

Case Report

A Case of Classical 'SCIWORA' in an Adult Following Trivial Trauma

Toivo Hasheela, Aaron Musara

Neurosurgery Unit, Department of Surgery, University of Zimbabwe, Harare, Zimbabwe

Email address:

tukunah@yahoo.com (T. Hasheela), musaraaaron@zol.co.zw (A. Musara)

To cite this article:

Toivo Hasheela, Aaron Musara. A Case of Classical 'SCIWORA' in an Adult Following Trivial Trauma. *International Journal of Neurosurgery*. Vol. 2, No. 2, 2018, pp. 23-26. doi: 10.11648/j.ijjn.20180202.11

Received: August 8, 2018; **Accepted:** September 11, 2018; **Published:** October 17, 2018

Abstract: Spinal cord injury without radiographic abnormality (SCIWORA) is a well-documented finding in the paediatric population age groups, however in adults it is a rare occurrence. This case report gives an account of a case of an adult patient in whom a diagnosis of cervical SCIWORA was made and confirmed by MRI, following, seemingly, trivial trauma. A 46 year old man jumped from a small bridge, landed on his feet and fell backwards, immediately thereafter could no longer move or feel his trunk and limbs. Upon neurological assessment, he was found to have spastic quadriparesis, sensory level of C4, as well as bowel and bladder dysfunction. CT scan did not reveal any abnormalities; however MRI demonstrated spinal cord signal changes consistent with spinal cord contusion. Patient was managed conservatively in a rigid cervical collar, as well as per local protocols for the management of quadriplegia. He however eventually succumbed to respiratory failure compounded by aspiration pneumonia. Although SCIWORA is rare in the adult population groups, it does occur and can lead to significant morbidity and high mortality rates. Therefore adult patients presenting with neurologic deficits and normal static radiographs and CT scans, on a background of any degree of trauma, be it trivial, should not be brushed off lightly but rather investigated further with dynamic radiographs and MRI.

Keywords: SCIWORA, Contusion, MRI, CT Scan, Static/Dynamic Radiographs

1. Introduction

The syndrome of spinal cord injury without radiographic abnormality (SCIWORA) was first described by Pang and Wilberger in 1982 [1]. It refers to patients who present with signs of myelopathy after trauma, with no evidence of traumatic abnormalities on plain radiographs and CT scans. However, MRI, if done, would reveal spinal cord signal changes indicative of spinal cord contusion or oedema, evidence of ligamentous/disc injuries, or even evidence of cord transection. The definition does not include spinal cord injury from electric current, obstetric complications, congenital spinal anomalies or penetrating spinal injury [2].

SCIWORA is a clinical-radiological condition that mostly affects children. Lesions are found mainly in the cervical spine but can also be seen, although much less frequently, in the thoracic or lumbar spine [3].

The onset of symptoms has been described both in the

immediate setting or may be delayed as late as up to 4 days after injury. The most affected age group is young children owing to their immature more flexible and deformable vertebral column, which may accommodate degrees of hyper-flexion/extension or distraction that may subject the spinal cord to traction injuries without sustaining osseous fractures or subluxations. The syndrome has also been described in the adult population, but rarely, and a different mechanism of injury, involving the presence of pre-existing degenerative changes, is involved.

2. Case Presentation

A 46 year old man jumped from a small bridge (approximately 3m high) in attempt to escape from perceived robbers, he landed on his feet and fell backwards, and immediately thereafter could no longer move or feel his trunk and limbs. Upon neurological assessment, he was found to have spastic quadriparesis with central cord syndrome, with

complete loss of power in the upper limbs and preservation of some power in the proximal myotomes of the lower limbs, 1/5 and 2/5 in L2 and L3, respectively, bilaterally. Assessment of sensation revealed a sensory level of C4, with loss of all modalities of sensation below the C4 dermatome. Before catheterization it was noted that patient had urine continuously leaking and he admitted not being able to retain it. Bulbocavernosus reflex was present indicating that patient was not in spinal shock at the time. A clinical diagnosis of incomplete cervical spinal cord injury with central cord syndrome was made. However the CT scan ordered did not

reveal any abnormality (Figure 1). Patient was admitted to the ward in a rigid cervical collar. An MRI done at day3 post admission revealed a high signal lesion at C3/C4 intervertebral disc level on T2WI (Figure 2). Patient was managed conservatively as per local protocols for the management of quadriplegia, mainly with emphasis on avoidance and prevention of complications of prolonged recumbency, however he eventually succumbed to respiratory failure due phrenic nerve dysfunction (which takes origin from C3-C5 nerve roots), compounded by aspiration pneumonia.



Figure 1. CT scan showing normal findings.

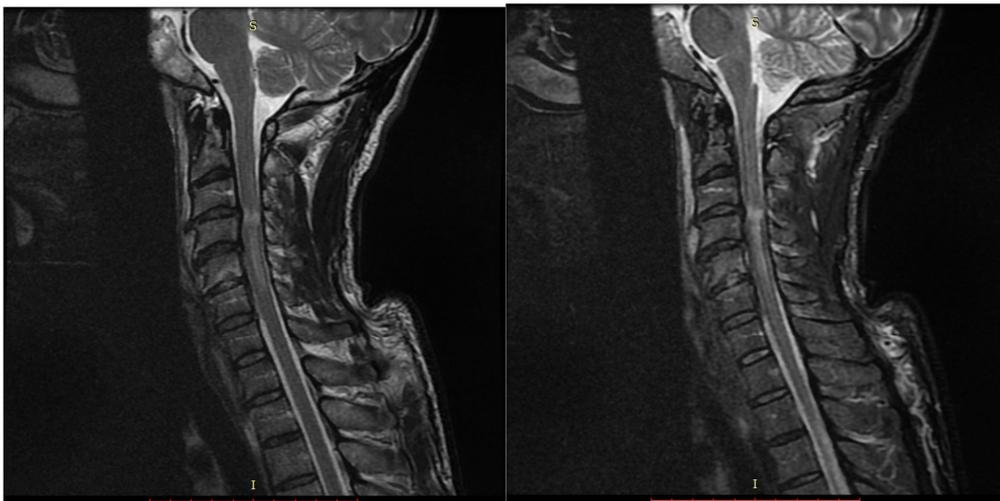


Figure 2. T2WI (left) and STIR (right) MRI images showing a hyperintense lesion (contusion) at C3/C4 and peri-lesional cord edema.

3. Literature Review

The concept was first described by Pang and Wilberger in 1982 when they noted that spinal cord injury in children was more likely to occur without bony fractures or dislocations [1]. They further noted that spinal cord injury without radiographic abnormality (SCIWORA) was more frequent and more severe in children under the age of 8 years [1]. This observation is believed to be attributable to the peculiarities of spinal biomechanics observed in this age group. Children less than 8 years old generally demonstrate hypermobility of the spinal column as a result of their underdeveloped paraspinal muscles, greater ligamentous elasticity, anterior wedging of vertebral bodies and the more horizontal alignment of their

facet joints [1]. Although SCIWORA is also encountered in the adult population, it is much more rarer, and the biomechanical factors predisposing to SCIWORA in adults are quite different. The injury is more likely to occur in adults with presence of pre-existing degenerative changes causing mechanical compression or pinching of the cord between osteophytes and the hypertrophied 'ligamentum flavum'. Bone spurs growing from the posterior endplates of vertebral bodies and in-buckling of the yellow ligament into the spinal canal (during extension) can narrow down the spinal canal by up to 50% [4].

Incidence reported in literature ranges between 13% [5] and 66.7% [3] of all children with spinal cord and/or vertebral column injury. While in adults, Kasimatis et al., in their 2008

study found the incidence of SCIWORA to be around 5% of all cervical spinal injuries [4].

Bondurant and Oró, in 1993, noted that there may be an increased risk of SCIWORA among young children with asymptomatic Chiari I malformation [6].

Of the children with SCIWORA, 52% have delayed onset of paralysis up to 4 days after injury during which period they may experience transient numbness, paresthesia, Lhermitte's sign, or a feeling of total body weakness [1].

The MRI findings can be divided into two groups; extraneural and neural. Extraneural lesions include ligamentous injury and disc herniations while neural findings include intramedullary haemorrhages, contusions and cord oedema [3].

The current guidelines for the evaluation of SCIWORA patients recommend MRI of the region of suspected injury, radiographic screening of entire the spine, and dynamic flexion-extension x-rays both in the acute setting and at late follow-up to assess spinal stability, even if MRI is negative [7].

Management of these patients include external immobilization of the spine for up to 12 weeks, avoidance of both contact and non-contact sports for 6 months to reduce the risk of re-injury and/or exacerbation of symptoms [7]. A detailed discussion with the patient and the family about the seriousness of the injury and importance of compliance with prescribed treatment should form an integral part of the management plan. Regular follow-up visits for monitoring condition and compliance are recommended [7]. For asymptomatic patients who obtain negative flexion-extension dynamic radiographs, external immobilization devices can be removed earlier. Medical treatment may include the use of analgesics for pain relief, thromboprophylaxis for bed-bound patients, and antihypertensive or vasopressor agents to maintain blood pressure within normal limits to prevent secondary spinal cord injury.

4. Discussion

The acronym 'SCIWORA' stands for "*Spinal Cord Injury Without Radiographic Abnormality*", however some authors prefer use of the term 'SCIWORET', for "*Spinal Cord Injury Without Radiographic Evidence of Trauma*" because the former would not be an accurate description for radiographs with pre-existing degenerative changes in the elderly for example, as those should, in the true sense of the word, count as radiographic abnormalities. SCIWNA (*spinal cord injury without neuroimaging abnormality*) is a recently coined term to describe patients with normal MRI findings but demonstrate hyperintense lesions on DWI [8]. This clinical utility of diffusion weighted imaging (DWI) in the evaluation of patients with SCIWORA was recently demonstrated Shen et al. [9].

The mechanism of neural tissue injury in SCIWORA may involve hyper-flexion/extension causing direct compression and crush injury, longitudinal distraction causing shearing injuries, and/or ischemia causing infarction. The

patho-morphologic lesions may include traumatic cord contusion, infarction, traumatic disc prolapse, meningeal rupture and even cord transection. Cord compression by epidural hematoma formation resulting from vascular injury may also be a plausible explanation.

The specific vulnerability of the paediatric cervical spine to SCIWORA injuries can be explained on the basis of the peculiarities of the osseous anatomy of the paediatric spine. Firstly, the plane of orientation of the facet joints is more horizontal than in adults. Secondly, the anterior portions of the vertebral bodies are wedged forward. These features are most pronounced in the cervical spine making back-and-forth slippage between adjacent vertebral bodies more likely in this particular region in young children. Furthermore, the rather flat uncinat processes in this age group may not withstand excessive flexion-rotation forces without the risk of slippage of the vertebrae over one another. Also, the high head to body ratio with relatively underdeveloped neck musculature makes children highly susceptible to flexion/extension injuries in general.

Although imaging did not reveal overt underlying degenerative changes in our patient, adult patients who suffer SCIWORA typically have varying degrees of degenerative spondylosis or spinal canal stenosis. The level of injury usually corresponds to the location of these changes which suggests that degenerative spine conditions predispose to SCIWORA injuries [4]. Even mild hyperextension injury can cause a central cord syndrome in patients with spinal stenosis [4].

During hyperextension, the interlaminar ligaments of the cervical spine bulge forward into the spinal canal, narrowing the cervical canal at that level, the narrowing could be further compounded by presence of spondylotic spurs. This is the most probable mechanism of spinal cord injury without radiologic abnormality in adults like our patient. Furthermore, hyper-extension of the spine may also cause temporary occlusion or induce vasospasm of the vertebral arteries [10], the anterior spinal artery or the distal branches of the central sulcus arteries [11] leading to spinal cord infarction.

In the initial management of SCIWORA patients, admission of the patient to hospital, including those with subtle symptoms, would help to emphasize seriousness of the injury.

Rigid external immobilisation for 12 weeks and avoidance of sporting activities for 6 months are the mainstay of management. The role of surgical intervention in SCIWORA is controversial, routine surgical decompression by laminectomy in anticipation of spinal cord oedema has been tried but has not shown benefit [12]. However, surgical decompression or fusion should be considered in patients with evidence of spinal cord compression or instability, respectively, to prevent secondary spinal cord injury.

5. Conclusion

Although SCIWORA is rare in the adult population, it does occur and can lead to significant morbidity and high mortality

rates. Onset of neurological symptoms may be delayed up to 4 days in some patients. Therefore, adult patients presenting with neurologic deficits and normal static radiographs and CT scans, on a background of any degree of trauma, be it trivial, should not be brushed off lightly but rather investigated further with dynamic radiographs and MRI to rule out ligamentous instability and the possibility of on-going spinal cord compression.

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