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Combining Posterolateral Lumbar Fusion and Posterior Lumber Interbody Fusion Surgery for Treating Three-Level Lumber Spondylolysis and Single-Level Spondylolisthesis: Case Report

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Abstract

Lumbar spondylolysis is a relatively common condition that can cause a variety of clinical manifestations related to the lumbar spine. However, multilevel lumbar spondylolysis is rare and accounts for less than 6% of lumbar spondylolysis. We report a case of three-level lumbar spondylolysis with single-level spondylolisthesis. A 47-year-old woman presented to us with low back pain for 9 years that progressively worsened and the pain was exacerbated with standing and walking. She was diagnosed with three-level lumbar spondylolysis at L3-5 and spondylolisthesis at L4. We performed posterolateral lumber fusion (PLF) and posterior lumbar interbody fusion (PLIF) surgery for her. During the same period, pain recovery and fusion rate of the patient were evaluated after surgery. The results were favorable and proved the efficacy of combining PLF and PLIF technique for treatment for three-level lumbar spondylolysis and single-level spondylolisthesis.

Keywords

Multilevel Lumbar Spondylolysis, Low Back Pain, Isthmic Spondylolisthesis, Spinal Fusion

1. Introduction

Isthmic spondylolisthesis (IS) is the condition where a defect in the pars interarticularis (spondylolysis) of a lumbar vertebra leads to anterior translation of a superior vertebra upon an inferior vertebra. The incidence of lumbar spon-

dylolysis in the adult population is approximately 6% [1] and in more than 90% of cases involves the L5 level [2]. However, multilevel lumbar spondylosis is rare and multilevel isthmic spondylolisthesis is even rarer [3] [4]. Most young patients with lumbar spondylolysis can be properly managed with conservative treatment, but a small number of patients do not respond effectively to conservative treatment and eventually require surgical treatment.

Surgical treatment of multilevel spondylolysis varies between fusion, direct isthmic repair, and combined management associating two procedures at different levels [5]. Although direct repair surgery preserves the motion in the affected segment and has gained popularity for young patients with spondylolysis, it is suitable in case without spondylolisthesis and could not correct the degree of the slip. Arthrodesis using a pedicle screw system is the most popular spinal fusion technique to treat isthmic spondylolisthesis. The patient presented in this article is a very rare case of three-level lumbar spondylolysis with single-level spondylolisthesis.

2. Case Report

A 47-year-old woman presented to us with low back pain for 9 years. The pain was worse in the standing position, with flexion and extension and less in sitting and supine status. Physical examination revealed no significant finding. The standard anteroposterior, lateral views and computed tomography (CT) reconstructions showed three-level lumbar spondylolysis at L3-5 with spondylolisthesis at L4 (**Figure 1** and **Figure 2**). In the lumbar dynamic films, we found apparent instability at level of L4-5 and L5-S1 (**Figure 3**). The lumbar MRI found

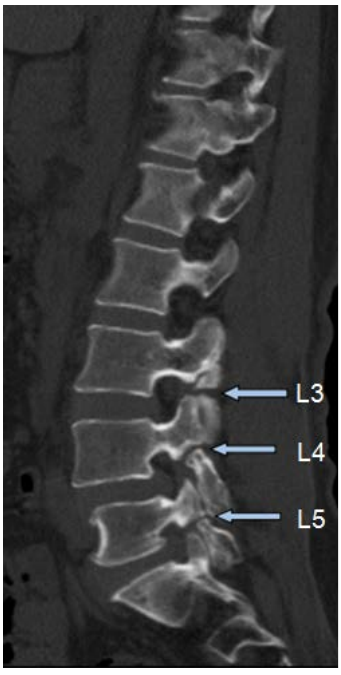

Figure 1. Preoperative computed tomography (CT) sagittal reconstructions showed L3, L4 and L5 isthmic spondylolisthesis.

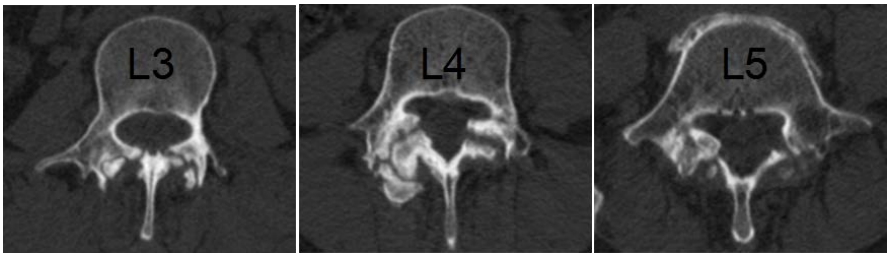

Figure 2. Preoperative computed tomography (CT) transversal reconstructions showed bilateral spondylolisthesis.

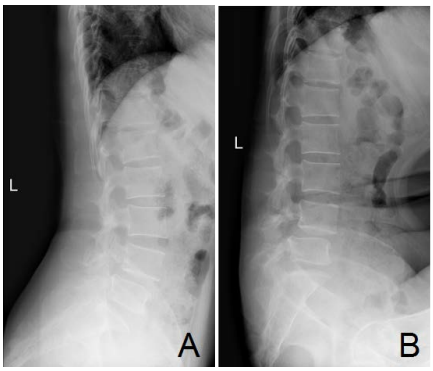

Figure 3. Preoperative flexion-extension views showed apparent instability at level of L4-5 and L5-S1.

the L3-L4 discs intact with no nerve root compression and L4-S1 disc with early signs of discopathy. Medical treatment with analgesics, anti-inflammatory medications, and myorelaxants did not improve the situation. It was noted that the patient had complete relief of back pain after blocking L3, L4, and L5 pars. As the patient had symptomatic spondylolisthesis at L4 and apparent instability at L4-S1, we decided to conduct posterolateral lumber fusion (PLF) at L3-L4 and posterior lumbar interbody fusion (PLIF) at L4-S1 surgery for her.

The patients were carefully placed prone, a skin incision was made in the midline. After spinous processes, laminae, and the bilateral facets were exposed, transpedicular screws were inserted in the L3, L4, L5 and S1 to ensure stability and consolidation. Lateral fluoroscopy was used to confirm the screw placement and assess the slippage reduction. Then, the patients underwent complete removal of the bilateral floating laminae and decompression of nerve root far distally and laterally. The rods were contoured and provisionally secured to the caudal screws, leaving a gap between the cephalad pedicle screws. The cephalad screws were drawn back onto the rods with reduction system, achieving the correction of the spondylolisthesis. Then, cleared out the disk space contents bilaterally and removed the cartilaginous end plates. A PEEK cage, filled with bone chops taken from posterior elements, was inserted to the disk space for interbody fusion. Intertransverse fusion was performed by using bone chips from resected lamina and spinous. Finally, the pedicle screws were compressed to restore the lumbar lordosis.

3. Discussion

Lumbar spondylolysis is a relatively common condition that can cause a variety of clinical manifestations related to the lumbar spine. However, multilevel lumbar spondylosis is rare and accounts for less than 6% of lumbar spondylolysis. Most previous studies were conducted for patients with multilevel spondylolysis and most treatments of that were direct repair. Zhang *et al*. [6] reported that the PLIF allows for adequate interbody height restoration and neural decompression while maintaining posterior support structures for double-level lumbar spondylolysis and spondylolisthesis. Liu *et al*. [7] found the same result that the pedicle screw fixation could significantly improve pain and disability in patients with multilevel lumbar spondylolisthesis and achieve good mid-term prognosis.

Although the exact pathophysiologic mechanism of lumbar spondylolysis still remains unknown, it is considered two factors might explain isthmic lysis, both genetic and mechanical. Some studies stated that no specific genetic variation was identified, but it would seem that a genetic predisposition to this pathology may exist [8]. From a mechanical point of view, heavy work and repeated was associated with the appearance of spondylolisthesis through isthmis lysis. Lots of studies have described the association of sports activities with spondylolysis, and IS is considered to represent a fatigue fracture of pars interarticularis of the neural arch [2] [9].

Treatment of multilevel spondylolysis has not met with consensus. A brace can be proposed but seems to provide little improvement [10] [11]. When it does cause back pain and can't be controlled with conservative treatment, surgical intervention is indicated. Several surgical options have been introduced, including direct repair (DR) and fusion surgery at the affected lumbar level, such as PLIF and PLF [12] [13] [14]. DR surgery has become a notable surgical option for young patients with lumbar spine spondylosis, which can preserve the motion in affected segment and avoid problems in adjacent segment [15] [16]. However, existence of signs of disc degeneration or spondylolisthesis in imaging studies is a contraindication of this strategy. The basic principle of surgical treatment for disc degeneration or spondylolisthesis is decompression and stabilization. Instrument-assisted PLIF and instrument-assisted PLF are the two most common techniques for the surgical treatment of IS.

PLIF was first attempted by Cloward in 1950s and later modified and extensively used. The interbody fusion immediately produces a biomechanically stable postoperative spine, thus enhancing the opportunity for arthrodesis [17]. Some researchers believe that once the unstable segment is successfully fused, mechanical back pain due to a pars defect or facet arthropathy can be reduced, which may contribute to good functional outcomes [18] [19]. However, it is suggested that the goals of surgical treatment of spondylolisthesis were fusion of as few motion segments as possible, restoration of the sagittal balance of lumber spine. PLF could achieve fusion without the need to decompress nerve roots. When patients only have symptom of back pain without nerve root compression

and spondylolisthesis, the posterolateral lumber fusion may be a better option. Our case was unique in that there were three-level lumbar spondylolysis at L3-5 and single-level spondylolisthesis at L4. Dynamaic film showed apparent instability at level of L4-5 and L5-S1 and there have been early signs of discopathy at L4-S1 with no nerve root compression. So we performed posterolateral lumber fusion (PLF) at L3-4 and posterior lumbar interbody fusion (PLIF) at L4-S1 surgery for her. Our case had undergone a follow-up of 2 years, and her low back pain was almost completely disappeared. The anteroposterior and lateral X-rays showed a satisfactory position of instrumentation (Figure 4) of 1-year follow-up and the flexion-extension X-rays showed good stability and excellent fusion (Figure 5).

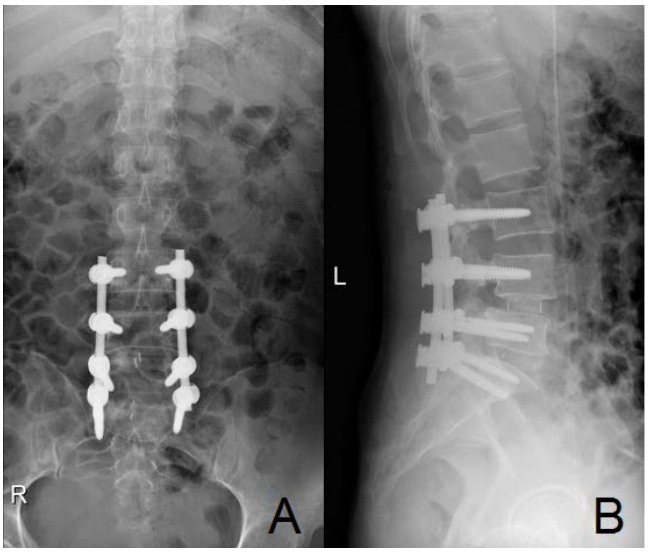

Figure 4. Postoperative anteroposterior and lateral views showed a satisfactory position of instrumentation.

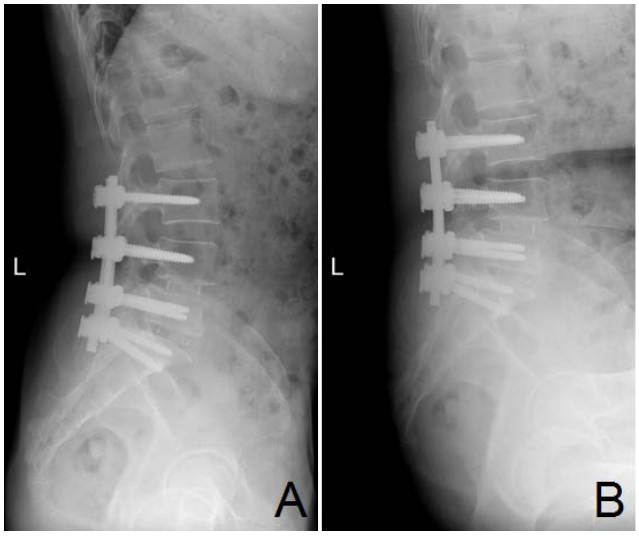

Figure 5. The flexion-extension views of 1-year follow-up showed good stability and excellent fusion.

4. Conclusion

We reported a case of three-level lumbar spondylolysis at L3-5 and single-level spondylolisthesis at L4, which is very rare. The result was favorable and proved the efficacy of combining PLF and PLIF technique for treatment for three-level lumbar spondylolysis and single-level spondylolisthesis.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Fredrickson, B.E., Baker, D., McHolick, W.J., Yuan, H.A. and Lubicky, J.P. (1984) The Natural History of Spondylolysis and Spondylolisthesis. *The Journal of Bone & Joint Surgery*, **66**, 699-707. https://doi.org/10.2106/00004623-198466050-00008

[2] Sakai, T., Sairyo, K., Suzue, N., Kosaka, H. and Yasui, N. (2010) Incidence and Etiology of Lumbar Spondylolysis: Review of the Literature. *Journal of Orthopaedic Science*, **15**, 281-288. https://doi.org/10.1007/s00776-010-1454-4

[3] Stewart, T.D. (1953) The Age Incidence of Neural-Arch Defects in Alaskan Natives, Considered from the Standpoint of Etiology. *The Journal of Bone & Joint Surgery*, **35**, 937-950. https://doi.org/10.2106/00004623-195335040-00012

[4] Al-Sebai, M.W. and Al-Khawashki, H. (1999) Spondyloptosis and Multiple-Level Spondylolysis. *European Spine Journal*, **8**, 75-77. https://doi.org/10.1007/s005860050130

[5] Higashino, K., Sairyo, K., Katoh, S., Sakai, T., Kosaka, H. and Yasui, N. (2007) Minimally Invasive Technique for Direct Repair of the Pars Defects in Young Adults Using a Spinal Endoscope: A Technical Note. *Minimally Invasive Neurosurgery*, **50**, 182-186.

[6] Zhang, S., Ye, C., Lai, Q., *et al*. (2018) Double-Level Lumbar Spondylolysis and Spondylolisthesis: A Retrospective Study. *Journal of Orthopaedic Surgery and Research*, **13**, 55. https://doi.org/10.1186/s13018-018-0723-3

[7] Liu, X., Wang, L., Yuan, S., *et al*. (2015) Multiple-Level Lumbar Spondylolysis and Spondylolisthesis. *Journal of Neurosurgery Spine*, **22**, 283-287. https://doi.org/10.3171/2014.10.SPINE14415

[8] Wiltse, L.L. (1962) The Etiology of Spondylolisthesis. *The Journal of Bone & Joint Surgery*, **44**, 539-560. https://doi.org/10.2106/00004623-196244030-00011

[9] Standaert, C.J. and Herring, S.A. (2007) Expert Opinion and Controversies in Sports and Musculoskeletal Medicine: The Diagnosis and Treatment of Spondylolysis in Adolescent Athletes. *Archives of Physical Medicine and Rehabilitation*, **88**, 537-540.

[10] Ogawa, H., Nishimoto, H., Hosoe, H., Suzuki, N., Kanamori, Y. and Shimizu, K. (2007) Clinical Outcome after Segmental Wire Fixation and Bone Grafting for Repair of the Defects in Multiple Level Lumbar Spondylolysis. *Journal of Spinal Dis-*

orders & Techniques, **20**, 521-525. https://doi.org/10.1097/BSD.0b013e3180335c1f

[11] Park, K.H., Ha, J.W., Kim, H.S., Moon, E.S., Moon, S.H., Lee, H.M., Kim, H.J. and Kim, J.Y. (2009) Multiple Levels of Lumbar Spondylolysis—A Case Report. *Asian Spine Journal*, **3**, 35-38. https://doi.org/10.4184/asj.2009.3.1.35

[12] Debnath, U.K., Freeman, B.J., Grevitt, M.P., Sithole, J., Scammell, B.E. and Webb, J.K. (2007) Clinical Outcome of Symptomatic Unilateral Stress Injuries of the Lumbar Pars Interarticularis. *Spine*, **32**, 995-1000. https://doi.org/10.1097/01.brs.0000260978.10073.90

[13] Menga, E.N., Jain, A., Kebaish, K.M., Zimmerman, S.L. and Sponseller, P.D. (2014) Anatomic Parameters: Direct Intralaminar Screw Repair of Spondylolysis. *Spine*, **39**, E153-E158. https://doi.org/10.1097/BRS.0000000000000118

[14] Hioki, A., Miyamoto, K., Sadamasu, A., Nozawa, S., Ogawa, H., Fushimi, K., Hosoe, H. and Shimizu, K. (2012) Repair of Pars Defects by Segmental Transverse Wiring for Athletes with Symptomatic Spondylolysis: Relationship between Bony Union and Postoperative Symptoms. *Spine*, **37**, 802-807. https://doi.org/10.1097/BRS.0b013e318232303a

[15] Lim, M.R., Yoon, S.C. and Green, D.W. (2004) Symptomatic Spondylolysis: Diagnosis and Treatment. *Current Opinion in Pediatrics*, **16**, 37-46. https://doi.org/10.1097/00008480-200402000-00008

[16] Mutchnick, I.S., Clegg, T.E., Carreon, L.Y. and Puno, R.M. (2011) Motion Segment-Sparing Repair of Symptomatic Chronic Pars Defects. *Journal of Neurosurgery Spine*, **15**, 159-163. https://doi.org/10.3171/2011.4.SPINE10324

[17] Voor, M.J., Mehta, S., Wang, M., Zhang, Y.M., Mahan, J. and Johnson, J.R. (1998) Biomechanical Evaluation of Posterior and Anterior Lumbar Interbody Fusion Techniques. *Journal of Spinal Disorders*, **11**, 328-334. https://doi.org/10.1097/00002517-199808000-00011

[18] Christensen, F.B., Hansen, E.S., Eiskjaer, S.P., Høy, K., Helmig, P., Neumann, P., Niedermann, B. and Bünger, C.E. (2002) Circumferential Lumbar Spinal Fusion with Brantigan Cage versus Posterolateral Fusion with Titanium Cotrel-Dubousset Instrumentation: A Prospective, Randomized Clinical Study of 146 Patients. *Spine*, **27**, 2674-2683. https://doi.org/10.1097/00007632-200212010-00006

[19] Wetzel, F.T., Brustein, M., Phillips, F.M. and Trott, S. (1999) Hardware Failure in an Unconstrained Lumbar Pedicle Screw System. A 2-Year Follow-Up Study. *Spine*, **24**, 1138-1143. https://doi.org/10.1097/00007632-199906010-00014