PREDICTORS IN ADULT SCIWORA

PREDITORES NO QUADRO SCIWORA DO ADULTO

PREDICTORES EN EL CUADRO SCIWORA DEL ADULTO

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ABSTRACT

Objectives: Kinematic analysis, recognize the clinical presentation, describe image tests, consider therapeutic possibilities and assess progress. Method: Analysis of 13 male patients with SCIWORA (Spinal cord injury without radiographic abnormality) between 2005 and 2012. Evaluates clinical presentation, treatment, complications and outcome. Results: 10 patients over 45 years showed signs of spondyloarthritis with minimal symptoms. Of the three with less than 45 years, only one had a constitutional asymptomatic stenosis. All had suffered low-energy trauma. In the magnetic resonance prevailed intramedullary haematoma and clinically all patients over 45 years had a central cord syndrome with severe symptoms (ASIA A-B). Seven patients were initially treated conservatively; one patient worsened and had to undergo surgery after 18 months and another died in the early hours; the remaining patients had good performance. Six patients required surgery (laminoplasty) in the first 10 days; three died and the remaining patients improved at least one ASIA level. Conclusions: The lower age, the mild cases and intramedullary edema are good prognostic factors and are favored by conservative treatment. The higher age, spondyloarthritis and severe or progressive conditions are factors of poor prognosis and may require surgical treatment.

Keywords: Central cord syndrome; Treatment; Spinal cord injuries.

RESUMO

Objetivos: Análise cinemática, reconhecer apresentação clínica, descrever imagens, considerar as possibilidades terapêuticas e avaliar a evolução. Método: Análise de 13 pacientes do sexo masculino com SCIWORA (em ingles Spinal cord injury without radiographic abnormality) entre 2005 e 2012. Avalia-se quadro clínico, tratamento, complicações e resultado. Resultados: Dez pacientes com mais de 45 anos apresentaram sinais de espondiloartrose com sintomas mínimos. Dos três pacientes com menos de 45 anos, apenas um tinha estenose de canal constitucional assintomática. Todos haviam sofrido trauma de baixa energia. Na ressonância magnética prevaleceu hematoma intramedular e clinicamente todos os pacientes com mais de 45 anos tinham síndrome medular central grave (ASIA A-B). Sete pacientes foram inicialmente tratados de forma conservadora; um paciente piorou e teve que ser submetido a cirurgia 18 meses depois e outro morreu nas primeiras horas, o restante teve bom desempenho. Seis pacientes necessitaram de cirurgia (laminoplastia) nos primeiros 10 dias; três morreram e os pacientes restantes melhoraram pelo menos um nível ASIA. Conclusões: A idade mais baixa, os casos não graves e o edema intramedular são bons fatores prognósticos e são favorecidos pelo tratamento conservador. A idade mais elevada, a espondiloartrose e os quadros graves ou progressivos, são fatores de mau prognóstico e podem necessitar de tratamento cirúrgico.

Descritores: Síndrome medular central; Tratamento; Traumatismos da medula espinal.

RESUMEN

Objetivos: Analizar cinemática, reconocer cuadro clínico de presentación, describir imágenes, considerar posibilidades terapéuticas y evaluar evolución. Método: Se analizan 13 pacientes del sexo masculino que presentaron SCIWORA (en inglés Spinal cord injury without radiographic abnormality) entre el 2005 al 2012. Se evalúan cuadro clínico, tratamiento, complicaciones y evolución. Resultados: 10 pacientes mayores de 45 años presentaban signos de espondiloartrosis con mínimos síntomas. De los tres menores de esta edad solo uno presentaba estenosis de canal constitucional asintomática. Todos sufrieron trauma de baja energía. En la resonancia magnética prevaleció el hematoma intramedular y clínicamente todos los pacientes presentaban un síndrome medular central, con cuadro severo (ASIA A-B) en los mayores de 45 años. Siete pacientes fueron tratados inicialmente en forma conservadora; un paciente empeoró y tuvo que ser sometido a intervención quirúrgica 18 meses después y otro falleció en las primeras horas, el resto de los pacientes tuvieron buena evolución. Seis pacientes requirieron cirugía (laminoplastía) en los primeros 10 días; tres fallecieron y el resto mejoro por lo menos un nivel ASIA. Conclusiones: La menor edad, los cuadros leves y el edema intramedular son factores de buen pronóstico y se ven favorecidos con el tratamiento conservador. La mayor edad, la espondiloartrosis y los cuadros severos o progresivos, son factores de mal pronóstico y puede ser necesario su tratamiento quirúrgico.

Descriptores: Síndrome del cordón central; Tratamiento; Traumatismos de la médula espinal.

INTRODUCTION

The term SCIWORA (Spinal Cord Injury without Radiologic Abnormality) describes spinal cord injury that is demonstrable through magnetic resonance imaging, but that does not demonstrate bone lesion in complementary studies, such as radiographies and/or tomography.[1-8]

The incidence of spinal cord injury in a cervical trauma ranges from 0.9 to 6%,[5,9,10] increasing from 2 to 27% when associated with other injuries in the context of a patient with multiple trauma.[9,11] The presence of neurological damage without traumatic bone lesion in adults can range from 0.08 to 15%.[8,12-15]

Spinal cord injuries have catastrophic consequences, both for the patients and for their social circle. Factors have been identified that significantly influence survival in patients who have suffered a spinal cord trauma, namely, age, extent of the damage, degree of primary injury[7,14,16,17] and secondary injury.[7,18,19]

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Mortality in these patients can range from 4 to 11%, and the causes are directly related to the trauma or its complications, including urinary, cardiopulmonary and infectious complications.[5,17]

Loyd in 1907 apud Fermín[20] and Launay et al.[21] was the first to describe this syndrome. Pang and Wilberger[22] in 1982, described this syndrome in the pediatric population with principal occurrence in children aged under 8 years, but authors like Hendey et al.[13] mention the appearance of SCIWORA in adult age, and its direct relationship with degenerative pathology.

Four age groups can be described, that have a predisposition to this syndrome: the first group is newborn infants, with longitudinal traction being the main cause of the condition; the second is children aged under 16 years, in whom the mechanism of distraction is primarily due to ligament elasticity; the third group is individuals aged between 16 and 14 years; in this age group it is rare for spinal cord injury to occur without bone and/or ligament lesions, except in cases of constitutional stenosis of the cervical canal; and the fourth group consists of individuals aged over 45 years, in whom spondyloarthrosic degeneration is prevalent, with the main mechanism being hyperextesion.[22-24]

The majority of authors agree that populations aged under 8 years and over 60 years are more predisposed to the condition, due to anatomical and biological differences in these groups.[8,24]

While neurological symptoms may vary, the prevalent complication in these cases is central cord syndrome (CCS)[5,11,13,14,16,25-27] particularly in low-energy traumas,[24] such as falling over (43%), traffic accidents (33%), and falling from a height (12%).[23,28]

Magnetic resonance imaging has become the method of choice for evaluating these patients.[7,8,14,29] This technique is used to identify the causes of the syndrome, dividing them into extramedullary (disc hernia, canal stenosis, legion of the anterior common vertebral ligament or posterior ligament complex and intracanal hematoma) and intramedullary (edema, contusion and hemorrhage).[7,15,30-32] The presence of hemorrhage in the spine is a sign of poor prognosis in the evolution of the patient.[5,7,16,19,32,33]

Young patients with stable neurological symptoms can be treated conservatively with immobilization and corticotherapy; while older patients, or those with progressive deficit, should be treated with surgery.[28]

The objectives of this study are: to analyze the kinematics, recognize clinical symptoms of presentation, describe images, consider therapeutic possibilities, and evaluate evolution.

MATERIAL AND METHODS

Thirteen male patients, average age of 56.54 years (range 16 to 84) who, following a trauma, were admitted to the Emergency Service with a diagnosis of neurological deficit without proven diagnosis of fracture and/or luxation, between June 2005 and June 2012.

The neurological examinations on admission and at 6 months were carried out using the ASIA scale and the Japanese Orthopedic Association Scale. Follow-up was carried out using the same scales for the majority of the patients.

In terms of imaging exams, radiographies and MRI were performed on admission: in some cases tomography was also performed.

The treatment carried out, the presence of complications, and the neurological clinical evolution were evaluated.

RESULTS

The older patients reported, previously, mild symptomology associated with their previous spondyloarthrosis. The patients aged under 45 years did not report any symptoms prior to the trauma.

The traumas were related to traffic accidents in eight cases, two passive mobilizations (one rotation in situation of robbery and one flexion-extension), two cases of falling over, and one sports trauma. One patient confirmed multiple trauma by association of cranial and thoracic trauma. (Table 1)

Table 1. Age, kinematics and associated injuries.

Patient	Age	Kinematics	Associated injuries
1	55	Driver not wearing seatbelt	Cranial and thoracic trauma
2	46	Driver	
3	60	Passive rotation	
4	75	Driver not wearing seatbelt	
5	53	Driver wearing seatbelt	
6	84	Falling from a height	
7	63	Passive flexion-extension	
8	63	Bicycle	
9	65	Falling from a height	
10	20	Driver wearing seatbelt	
11	27	Front seat passenger	
12	16	Rugby	
13	58	Rear seat passenger	

Table 2. Imaging results.

Patient	Age	Radiography	MRI		
			Intramedullary lesion	Levels affected	Diameter of compromise
1	55	Spondyloarthritis	Hematoma	C4-C6	>50
2	46	Spondyloarthritis	Edema	C5-C6	<50
3	60	Spondyloarthritis	Edema	C5-C7	<50
4	75	Spondyloarthritis	Hematoma	C3-C5	>50
5	53	Spondyloarthritis	Edema	C4-C6	<50
6	84	Spondyloarthritis	Hematoma	C3-C6	>50
7	63	Spondyloarthritis	Hematoma	C4-C5	<50
8	63	Spondyloarthritis	Hematoma	C3-C6	>50
9	65	Spondyloarthritis	Hematoma	C2-C3	>50
10	20	Normal	Hematoma	C3-C4	>50
11	27	Constitutional Stenosis of the Canal	Mixed	C3-C5	>50
12	16	Normal	Hematoma	C5-C6	<50
13	58	Spondyloarthritis	Mixed	C3-C4	>50

In the evaluation on admission in the patients aged over 45 years, severe neurological impairment was prevalent (3 ASIA A and 3 B).

All the patients presented central cord syndrome and were submitted to radiographies and MRI, and six also underwent axial tomographies. The radiographies showed signs of spondyloarthritis in all the patients over 45 years: below this age, only one patient had constitutional stenosis of the canal. MRI showed edema in three patients, mixed pattern in two, and hematoma in the remainder; without the presence of disc hernia or ligament lesions. (Table 2)

All the patients underwent treatment with methylprednisolone, according to the NASCISS protocol.

Seven patients were treated conservatively (Figure 1A,B): one died before the first follow-up, and another had worsening of the neurological state and had to undergo surgical treatment with laminopathy 18 months afterwards, with good results, although with spasticity of gait (patient 5), the same occurred for another patient (patient 10), and one had decreased range of flexion of the wrist (patient 13).

Six patients underwent surgical release of pressure by the laminoplasty technique, by the posterior approach in the first 72 hours, and one at 10 days. (Figure 2A-C)

There was one case of pre-surgical pneumonia (patient 1), two post-surgical (patients 7 and 8), one superficial infection of the surgical wound (patient 9), and one urinary infection (patient 1). Four patients died.

The patients aged under 45 years treated conservatively (collar and corticoids) evolved favorably. Those over this age with partial neurological compromise, and who were treated surgically before 10 days, showed neurological improvement, as did those who underwent surgery 18 months after the trauma, with improvement of at least one level on the ASIA scale, and five points on the JAO scale. (Tables 3 and 4)

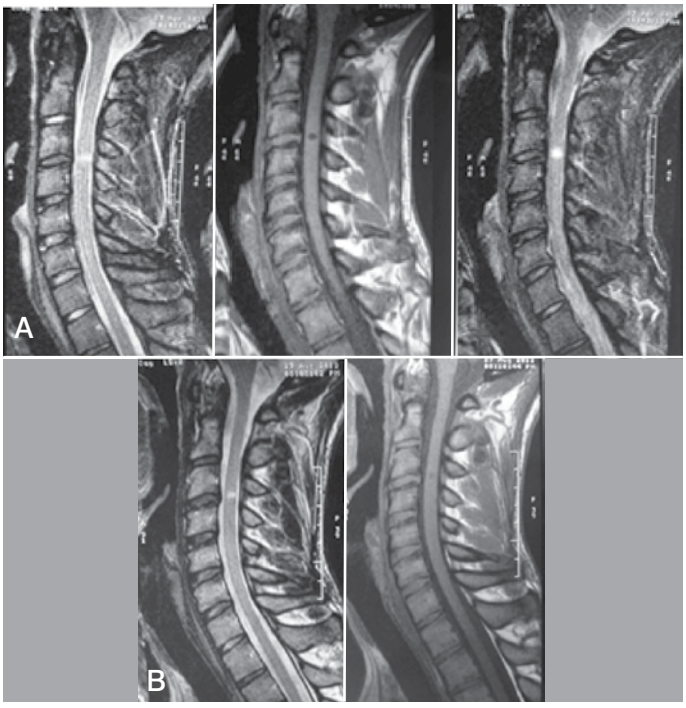

Figure 1. Patient aged 20 years, driver wearing a seatbelt (A) sagittal MRI sections in T2, T1 and STIR on admission, showing an intramedullary lesion (hematoma). (B) Sagittal sections in T2 and T2 6 months after conservative treatment.

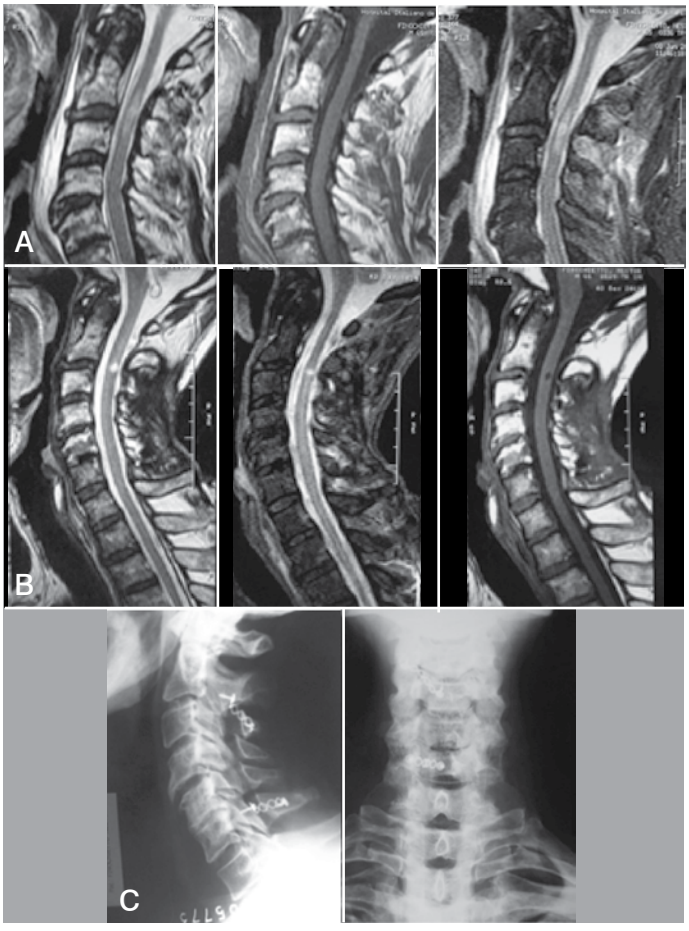

Figure 2. Patient aged 65 years who suffered a fall from a height, (A) Sagittal sections with initial MRI in T2 T1 and STIR, showing intramedullary hematoma C2-C3 with narrowing of the cervical canal, (B) the same sections immediately after surgery. (C) Radiographic control of stenosis of the canal and osteosynthesis material.

Table 3. Evolution of neurological symptoms according to the ASIA scale.

Patient	ASIA start	Surgery	6 months	1 year	2 years	3 years	4 years	ASIA end
1	C	X	D	C	D	D	D	D
2	B	X	C	C	C	C	C	C
3	C		E	E	E	E	E	E
4	A	X	A	Death				
5	D	X	D	C	D	E	E	E
6	A		Death					
7	B	X	C	Death				
8	A	X	Death					
9	B	X	E	E	E			E
10	B		E	E	E			E
11	C		E	E				E
12	C		E					E
13	C		E					E

Table 4. Evolution of values on the Japanese Orthopedic Scale (JAO).

Patient	6 months	1 year	2 years	3 years	4 years	JAO end
1	14	11	12	13	13	13
2	10	12	12	12	12	12
3	15	15	16	16	16	16
4	8	Death				
5	14	10	13	15	15	15
6	Death					
7	11	Death				
8	Death					
9	12	14	14			14
10	16	16	16			16
11	16	16				16
12	17					17
13	15					15

DISCUSSION

Some authors affirm that degenerative changes or calcification of the posterior common vertebral ligament produce excessive traction of the spinal cord during the accident and can influence the development of SCIWORA;[34] while others deny this relationship, and believe these changes have no direct influence on the presence of neurological impairment following low-energy trauma.[35]

For the diagnosis, MRI is considered the method of choice[15,36] but when this is not conclusive; diffusion MRI or proton emission tomography (PET) may be useful in those patients with negative MRI and with myelopathic neurological syndrome. Another option to be considered is the use of somatosensory evoked potentials.[30]

Radiographic dynamic study of the profile in maximum flexion and extension in acute should be contraindicated, due to the possibility of worsening of the neurological impairment.[1,36]

There are factors that influence the likelihood of neurological recovery[37] in these patients, and these are primarily related to the initial injury,[44] the diameter of the canal,[4,38,39] the patient's age, the extent of the injury, the presence of disc-ligament lesions[40,41] and the severity of the neurological syndrome.[1] For this reason, surgery is not the gold standard for treatment.[11,33] For Saruhashi et al.[28] patients who show good response to treatment with corticoids should be indicated for immobilization, while those with severe or progressive symptoms should be indicated for surgery.

Bhatoe et al.[42] prefer a non-surgical form of treatment in traumas by hyperflexion, as they believe that injuries originating in the syndrome are of the vascular type. Other authors, like La Rosa et al.,[43] also defend medical treatment due to the risk of increased complications.

On the other hand, authors like Dolan,[44] Chen,[45] Fehling[18] and Lenehan et al.[46] support rapid release to prevent secondary damage[19] and complications.[37]

CONCLUSIONS

Low energy trauma can cause an imbalance in the container--content relationship in asymptomatic arthritic spines or spines with constitutional stenosis, and can be devastating for the patient.

Post-traumatic neurological deficit after ruling out bone injury in radiographies and/or CT scan perform the diagnosis of SCIWORA, a syndrome characterized mainly by a central spinal cord syndrome.

MRI is used for the diagnosis of the soft tissues (ligament and spinal disc).

Age under 45 years, neurological compromise with moderate to mild incomplete neurological symptoms and intramedullary edema are factors that suggest a good prognosis and are favored by conservative treatment, with sequelae involving low disability.

Age over 45 years, the presence of previous container-content conflicts (spondyloarthritis), and severe or progressive neurological deficit, are generally factors of poor prognosis, and can improve with laminoplasty by at least one level on the ASIA scale. However, the possible postoperative complications can be severe.

All authors declare no potential conflict of interest concerning this article.

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