Tetraparesis due to spinal cord injury without radiological abnormality in adults

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ABSTRACT

Introduction: Spinal cord injury without radiological abnormality (SCIWORA) is defined as spinal cord injury with no evidence of vertebral fractures or malalignment on radiographs or CT. SCIWORA is commonly seen in paediatric population, while only very few cases have been reported in adults. We report a case of SCIWORA to improve our understanding regarding the pathophysiology of SCIWORA, current diagnostic options, and also treatment options available.

Methods: We report a case of a 49 year old male with tetraparesis after falling from 3 meters height. Physical examination found decreased sensation below the C5 dermatome level, with motoric weakness at both upper and lower extremities. Radiographs and CT showed no fractures or dislocation. MRI suggested that there was myelitis of intramedullary spinal on the C4 level. Conservative treatment was done by using hard collar neck for immobilization together with painkiller and neuroprotector administration.

Results: Spinal trauma patients exhibiting neurological deficit but no radiological abnormality should be treated as a case of SCIWORA. SCIWORA is caused by a contusion or ischemia, followed by a spontaneous return of vertebrae to their original position. The principal treatment has been immobilization and avoidance of high-risk activities. The conservative treatment that was done to our patient gave satisfactory outcomes (return of sensorics and improve motor functions 4/4).

Conclusion: SCIWORA is not uncommon in adults. MRI was used as a diagnostic investigation method for spinal trauma, but there are currently no consensus of diagnostic criteria for classifying cases as SCIWORA. External immobilization of the spinal segment of injury is recommended for up to 12 weeks.

Keywords: SCIWORA, adult, tetraparesis, MRI, radiography, external immobilization

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ABSTRAK

Pendahuluan: Spinal cord injury without radiological abnormality (SCIWORA) didefinisikan sebagai kasus cedera tulang belakang dimana tidak ditemukan adanya fraktur vertebra atau malalignment pada radiografi atau CT scan. SCIWORA lebih sering dilaporkan terjadi pada populasi anak. Sangat sedikit kasus SCIWORA yang dilaporkan pada populasi orang dewasa. Kami melaporkan satu kasus SCIWORA untuk meningkatkan pemahaman mengenai patofisiologi kondisi ini, pilihan diagnostik yang dapat digunakan, serta pilihan tata laksana yang dapat dilakukan.

Metode: Kami melaporkan laki-laki usia 49 tahun dengan tetraparesis setelah terjatuh dari ketinggian ± 3 m. Pada pemeriksaan fisik ditemukan penurunan sensasi pada level dermatom C5 ke bawah, dan penurunan kekuatan motorik pada ekstremitas atas (2/2) dan bawah (3/3). Tidak ditemukan kelainan pada pemeriksaan radiografi dan CT scan. Pada pemeriksaan MRI ditemukan adanya myelitis di intramedula spinalis setinggi level C4. Pada pasien ini dilakukan terapi konservatif dengan penggunaan hard collar neck untuk immobilisasi, pemberian penghilang nyeri dan neruprotektor.

Hasil: Pasien dengan riwayat cedera tulang belakang dengan deficit neurologis namun tidak ditemukan kelainan radiologis harus dianggap sebagai kasus SCIWORA. Kondisi ini terjadi akibat kontusio atau iskemia yang ditikut idengan kembalinya vertebrae ke posisi semula. Tata laksana utama pada kasus ini adalah dengan immobilisasi dan menghindari aktivitas risiko tinggi. Terapi konservatif yang diberikan pada pasien ini memberikan hasil yang memuaskan (kembalinya fungsi sensorik dan peningkatan motoric 4/4).

Kesimpulan: SCIWORA tidak jarang terjadi pada orang dewasa. MRI digunakan sebagai metode diagnostik untuk trauma tulang belakang, namun belum ada konsensus untuk mengklasifikasikan kasus sebagai SCIWORA. Immobilisasi eksternal pada segmen yang cedera direkomendasikan selama 12 minggu.
INTRODUCTION

The term spinal cord injury without radiological abnormality (SCIWORA) was first described by Pang and Wilberger in 1982. They used this term and define it as clinical symptoms of traumatic myelopathy with no radiographic or computed tomographic features of spinal fracture or instability. With the emergence of magnetic resonance imaging (MRI), occult damage in the soft tissues of the spine and the patterns of the cord in SCIWORA have been revealed. Nonetheless, this acronym is still used when the spinal cord injury is not identifiable by routine radiograph or CT scan, and by considering that MRI in the strict scientific sense does not involve radiation. SCIWORA is commonly seen in paediatric population with reported incidence ranges from 4 to 66%. The prevalence is the highest among children below 8 years of age who also have the most unfavorable prognosis, which is possibly related to their relatively heavy head, weaker neck muscles and greater elasticity of vertebral ligaments in this patient population. Very few cases of SCIWORA have been reported in adult population and majority of these cases are in cervical spine. We report a case of SCIWORA to improve our understanding regarding the pathophysiology of SCIWORA, current diagnostic options that could be used to investigate this clinical-radiological condition, and also the treatment options available.

CASE ILLUSTRATION

We report a 49 year old male that came to our hospital with chief complaint of weakness of both upper and lower extremities for the last 3 days before hospital admission. The patient fell from an about 3-meter height tree. He fell in sitting position with his buttock hit the ground first, then his head hit the tree with unknown mechanism. After the fall, he felt weakness in his both upper and lower extremities. There was no history of loss of consciousness, seizures, vomiting, previous neurological disorder, or bleeding coming from his body.

Physical examination revealed that there were no deformities or wound (Figure 1). There was diffuse tenderness at the cervical vertebral level. There was decreased sensation below the C5 dermatome level. Motor strength as per MRC (medical research council) grading in the upper limb was 2/2, while in both of the lower limbs was 3/3. We found normal bladder and bowel functions. Deep and superficial tendons reflexes were present in bilateral lower limbs. The rest of the systemic examination was unremarkable. There was no evidence of any other musculoskeletal injuries.

Laboratory findings were unremarkable. Radiographic examination of the cervical spine (Figure 2) was carried out, but there were no significant radiological findings correlated to the clinical examination. Computerized tomography (CT) Scan of the cervical spine was performed, showing no fracture and dislocation (Figure 3). Magnetic resonance imaging of the cervical spine showed hyperintense lesions in the spinal cord at the C4 vertebrae on T2 weighted images suggesting that there was myelitis of intramedullary spinal on the C4 level (Figure 4).
Figure 3. CT scan image of cervical spine

Figure 4. MRI of cervical spine
RESULTS

We diagnosed this patient with tetraparesis due to spinal cord injury without radiological abnormality. We manage the patient with complete bed rest and the cervical vertebrae were immobilized by using hard collar neck. We also gave NSAID (Ketorolac 3x30 mg) and methylcobalamin 3x500 mg. Sensory function was improved in 10 days after the injury. The patient regained his muscle strength with MRC grade of 4/4 for both the upper and lower extremities at 6 weeks following the injury. After 6 weeks, the external immobilizer was discontinued. His last follow up was at 6 months after the injury and there were no further muscular or sensory improvements.

DISCUSSION

In this report, we present a case of a 49 year old male with tetraparesis due to SCIWORA. SCIWORA is characterized by acute traumatic myelopathy in spite of normal plain radiographs and computed tomographic studies. SCIWORA is more common in children than in adults and represents a significant percentage of paediatric spinal cord injuries. Another literature mentioned that SCIWORA is responsible for 6 to 19% in children, and 9% to 14% in adults. In one series, SCIWORA was diagnosed in 32% of children from birth to 8 years of age with spinal injuries, and in 16% of children from birth to 16 years old. The difference in the incidence rate between these two age groups is due to anatomic reasons: children under 8 years are particularly susceptible to SCIWORA probably associated with the relatively heavy head, weaker neck muscles and greater elasticity of vertebral ligaments in this patient population. More horizontal orientation of the facet joints increases further the susceptibility to these injuries. Specific biomechanics of the vertebral column in children allows the musculoskeletal system to move beyond the normal physiological range of motion without the risk of fracture.

The injury to the spinal cord is caused by a contusion or ischemia due to momentary occlusion of vertebral arteries followed by a spontaneous return of the vertebrae to their original position. Conventional X-rays are performed as the first-line imaging test. A lateral spine X-ray can identify 75% of fractures with sensitivity of 85%. Anteroposterior (AP), lateral, oblique and open mouth or odontoid radiographs should also be taken. The stability of the cervical spine can also be assessed by flexion and extension dynamic radiographs. However, it should be noted that plain X-rays provide inconclusive evidence in patients with post-traumatic cervical dystonia, so this treatment should be postponed until complete resolution of muscle spasm. Computed tomography is the most accurate in detecting bony pathology. CT scan can be used to visualize subtle injuries to the posterior arch or lateral mass of the vertebra, and injuries to the atlas, and odontoid process that are poorly visible in standard X-rays.

When a diagnosis of spinal fracture can be excluded from the results of X-rays and CT scan, SCIWORA should...
be suspected and MRI should be performed in patients with blunt trauma injuries and neurologic deficits. Radiographic screening of the entire spinal column is recommended. MRI is useful not only for investigating soft tissue abnormalities, but it also allows for the identification of bone marrow edema in injured vertebrae that cannot be seen in CT scan. The integrity of the spinal cord can be clearly ascertained in sagittal plane. The main symptoms of an acute spinal cord injury (SCI) include edema, hematoma, anatomic transection of the spinal cord, and prolapsed nucleus pulposus. Magnetic resonance imaging is effective not only for investigating soft tissue abnormalities, but it also allows for detection of bone marrow edema in injured vertebrae that cannot be seen in CT scan. T1 MR images provide information about the morphology and anatomy of the spinal cord. Bleeding can be best identified in T2-weighted images. An increase in the concentration of deoxyhemoglobin in fresh hematomas causes a decrease in signal intensity in T2WI. In about a week or more later, hematoma is seen in hyperintense signal in T2WI. However, in chronic phase, hemorrhages will look hypointense again in T2WI due to the presence of hemosiderinladen macrophages. Spinal cord edema is seen as hyperintense signal in T2WI, in contrast with the background of normal nervous tissues. Radiological features of the post-traumatic disc herniation are similar to those of non-traumatic. Therefore, it is often almost impossible to identify the difference between the two forms of disc prolapse. Only the presence of other post-traumatic lesions at the same level may imply probable diagnosis.

In SCIWORA, there are no subluxation or malalignment, therefore the principal treatment has been immobilization and avoidance of activities that may either lead to the exacerbation of the present injury or the increase in the potential for injury recurrence. Pang and Pollack recommended the use of external immobilization for 12 weeks to allow an adequate time for healing of the presumed ligamentous strain/injury, and to prevent exacerbation of the myelopathy. However, the role of immobilization is still unclear concerning that dynamic X-rays have displayed no instability. The time period and even the need for immobilization is remain debatable. Early discontinuation of external immobilization is advised for patients who become asymptomatic and for patients whose spinal stability have been confirmed with flexion and extension radiographs. High-risk activities should be refrained for up to 6 months. Some studies had included steroids as part of their treatment along with bed rest. The use of steroids is not supported by substantial evidence in these cases.

In our patient, we gave NSAID (Ketorolac 3x30 mg) to alleviate pain and also to suppress the inflammation. We also gave methylcobalamin 3x500 mg, with expectation that it will exerts neuronal protection by promoting regeneration of the injured nerves and antagonizing the glutamate-induced neurotoxicity. The outcomes for patients with SCIWORA are varied, which correspond to the severity of the injury. The spinal cord signal changes have prognostic values for the recovery from injury. Some studies suggested that MRI abnormalities (or lack of abnormalities) of the cord was more predictive than presenting the neurological status. On the other hand, children have been documented to have recurrent SCIWORA, and predictors for “high-risk” subgroup of children with SCIWORA for recurrent injury may exist. The treatment outcomes are worst in patients with cord disruption, poor in patients with haemorrhage and good in patients with edema or normal cord. However, recurrent cases of SCIWORA have been documented, and predictors for “high-risk” subgroup of patients with SCIWORA for recurrent injury may exist.

CONCLUSION

The incidence of SCIWORA is not uncommon in adults, there is an increasing number of SCIWORA cases in adults that are being reported in the literature. Routine radiographs, and sometimes even computerized tomography, can miss this injury and SCIWORA should be suspected in these cases of spinal injury presenting with neurological involvement. Our patient fulfilled the definition of SCIWORA. In our patient, physical examination correlated well with the MR imaging findings, without abnormalities in radiographic. The patient was treated conservatively with collar neck as an external immobilization for a good prognosis.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.
REFERENCES


