

## Case Report

# The Ligamentotactic Effect on a Herniated Disc at the Level Adjacent to the Anterior Lumbar Interbody Fusion : Report of Two Cases

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The authors report two cases of spontaneous regression of disc herniation at the level adjacent to the anterior lumbar interbody fusion (ALIF) level. This phenomenon may be due to the increased tension on the posterior longitudinal ligament (PLL) by appropriate restoration of the disc height and lumbar lordosis, which is a mechanism similar to ligamentotaxis applied to the thoracolumbar burst fracture.

**KEY WORDS :** Ligamentotaxis · Herniated disc · Anterior lumbar interbody fusion.

## INTRODUCTION

Already degenerated discs or disc herniation located at the level adjacent to which fusion is expected is a problematic situation in lumbar spinal surgery. This is because a herniated or degenerated disc at the segment adjacent to the fused level is more likely to deteriorate<sup>3)</sup>. However, levels being decompressed but not included in the fusion are also known to be more likely to undergo degeneration<sup>4)</sup>. This situation poses a dilemma to fusion surgery.

We observed prompt spontaneous regressions of the disc herniation at the level adjacent to anterior lumbar interbody fusion (ALIF) by a tensile posterior longitudinal ligament (PLL). To the best of our knowledge, there has been no prior report regarding this kind of phenomenon. We report two cases of disc herniation of the segment adjacent to the fused level that showed prompt spontaneous regression with ALIF, and discuss the possible mechanism.

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## CASE REPORT

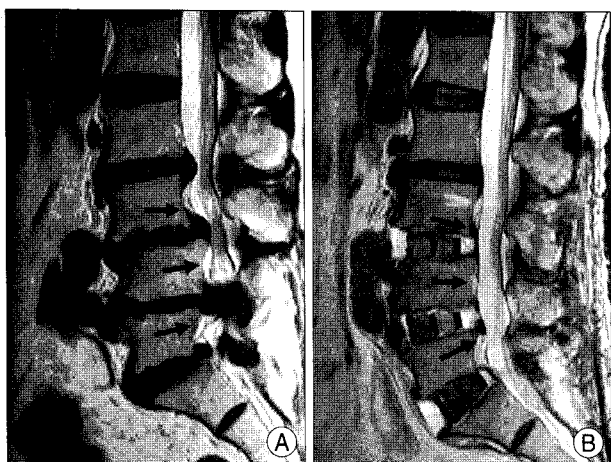
### Case 1

#### Presentation and examination

This 68-year-old woman presented with a several-year history of neurogenic claudication. She also complained of back and left leg pain. A neurological examination revealed no deficits. A dynamic lumbar radiograph revealed anterolisthesis at L3/4 and retrolisthesis at L4/5. Magnetic resonance (MR) imaging studies revealed spinal stenosis at L3/4 and L4/5, foraminal stenosis at left L5/S1, and disc herniation at L2/3 (Fig. 1). Specifically, the PLL was shown to have come undone from the vertebral body, because of disc space collapse and disc herniation (Fig. 1).

#### Operation

The disc spaces of L3/4, L4/5, and L5/S1 were assessed via a laparotomic retroperitoneal approach. After removing a sufficient amount of disc material and posterior annulus, large wedge-shaped lordotic cages were inserted as an interbody device containing allograft bone chips for appropriate restoration of the disc space. The PLL was preserved. After performing ALIF, facetectomy was performed at left L5/S1 for decompression of the foraminal



**Fig. 1.** A : Preoperative sagittal T2-weighted magnetic resonance (MR) imaging revealing the spondylolisthesis at L3/4, retrolisthesis at L4/5, and disc herniation at L2/3. The posterior longitudinal ligament (PLL) has come undone from the vertebral body (arrow). B : Postoperative sagittal T2-weighted MR imaging revealing the well-balanced and well-decompressed state and the regression of the disc herniation at L2/3. The PLL is tightened as compared with the preoperative state (arrow).

stenosis. Pedicle screws were inserted through a midline skin incision under fluoroscopic guidance.

#### Postoperative course and examination

The postoperative course was uneventful. The patient reported subjective improvement in claudication and leg pain. Postoperative MR imaging obtained 12 days after operation revealed a well-balanced and well-decompressed state of the lesion (Fig. 1). Another finding was that the PLL, which was shown to have come undone from the vertebral bodies with preoperative MR imaging, was now tightened and the disc herniation at L2/3 was regressed (Fig. 1).

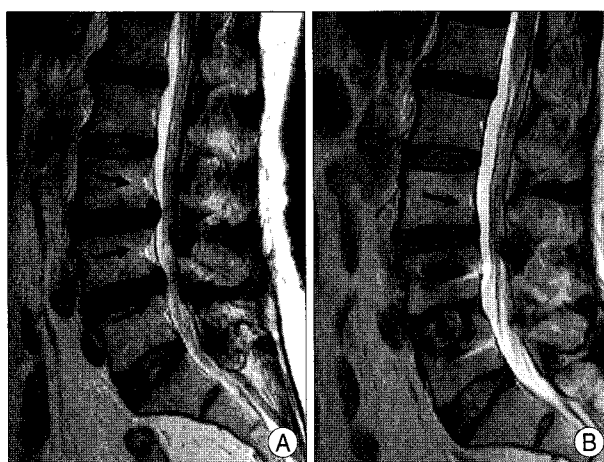
#### Case 2

##### Presentation and examination

This 54-year-old woman presented with a several-month history of right leg and back pain. A neurological examination revealed slight resistance during the straight leg raising test on the right side. A dynamic lumbar radiograph revealed degenerative spondylolisthesis at L4/5 (Fig. 2). MR imaging studies revealed spinal stenosis and facet arthropathy at L4/5 and disc herniation at L3/4 (Fig. 2). The PLL had come undone from the vertebral body because of disc protrusion (Fig. 2).

##### Operation

The same procedure used in case 1 was performed at L4/5. Without posterior decompression, a percutaneous pedicle screw system (Sextant, Medtronic Sofamor Danek, Memphis, Ten) was used for fixation.



**Fig. 2.** A : Preoperative sagittal T2-weighted magnetic resonance (MR) imaging revealing the spondylolisthesis at L4/5 and disc herniation at L3/4. The posterior longitudinal ligament (PLL) has come undone from the vertebral body (arrow). B : Postoperative sagittal T2-weighted MR imaging revealing the well-balanced and well-decompressed state and the regression of the disc herniation at L3/4. The PLL is tightened as compared with the preoperative state (arrow).

#### Postoperative course and examination

The postoperative course was uneventful. The patient reported subjective improvement in leg pain. Postoperative MR imaging performed 7 days after the operation revealed a well-balanced and well-decompressed state of the lesion (Fig. 2). The PLL, which was shown to have come undone from the vertebral bodies on preoperative MR imaging, was tightened, and disc protrusion at L3/4 was regressed (Fig. 2).

#### DISCUSSION

The current study demonstrates that increased tension of the PLL can reduce disc herniation at the level adjacent to the fused level to some extent. Originally, ligamentotaxis was defined as a method for indirect reduction of a fracture by the application of a strong distraction force, which is transmitted through intact ligaments and capsules<sup>1</sup>. This phenomenon is applied mainly to the thoracolumbar burst fracture. In the case of ALIF, it may be induced by increased tension on the PLL during lordosis and distraction<sup>2</sup>.

ALIF has been known to be the best approach to recreate the height of the disc and restore normal biomechanical lordosis<sup>3</sup>. Therefore, appropriate restoration of the disc height and lumbar lordosis with ALIF may induce increased tension on the PLL, a mechanism similar to that applied to the thoracolumbar burst fracture. A tensile PLL that can reduce bony fragment may also reduce disc herniation. However, a prerequisite for ligamentotaxis is an intact PLL and attachment of the retropulsed fragments to the ligament<sup>2</sup>. In addition, the effect of ligamentotaxis is weak below the L3 level for anatomical reason<sup>1</sup>. Therefore, the

ligamentotactic effect on disc herniation may be applied to the contained disc herniation above the L3/4 level. However, this ligamentotactic effect can be applied in ALIF, but not in the other interbody fusion approaches such as posterior lumbar interbody fusion (PLIF) or transforaminal lumbar interbody fusion (TLIF). This is because only ALIF can preserve the PLL.

## CONCLUSION

The authors report the case of spontaneous regression of disc herniation at the level adjacent to the ALIF level. The authors hypothesize that ligamentotaxis could be the possible mechanism for this phenomenon. This phenomenon may be more effective above the L3/4 level.

### • Acknowledgements

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