI-confirmed spinal cord injury, with the majority of patients with incomplete neurological impairment showing better improvement and rarely requiring surgery. Although hormone therapy has not been shown to be effective in SCIWORA patients, in this case it was started within eight hours after injury and continued for 48 hours. The result was a slight improvement in the right lower extremity. After comprehensive treatment with NSAIDs, neurotrophic and rehabilitation exercises were performed. The patient was able to walk slowly and independently without the aid of an assistive device after two months, although it was not completely normal; nonetheless, the recovery was surprising and may be further improved.

Conclusion

We report a case of SCIWORA manifesting as BSS due to the rotation-stretching injury, which presented with difficulties in clinical diagnosis. We also summarise some experience from this case. When X-ray and CT scans rule out the diagnosis of spinal fractures, SCIWORA should be suspected, and MRI should be performed in patients with blunt trauma and neurological deficits. SCIWORA due to spinal cord rotation-stretching injury, manifesting as BSS, is a very rare mechanism of injury. We advocate that clinicians should have a comprehensive and systematic understanding of this disease in order to reduce the risk of misdiagnosis and improve the level of treatment.

Consent: Patient consent was obtained for publishing his case.

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Conflict of Interest: None.

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