

Isthmic Spondylolisthesis Associated with Foraminal Disc Herniation Treated by Anterior Lumbar Interbody Fusion

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A 45-year-old man presented with lower back pain and pain in the right leg of 3years duration. A plain radiographic examination revealed grade I isthmic spondylolisthesis, with instability at L4-5. Computed tomography and magnetic resonance imaging demonstrated bilateral foraminal stenosis, with soft foraminal disc herniation on the right side at the L4-5 level. He underwent anterior lumbar interbody fusion(ALIF) with percutaneous posterior fixation(PF) at the L4-5 level. Without removing the posterior bony structures, removal of foraminal disc herniation and reduction of spondylolisthesis were successfully performed using ALIF with percutaneous PF. When there is no hard disc herniation or lateral recess stenosis, ALIF with percutaneous PF can be one of the treatment options for isthmic spondylolisthesis, even in the presence of foraminal disc herniation, as in our case.

KEY WORDS : Anterior lumbar interbody fusion(ALIF) · Isthmic spondylolisthesis · Foraminal disc herniation.

Introduction

With the evolution of recent surgical techniques, anterior lumbar interbody fusion(ALIF) has been performed as one of the treatment options for degenerative lumbar diseases, including discogenic back pain, instability, and failed back surgery syndrome^{2,3,5,8-10}. Among degenerative lumbar diseases, low-grade isthmic spondylolisthesis is also a good candidate for ALIF in selected cases. With additional percutaneous posterior fixation(PF), isthmic spondylolisthesis can be successfully treated by ALIF, without removing the posterior bony structures or retracting the neural structures at all^{4,7}. However, many spine surgeons still wonder whether the treatment of isthmic spondylolisthesis is possible by indirect decompression using ALIF with percutaneous PF.

Herein, the authors present a case of isthmic spondylolisthesis, associated with foraminal disc herniation, successfully treated by ALIF with percutaneous PF. Intraoperative and postoperative radiological images, demonstrating decompr-

ession of neural foramen and foraminal disc herniation, will also be presented.

Case Report

A 45-year-old male presented with lower back pain of 3years duration. He also complained of pain in the right leg along the L5 dermatome during walking. On neurological examination, he showed big toe dorsiflexion weakness (power grade IV) and decreased knee jerk. A plain radiographic examination revealed grade I isthmic spondylolisthesis, with instability at the L4-5 level. Computed tomography(CT) and magnetic resonance imaging(MRI) demonstrated bilateral foraminal stenosis, with soft foraminal disc herniation on the right side at the L4-5 level, whereas no root compression due to pseudoarthrosis at the spondylolysis site was observed (Fig. 1). It was decided to perform ALIF with supplemental percutaneous PF.

Through a midline skin incision, a retroperitoneal approach

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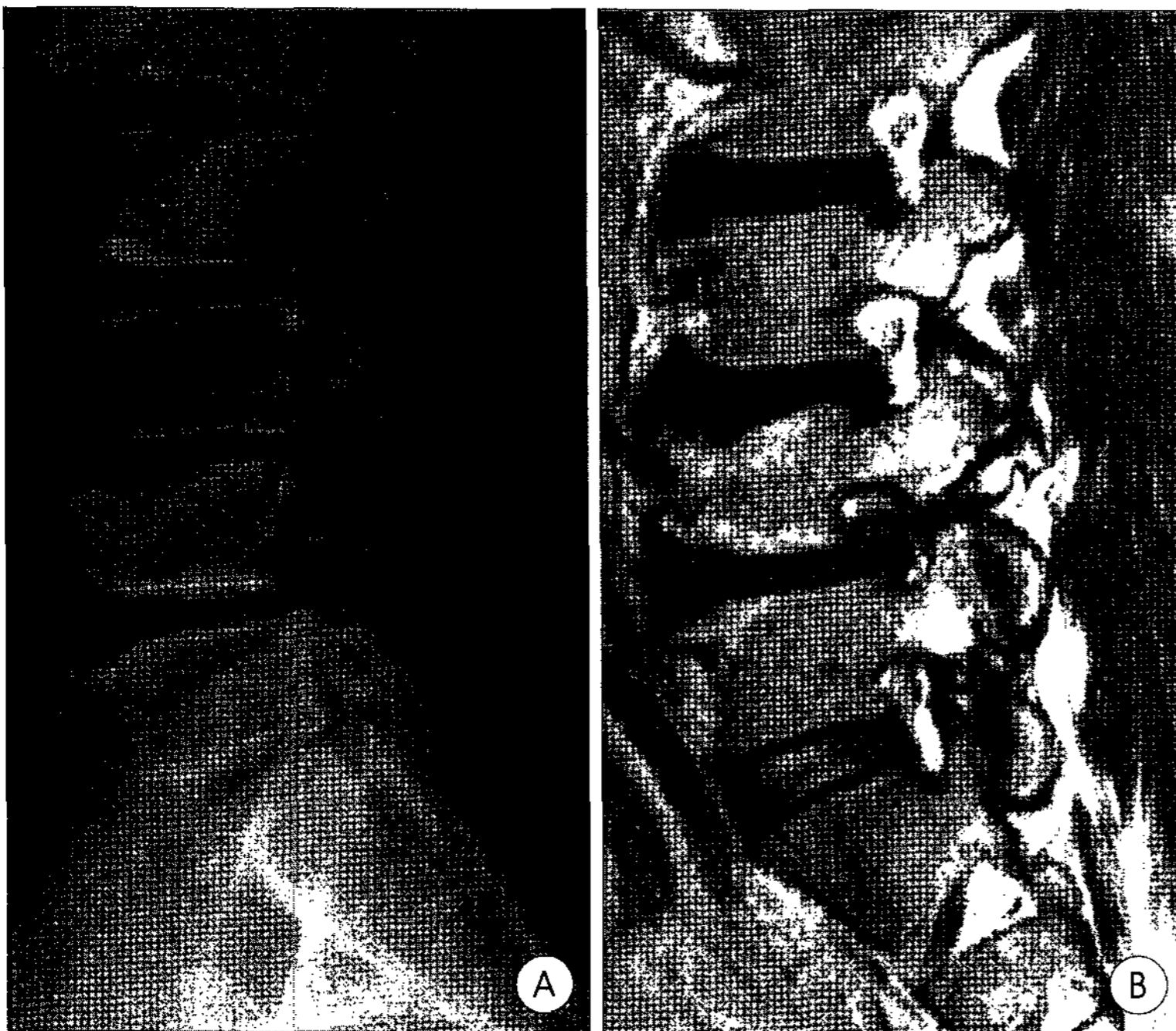


Fig. 1. Standing lateral radiography(A) demonstrating isthmic spondylolisthesis at the L4–5 level. On T2–weighted sagittal magnetic resonance image(B), there is foraminal stenosis due to the anterolisthesis and foraminal disc herniation at the L4–5 level.

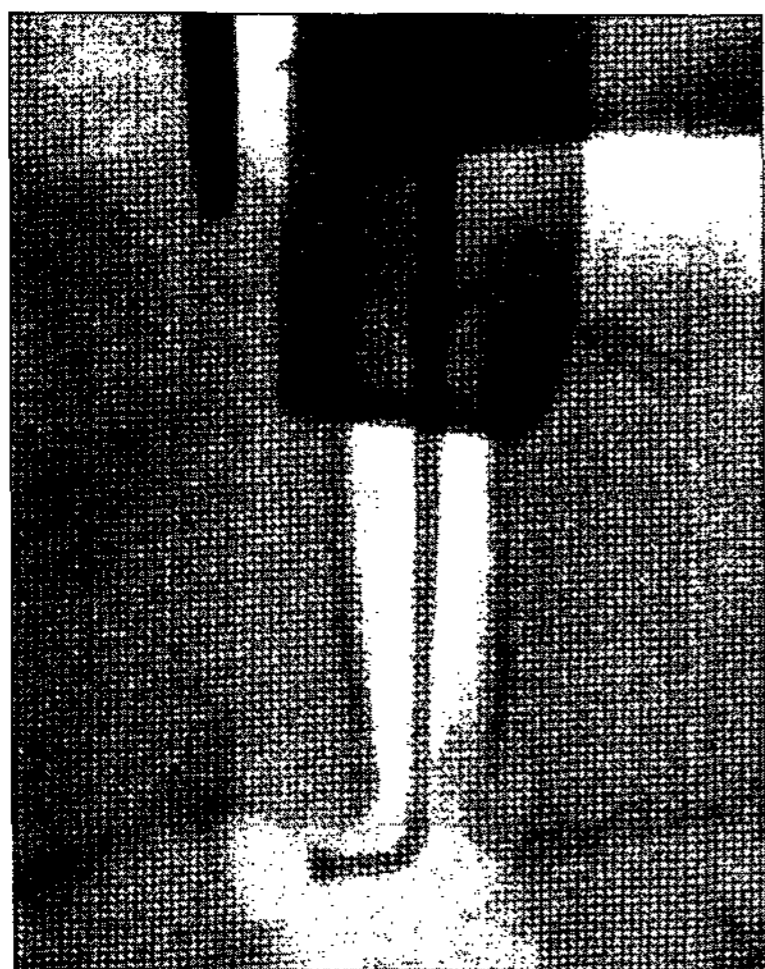


Fig. 2. Intraoperative fluoroscopic image. After removal of the posterior annulus and foraminal disc herniation, probe in the foramen suggested adequate decompression of the right L4 root.

in the foramen suggested adequate decompression of the right L4 root (Fig. 2). Finally, a Syncage filled with allograft bone, was placed into the disc space. With the placement of the Syncage, the intervertebral height and segmental lumbar lordosis were increased and the spondylolisthesis reduced. Then, for supplemental percutaneous PF, small bilateral paraspinal incisions were made on the patient's back. Under the guidance of fluoroscopy, additional percutaneous PF was performed using pedicle screws via bilateral paraspinal routes.

Postoperative MRI showed decompression of the neural

was performed. After incision of the anterior longitudinal ligament and anterior annulus, disc removal and preparation of the end plate were performed. The posterior annulus was carefully removed using a Kerrison punch, until the posterior longitudinal ligament was exposed. Then, the left foraminal disc herniation in the subligamentous portion was removed. Probe

isthmic spondylolisthesis, including Gill laminectomy, posterolateral fusion, posterior lumbar interbody fusion, and circumferential fusion. With all of these surgical methods, the posterior bony structures, including pseudoarthrosis at the spondylolysis site, are removed for direct decompression of the nerve roots. During decompression and fusion, the nerve roots are usually retracted with the use of all these posterior fusion methods⁶.

With low-grade isthmic spondylolisthesis, the nerve roots are usually compressed due to the foraminal stenosis caused by both anterolisthesis and the resultant pseudo-herniated disc at the intervertebral disc level, whereas the nerve roots are usually not compressed by pseudoarthrosis at the spondylolysis site. This is why it is possible to indirectly decompress foraminal stenosis in low-grade isthmic spondylolisthesis using ALIF. After the removal of the posterior annulus, a pseudo-herniated disc can be removed by an anterior approach, which results in anterior decompression of the foramen; then, placement of an interbody cage into the disc space, via an anterior approach, causes an increase of the intervertebral height and the reduction of anterolisthesis, which result in a further increase in the foraminal volume. Therefore, when there is no hard disc herniation or lateral recess stenosis, low-grade isthmic spondylolisthesis can be successfully treated using ALIF, without removing bone or retracting the nerve root at all; namely indirect decompression. Chen et al.¹⁾ has already demonstrated with cadaver lumbar spines that only increase of disc height, with anterior systems such as the BAK system,

foramen and foraminal disc herniation (Fig. 3). Six months after the operation, the patient complained of no back or leg pain at all.

Discussion

ALIF has several advantages over posterior fusion methods. First, ALIF can provide a wide fusion bed; therefore, the postoperative fusion rate is very high. Second, using a specially designed interbody cage, such as Syncage, ALIF can provide enough correction of the intervertebral height and restoration of lumbosacral lordosis⁸⁾. Third, in selected cases, including some patients with failed back surgery syndrome, using ALIF fusion can be performed without removing bone or retracting the neural structures at all³⁾.

Among lumbar spine diseases causing spinal instability, isthmic spondylolisthesis is a good candidate for ALIF in selected cases. There are several surgical options for the treatment of



Fig. 3. Standing lateral radiography (A) performed after the operation shows an increase of the intervertebral height, segmental lordosis and foraminal area, along with the reduction of anterolisthesis. Sagittal magnetic resonance image performed after the operation (B) demonstrates decompression of the foraminal stenosis. Note the preserved posterior bony structures.

could significantly increase the neuroforaminal volume and area, providing adequate space for the nerve root and improving neuroforaminal stenosis.

With regard to clinical studies, Ishihara et al.⁴⁾ analyzed the surgical outcome of ALIF alone for isthmic spondylolisthesis. Though ALIF provided satisfactory long-term clinical results, the fusion rate was relatively low (83%). Recently, Lee et al.⁷⁾ reported on the surgical outcome of mini-ALIF, followed by additional percutaneous PF, for low-grade isthmic spondylolisthesis. In their report, the rate of successful outcome of ALIF followed by percutaneous PF was 94.5%, with a fusion rate of 97.3%. Due to the supplemental percutaneous PF, their fusion rate was higher than that of Ishihara et al.

In the case reported herein, even isthmic spondylolisthesis was accompanied by foraminal disc herniation, it was successfully treated by ALIF with percutaneous PF. Along with MRI, CT scan is essential in the surgical planning of ALIF with percutaneous PF. As the foraminal disc herniation in our case was soft on the CT scan, it was thought it could be removed via an anterior approach. Whether or not nerve roots are compressed at the lateral recesses is also important on the preoperative radiological images. In the case of hard disc herniations or the presence of lateral recess stenosis, a posterior approach should be considered. As mentioned before, as with an anterior cervical discectomy and fusion, the removal of the posterior annulus is also essential in ALIF for adequate

neural decompression, restoration of the intervertebral height and the reduction of anterolisthesis. Only after the removal of the posterior annulus and exposure of the posterior longitudinal ligament, removal of the foraminal disc herniation in the subligamentous location is possible via an anterior route, as in this case.

In case of foraminal disc herniation without ruptured epidural free fragment, probing of foramen can provide indirect evidence of decompression after removal of herniated disc via anterior approach, as in this case. In case with ruptured free fragment, however, we think it better to perform posterior approach because it is not easy to perform full decompression of foramen with anterior approach.

Conclusion

When there is no hard disc herniation or lateral recess stenosis, ALIF with percutaneous PF can be one of the treatment options for low-grade isthmic spondylolisthesis, even in the presence of a foraminal disc herniation, as in our case.

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