Case Report | Journal of Orthopaedic Case Reports 2024 October:14(10):Page 84-89

L4-L5 Facet Dislocation Treated in a Delayed Fashion with Excellent Early Clinical Results

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Learning Point of the Article:

Delayed surgical intervention may be a viable treatment strategy for acute traumatic lumbar facet dislocations in neurologically intact patients when medical comorbidities complicate immediate surgical fixation.

Abstract

Introduction: Introduction: Lumbar facet fracture-dislocations are rare injuries that are generated from a significant trauma. Literature regarding these injuries is limited to case reports, and there are even more limited reports concerning whether the delay of operative intervention in neurologically intact patients can achieve good clinical results if concomitant injuries and/or medical issues preclude urgent operative intervention. There has been no consensus on which operative techniques are effective in achieving an anatomic reduction of these injuries.

Objectives: A case report of an L4-L5 facet fracture-dislocation with delayed operative intervention and previously not reported adjunctive reduction technique is presented with an excellent clinical outcome result being achieved.

Case Report: A 38-year-old female who presented with an L4-L5 facet fracture-dislocation without neurological deficit after an unknown mechanism of injury. Due to concerns for elevated risk of intra and perioperative complications from general anesthesia secondary to recent drug use, the patient ultimately underwent open reduction and L4-L5 posterior instrumentation and fusion, with a resection of the superior aspect of the L5 pedicle being performed to help achieve reduction. The patient did not report any significant lower back pain and remained motor intact at 6-month post-operative, with the only neurological symptom during her post-operative course being hypesthesias in the right L5 dermatome at 6-week post-operative.

Conclusion: Excellent clinical results can be achieved with delayed open reduction and posterior stabilization in patients that sustain lumbar facet-fracture dislocations. The precise timing for operative management for patients who sustain these injuries is unknown, but medical stability should be considered before proceeding with an operative intervention in neurological intact patients. Partial resection of the pedicle is a safe and effective reduction technique in certain fracture-dislocation patterns.

Keywords: Lumbar facet, fracture-dislocation, posterior spinal fusion.

Introduction

Traumatic dislocations of the lumbar spine are rare injuries associated with major trauma. The majority of existing literature regarding the management of these injuries is limited to case reports [1-9]. Most published case reports describe urgent stabilization of these injuries [1, 3, 4, 6], with only a few that describe delayed surgical intervention due to either delay in presentation or patient refusal of operative intervention [7-9]. At present, there is no consensus about the timing of operative intervention for traumatic dislocation injuries if there are concomitant injuries and/or medical issues that may preclude urgent operative intervention. In addition, there is no agreement on the most reliable operative technique to obtain an anatomic reduction of these injuries.

Access this article online

Website: www.jocr.co.in

DOI: https://doi.org/10.13107/jocr.2024.v14.i10.4820

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Submitted: 04/07/2024; Review: 20/08/2024; Accepted: September 2024; Published: October 2024

DOI: https://doi.org/10.13107/jocr.2024.v14.i10.4820

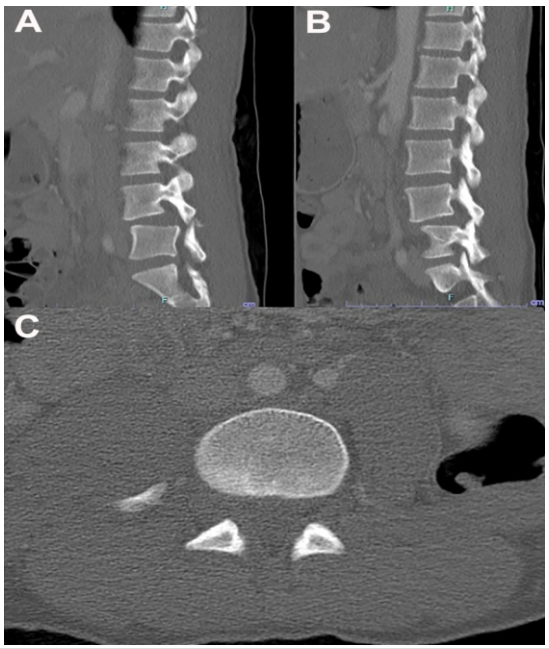

Figure 1: Preoperative initial computed tomography (CT) imaging of the patient. CT imaging demonstrates a right L4-L5 facet dislocation with a small associated right L5 superior articular process fracture [A] and a left L4-L5 perched facet without associated fracture [B]. Axial CT-imaging at the L4-L5 facet dislocation demonstrates an empty facet sign [C].

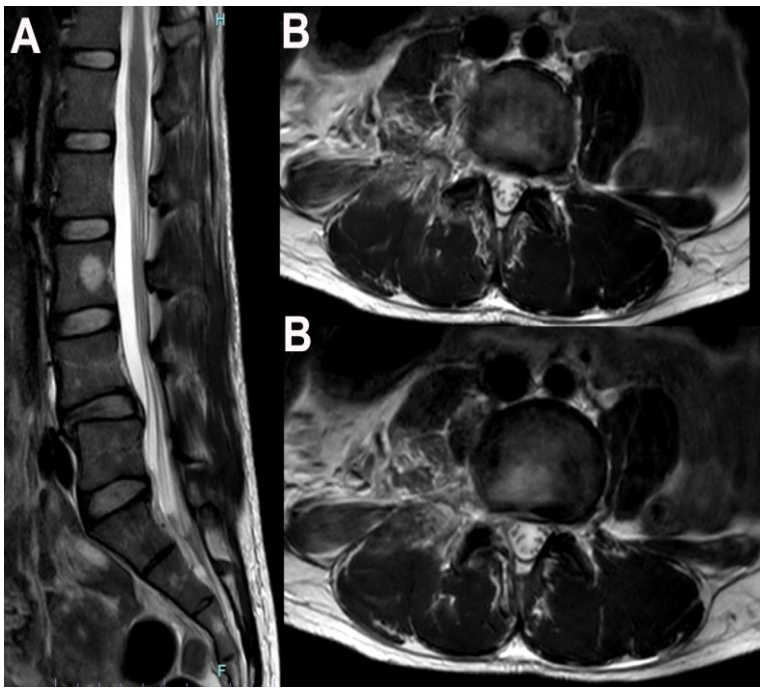

Figure 2: Preoperative magnetic resonance imaging (MRI) imaging of the patient. Sagittal (a) and coronal (b) T2-weighted MRI imaging demonstrates anterior and posterior disc protrusions and bilateral foraminal morphological changes at L4-L5.

We present a case report of an isolated, traumatic L4-L5 lumbar facet dislocation that was managed in a delayed fashion (>48 h from presentation) which required a partial pedicle resection to achieve a reduction. The patient provided written informed consent for publication of this article. We also review the existing literature regarding these rare injuries.

Case Report

A 38-year-old intoxicated female was discovered in her vehicle with complaints of severe lower back pain. The patient did not remember any specific events of the prior night other than getting her vehicle stuck in the mud while trying to drive home. She was transported to an outside facility where computed tomography (CT) imaging demonstrated a right L4-L5 facet dislocation, left L4-L5 perched facet, and associated right L3-L5 transverse process fractures.

The patient was subsequently transferred to our institution for management of her lumbar spine injuries. On presentation to our hospital, she was found to have intact strength in all motor groups in the bilateral lower extremities but did exhibit episodic lower extremity paresthesias. The patient did not have saddle anesthesia, bowel or bladder incontinence, or difficulties with voiding. She was hemodynamically stable, had a Glasgow coma scale of 15, and displayed no external signs of significant trauma upon initial presentation. The urine drug screen performed was positive for amphetamines, cannabinoids, cocaine, opioids, and fentanyl.

A review of CT imaging of the lumbar spine demonstrated a right L4 -L5 facet dislocation with a small right L5 superior articular process fracture and a left L4-L5 perched facet with 20% anterolisthesis of L4 on L5. There was focal kyphosis of approximately 13° through the dislocated segment (Fig. 1). CT imaging of the cervical and thoracic spine did not demonstrate any evidence of an acute injury. On additional review of CT imaging of the head, thorax, abdomen, and pelvis from the outside facility, the only other pertinent finding was a large retroperitoneal hematoma which was deemed non-operative by our general surgery trauma service. Magnetic resonance imaging (MRI) of the lumbar spine demonstrated L4-L5 disc herniation with stenosis of the bilateral neuroforamina (Fig. 2). The MRI of the cervical and thoracic spine did not display any evidence of an acute injury. The patient was initially admitted to the general surgery trauma service for a period of uneventful observation before being transferred to the orthopedic spine service.

Surgery was indicated for an open reduction and posterior fusion from L4 to L5. Risks, benefits, and alternatives were reviewed with the patient and informed consent was obtained. The surgical intervention initially was planned within 24 h of presentation. However, due to the urine-drug screen being

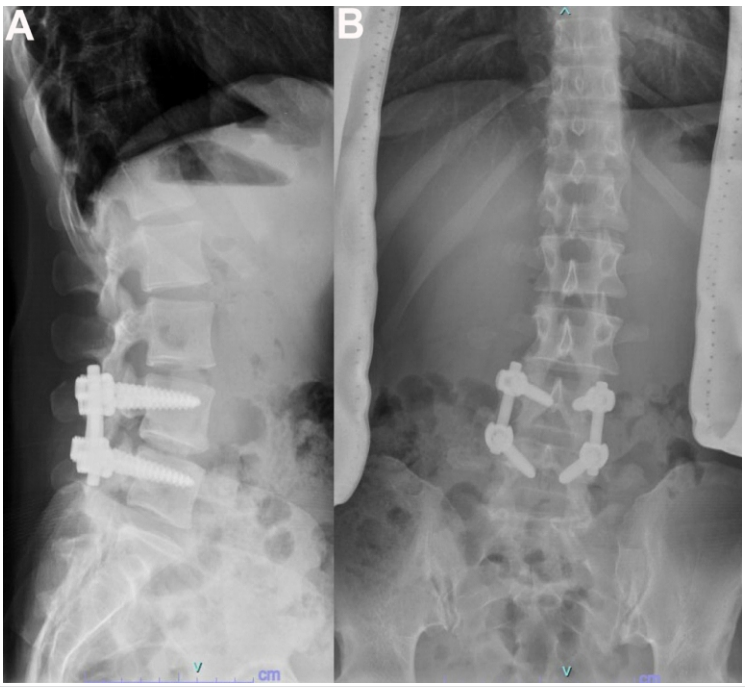

Figure 3: Post-operative radiographs of patient. Lateral (A) and anterior-posterior radiographs (B) of the patient approximately 6 weeks post-operatively, demonstrated reduction was maintained. There was no evidence of hardware failure. The patient's pedicle screws were appropriately positioned with no evidence of hardware failure.

positive for amphetamines, the anesthesiology team requested to delay operative intervention for several days. Studies detailing pre-operative complications associated with amphetamine use before undergoing orthopedic surgery are limited [10, 11]. There is evidence to suggest the use of amphetamines within 7 days of undergoing surgery can increase the risk of intraoperative hemodynamic instability [12]. Since the patient was neurologically intact, hemodynamically stable, and did not endorse any neurological symptoms apart from periodic lower extremity paresthesias, delaying operative intervention with close neurological monitoring including q4 neurological examinations was deemed a reasonable management strategy. The patient's neurological examination was monitored serially over the ensuing days, with the understanding that any deterioration of her neurological examination would necessitate urgent operative intervention.

Ultimately, the patient was brought to the operating room 4 days after her initial presentation after a discussion with the anesthesiology team about their concerns regarding perioperative cardiovascular complications given the patient's recent amphetamine use. The patient's subjective episodic lower extremity paresthesias persisted; however, the patient remained otherwise neurologically intact throughout her hospital course before operative intervention.

Procedure

The patient was placed prone on a flat Jackson table and was prepped and draped in standard fashion. Neuromonitoring was utilized throughout the procedure and perioperative antibiotics were administered. A posterior lumbar incision centered over L4-L5 was carried down to the posterior elements. The right L4-L5 facet dislocation was identified as well as the right L4 and L5 transverse process fractures. The ligamentum flavum, inter-, and supra-spinous ligaments at that level were also completely disrupted. Transfacet decompression was performed on the right, with a facetectomy being performed by resecting the inferior articular process of L4 and the superior articular process of L5. After we resected the facet, the level collapsed, such that the inferior endplate of L4 was locked on the superior aspect of the L5 pedicle, thereby preventing complete reduction. In hindsight, the asymmetric collapse was likely related to the left-sided facet remaining perched at this point in the procedure. At that time, it was decided to proceed with resection of the cranial third of the right L5 pedicle. This allowed for a complete reduction of the patient's dislocation, including the left-sided perched facet. Anatomic reduction of the dislocation was confirmed with intra-operative fluoroscopy.

Bilateral pedicle screws were then placed at L4 and L5 under fluoroscopy. The L5 pedicle was large, which allowed for screw placement inferior to the previously resected cranial portion of the L5 pedicle. Next, rods were placed, locked, and tightened. Autograft from decortication of the exposed posterior elements in addition to demineralized bone graft was used to create a suitable fusion bed. The patient's wound was copiously irrigated, and vancomycin powder was placed in the sub- and supra-fascial planes. Multilayer closure was then performed including closure of the fascia, subcutaneous tissues, and skin. After an uneventful extubation, the patient was transferred to the post-anesthesia care unit in stable condition.

There were no major post-operative complications and the patient's overall hospital stay was uneventful. The patient was given a thoraco-lumbo-sacral orthosis (TLSO) brace to assist with pain control and ambulation postoperatively. The patient was able to ambulate immediately postoperatively and was discharged from the hospital 3 days after surgery.

Follow-up

The patient was seen for outpatient follow-up at regular post-operative visits. She was most recently seen for her 6-month post-operative visit. At that time, she was doing very well. Pain was well controlled, and she was finishing up her course of

Case	Age/sex and mechanism	Bony and soft tissue injuries	Neurological status	Time until the operative intervention	Operative intervention	Follow-up
Mori et al. [9]	32 F Head on MVA	L4-L5 bilateral facet dislocation, right L4-L5 TP fractures, PLL, facet capsule, supra- and interspinous ligaments, ligamentum flavum rupture	No neurologic deficits	2 weeks	L5 superior facet resection, L4-L5 posterior pedicle screw fixation, and posterior interbody fusion	1.5 years with no back pain or neurological symptoms
Deniz et al. [7]	44 M Fall off tractor	Bilateral L4-L5 facet dislocation, bilateral L4 inferior articular process fractures, L4-L5 foraminal disc herniation	Bilateral lower extremity numbness and weakness	4 months due to patient refusal	Decompression with discectomy, posterolateral fusion L3-L5 with interbody fusion L4-L5	3 months with no lower back pain or neurological symptoms
Zenonos et al.[6]	36 M Head on MVC	L4-L5 bilateral facet dislocations, right L5 superior articular process fracture, right L1-L5 TP fractures, L5 vertebral body fracture, L4 spinous process fracture, rupture of L4-L5 disc, ALL, PLL L3S1 interspinousand supraspinous ligaments	No neurologic deficits	1 day	L5 pars, superior articular facets, and laminectomy L3-S1 PSF	3 months being neurologically intact and no lower back pain
Im et al. [5]	37 M Pinned by 2000 kg iron plate	L4-L5 bilateral facet dislocations, L4-L5 disc rupture, supra- and interspinous ligament tears, ligamentum flavum tear	Right posterolateral thigh numbness, 4/5 strength in ankles and toes bilaterally	Not reported	Resection of L5 superior facets, L4 laminectomy, PSF from L4-L5 with interbody cage	6 months with no lower back pain and no neurological symptoms
Fok and Cheung [3]	40 M Fall from height onto the metal bar	Grade II traumatic spondylolisthesis L4-L5, bilateral L4-L5 facet dislocations, left L1-L4 TP fractures, left L4 Pedicle, L4 spinous process, L4 vertebral body with retropulsion	Cauda equina syndrome with Grade 2/5 hip flexion and knee extension, Grade 0/5 ankle and toe dorsiflexion, absent sensation L5-S1 bilaterally, absent anal sphincter tone	6 h	L3-L5 laminectomy, L3-L5 PSF	9 months with intact rectal tone and able to walk, full neurologic recovery in RLE, Grade 2/5 weakness in left ankle and toes
Song and Lee [1]	47 F Head on MVA	Bilateral L4-L5 facet dislocation, left L5 TP fracture, L5 vertebral body PLL rupture, facet capsule disruption	No neurological deficits	Immediate	Open reduction, laminectomy L4-L5, posterior interbody fusion L4-L5	10 months with fusion achieved
Park et al. [8]	34 F Head on MVC	Left L5 superior articular facet fracture and PLC injury with delayed dislocation of bilateral L4-L5 facets	No neurological deficits	3 months due to delayed dislocation of lumbar facets	Resection of L5 superior articular facet, L4-L5 interbody fusion	1 year with no lower back pain and neurologically intact
Cho et al. [2]	35 M High-Speed MVA	Left L4-L5 facet dislocation, L1-L5 TP fractures, ALL, PLL, and intervertebral disc ruptures	No neurological deficits	Not Reported	Resection of left L4 inferior and L5 superior articular processes, L4-L5 PSF	No new neurological deficits were reported post-operatively
Nakao and Kajino [4]	49 M Crushed by Bulldozer	Left L1-L2 facet dislocation, right L4L5 facet dislocation, right TP T12-L4, left L2-L5 TP, left superior articular process L5, rupture of thoracolumbar fascia, dural tear, avulsion L5-S1 nerve roots	Absent L5-S1 sensorimotor function Grade 3/5 in remaining LLE, Grade 2/5 remaining RLE, decreased rectal tone, reduction sensation below L1	Urgently upon presentation (<24 h)	Posterior spinal fusion from T12-S1	1 year with right foot drop, Grade 4/5 in remainder of RLE, numbness in L5-S bilaterally, preserved bowel and bladder function

MVA: Motor vehicle accident, MVC: Motor vehicle crash, TP: Transverse process, ALL: Anterior longitudinal ligament, PLL: Post erior longitudinal ligament, PLC: Posterior ligamentous complex, LLE: Left lower extremity, RLE: Right lower extremity, PSF: Posterior spinal fusion

Table 1: Case reports of lumbar facet dislocations with patient and injury demographics, timing, technique of operative intervention, and clinical outcome.

physical therapy. She was able to ambulate without the use of any assistive devices and has been completely weaned off her TLSO brace. No other complaints were noted at this visit. She was neurovascularly intact in the bilateral lower extremities. X-ray imaging demonstrated stable L4-L5 posterior instrumentation, without evidence of hardware failure and maintenance of reduction of her L4-L5 facet dislocation (Fig. 3).

Discussion

Dislocations of the lumbar spine are extremely rare injuries and literature regarding these injuries is limited primarily to case reports. This is because an extremely large flexion distraction force is required to overcome the strong stabilizing ligaments of the lumbar spine, large vertebral bodies, and more sagittal-oriented lumbar facets. Therefore, in patients presenting with high-energy trauma mechanisms, a diligent physical examination and review of advanced imaging are paramount to diagnosing lumbar facet dislocations which may not always present with a neurological deficit. Typically, a CT scan is the modality of choice for diagnosis which demonstrates a "naked facet sign" or "reverse hamburger sign" where the superior facet of the caudal vertebrae does not have the corresponding inferior facet of the cranial vertebrae above it. The current dogma is for prompt operative intervention in the form of an open reduction with instrumented fusion, and possible interbody fusion which has achieved favorable clinical outcomes in patients (Table 1).

However, the majority of the current literature is predominantly limited to lumbosacral facet dislocations, which are much more

common likely secondary to the fact that the lumbosacral junction is a transition zone with more motion, more prone to traumatic injury, and slightly more coronal orientation when compared to the lumbar facets [13-22]. Similar to lumbar facet dislocations, good early clinical results can be achieved with open reduction and posterior spinal fusion [10-19].

There are few reports of acute lumbar facet dislocations that have been treated in a non-emergent/non-urgent fashion. Like our case, Park et al. [8] reported on the treatment of a patient who presented with an L5 left superior articular process fracture without dislocation/subluxation of the facet joint and associated posterolateral corner injury injury after a head-on motor vehicle collision. As there was no evidence of facet dislocation nor kyphotic deformity based on CT imaging, the patient was initially treated conservatively for 3 months, with the first 3 weeks of treatment consisting of absolute bed rest. Afterward, the patient was permitted to ambulate as tolerated with a lumbosacral orthosis. Despite this, the patient continued to have persistent and severe lower back pain. Repeat CT and MRI imaging demonstrated a locked L4-L5 facet, kyphotic deformity, and ruptured intervertebral disk with mild compression of the L5 nerve root. The patient subsequently had an open reduction and posterior instrumented fusion from L4-L5 and was discharged without neurological deficits [8].

The ideal surgical technique for the reduction of these rare injuries is yet to be determined, but partial resection of the articular processes at the involved vertebral levels has provided an effective method to achieve the required distraction, disimpaction, and subsequent reduction [1-9]. In our case, the delayed presentation to the operating room may have been one reason that facetectomies alone are insufficient for obtaining the necessary distraction. As a result, we resected the superior aspect of the L5 pedicle in addition to the facetectomies to achieve reduction. Based on this patient's excellent early clinical outcome assessment, this appears to be a safe and viable adjunctive reduction technique. Prior case series have demonstrated that pediculectomies are an effective option to reduce thoracolumbar burst fractures, but currently, there are no reports of this technique being used for the reduction of lumbar facet dislocations [23, 24]. In addition, there is no consensus on which instrumentation construct maximizes the potential for fusion, although both interbody and short-segment posterior fusion constructs have shown favorable clinical post-operative outcomes in presenting with lumbar facet dislocations [1-9].

Conclusion

Delayed surgical intervention may be a viable treatment strategy for acute traumatic lumbar facet dislocations in neurologically intact patients when medical comorbidities complicate immediate surgical fixation. Pedicle resection can be an effective adjunctive tool to help achieve an anatomic reduction in patients with these rare traumatic injuries. We achieved excellent clinical results with delayed open reduction and posterior stabilization in our patient who sustained a lumbar facet dislocation at L4/L5. The precise timing of operative management for patients who sustain these injuries is unknown, but medical stability should be considered before proceeding with operative intervention in neurologically intact patients.

Clinical Message

This case describes excellent early clinical results with a delayed adjunctive reduction technique not previously reported for the treatment of lumbar facet dislocations. The precise timing of operative management of these injuries is unknown, but medical stability should be considered before proceeding with operative intervention in neurologically intact patients.

Declaration of patient consent: The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient has given the consent for his/ her images and other clinical information to be reported in the journal. The patient understands that his/ her names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Conflict of interest: Nil **Source of support:** None

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Conflict of Interest: Nil
Source of Support: Nil

Consent: The authors confirm that informed consent was obtained from the patient for publication of this case report

How to Cite this Article

Meixner S, Adapa N, Lavelle W, Tallarico R. L4-L5 Facet Dislocation Treated in a Delayed Fashion with Excellent Early Clinical Results. Journal of Orthopaedic Case Reports 2024 October;14(10): 84-89.