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Cauda Equina Syndrome Following Interbody Cage Migration after Lumbar Fusion: A Rare Case Report

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Learning Point of the Article:

Larger Cage Footprint Improves Stability

The LTLIF cage provides wider endplate coverage, improving load distribution and reducing focal stress concentration on the vertebral endplates. This may reduce the risk of cage migration and cage subsidence.

Abstract

Introduction: Transforaminal lumbar interbody fusion (TLIF) is a widely accepted surgical technique for the management of degenerative lumbar spondylolisthesis. The procedure provides circumferential decompression, restoration of disc height, and segmental stabilization. Despite favorable outcomes, complications such as interbody cage migration or posterior cage back-out may occur compromise surgical success, necessitating revision surgery.

Case Report: We present the case of a 45-year-old male with symptomatic degenerative L4–L5 spondylolisthesis who underwent minimally invasive TLIF (MIS-TLIF) after failure of conservative treatment. Postoperatively, the patient developed posterior migration of the interbody cage with neural compression leading to Cauda Equina syndrome. Revision MIS-LTLIF (MIS-TLIF using a large-footprint cage) was performed with removal of the migrated cage of size 9 × 22 mm and insertion of a larger footprint interbody cage of size 10 × 40 mm following meticulous bilateral disc space clearance and endplate preparation. Post-revision surgery imaging demonstrated stable implant positioning, and the patient showed significant clinical improvement without further complications.

Conclusion: Interbody cage back-out following TLIF is a preventable complication. Inadequate disc space preparation and selection of a suboptimal cage footprint may significantly contribute to cage migration. Proper surgical technique and appropriate implant choice are essential to ensure construct stability and favorable clinical outcomes.

Keywords: Degenerative spondylolisthesis, transforaminal lumbar interbody fusion, LTLIF, cage migration, lumbar spine, revision spine surgery

Introduction

Degenerative lumbar spondylolisthesis is a common cause of low back pain and radiculopathy in adults, most frequently involving the L4–L5 motion segment. It results from progressive intervertebral disc degeneration, facet joint arthropathy, and ligamentous laxity, leading to anterior translation of the cephalad vertebra and segmental instability [1,2,3]. Clinically, patients may present with mechanical low back pain, radicular symptoms, or neurogenic claudication, often resulting in significant functional disability and reduced quality of life.

Surgical intervention is indicated in patients with persistent symptoms who fail adequate conservative management.

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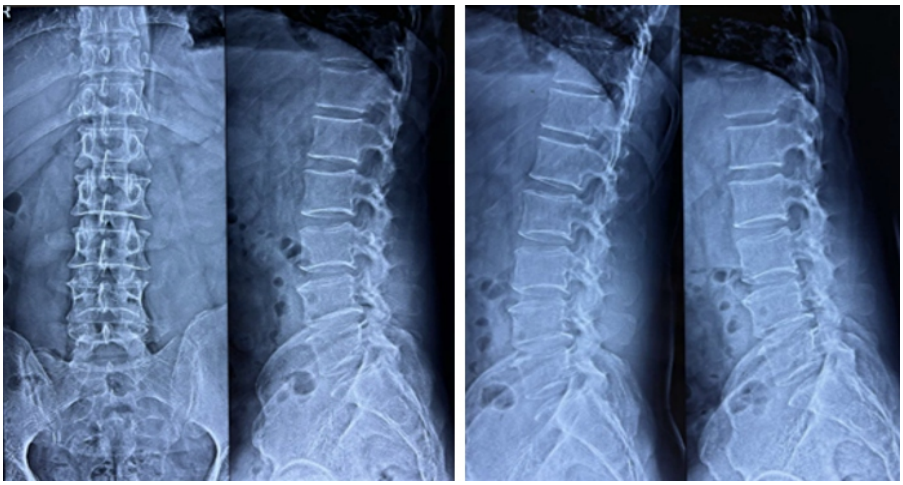

Figure 1: X-ray lumbosacral spine anteroposterior view and lateral flexion and extension view before index surgery.

Transforaminal lumbar interbody fusion (TLIF) has gained widespread acceptance as an effective surgical option for degenerative spondylolisthesis, as it allows decompression of neural elements, restoration of disc height, and circumferential fusion through a unilateral posterior approach while minimizing neural retraction [4,5,6]. Favorable clinical and radiological outcomes have been reported with TLIF when appropriate patient selection and surgical technique are employed [7].

Despite its advantages, TLIF is not devoid of complications. Interbody cage migration, particularly posterior cage back-out, is a recognized but potentially preventable complication that may lead to recurrent pain, neurological compromise, loss of fusion potential, and need for revision surgery [8,9,10]. Several factors have been implicated in cage migration, including inadequate disc space preparation, improper cage sizing, insufficient endplate contact, cage positioning, and biomechanical instability at the operated segment [11,12,13].

This case report describes interbody cage back-out following TLIF for degenerative L4–L5 spondylolisthesis and highlights the critical role of meticulous disc space preparation and appropriate cage footprint selection in preventing this complication.

Case Report

A 45-year-old male presented with chronic low back pain associated with left radicular pain radiating along the L5 dermatome. Symptoms had progressively worsened over several months and were aggravated by prolonged standing and walking. The patient had undergone more than 6 months of conservative treatment, including non-steroidal anti-inflammatory drugs, activity modification, and supervised physiotherapy, without satisfactory relief (Fig. 1).

Neurological examination revealed radicular pain without objective motor weakness. Sensory examination was normal, deep tendon reflexes were preserved, and there was no bowel or bladder involvement.

Plain radiographs of the lumbosacral spine demonstrated degenerative Grade 1 spondylolisthesis at the L4–L5 level. Dynamic flexion–extension views suggested segmental instability. Magnetic resonance imaging revealed disc degeneration at L4–L5 with associated central canal stenosis and compression of the traversing nerve roots in combination with bilateral facet arthropathy, correlating with the patient's clinical presentation. Computed tomography was used to further assess bony anatomy and assist in surgical planning (Fig. 2).

Given the persistence of symptoms despite adequate conservative management and the presence of radiological instability, surgical intervention was planned. The patient underwent an uneventful (minimally invasive [MIS]-TLIF) for L4–L5 level in another hospital. An interbody cage of size 9 × 22

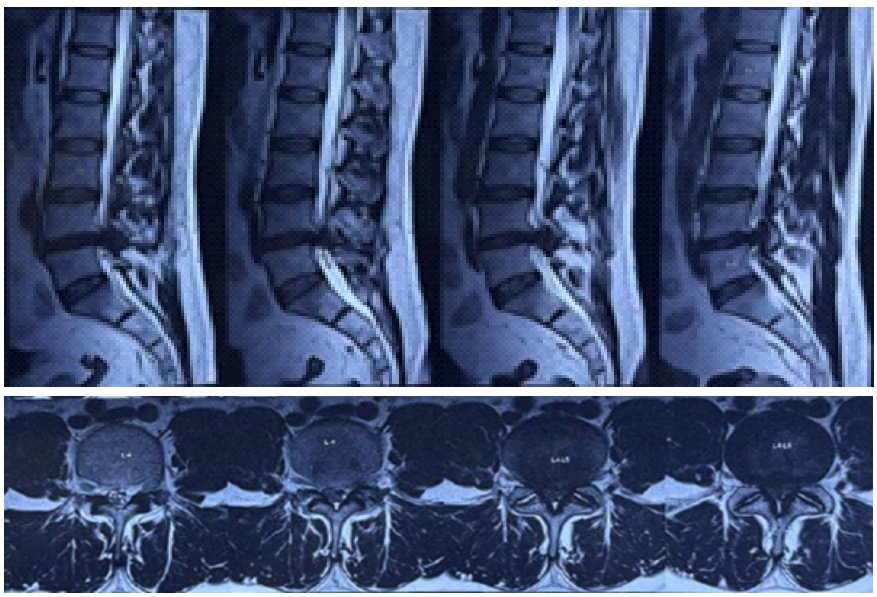

Figure 2: Magnetic resonance imaging lumbosacral spine T2 sagittal axial views before index surgery.

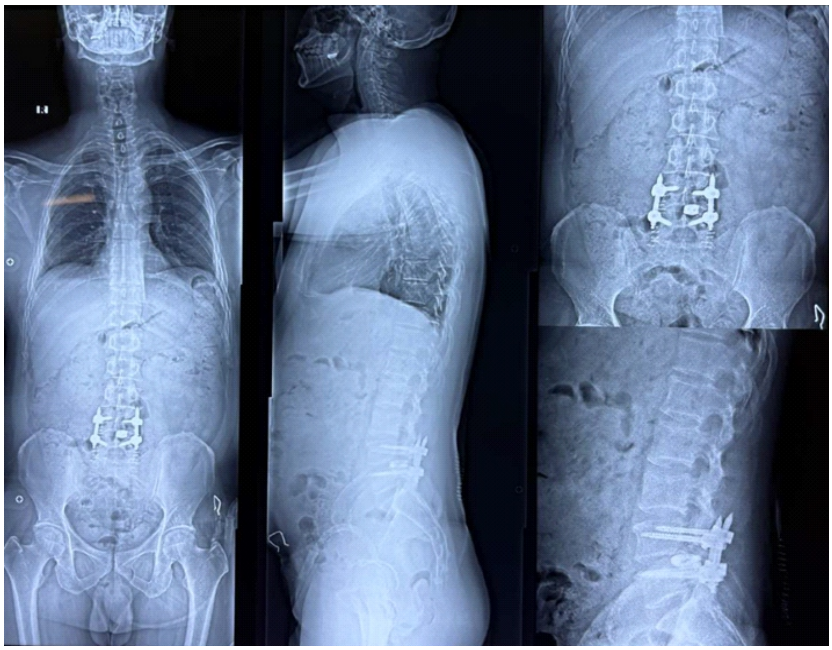

Figure 3: X-ray lumbosacral (LS) whole spine with focused LS spine anteroposterior view and lateral view after index surgery, indicating cage back-out.

mm was inserted following disc removal, and posterior instrumentation was applied. Immediate post-operative radiographs were satisfactory.

On post-operative day 5, the patient started complaining of weakness in both lower limbs, urinary retention and bowel disturbances. Subsequent imaging revealed posterior migration (back-out) of the interbody cage. The patient was subsequently referred to our tertiary spine care center for further management. Considering the intracanalicular location of the cage and cauda equina syndrome, emergency revision surgery was planned (Fig. 3).

Revision surgery involved the MIS-LTLIF approach with removal of the migrated cage from the left side. A complete contralateral facetectomy was then performed on the right side. The disc space was thoroughly re-explored, and meticulous disc clearance was performed bilaterally with careful preparation of the vertebral endplates while preserving subchondral bone. A larger-footprint interbody cage measuring 10 × 40 mm was selected and inserted using a reverse orthogonal maneuver from the right side to orient the large footprint cage in an optimal position. Final stabilization was achieved with pedicle screw instrumentation.

Post-revision radiographs and computed tomography confirmed appropriate cage positioning and restoration of disc height without evidence of migration. The patient demonstrated significant improvement in low back pain, lower limb weakness with complete recovery of bowel and bladder function over a 6-week period and remained clinically stable without further complications (Fig. 4).

Discussion

Interbody cage migration following TLIF is an infrequent but clinically significant complication. Posterior cage back-out may result in recurrent pain, neurological compromise, construct instability, and failure of fusion [8,9,10]. The etiology of cage migration is multifactorial and includes implant-related, technical, and patient-specific factors (Fig. 5).

Inadequate disc space preparation is a critical technical factor contributing to cage instability. Residual disc material and insufficient endplate preparation can prevent optimal cage seating, reduce frictional resistance, and compromise cage-endplate contact, thereby increasing the risk of migration [11,12]. Preservation of subchondral bone while achieving adequate endplate exposure is essential to ensure stable cage placement and promote fusion.

Cage footprint and appropriate cage height also play pivotal roles in preventing migration. Larger-footprint cages increase the contact surface area between the implant and vertebral endplates, thereby improving load distribution and reducing

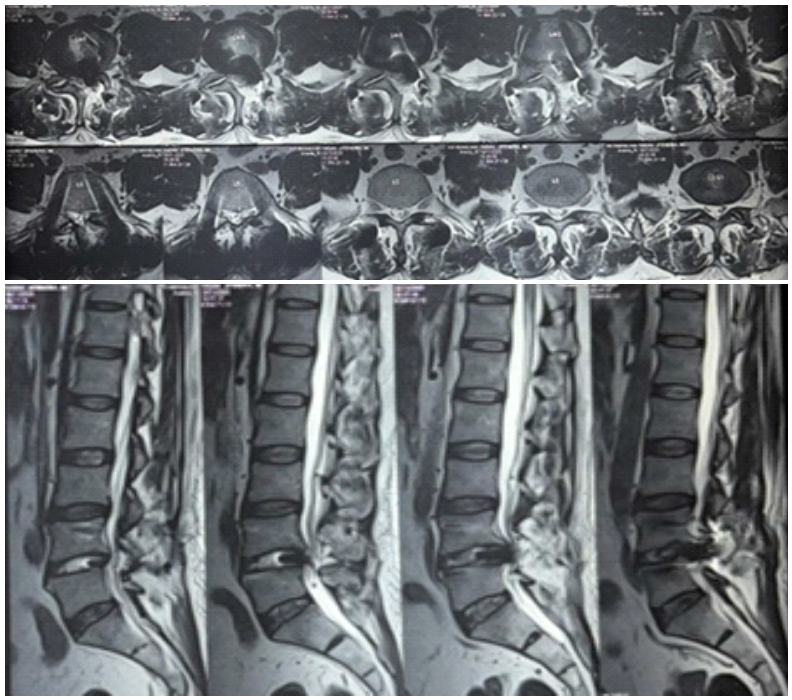

Figure 4: Magnetic resonance imaging lumbosacral spine T2 sagittal axial views after index surgery, indicating cage back-out.

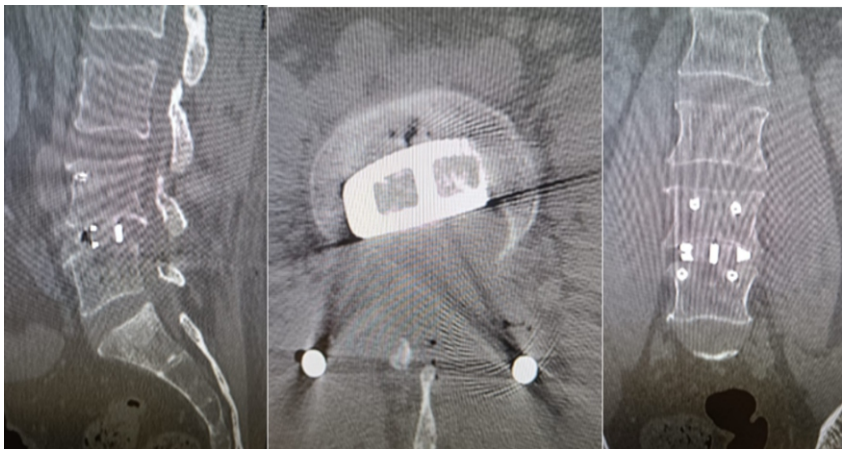

Figure 5: Final post-operative computed tomography lumbosacral spine with large footprint cage.

peak endplate stress. This reduces focal stress concentration on the vertebral endplates and enhances resistance to posterior migration [13,14,15,16]. This is particularly important in degenerative spondylolisthesis, where inherent segmental instability and altered biomechanics increase the risk of implant failure.

In the present case, revision surgery with meticulous disc space preparation and insertion of a larger footprint cage via MIS-LTLIF approach resulted in stable fixation and satisfactory clinical outcome. This highlights the importance of surgical technique and appropriate implant selection in preventing cage back-out following TLIF.

Conclusion

Interbody cage back-out following TLIF is a preventable complication. Thorough disc space preparation and selection of an adequately sized, large footprint interbody cage are essential for achieving stable fixation and preventing cage migration. Early diagnosis and timely revision surgery using appropriate surgical technique can lead to favorable clinical outcomes.

Clinical Message

Meticulous disc preparation and appropriate large-footprint cage selection are critical in preventing cage migration following TLIF for degenerative lumbar spondylolisthesis.

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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