

INCOMPLETE NEUROLOGICAL INJURY SECONDARY TO HIGH ENERGY ASIA B L3-L4 FRACTURE DISLOCATION BY TRAUMA IN THE LUMBAR REGION

LESÃO NEUROLÓGICA INCOMPLETA DE ASIA B SECUNDÁRIA A FRATURA LUXAÇÃO L3-L4 DE ALTA ENERGIA POR TRAUMA NA REGIÃO LOMBAR

LESIÓN NEUROLÓGICA INCOMPLETA ASIA B SECUNDARIO A FRACTURA LUXACIÓN DE L3-L4 POR TRAUMATISMO DE ALTA ENERGÍA EN REGIÓN LUMBAR

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ABSTRACT

In fracture dislocations of the lumbar region, two anatomical facts can help preserve neurological damage in patients, when compared with trauma in the cervical or thoracic region. Firstly, the spinal cord in adults extends only to the lower edge of the first lumbar vertebra, and secondly, the large vertebral space in this region gives ample space for the roots of the cauda equine. As a result, the nerve injury may be minimal, because the nerve roots in this region are accommodated in a larger area, with less content and space. This study presents the case of a 48 year-old male, a construction worker, who suffered a fall from a height of approximately 15 meters, directly hitting the lumbar region against a beam, and presenting pain and inability to move the legs. The patient was brought to the emergency room one hour after the accident, clinically assessed, submitted to x-rays and a CT scan, and diagnosed as having an ASIA B L3-L4 fracture dislocation. Three hours after the accident, reduction was performed via posterior transpedicular fixation. One week later, an anterior approach was performed. The patient progressed to ASIA C 24 hours after the first surgery. Three months later, the patient was functional with ASIA D and good sphincter control. The author's purpose is to show the results obtained by an intervention in the initial hours of the trauma, which helped promote the evolution from a nonfunctional injury to a functional one, with near-total recovery.

Keywords: Dislocations/surgery; Lumbar vertebrae/injuries; Spinal fractures/surgery; Thoracic vertebrae/injuries; Accidental.

RESUMO

Nas fraturas-luxações da região lombar dois fatos anatômicos podem contribuir para o paciente apresentar menos danos neurológicos em comparação aos traumatismos na cervical ou torácica. Em primeiro lugar, a medula espinhal no adulto se estende apenas até o nível da borda inferior da primeira vértebra lombar, em segundo lugar, o grande buraco vertebral nesta região dá amplo espaço para as raízes da cauda equina nesta região vertebral dá amplo espaço para as raízes da cauda equina, portanto, a lesão do nervo, pode ser mínima nesta região porque nesta área raízes nervosas são acomodados um grande espaço, com menos conteúdo e mais continente. Neste estudo, apresentamos o caso de um trabalhador da construção civil masculino, 48 anos de idade, que sofreu queda de uma altura de aproximadamente 15 metros, batendo diretamente na parte inferior das costas contra uma viga, apresentando dor e incapacidade de mover as pernas, levado a emergência uma hora após o acidente, para avaliação clínica. De acordo com as radiografias e tomografias, foi diagnosticado como fratura-luxação L3-L4 com ASIA B. Três horas após o acidente, foi realizada redução e abordagem transpedicular posterior. Uma semana depois, ela se submeteu a abordagem anterior. Progrediu para a Ásia C primeiras 24 horas após a cirurgia. Três meses após o paciente funcional com ASIA D e controle do esfíncter. O objetivo do autor é mostrar os resultados obtidos por uma intervenção nas primeiras horas do trauma que ajudaram a favorecer a evolução de uma lesão não-funcional a uma lesão funcional, a recuperação quase completa.

Descritores: Luxações/cirurgia; Vértebras lombares/lesões; Fraturas da coluna vertebral/cirurgia; Vértebras torácicas/lesões; Acidentes por quedas.

RESUMEN

En las fracturas luxaciones de la región lumbar, dos hechos anatómicos pueden ayudar al paciente a presentar un daño neurológico menor en comparación con los traumatismos en la región cervical o torácica, en primer lugar, la médula espinal en el adulto se extiende solo hasta el nivel del borde inferior de la primera vértebra lumbar, en segundo lugar, el gran tamaño del agujero vertebral en esta región da amplio espacio a las raíces de la cola de caballo, por lo tanto, la lesión nerviosa puede ser mínima en esta región, ya que en esta área se alojan raíces nerviosas con un gran espacio, menor contenido y mayor continente. En este estudio se presenta el caso de un hombre de 48 años de edad, trabajador de la construcción, el cual sufrió caída de una altura aproximada de 15 metros, golpeándose directamente sobre la región lumbar contra una viga, presentó dolor e incapacidad para movilizar las piernas; llevado con urgencia, una hora después del accidente, se analizó clínicamente. Se tomaron radiografías y tomografía, y se diagnosticó como fractura luxación L3-L4 con ASIA B. Intervenido tres horas después del accidente con reducción vía posterior y fijación transpedicular. Una semana después se realizó abordaje anterior. Progreso hacia ASIA C, 24 horas después de la primera cirugía. Tres meses después, paciente funcional con ASIA D y control de esfínteres. El propósito del autor es mostrar los resultados obtenidos mediante una intervención en las primeras horas del traumatismo, la cual ayudó a pasar de una lesión no funcional a una lesión funcional, casi con recuperación total.

Descriptorios: Luxaciones/cirurgia; Vértebras lombares/lesiones; Fracturas de la columna vertebral/cirurgia; Vértebras torácicas/lesiones; Acidentes por caídas.

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INTRODUCTION

Due to disproportionate growth of the vertebral column during development compared with the spinal cord the length of the roots increases progressively from the top down, so that the spinal cord does not constitute all the content of the medullary canal. Instead, the content is comprised of the lumbar and sacral nerve roots from the lower edge of the first lumbar vertebra in adults, which form a strand of nerves where the filum terminale is posteriorly located. Together, these lower nerve roots are known as the cauda equine, or horse's tail.

Spinal cord injury can result in partial or complete loss of function at the level of the injury, and partial or complete loss of the function of the afferent and efferent nerve tracts below it.

The best prognosis for spinal cord injuries in the lower lumbar spine has been reported in the works of Holdsworth¹, in which paraplegia may be limited, and impingement by bruising and solid objects is of less consideration, placing the recovery in doubt, regardless of the time between the accident to surgery.¹

Reaction and axonal degeneration are the changes that occur in a nerve cell when its axon is cut or injured. The changes begin to appear 24-48 hours after the injury. The degree of changes will depend on the severity of the axonal injury, and will be greater if the injury occurs close to the cell body.

A classification of injuries is needed in order to develop a common language for treatment indications. Several classification systems exist, the most common one being the Denis classification *apud Aebi*.²

In the 1990s, the AO Group, examining the classification of spinal cord injuries, concluded that there was no comprehensive classification system available, and that the classification of Denis was the most commonly used one at that time. There was a major problem with the so-called three-column concept, namely, the central column. The central column is a virtual column and not an anatomical entity *per se*, therefore it is not suitable for use in the classification of injury types. A stable spine can withstand three main forces: axial compression force, axial distraction force, and torsion forces, with rotation around the longitudinal axis.

The broad AO classification of the thoracolumbar spine is based on more than 1,400 fractures and was published in the *Journal Spine Europeo* in 1994.

The AO-spine classification is the most complete and logical classification available to date, but it has never been systematically validated. There are three different types of lesion that can be differentiated: Type A (compression), B (distraction) and C (rotation).²

High energy force is needed to create a complete fracture-dislocation of the lumbar spine. Reducing the dislocation is difficult due to the large forces acting on the lower lumbar spine. The purpose of surgery is to restore the anatomy through an appropriate reduction, maintain the reduction through instrumentation, reestablish sagittal balance, and promote fusion of the affected vertebrae.¹⁻⁴

Although there is one case in the literature that reports spontaneous reduction of a fracture-dislocation when carrying out imaging studies,⁵ there are few cases reported in the worldwide literature on recovery of neurological function after surgery, with adequate reduction of dislocations of distal segments of the lumbar region.^{2,3,6-9}

Antony J. Herrera et al. in Belgium, in their report of a case called single-level transforaminal fusion, concluded that in traumatic fracture dislocation, intersomatic fusion is considered an option.⁶

Case report

Male 48 years old, treated at Hospital de Especialidades, Centro Medico Nacional de Occidente IMSS, who fell from about 15 meters while working as a laborer on a construction site, suffering a direct blow to the lumbar region with a blunt object. He presented acute, intense pain, with inability to move his lower limbs and loss of sensation. He was taken to the emergency department and was received in the shock room one hour after the injury, where he was placed on an ATLS regimen, hemodynamically stable, with a Glasgow score of

15. The loss of sensation was confirmed by fine touch to distal L3, strength of 0 for distal L3. Last functional level L2.

With no primitive reflexes or osteotendinous patellar and Achilles reflexes, the patient moved en bloc prior to immobilization of the cervical region; the dorsolumbar region was examined to assess a large ecchymosis in the lumbar region, painful to touch, with palpable tumor. Patient was placed on NASCIS regimen due to suspected lumbar neurological injury, imaging studies, radiographs of the neck, chest and pelvis were requested, but no damage was found, when evaluated through the technique of imaging of the lumbar region with simple radiographs in two projections and computed axial tomography. Fracture-dislocation at L3-L4 was assessed and classified as an AO 53C3.2 fracture with ASIA B neurological injury. (Figures 1, 2 and 3)

Management carried out and surgical findings

Three hours after the injury, the patient was sent to the operating room for posterior reduction of L3-L4 with long posterior transpedicular screw instrumentation at L1-L2-L4-L5, bilateral rods, and crosslink system with monoaxial screw with posterior release at L3, and posterolateral fusion with autologous corticocancellous graft and bone matrix. (Figure 4)



Figure 1. Presurgical lateral X-ray.



Figure 2. Presurgical CT.

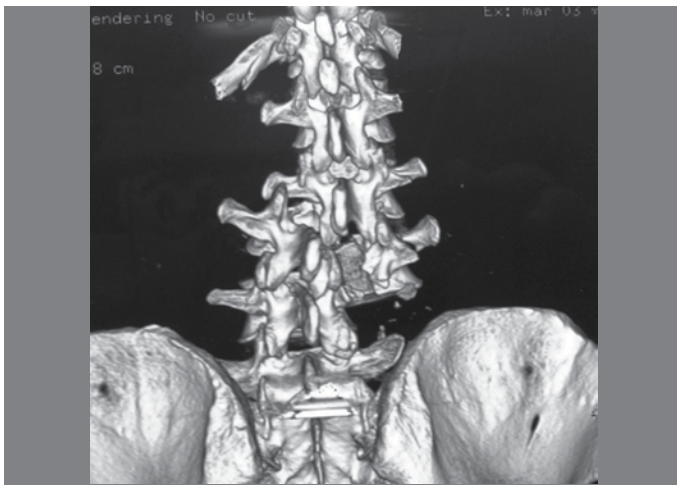


Figure 3. Presurgical CT.



Figure 4. Presurgical X-ray.

During surgery, an extensive lesion of soft tissues was observed, comprising both paravertebral muscles and ligaments, dislocation of L3 on L4 with lateralization of same, instability of the posterior elements, and hematoma in this region.

The neural canal was examined, with finding of a lesion in the dura mater and leakage of cerebrospinal fluid, which was repaired with sutures and application of DuraGen. Roots intact, without signs of root section.

One week later, in a second surgical procedure, left-side anterolateral approach was performed, with corpectomy of L3 and placement of a vertebral replacement device. Procedure performed without incidents or accidents. (Figure 5).

Postoperative evolution

Twenty-four hours after the first event, the patient was re-examined, and presented primitive reflexes and return of sensation in all the dermatomes on crude touch, hypostasis of L4-L5-S1 on fine touch, complete mobility up to L3, strength of 2 for L4-L5-S1.

Nine days after the injury without sphincter control, osteotendinous, patellar and Achilles reflexes were present. Full strength to L3, L4 of 3. L5-S1 of 3.

Outpatient was assessed at 4, 8, 12, 16, 20 and 24 weeks. At six months, a CT was reported in which adequate restoration of anatomy was observed, with recovery of sagittal balance, instrumentation material still in situ without loosening or signs of fatigue, and signs of posterolateral fusion.

Clinically, patient begins walking with the help of family

members, supported on the left arm, walking slowly, strength restored in all the myotomes, sensitivity preserved, and sphincter control recovered. (Figure 6).

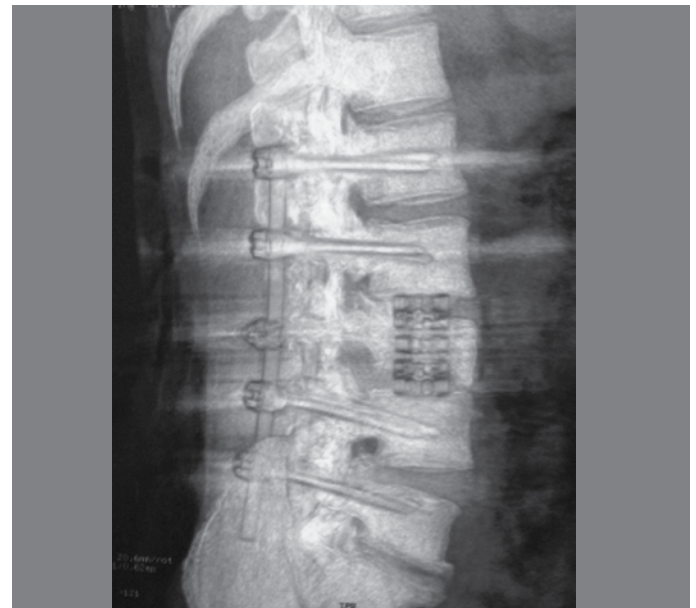


Figure 5. Postsurgical CT.

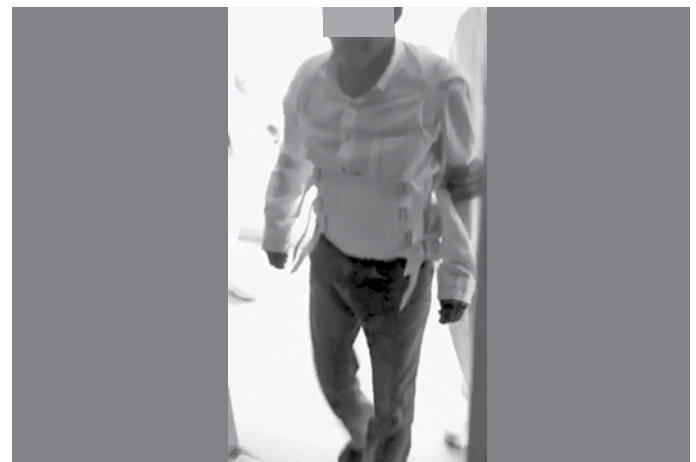


Figure 6. Patient walking after three months of surgery.

DISCUSSION

Fractures of the lumbar vertebrae are not always accompanied by neurological deficit or instability. White and Panjabi¹⁰ described the criteria for classifying a stable or unstable spine. There are also classifications for assessing neurological deficit and in this case, we used the ASIA scale.

When assessing a patient with a fracture of the lumbar region with signs of neurological instability involvement, it is essential to consider the possibility of surgical treatment, with the aim of limiting the neurological damage or its progression, being that the recovery of lost function is secondary.

In addition goals are to provide adequate stability with restoration of sagittal balance. MacCormack et al.¹¹ describe criteria for performing an anterior approach, which take into account three points: percentage of collapse or fracture of the vertebral body; degree of regional kyphosis; and invasion of the neural canal by fragments.

On this occasion, of the five options described for the treatment of thoracolumbar fractures (short posterior instrumentation, long posterior

instrumentation, short posterior instrumentation with anterior replacement, long instrumentation with anterior replacement, or only placement of anterior replacement) a two-stage procedure was decided on.

The lesion was classified as A0 53c3.2 with ASIA B, signifying great instability with neurological injury, which is often associated with poor outcomes after surgery and poor evolution for the patient in the long and short terms.

The aim of this case report is to show that early reduction and decompression in cases of vertebral fracture-dislocation promote

recovery from the neurological problems that the patient may suffer in a case of serious injury, especially in the lumbar region, and thanks to early reduction (within 3 hours) in this case, the patient evolved from ASIA B neurological injury to ASIA D injury three months after surgery.

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

REFERENCES

- Kelly RP, Whitesides TE Jr. Treatment of lumbodorsal fracture-dislocations. *Eur Spine J.* 2010;19 (Suppl 1):S2-S7.
- Aebi M. Classification of thoracolumbar fractures and dislocations. *Eur Spine J.* 2010;19(Suppl 1):S2-S7.
- Zarate-Kalfopoulos B, Romero-Vargas S, Alcántara-Canseco C, Rosales-Olivarez LM, Alpizar-Aguirre A, Reyes-Sánchez A. Traumatic posterior L4–L5 fracture dislocation of the lumbar spine: a case report. *Global Spine J.* 2012;2:235–8.
- Lim CT, Hee HT, Liu G. Traumatic spondylolisthesis of the lumbar spine: a report of three cases. *J Orthop Surg (Hong Kong).* 2009;17(3):361-5.
- Lee KS, Bae WK, Bae HG, Yun IG. Natural course of spontaneously reduced lumbo-sacral fracture-dislocation—a case report. *J Korean Med Sci.* 1993;8(5):390-3.
- Herrera AJ, Berry CA, Rao RD. Single-level transforaminal interbody fusion for traumatic lumbosacral fracture-dislocation: a case report. *Acta Orthop Belg.* 2013;79(1):117-22.
- Deniz FE, Zileli M, Çağlı S, Kanyılmaz H. Traumatic L4-L5 spondylolisthesis: case report. *Eur Spine J.* 2008;17(Suppl 2):S232-5.
- Hsieh CT, Chen GJ, Wu CC, Su YH. Complete fracture-dislocation of the thoracolumbar spine without paraplegia. *Am J Emerg Med.* 2008;26(5):633.e5-7.
- Chana M, Estébanez B. Complete lumbar dislocation after a car crash. *Mayo Clin Proc.* 2012;87(8):e61.
- Panjabi MM. Clinical Spinal Instability and low back pain. *J Electromyogr Kinesiol.* 2003;13(4):371-9.
- McCormack T, Karaićovic E, Gaines RW. The load sharing classification of spine fractures. *Spine (Phila Pa 1976).* 1994;19(15):1741-4.