The term spondylolisthesis is derived from the combined Greek terms spondylos (vertebra), and listhesis (to slip). The term literally means the “slippage of one vertebra forward in relation to the adjacent vertebra.”

Five types were classified according to the Wiltse classification system: dysplastic, isthmic, degenerative, traumatic, and pathologic. Isthmic spondylolisthesis is caused by a defect in the pars interarticularis area of the lamina, and is the most common spondylolytic disorder. The reported incidence is 4%–6% of the general population. However, true double-level isthmic spondylolisthesis is caused by a defect in the pars interarticularis area of the lamina, and is the most common spondylolytic disorder. The reported incidence is 4%–6% of the general population. However, true double-level isthmic spondylolisthesis is rare. Only a few reports have examined the outcomes of surgical treatment of double-level spondylolisthesis. The authors present an unusual case of double-level isthmic spondylolisthesis of the lumbar spine. The patient had low-back pain for 20 years and did not respond to conservative treatment. Radiographs revealed bilateral pars defects at L-4 and L-5. Grade 2 isthmic spondylolisthesis was present, both at L4–5 and at L5–S1. The patient underwent decompression, reduction, and posterior lumbar interbody fusion with autogenous bone chips from posterior decompression. At follow-up after 12 months, the patient was free of pain, slippage was corrected, and fusion was achieved. Posterior lumbar interbody fusion with posterior instrumentation and reduction may yield good functional short-term results for double-level spondylolisthesis.

http://thejns.org/doi/abs/10.3171/2013.12.SPINE13521

Key Words • double-level isthmic spondylolisthesis • low-back pain • lumbar • surgery

Abbreviations used in this paper: ALIF = anterior lumbar interbody fusion; PLIF = posterior lumbar interbody fusion; TLIF = transforaminal lumbar interbody fusion.

Case Report

History. This 64-year-old woman presented with a 20-year history of intermittent low-back pain, with radiation into the bilateral lower extremity during the last 3 years. The pain was aggravated by activities such as extension and prolonged standing. She had no previous trauma or family history of low-back pain. At the time of presentation, the patient’s pain was intense and restricted her everyday activities.

Examination. On examination, there was a stepoff in the lumbosacral region on palpation. The range of lumbar spinal motion was decreased, especially with regard to the extension of the lumbar spine. The straight leg test was limited to 50° on the right side, reproducing right buttock and leg pain. Furthermore, there was decreased sensation to light touch over the right L-5 distribution. Motor strength of the lower limb was normal, and patellar and Achilles tendon reflexes were equal and symmetrical.

Radiographs revealed pars defects at L-4 and L-5, and Grade 2 spondylolisthesis at both L4–5 and L5–S1 (Fig. 1). The angles of lumbar lordosis, pelvic incidence, and sacral inclination were 54°, 65°, 46°, respectively. The slip angle was –9° at the L4–5 level and –3° at the L5–S1 level. The CT scans demonstrated bilateral pars defects involving the L-4 and L-5 levels (Fig. 2A and B). The MRI studies showed degenerative disc disease at L4–5 and L5–S1, hypertrophic ligamentum flavum at L4–5, and Modic Type 2 changes at the vertebral endplate of L-5 and S-1 (Fig. 2C and D).

After 6 months of conservative treatment, including...
rest, NSAIDs, and physical therapy, the pain was not relieved; she was unresponsive to nonoperative treatment. Finally, surgical treatment was recommended.

**Operation.** The patient was placed prone under general anesthesia. A routine midline approach was made. Under fluoroscopic control, reduction screws were inserted into L-4 and L-5, and regular screws were used for S-1. Decompression was commenced via the midline. When decompression of the spinal canal was completed, nerves were then retracted to expose the disc space. A ring incision was made on one side of the anulus, and the disc material was removed with pituitary rongeurs. After removal of the L4–5 and L5–S1 discs, the rods were contoured and cut to length following templating. Both rods were then applied to the pedicle screw heads, with nut application. Then the disc space was distracted and the reduction was performed. The L-4 and L-5 vertebrae were pulled backward to the posterior vertebral line, and anatomical reduction was achieved. The endplates of L4–5 and L5–S1 were denuded, until observation of blood from the spongy tissue. Bone chips procured from the decompression were compressed into the disc space to make it compact by using bone tamps. A Keystone plug was tapped in posterior to the bone fragments and locked into place, countersinking the plug 2–5 mm to prevent encroachment on the canal. Final tightening of the nuts was performed under compression with the torque wrench. Hemostasis was secured and the wound was closed in layers. The patient was mobilized the next day, with a lumbar orthosis to be worn for 12 weeks.

**Postoperative Course.** At her follow-up visit after 12 months, the patient was free of pain, root tension signs were negative, and neurological examinations revealed no deficits. Radiographs demonstrated good fusion with a well-fixed implant, and with no evidence of motion at both levels. The slippage of both levels was corrected. After reduction, the slip angle was −16° at the L4–5 level and −1° at the L5–S1 level. The angles of lumbar lordosis, pelvic incidence, and sacral inclination were 49°, 55°, and 42°, respectively, at the postoperative follow-up (Fig. 3).

**Discussion**

Of the different types of spondylolisthesis, the isthmic type is the most common. The most common site of spondylolytic defects occurs at L-5 (85%–95%), with much of the remainder occurring at L-4 and above. However, most of the cases with a pars interarticularis lesion present only with spondylolysis, and only approximately 15% of individuals have progression to spondylolisthesis. The incidence of multiple-level isthmic spondylolisthesis is extremely rare; to date there have been few reports of this disorder in the literature. Although the cause and risk factors for progression of the slip to spondylolisthesis are still not quite clear, it has been proven to be multifactorial: hereditary, traumatic, mechanical, and hormonal factors are all believed to play a role. It has been observed that repetitive flexion-extension, axial, and rotational load-

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**Fig. 1.** Anteroposterior (left) and lateral (right) preoperative radiographs revealing pars defects at L-4 and L-5 and double-level spondylolisthesis, both Grade 2, at L4–5 and at L5–S1.

**Fig. 2.** Axial CT scans demonstrating the defect bilaterally at the L-4 (A) and L-5 (B) levels in the pars. Sagittal MRI studies revealing degenerative disc disease at L4–5 and L5–S1, hypertrophic ligamentum flavum at L4–5, and Modic Type 2 changes at the vertebral endplate of L-5 and S-1 (C and D).
load, which enhances bony fusion. Furthermore, internal fixation could provide immediate structural support. In this case, the bone chips procured during posterior decompression were used as interbody graft. The literature supports use of this kind of bone chips in PLIF for the treatment of spondylolisthesis, with a 90% fusion rate and 70% objectively good results. This technique can shorten the operating time and reduce donor site morbidity and blood loss, because a bone harvesting procedure is not necessary. The graft is biomechanically compatible with its host tissues, and compared with allograft it can provide a comparatively stable environment conducive to fusion.

Anterior lumbar interbody fusion (ALIF) is advocated for the treatment of isthmic spondylolisthesis because of the following advantages: avoidance of epidural scarring, which is a serious complication of posterior surgery; avoidance of back muscle trauma and posterior ligament structure; and high fusion rate. Transforaminal lumbar interbody fusion (TLIF) is frequently used today in isthmic spondylolisthesis, mainly due to reduced violation of the spinal canal. It has been proved to be feasible, safe, and an effective technique, with the added benefit of reduced soft-tissue disruption. Theoretically it can prevent typical complications associated with ALIF and PLIF. Despite proven success in achieving surgical goals through these techniques, each one has its own shortcomings, and they have never been applied to double-level isthmic spondylolisthesis. Whether those techniques can be used for the disorder needs to be further researched.

Conclusions

The prevalence of multiple-level isthmic spondylolisthesis is rare, and our treatment method provided successful short-term results for this patient. The search for the optimum treatment warrants further investigation in a larger sample of patients.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author contributions to the study and manuscript preparation include the following. Conception and design: Deyong Song. Drafting the article: Deyong Song. Critically revising the article: all authors. Reviewed submitted version of manuscript: Deyong Song, Zhong Chen. Approved the final version of the manuscript on behalf of all authors: Deyong Song. Study supervision: Zhong Chen.

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Manuscript submitted June 7, 2013.
Accepted December 17, 2013.
Please include this information when citing this paper: published online January 31, 2014; DOI: 10.3171/2013.12.SPINE13521.
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