Circumferential Fusion using Combined Unilateral TLIF and Contralateral Pedicle Screw Fixation for Spondylolytic Spondylolisthesis at L4/5 and L5/S1: A Case Report

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ABSTRACT

Objective: A case of spondylolytic spondylolisthesis at L4/5 and L5/S1 was treated by performing 360 degree fusion using combined unilateral transforamin al lumbar interbody fusion (TLIF) and contralateral pedic le screw fixation (PSF).

Case report: A 78-year-old man presented with 8-year history of low back pain and left leg pain. Neurological examination showed positive straight leg raising test on the right and hypesthesia in the left L4 region. Computerized tomography and magnetic resonance imaging demonstrated spondylolysis at L4 and L5 with slip at L4/5. The patient was treated with a single cage by performing TLIF from the left L4-5 foramen obliquely to the ventral cortex (45 degree to vertical plane), and then PSF at L4, L5 and S1 under an intraoperative fluoroscopy.

Result: Postoperatively, the patient showed a marked recovery. His left leg pain and low back pain subsided, and he was back to work shortly after the operation.

Conclusion: Spondylolytic spondylolisthesis is one of the targets of spinal instrumentation. Although a broad combination of implants can be selected for this pathological condition, combined TLIF after discectomy and contralateral PSF was useful in a case like this.

Key words: lumbar spine, transforaminal lumbar interbody fusion, spondylolysis, spondylolisthesis, pedicle screw fixation

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Introduction

Because many cases of pseudoarthrosis after simple discectomy and fusion without instrumentation have been reported, supplemental spinal instrumentation has improved the stability of lumbar spine after a decompressive procedure [7,12,14]. Circumferential fusion with various spinal instrumentation techniques has been advocated to improve fusion rates and clinical outcomes in treatment of the lumbar spine with significant instability [1-4]. Posterior lumbar interbody fusion (PLIF) to support the anterior column has been used since the 1940s [11], and has often been combined with a posterolateral fusion using pedicle screw systems for the circumferential fusion [15].

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In 1982, Harms and Rolinger [5] pioneered a modified PLIF technique called transfemoral lumbar interbody fusion (TLIF) as a substitution for PLIF. Compared with other traditional techniques, it provides several advantages such as direct access to the far-lateral to foraminal portion of the disc space by the transmuscular approach, without extensive dissection of the paravertebral muscles for removal of the herniated disc and insertion of cages obliquely.

This paper presents a laterally protruded herniated disc associated with spondylolytic spondylolisthesis treated by performing TLIF on left L4/5 and the pedicle screw fixation from L4 to S1 on the other side. This technique is a reliable method not only to achieve a circumferential fusion but also to provide a safe and effective fusion with less violation of the posterior elements.

Case Report

This 78 year-old man presented with 8-year history of low back pain (LBP). Four years previously he noticed left leg pain which was enhanced by 50 meter walking. He was admitted to a local hospital repeatedly for conservative treatments for his LBP. He was referred to our hospital because of progression of his leg pain and lumbago. Neurological examination showed a positive straight leg raising test on left (45 degree) and numbness and slight hypesthesis in left L4 region. Plain radiography of the lumbar spine revealed grade 1 spondylolisthesis at L4/5 and L5/S1, and computerized tomography (CT) confirmed spondylolysis of L4 and L5. Magnetic resonance (MR) imaging revealed a far lateral herniated disc at the left L4/5 (Fig.1).
The patient was placed in a prone position. After medial skin incision was made from L4 to S1 and the subcutaneous tissue was separated bilaterally, the multifidus muscle and the medial intercostals muscle were dissected to expose the posterolateral portion of the spinal column. At first, removal of the herniated disc and subsequent TLIF were performed on the left side. After partial drilling of the transverse process of L4 and L5 as well as pars interarticularis was performed, the L4 nerve root was first identified at the vertebral foramen. The L4 nerve root was retracted rostrally for discectomy. Following discectomy, a tubular retractor was impacted obliquely to the ventral cortex of the vertebral body (45 degrees to the vertical plane) under an intra-operative fluoroscope, and after reaming and tapping, a single TFC cage 12 mm in diameter and 26 mm in length (Striker, USA) was placed laterally in the L4/5 disc space. Bone chips obtained from the resected lamina and transverse process were packed inside the cage. Then, a transmuscular approach was performed on the other side. Pedicle screws of TSRH system (Medtronic Sofamore-Danek, Tennessee, USA) were inserted into each pedicle after exposure of the right L4, L5 and S1. Bone chips was scattered between the right L5 and S1 transverse process, followed by fibrin-glue application (Fig. 2). There was no CSF leak or nerve injury. The patient’s postoperative course was
uneventful. He wore a hard shell type lumbar corset for 2 months and a soft lumbar corset for 1 month. He was back to work 4 months after the operation without a LBP or left leg pain.

Discussion

Posterior fusion using PSF in combination with PLIF for spondyloytic spondylolisthesis is widely used, but requires bilateral exposure of the posterior aspect of the spinal column with partial loss of the posterior tension band at the level of fusion. In addition, extensive dissection of the paravertebral muscles is necessary. Spondyloytic spondylolisthesis is different from degenerative spondylolisthesis in the respect that it is not associated with a narrow spinal canal caused by hypertrophy of the ligamentum flavum and facet joint. Therefore, the main symptom of spondyloytic spondylolisthesis is low back pain due to instability. Fusion without decompressive laminectomy might be a procedure of choice, while lumbar canal stenosis associated with degenerative spondylolisthesis requires decompression and fusion. However, removal of the herniated disc should be performed to resolve sciatic pain as in the present case, as spondyloytic spondylolisthesis is associated with the intervertebral herniated disc.

In the present case described here, L4 nerve root was considered to be compressed by bulging of the herniated disc at the extracanalicular portion of L4-5. Therefore, the lateral approach as a minimally invasive procedure for decompression of L4 nerve root and fusion using a unilateral interbody cage to avoid extensive separation of paravertebral muscles through the midline. Transforaminal lumbar interbody fusion offers an opportunity to access the spine while leaving the contralateral laminar surface intact as an additional surface for bone graft placement [6]. By preserving the spinous processes and the contralateral ligamentum flavum, the original posterior tension band is preserved. TLIF maintains the inherent benefits of the posterior approach. It can decompress a unilateral nerve root caused by a laterally protruded herniated disc, and reconstitute the normal sagittal anatomic relation between the motion segments [11]. The larger area of bony contact between the grafts and the vertebral bodies greatly enhances fusion [10].

A circumferential fusion with PSF combined with PLIF or TLIF for spondyloysis presents a stiffer construction than either an anterior or posterior fusion alone [4,8,9,23]. Posterior lumbar interbody fusion is usually performed with two cages for stable fusion, one in the right side and one in the left side of the interbody space after necessary disectomy. In the present case, decompression was necessary only at the left side, therefore PSF instead of PLIF was selected at the contralateral side via transmuscular route to add the further stability. The contralateral PSF was performed from L4 to S1 because of avoiding the possible adjacent instability at L5-S1. Particularly for a spondyloytic spondylolisthesis without a narrow canal, circumferential fusion with unilateral PSF and TLIF by transmuscular approach offers not only immobilization of an unstable lumbar spine after decompression of a nerve root, but also preservation of paravertebral muscles as well as a posterior tension band.

References


Reviewer's comment : Izumi Koyanagi, M.D.
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The authors present an elegant surgical technique to decompress the unilateral nerve root and solid fusion without extensive damage to the posterior spinal elements in this case report. Bilateral pedicle screw fixation with or without posterior lumbar interbody fusion has been a common surgical procedure for spondylolytic spondylolisthesis. However, the procedure usually needs extensive muscle damage to achieve pedicle screw insertions and decompression. Transforaminal lumbar interbody fusion (TLIF) is a relatively new method to obtain interbody fusion and decompression of intervertebral foramen, although the long-term follow-up data have not been reported. Combination of unilateral TLIF and pedicle screw fixation via transmuscular approach will be one of good surgical options for the patients with spondylolytic spondylolisthesis since the approach preserves the ligaments and muscles attached to the spinous processes and laminae at the affected level. Although the surgery results in excellent clinical outcome in this case, long-term follow-up will be needed to establish the indication and validity of this surgical treatment.

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Author reported complicated surgical case of lumbar pathology Spondylolytic spondylolisthesis in L4/5 and L5/S1 with far lateral disc herniation at L4/5.

They selected TLIF and pedicle screw fixation so called 360 degree fixation. Surgical strategy is very interesting because of applying new technology such as TILF and Tubular retractor for minimize surgical invasion. To select the surgical strategy for complicated pathology case, there are some important points. 1, precise neurological signs. 2, Radiographic compatibility with neurological signs. 3, neuronal decompression with biomechanical reconstruction. 4, long lasting good surgical outcome. Authors technique is unique idea for stabilize the lumbar spine; we expected long outcome results report.