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CASE REPORT

Unique Combination of Junctional Level Injuries to the Spine

Khalil Issa, MD*[1], Kevin R. Gurr, MD[2], Stewart I. Bailey, MD[2], Christopher S. Bailey, MD, MSc[2]

تجمع فريد لإصابات على مستوى المفارق الفقرية في العمود الفقري

د. خليل عيسى، د. كيفن غير، د. ستيوارت بيلي، د. كريستوفر بيلي

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INTRODUCTION:

Injuries of the spine are not uncommon,[1] they can have devastating consequences.[2,3] Serious accidents like traffic, falling and sports' accidents are commonly associated with spinal trauma.[2,4-6] In a 7-year review of 1,447 spine fractures, 202 (14%) were due to sporting or recreational causes, of which 84 (42%) were associated with paralysis,[1] they occur in 11.2% of motorcyclists and 14.1 % of car occupants accidents.[7] Burst fractures represent 15% of spine fractures, 10% of these are multiple; almost half of the multiple are non-contagious.[2] These mostly occur due to high energy impaction events, and the junctional ones are usually unstable and highly associated with neural tissue affection.[8] Lumbosacral traumatic spondylolesthesis is itself a rare entity.[9,10] Up to our knowledge and search of the literature through pub med, we didn't find any case reported with multiple junctional complicated injuries involving thoracolumbar burst fracture dislocation and lumbosacral fracture dislocation as in our case, adding the fact that our patient had a small flake fracture in the right occipital condyle and a tear drop fracture of C2.

CASE SUMMARY:

A high energy trauma victim was brought to our institution and admitted to the Trauma Resuscitation Unit, he was subjected to multiple injuries. After he was stabilized, whole computerized topographic spinal scan was performed on the same day which accurately delineated the multiple spinal injuries. MRI was also done on the same day as he was having neurological deficit. The mild occipito-cervical junction injury along with the C2 tear drop fracture was managed non-operatively. Definitive operative management of the serious complicated thoraco- lumbar junction and lumbo-sacral

***1** Spine-ortho, Faculty of Medicine, An-Najah National University, Nablus, Palestine. **2** Division of Orthopaedics, Spine Program, Department of Surgery, University of Western Ontario, London Health Science Center, Victoria Hospital, London, Canada. **N.B:** study was accomplished at 2*

** Corresponding author email: k.issa@najah.edu*

junction injuries was done on the next day of injury. Post operative exercises were started and Rehabilitation program was started after 3 weeks of his injury. The occipital condyle fracture which would probably been easily missed without this protocol was managed none surgically

Significant neurological improvement occurred as he improved from four to sixteen on the motor score. His back pain improved significantly and rehabilitation program was enabled to be starting early enough to ensure recovery. No injuries were missed in the initial patient evaluation

CASE REPORT:

A 36 year old male presented to the emergency room after being ejected forty feet from a snowmobile. He conveyed a short loss of consciousness and some amnesia surrounding the event. The trauma service initiating the ATLS protocol determined that he was stable following primary survey. The secondary survey demonstrated midline thoracolumbar tenderness as well as multiple skin lacerations, an obvious deformity of the right mid tibia, and significant right rib cage tenderness. A detailed neurological exam demonstrated sensation loss below L3 bilaterally and 1/5 strength in the hip flexors and knee extensors, with no motor function in the distal myotomes bilaterally. He had no rectal tone and his bulbocavernous reflex was intact.

CT diagnosed a right occipital condyle avulsion fracture, small C2 extension tear drop fracture, multiple thoracic spinous process fractures, a T12-L1 flexion-distraction injury with an associated L1 burst fracture, and an L5-S1 spondylolesthesis secondary to a bilateral facet fracture dislocation and associated L5 burst fracture. MRI confirmed the above mentioned spinal injuries and demonstrated severe thecal sac compression at the T12-L1 level secondary to a combination of retro pulsed bone and a dorsal epidural hematoma, in association with increased signal in the adjacent conus medullaris.

Associated injuries included multiple right rib fractures, small retroperitoneal bleed, closed right tibial shaft, tibial plateau, and patellar fractures, right ankle and undisplaced talar neck fracture.

Surgical Treatment:

Approximately twenty-four hours following the accident the patient underwent surgical treatment of his thoracolumbar and lumbosacral injuries. The patient was positioned prone on the Jackson frame OSI bed. Intra-operative fluoroscopy revealed a well aligned thoracolumbar junction following positioning, while the lumbosacral junction remained anterolisthesed. A large posterior skin incision was made from the mid lower thoracic region to the sacrum. Working simultaneously with two Cell Saver suction tips and two electro-cautary units the thoracolumbar junction was exposed from T10 to L3, followed by the lumbosacral junction. Across the thoracolumbar junction 6.5mm pedicle screws were placed two levels above and two levels below L1. As the overall alignment of the thoracolumbar junction was close to anatomic, rods were placed so to not exact any further reduction. A direct decompression was not performed as we felt the spinal cord injury was complete and radiographically no significant retropulsion remained. Local autogenous bone graft was placed to facilitate a thoracolumbar fusion.

At the L5-S1 junction, it was quite evident that there remained a dislocation with bilateral empty superior S1 facets, a locked right and floating left inferior L5 facet. Using fluoroscopic guidance 6.5mm and 7.5mm pedicle screw were secured into L5 an S1 respectively. By Distracting between L5 and S1 while simultaneously applying a posterior directed translational force through the L5 screws an acceptable reduction at the L5-S1 junction was obtained. We then performed a L5-S1 PLIF (contact cages, synthesis) and asymmetrically compressed the right side relative to the left so to correct a remaining scoliotic deformity across the injured level. At the time of discectomy it was evident that the disc had been traumatically avulsed.

Post operative Course:

The patient was managed in a sternal-occipital-manibular orthosis for eight weeks to protect his occipital avulsion fracture. A post-operative CT of the thoracolumbar spine was performed to confirm that there remained no dural sac compression following the indirect decompression. Following a three week, uncomplicated acute hospital stay, the patient was transferred to the regional spinal cord injury rehabilitation program for an additional 8 week admission prior to being discharged home.

Over the 12 month postoperative period the patient has demonstrated a progressive neurologic improvement in his hip flexors and knee extensors. At the one month post operative point his strength in these muscles had improved to 3/5 and by 12 months he had almost full strength (4+/5). Although he denies sensation, he does obtain routine and spontaneous bowel and bladder evacuation with minimal episodes of incontinence. Although he complains of no neck or back pain after the initial few weeks had elapsed, he remains on short and long acting narcotics. Likewise he denies any significant neuropathic pain but persists in taking low dose Gabapentin. All radiographic parameters have remained preserved through the 12 month post operative course.

DISCUSSION:

This report describes a unique case of a patient who has sustained multiple, non contagious significant spinal injuries, all occurring at junctional levels. It is well recognized that a high index of suspicion for non contagious spinal injuries should be maintained in the setting of high energy trauma. Hunderson et al[11] showed that 15% of spinal fractures are multiple and that

	Pre operative	6 Month. Post op.	12 Month Post op.
Body height Loss of L1	40 %	10 %	10%
Thoraco-lumbar sagittal alignment (cobb angle)	20 deg.	3.0 deg.	3.0 deg.
Motor score	4	16	16
Lumbosacral anterior slip	40%	Reduced	Reduced

Table1: *summarizes the patients' pre and post operative parameters.*

the incidence of non contagious spinal injuries is increasing. Almost half of these are associated with an ejection from a motor vehicle; demonstrating the association with high energy trauma. It is being advocated that because of the high incidence of concomitant spinal injury at noncontiguous levels, in case of an established spinal injury, the whole spine should be imaged.[2,12,13]

Junctional spinal levels, particularly the cervico-thoracic and thoraco-lumbar, are predisposed to significant injuries. This principally occurs because they represent transition zones between regions of differing relative mobility. Considering the thoracolumbar spine for example, the increased stiffness in the sagittal plane of the thoracic spine relative to the lumbar spine creates a long moment arm with a fulcrum of rotation at the junction. Furthermore, the thoracolumbar spine represents the transition in sagittal alignment and facet orientation. Therefore, following high energy trauma, junctional levels are frequently the location of severe injuries such as flexion-distraction or fracture-dislocations.

This patient sustained a unique noncontiguous injury at the occipital-cervical, thoraco-lumbar, and lumbo-sacral junctions. At the occipital-cervical level, his type III occipital condyle fracture represented potential occipital-cervical instability. Although an occipital-cervical dislocation is a relatively rare phenomenon, other injuries which may be seen in association and occur from a similar mechanism of injury are not. Typical injuries are avulsion fractures which include type III occipital condyle fractures (alar ligament avulsion), and type I odontoid fractures (apical ligament avulsions). For this reason, type III occipital condyle fractures must be differentiated from other types and treated with more vigilance. This patient was immobilized for 8 weeks and then had flexion-extension x-rays performed to exclude associated instability.

The thoraco-lumbar junctional injury this patient sustained was complex because it included a combination of a burst fracture and flexion-distraction injury. Fractures in the thoracic and lumbar region are typically described based on the number of columns that are involved. Denis et al popularized the three column theory which divided the vertebral body equally into anterior and middle columns, and the posterior elements, including the pedicles, into the posterior column. At one time a burst fracture, defined as a compression fracture of the anterior and middle vertebral columns with associated retropulsion of vertebral body fragment into the spinal canal,[2,14] was defined as unstable. However, James et al demonstrated that the posterior column had to be incompetent to produce true mechanical instability. Magerl's comprehensive classification of thoracolumbar spine injuries[15] is defined by mechanism of injury. A distraction injury to the posterior column (type B injury) is the most important mechanism of injury in this patient, as it produces the unstable fracture pattern. As a compression force also produced a burst fracture (type A injury), the patient would be classified as having a B + A injury, thus demonstrating the complexity of the injury. Vaccaro *et al* recently advocated a new system for classification of TL injuries (Thoracolumbar Injury Severity Score Classification System) TLICS that aimed mainly to aid the facilitation of surgical versus non surgical mode of management of this injury. The system was further reviewed and tested for reliability and reproducibility and concluded to be highly reliable and advocated for daily use.[16,17,18] In view of this classification system which advocates surgical intervention for patients having more than 4 points, our patient collected the total of 9 points (table 2).

Description	Points
Injury Mechanism: Distraction.	4
PLC Status: Injured.	3
Neurological Status: complete Conus Injury.	2
Total Points	9

Table2: *Thoracolumbar Injury Severity Score Classification System (TLICS) of the patient.*

The goals of treatment in thoracolumbar fractures are restoring vertebral column stability and obtaining spinal canal decompression, leading to early mobilization of the patient. Treatment of thoracolumbar burst fractures remains a controversial issue.[19] In this patient, we choose to do a posterior reduction and stabilization technique. Because of the vertebral body comminution and height loss, short segment (pedicle screws one level above and below the fractured level) instrumentation without anterior/middle column reconstruction would risk a high failure rate. Furthermore, as the neurological injury was complete, implying a low likelihood of functional neurologic improvement, we did not consider it necessary to perform a direct decompression by removing the retropulsed vertebral body. Therefore, a four level pedicle screw construct and indirect decompression was performed. However, the drawback to this approach is that fewer motion segments remain functioning, and in combination with the L5-S1 fusion, creates concern about adjacent segment disease in the future.[20]

Because of its rarity, mostly single case reports are found in the literature regarding traumatic lumbosacral dislocation which is often characterized by a fracture dislocation of L5-S1 articular facets associated with anterior L5 slipping. A multi central study of 11 cases was first time conducted by Vialle et al[10] and was done over 14 years showed that traumatic lumbosacral dislocations are rare injuries always associated with high-energy trauma, associated neurological impairment was frequently found in those patients.

High energy accident victims should always be taken seriously regarding their spine injury with high consideration of the multiplicity of these injuries and their seriousness. Precise early diagnosis and definitive management of such injuries helps enhancing improvement and gives rehabilitation its feasibility and success.

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