Topics in diagnostic imaging

Two-level traumatic lateral lumbar fracture and dislocation in a heavy equipment operator: a case report

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Abstract

Objective: Lumbar fracture-dislocations are rare and invariably due to high-energy trauma. The purpose of this study is to report the surgical management of a man with lateral lumbar dislocations in 2 noncontiguous lesions.

Clinical features: A 49-year-old Asian man was crushed by a bulldozer. The patient was transported to a major medical center where he was found to be conscious, and the primary spinal injuries were fracture-dislocation of L1-L2 and L4-L5. His preoperative neurologic status showed a partial paraparesis to all motor groups of the lower extremities bilaterally. His radiological and operative findings showed a rupture of the thoracolumbar fascia and latissimus dorsi muscle, left L1-L2 dislocated facet, right L4-5 facet fracture, and dural tear.

Intervention and outcome: The patient underwent a posterior reduction, decompression, instrumentation, and fusion surgery from T12 to S1 with autologous bone graft and pedicle screw instrumentation. Postoperatively, his neurologic status improved, allowing him to be ambulatory using a Lofstrand crutch with improved lumbosacral alignment being well maintained. Two weeks postoperatively, the patient regained voluntary bowel and bladder function. At the 1-year follow-up evaluation, his motor power was full in the left leg; however, sensation to pin prick remained lost on the right L5 and S1 distributions. He continued to ambulate using a Lofstrand crutch.

Conclusion: Lateral lumbar fracture-dislocation at 2 noncontiguous levels is an unusual injury that results from high-energy trauma. Prompt recognition of the injuries, reduction of the fracture-dislocations, and posterior stabilization are recommended for neural decompression, spinal alignment, and long-term stabilization.

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Introduction

Multilevel but separated fracture-dislocation is a severe translational injury with disruption of all spinal elements.^{1,2} The thoracolumbar junction is the most common injury site for thoracic and lumbar trauma; however, lumbar fracture-dislocations are relatively rare and invariably due to high-energy trauma.³ Watson-Jones⁴ described the first traumatic spondylolisthesis case in 1940 and about a hundred cases have been reported since then.⁵⁻¹² But most of the reported cases are traumatic dislocations at the L5-S1 level. These injuries usually occur at a single level.^{7,13} Although double-level lateral lumbar dislocation was reported by a few authors,^{14,15} to our knowledge, the presence of lateral lumbar dislocations in double noncontiguous lesions has not been reported.

In light of the above, the purpose of this report is to describe a unique case of a patient with traumatic noncontiguous double fracture-dislocations of the lumbar spine at L1-2 and L4-5 including the etiology, evaluation, and surgical treatment. In addition, the purpose of this report is to inform clinicians about the possibility of this unusual injury.

Case report

A 47-year-old Asian man was the driver of heavy equipment. He was run over and thrown to the ground, and then crushed by the operating equipment. When he presented at the hospital, he complained of low back pain, numbness, and weakness in both lower extremities.

On physical examination, he demonstrated nontender touch to the sternum, the clavicles, the pelvis, and both the upper and the lower extremities bilaterally. His pelvis was stable to stresses, and he had no hip pain. On neurological examination, hypoactivity of both patellar reflexes and left Achilles reflex was found. Right Achilles reflex was absent. The strength of the left lower limb was 3/5, whereas the motor strength in the right lower extremity was 2/5 throughout with the exception of the muscles innervated by the L5 and S1 nerves, which was 0/5. He had decreased, but not flaccid, rectal tone and a positive bulbocavernosus reflex. Sensation was reduced to pin prick below L1 level and lost on the right L5 and S1 distributions. There was some preserved perianal sensation to pin, but voluntary rectal tone was very weak. A bladder catheter was inserted.

Radiographic examination and computed tomography of the lumbar spine (Fig 1) revealed laterolisthesis at the L1-2 and L4-5. Also, there were fractures that involved the right 12th rib, right transverse processes of Th12 through L4, left transverse processes of L2 through L5, and left superior articular process of L5. There was no evidence of any cervical spinal injury. Because of the severity of the trauma, an urgent computed tomography scan of his thorax and abdomen with contrast material was performed. The computed tomography scan revealed no evidence of any vascular or visceral injury except for right thin pleural effusion.

After the examination, he was taken to the operating room for open reduction of the L1-L2 and L4-L5 fracture-dislocations on day of injury. A midline incision was made from the T12 level to the sacrum. In superficial and deep dissection onto the lumbar spine, large amount of somewhat liquefied hematoma and the rupture of thoracolumbar fascia and latissimus dorsi muscle were noted. After that, preliminary reduction of L1-2 and L4-5 was achieved by lifting up with the superior vertebra with a laminar developer to line up with the inferior vertebra. Using fluoroscopy, uniaxial pedicle screws were placed at T12-S1. Reduction was maintained by holding spinous processes. The pedicle screws were connected to 2 rods with Kaneda anterior posterior spinal system (KAPSS, Tech Industries Inc, Cleveland, Ohio). A laminectomy from T12-L5 was performed. There was the dural tear at the L4/5 level, and L5 and S1 roots were not found. Remarkably, there was no cerebrospinal fluid leakage. Autologous corticocancellous bone grafts from the decompression material were applied to the decorticated posterolateral elements to achieve high degree of stability and fusion rate. Drainage tubes were placed, and the wound was closed in layers. The final construct is shown in Fig 2.

After surgery, the patients' neurological status showed improvement after the operation; and intervention by physical therapist for rehabilitation was started on the day following the operation. The patient was able to maintain upright position with support on day 3. The wound healed without other complications. A rigid back brace was used for 2 months.

The patient demonstrated marked improvement of muscle strength in the lower extremities with the exception of a right complete foot drop due to dysfunction of muscle innervated by right L5 and S1 nerves. At the 1-year follow-up evaluation, his motor power was full in the left leg. On the right, motor power was as follows (muscle grade): hip extensors 4/5, hip flexor 4/5, knee extension 4/5, knee flexion 4/5, ankle dorsiflexion and extensor hallucis longus 0/5, and

Fig 1. Preoperative CT showed L1-L2 and L4-L5 lateral fracture-dislocations. L1 showed right lateral listhesis with right-sided perched facet and left-sided facet fracture; L4 showed left lateral listhesis with right-sided facet fracture and left-sided facet dislocation.

plantar flexion 0/5. He was ambulating using Lofstrand crutch. Sensation to pin prick remained lost on the right L5 and S1 distributions. The patient regained voluntary bowel and bladder function at 2 weeks postoperatively. At the time of writing this report, his radiographs demonstrated an anatomically aligned spine with intact instrumentation and a presumed solid spinal fusion.

Written informed consent was obtained from the patient for publication of this case report and accompanying images. The protocols for human procedures used in this study were approved by the ethics committee of our institution.

Discussion

Fracture-dislocations of the lumbar spine are invariably due to high-energy trauma and uncommon.^{1,8} Although “en bloc” lumbar segmental fracture,^{3,16,17} lateral lumbosacral dislocations,¹¹ and double-level fracture-dislocations lumbosacral spine¹² have been reported, there are no cases in which lateral lumbar dislocations at more than 1 junction have been described. To our knowledge, this is the first case report of the presence of lateral lumbar dislocations in 2 noncontiguous lesions.

Many classification schemes have been developed to guide clinical and surgical treatment of thoracolumbar spinal trauma. Commonly used classifications include the Denis system,¹ based on the “three column concept,” and the Magerl classification¹⁷, also known as the *AO Spine* system (ie, *AO* is from the AO Foundation, *AO* was originally from the German *Arbeitsgemeinschaft für Osteosynthesefragen*).

Fig 2. Postoperative plain film radiograph.

Although easily reproduced and with good acceptance in many centers, the Denis system is not detailed enough to account for all fracture types. The AO classification has yielded low observer agreement because of its complexity.¹⁸ The Thoracolumbar Injury Classification System^{19,20} was created to address the shortcomings that have hampered these systems. Aebi²¹ also describes a new classification of injuries to the spine based upon the severity of the injury, leading to suggestion of treatment modality. In this context, case-by-case management should be considered.²²

Fracture-dislocations of the lumbar spine are extremely unstable and complex lesions and can result in subsequent compression of the spinal cord, conus medullaris, and/or the cauda equine.⁹ The high-energy nature of this injury requires a thorough evaluation for bony and soft tissue injuries, neurologic status, and a critical determinant of surgical decision making. Preoperative neurologic status of the present case showed a partial paraparesis of the lower extremities bilaterally including right side L5, S1 paralysis. The initial imaging workup showed L1-2 right lateral listhesis with right-sided perched facet and left-sided facet fracture, L4-5 left lateral listhesis with right-sided facet fracture and left-sided facet dislocation, L1 (Denis type C), L5 (Denis type B) burst fracture, bilateral thoracolumbar transverse process fractures, and right thin pleural effusion. Intraoperative findings revealed complete dissection of the overlying soft tissues and paraspinal musculature and disruption of right L5, S1 nerve roots.

Fracture-dislocations are further characterized into shear, flexion-rotation, or flexion-distraction classes. There are several reports of traumatic lateral lumbar dislocation, which is mostly the result of tremendous lateral shearing forces.^{4,9} Although the unique injury pattern observed in our patient makes it difficult for us to know the exact mechanism of injury and whether fracture-dislocations at L1-2 and L4-5 occurred simultaneously or in sequence, multiple other vector forces must be at play, including distraction, lateral shear, and axial loading at the time of injury. A variable combination of mechanisms may have been involved in producing this specific injury. The patient in the present case was found to have rotational lateral dislocations with/without articular process fracture, burst fractures of the involved spine, transverse process fractures, and nerve root avulsion. This suggests a combination of compressive force and axial torque that leads to this flexion compression and rotational injury. Absence of isolated or multiple

compression/burst fracture may indicate that axial loading has little to do with this injury.

The treatment goals for patients with lumbar spinal injuries are to maintain or restore spinal alignment and stability, preserve neurologic function, assist appropriate management of other injuries, mobilize the patient, and start rehabilitation as soon as possible.^{23,24} Therefore, an early diagnosis and appropriate management are required when treating these cases.⁴

Nonoperative, postsurgical treatment of traumatic spinal injury may include a custom brace or cast, bed rest, or limited activity. Conservative treatment of fracture-dislocation of lumbar lesion is generally not effective because the lesion is fundamentally unstable.^{25,26} Therefore, surgical fixation is especially encouraged to provide decompression of neural structures, reduction, and stable fixation of the fracture-dislocation. Urgent and comprehensive treatment of this type of injury facilitates patient's early mobility that enables early discharge and improves neurological recovery.

Surgical treatment of traumatic spinal fractures can be effective and may achieve better functional outcomes than was earlier believed.²⁷ Current recommendations for treating are operative reduction and internal fixation with instrumentation through a posterior approach in these severe lesions.^{16,28} It is certainly debatable that other surgical treatment approaches could have been used, including consideration for circumferential treatment of both at L1-2 and L4-5 alone, double-segment fusion at Th12-L2 and L3-5, or a long instrumentation with short fusion only including L1-2 and L4-5 posteriorly. A long instrumentation with fusion at Th12-S1 was performed for the patient reported in this case because of the need to provide rigid fixation. An important factor we feel was important in the patient's recovery was early management with simultaneous surgical intervention that allowed prompt mobilization and more rapid initiation of rehabilitation.

Conclusion

A patient who presented with lateral lumbar fracture-dislocations at 2 noncontiguous levels responded positively with surgical posterior reduction and fixation. After surgery, his neurological status improved; and he was able to walk with a support of crutch. We recommend that immediate surgical fixation is required

for a patient with such an injury to achieve prompt mobility and rapid rehabilitation.

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