

# Spinal Cord Injury Without Radiological Abnormality (SCIWORA): Is It Still a Notable Definition?

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## Abstract

The developing Magnetic Resonance Imaging technologies have led to significant changes in the radiological diagnostic criteria of the Spinal Cord Injury without Radiological Abnormality (SCIWORA). Moreover, some authors even introduced alternative definitions for this specific disease recently. The aims of this study were to report an adolescent case with pure SCIWORA and to clarify its definition in the literature. A 16 year-old adolescent patient with thoracolumbar SCIWORA together with a pelvic fracture after a vehicle accident was presented in this case report. In neurological examination, both extremities were graded as Frankel type A. The X-ray and Magnetic Resonance Imaging revealed the right ischium-superior pubic ramus fracture and only edema of the spinal cord at T12, L1 and L2 vertebral levels, subsequently. A high dose of methyl-prednisolone was administered. Pelvic fracture was promptly fixed with an external fixator. After a follow-up period of two years, the neurological status of the patient showed progression to Frankel B. The patient continues to his life with wheelchair. In conclusion, an adolescent case with SCIWORA that fulfills all its original criteria was reported and a review of the literature was discussed in this study. In order to describe this special pathology, SCIWORA seems still to be the best ideal term.

**Keywords:** SCIWORA; Paediatric spinal trauma; Pelvic fracture

## Introduction

Spinal Cord Injury Without Radiologic Abnormality (SCIWORA) was firstly well documented by Pang and Wilberger in 1982 [1]. Different incidence rates between 4%-66% were reported in pediatric spinal cord injuries [2,3]. But, much lower incidence rates (lower than 1%) has been reported with the increasing development of Magnetic Resonance Imaging (MRI) techniques [4,5]. Recently, this lower incidence was reported surprisingly as low as 0.5% in a series of pediatric spinal trauma: 3 out of 578 patients were diagnosed as SCIWORA [5]. The diagnosis of SCIWORA is made by MRI. Computed Tomographic (CT) and/or X-ray signs are the adjunct methods for the diagnosis [3,6]. But, the continuous developments in the MRI technologies have led to significant changes in the radiological signs and diagnostic criteria of the SCIWORA. Moreover, by the time the extraneural compression sign which is not present in its original definition was also included to the signs of SCIWORA [7,8]. Recently, SCIWORA was also accepted in the differential diagnosis of accidental hypothermia [9]. It should also be kept in mind that this special pathology could also be observed in preschool-aged children [10]. Pang D. made a broad revision of SCIWORA in order to clarify the complexities on its definition [11]. As a different point of view, it was reported by Trigylidas et al. that the term Spinal Cord Injury Without Neuroimaging Abnormality (SCIWONA) - in which no pathological sign including extraneural compression sign is present radiologically- would be a more suitable term in order to describe the pathology [12]. The aims of this study were to report a 16 years old adolescent having the diagnosis of thoraco-lumbar SCIWORA with pelvic fracture by utilizing MRI and roentgenographic signs and to make a clarifying review on the articles in which the diagnostic criteria of this clinical entity were reported.

## Report of the Case

A 16 years old male patient was admitted to the emergency department, one and a half hour after a tractor had fallen down on him. He was evaluated promptly. The physical examination revealed hematoma in the pelvic region especially around the right iliac wing and paraplegia. After the stabilization of vital parameters, the radiological examination of both vertebral column and pelvis was performed. The X-Ray and MRI revealed the right ischium - superior pubic ramus

with iliac wing fractures (Figure 1) and edema of the spinal cord at T12, L1 and L2 vertebral levels (Figures 2a and 2b), respectively. Any radiological sign involving vertebral column such as extraneural compression or ligamentous injury was not detected. According to the classification of neurological loss, both extremities were graded as Frankel type A [13,14]. A high dose of methyl-prednisolone was administered (a bolus of 30 mg/kg IV followed by infusion at 5.4 mg/kg/hr IV for the next 23 hours). A urinary catheter was introduced. In the following hours, the urinary incontinence was present. Pelvic



Figure 1: Fracture of right ischio-pubic ramus.

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Received January 21, 2015; Accepted February 13, 2015; Published February 15, 2015

**Citation:** Buyukbebeci O, Bilge O, Karsli B, Kacira BK, Kutahya H, et al. (2015) Spinal Cord Injury Without Radiological Abnormality (SCIWORA): Is It Still a Notable Definition?. J Spine 4: 215. doi:10.4172/21657939.1000215

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Figure 2a: Spinal cord edema at Th12-L1-L2 vertebral levels (white arrows).



Figure 2b: Thoracic vertebrae of the same patient. Cord edema at the level of Th12 (white arrow).

fracture was promptly fixed with an external fixator in the operating theater. A hyperextension brace with a three point support was put on the patient emergently. After a final follow-up period of two years, the neurological status of the patient showed progression to Frankel type B. The urinary loss persisted. The patient continues to his life with wheelchair.

## Discussion

The MRI sign has been a sine qua non for the diagnosis of SCIWORA. As a generally accepted view, the pathology should be limited to the spinal cord and moreover should not include these subsequent signs: vertebral fractures, ligamentous complex injuries or extra-neural compression. The pathology in the spinal cord should include one of the signs below: edema, hemorrhage and infarction [11,13]. Transection and concussion were reported to be additional signs and were associated with poor prognosis in those cases [15]. It was argued that the MRI must be completely normal by some authors (Spinal cord injury without neuroimaging abnormality: SCIWONA). In other words, beside extra-neural compression signs, any pathology involving the spinal cord must be absent. In their series, the incidence was reported as 1% and they mentioned about very good prognosis.

If defined so, they emphasized that the true incidence of SCIWORA should be much lower. They pointed out that SCIWONA described this pathology better [2,16,17]. In contrast to these studies, in a recent study it was observed that abnormal signals were detected with diffusion-weighted MRI (DWMRI) even in cases having no neuroimaging sign in conventional MRI (SCIWONA) [18]. Therefore in our opinion, SCIWORA seems still to be the best defining term describing this special pathology. In the present case, no additional abnormalities other than edema in the spinal cord on MRI and X-ray were present. This reflects that this case is a really pure SCIWORA. Interestingly, SCIWORA can be observed within 4 days after trauma, also recurrence may be observed after healing [19]. Insufficient immobilization may be responsible for this recurrence. Although hyper-extension treatment is controversial in SCIWORA, early hyperextension orthosis was used, as this protective measure may prevent recurrence in this case. Although some good prognostic factors were present in this case (early diagnosis, adolescent age, edema in spinal cord without hemorrhage or infarction, early stabilization of vertebral column), a significant improvement in the neurological status of the patient was not observed. The neurological status of the patient was progressed from Frankel A to Frankel B only. The urinary incontinence persisted. The bad prognosis can be attributed to the long standing pressing injury under the tractor and accompanying complex pelvis fracture close to spine. It is advisable that treatment protocols and prognostic evaluation should be individualized and that hyperextension brace is not necessary for every case [20]. In another study, neuroimaging was found closely correlated with prognosis in such a way that, the amount and extent of edema in spinal cord, medullary hemorrhage and lesions at higher spinal cord levels were described as important prognostic factors [21]. The severity of the neurological status at the beginning and the age of the patient was also associated with prognosis [12,22]. As a result, an adolescent case with SCIWORA that fulfills all its original criteria was reported in this study. Although a lot of cases of SCIWORA and different treatment protocols were mentioned in the literature, no significant clinical improvements in terms of prognosis were reported. In our opinion, as far as the relevant literature has been investigated till now, SCIWORA is still the best ideal term, which describes this special pathology.

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