CASE REPORT

Anterior Decompression and Strut Grafting for Adjacent Segment Disease Nine Years after Posterior Lumbar Interbody Fusion

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Introduction

Degeneration in a mobile segment adjacent to a fused spinal segment, known as adjacent segment disease (ASD), is one of the most common complications of lumbar spine fusion. When conservative therapies have failed to relieve symptoms associated with pathology in an adjacent segment, surgical intervention is indicated¹. Such procedures always include a posterior decompression; most authors also recommend extension of the fusion to achieve stability²⁻⁴.

In comparison, anterior surgeries, although commonly implemented for treating trauma, tumors and infections of the lumbar spine, are rarely used to treat ASD. However, we believe they are appropriate alternatives to traditional posterior revision surgeries in some specific cases. We here report treatment of such a case by anterior decompression and strut grafting.

Case Report

A 63-year-old woman presented with ongoing low back pain and left leg radicular pain that had not responded to conservative treatment over the previous twelve months. Nine years earlier, she had undergone posterior interbody fusion of L₄₋₅ and L₅S₁ because of disc herniation and right leg radicular pain. The pain had been completely relieved by this procedure until new pain occurred one year prior to this presentation. She also had a history of chronic gastritis, hypertension, diabetes and mild depression, the last of which had been improved by psychotherapy 15 years earlier. Before admission, she had undergone thorough assessment by a psychiatrist, endocrinologist and cardiologist and was considered to be free of depression and major complications of diabetes and to have good glycemic control.

Physical examination revealed a 6 cm posterior midline scar but no deformity or tenderness of the spine. The motion of the lumbar spine was slightly limited. She scored 7 for back

pain and 6 for leg pain on a Visual Analog Scale (VAS). Her muscle strength was 4/5 for hip flexors, 4/5 for knee extensors, and 5/5 throughout the rest of her lower extremities. Sensation was decreased over the left medial leg. Left knee flexion was diminished. The straight leg rising test was negative bilaterally. The femoral nerve stretching test was positive on the left side. The Oswestry disability index was 50.8% preoperatively.

X-ray films showed a solid interbody fusion at L₄₋₅ and L₅S₁ with a narrowed intervertebral space at L₃₋₄ (Fig. 1). MRI demonstrated a disc bulge at L₂₋₃ and a disc herniation, moderate canal stenosis and facet joints arthrosis at L₃₋₄ (Fig. 2). There was electromyographic evidence of left L₄ nerve root impairment.

The patient therefore underwent surgical treatment. Under general anesthesia, a left-sided lateral incision was made. The vertebrae from L₂ to L₄ were accessed via a retro-peritoneal approach. A subtotal corpectomy of L₃, including discectomy of the adjacent discs, was performed, after which the posterior longitudinal ligament was excised. The anterior column was reconstructed with titanium mesh (Synmesh; Synthes Spine, Solothurn, Switzerland) filled with autologous bone graft from the corpectomy; this was supplemented by an anterior screws and rod system (VentreFix, Synthes Spine) (Fig. 3).

The intraoperative blood loss was approximately 250 mL and the operative time 110 minutes. There were no intraoperative or perioperative complications. The patient was allowed to ambulate wearing a brace on the third day postoperative day. At two-year follow-up, she had no leg pain (VAS 0) and experienced only mild lower back pain (VAS 1) in flexion. She was able to walk for more than 20 minutes or 1500 meters continuously. Muscle strength and sensation in her lower extremities was normal and her Oswestry disability index score 12.3%. She was very satisfied with the results of surgery. X-ray

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Disclosure: No funds were received in support of this work.

Received 6 June 2014; accepted 20 January 2015

Fig. 1 (a) Anteroposterior and (b) lateral radiographs demonstrating solid interbody fusion at L₄₋₅ and L₅S₁. The L₃₋₄ intervertebral space is narrowed.

Fig. 2 (a, b) Axial and (c) sagittal T2 weighted images revealed disc bulging at the (a) L₂₋₃ level and (b) disc herniation, moderate canal stenosis and facet joints arthrosis at the L₃₋₄ level.

Fig. 3 (a) Anteroposterior and (b) lateral radiographs on the third postoperative day.

Fig. 4 (a) Anteroposterior and (b) lateral radiographs at 2-year follow-up. The mesh cage has subsided slightly into the adjacent vertebral bodies without any evidence of implant loosening.

Fig. 5 (a) Coronal and (b) sagittal CT reconstruction at 2-year follow-up showing a solid fusion has been achieved. There is no significant evidence of new degeneration at the proximal adjacent segments (c) T₁₂L₁ and (d) L₁₋₂ nor of deterioration of preexisting facet arthrosis at the fusion segment (e) L₂₋₃ and (f) L₃₋₄ in the axial view.

films showed slight mesh cage subsidence into the adjacent vertebral bodies; however, there was no evidence of implant loosening (Fig. 4a,b). CT scan showed that that solid fusion had been achieved (Fig. 5a,b). Proximal adjacent degeneration at T₁₂L₁ and L₁₋₂ was minimal (Fig. 5c,d), and the preexisting facet arthrosis at the fusion segment of L₂₋₃ and L₃₋₄ had not progressed further (Fig. 5e,f). MRI revealed excellent decompression at the L₂₋₃ and L₃₋₄ levels (Fig. 6).

Discussion

Most orthopaedic surgeons prefer a posterior approach for treating symptomatic post-fusion ASD. Decompression and fusion of the degenerated adjacent segment via a posterior approach is usually safe and effective²⁻⁴. A higher fusion rate can be achieved by complementing the procedure with transpedicular fixation⁴. However, our patient had previously undergone a two-level posterior lumbar interbody fusion with total laminectomy and was now presenting with another two-level painful degeneration. Because a posterior

approach would have required extensive surgical exposure over the scarred epidural space and a long segmental instrumentation, we considered it was an inappropriate choice. We also believed a posterior approach would be associated with a greater risk of dural tear and more extensive surgical trauma to soft tissue than an anterior approach. The incidence of dural tear during lumbar spine revision surgeries is estimated to be as high as 13.2%–21.4%, compared with 7.6%–10% for primary surgeries^{5,6}. This high prevalence in revisions is probably attributable to dural scarring, fibrosis and dural out-pouching after the previous surgeries⁶. Another major concern is iatrogenic paraspinal muscle injury, which can occur when operating at the same surgical site for a second time. Postoperative back pain, muscle weakness and functional disability are reportedly associated with intraoperative back muscle injury⁷⁻⁹. Ischemic necrosis, atrophy, and denervation of paraspinal muscles may occur after posterior dissection and traction and these adverse effects seem to be long-lasting¹⁰.

Fig. 6 Sagittal view of the lumbar spine MRI at 2-year follow-up revealing excellent decompression of the spinal canal at the L₂₋₃ and L₃₋₄ levels.

For these reasons, we performed an anterior L₃ corpectomy and strut grafting on this patient rather than a traditional posterior surgery. Common indications for anterior lumbar spine surgery include spinal tumors, infections, fractures and deformities that require anterior decompression and reconstruction, and degenerative disc diseases that require anterior interbody arthrodesis or disc arthroplasty¹¹⁻¹⁴. However, use of an anterior approach has not yet been reported for ASD after posterior lumbar fusion. We believe this approach has some advantages over the posterior approach and is therefore appropriate for some specific cases. This patient's L₃₋₄ lateral recess stenosis was caused predominantly by bulging of the disc. Hypertrophy of the facet joints was only mild and she had no significant spondylolisthesis. We therefore

regarded her as a possible candidate for an anterior-only decompression and fusion procedure. Because she had no scars on the ventral side of the dural sac, decompression would be much safer. In addition, after insertion of the anterior screws and rod implants, posterior transpedicular fixation might no longer be mandatory, the latter procedure being associated with a 20%–30% incidence of superior facet joint violation^{15,16}. Thus, the facet joints could be preserved, decreasing the risk of new adjacent segment degeneration. The outcome in our patient illustrates these advantages. At two-year follow-up, there was minimal radiological evidence of new degeneration in the adjacent facet joints.

However, we do not recommend the anterior approach in patients who have central spinal stenosis, severe hypertrophy of facet joints or ligamentum flavum, spondylolisthesis or segmental instability. In these situations, decompression of the posterior elements or transpedicular fixation is almost always necessary. An anterior approach is also unsuitable for upper level adjacent segment disease as high as L₁₋₂ or T₁₂L₁ because diaphragm or thoracic cavity interference would be inevitable. In addition, because the risk of retrograde ejaculation is as high as 5.9%, we generally would not perform anterior lumbar surgery, unless absolutely essential, in young male patients¹⁷. Other major complications of anterior surgery include vascular injuries, deep venous thrombosis, neurologic injuries, and bowel and ureteral injuries¹⁸. Because the complications of anterior surgery have the potential to be more catastrophic than those of posterior surgery, very cautious patient selection and a detailed preoperative plan are mandatory and the procedure should always be performed by an experienced surgeon who is fully familiar with this approach.

In conclusion, although a posterior approach is widely used for fusing the degenerative segment adjacent to a previous lumbar fusion, we believe that anterior surgery is a feasible and preferable alternative in some cases. In our experience, anterior decompression and fusion is most suitable for mild to moderate spinal stenosis and disc herniation without significant posterior structure proliferation or segmental instability. Its major advantages over posterior surgery are protection of the important paraspinal muscles and avoidance of the epidural scar. However, when considering this option, care should be taken in patient selection, preoperative planning and every detail during the process of surgery because of this procedure's potential disastrous complications.

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