Spondylolisthesis following a pedicle subtraction osteotomy

Case report

CHEERAG D. UPADHYAYA, M.D., M.S.C.,1 SIGURD BERVEN, M.D.,2 AND PRAVEEN V. MUMMANENI, M.D.1
Departments of 1Neurological Surgery and 2Orthopaedic Surgery, University of California, San Francisco, California

Pedicile subtraction osteotomy (PSO) is a powerful technique for correcting a fixed sagittal plane deformity. The authors report the case of a 51-year-old man with a history of multiple prior lumbar operations, flat-back syndrome, thoracic kyphosis, and radiculopathy, who underwent deformity correction surgery with T3–S1 pedicle screw fixation and L-3 PSO. Progressive spondylolisthesis of the PSO segment associated with rod fracture then developed. The patient subsequently underwent anterior and posterior revision surgery. This case is a rare instance of spondylolisthesis following PSO. (DOI: 10.3171/2009.12.FOCUS09285)

KEY WORDS • pedicle subtraction osteotomy • spondylolisthesis • deformity

Abbreviations used in this paper: ALL = anterior longitudinal ligament; MCS = mental component summary; PCS = physical component summary; PSO = pedicle subtraction osteotomy; rHBMP-2 = recombinant bone morphogenetic protein; SF-36 = 36-Item Short Form Health Survey; VAS = visual analog scale.

Pedicle subtraction osteotomy is a powerful technique for the correction of a fixed sagittal plane deformity. This type of osteotomy has been associated with significant perioperative morbidity,1,2,4–6 which we have described as > 50% in patients undergoing PSO in a revision setting. We here report a rare case of pseudarthrosis at the level of a PSO due to spondylolisthesis of the PSO segment.

Case Report

History and Examination. This 50-year-old man who had undergone 4 prior thoracolumbar operations over the past decade presented with flat-back syndrome, thoracic kyphosis, and right leg radiculopathy (Fig. 1). His preoperative VAS back pain score was 8 out of 10, and his preoperative VAS leg pain score was 6 out of 10. His preoperative SF-36 scores were 28.6 for the PCS and 29.1 for the MCS. He was unable to ambulate a block without stopping.

Operation. We performed a deformity correction with T3–S1 pedicle screw fixation (Expedium 5.5 Ti System, DePuy Spine) and T6–8 Ponte (facet) osteotomies as well as an L-3 PSO (Fig. 2). We did not visualize the ALL. Posterolateral arthrodesis was performed with iliac autograft, local autograft from the spine, and demineralized bone matrix as a graft extender.

Postoperative Course. There were no immediate postoperative complications, and the patient was discharged home in good condition.

Six months later he was noted to have pseudarthrosis at L3–4 associated with rod fractures. He had a significant amount of back pain. Furthermore, radiographic studies showed that progressive spondylolisthesis of the PSO segment was developing (Fig. 3). We suspected that the ALL was torn. He subsequently underwent a T12–S1 revised posterior spinal fixation (Expedium 6.35 Ti system, DePuy Spine) and revised posterolateral fusion from T12–L5 bilaterally utilizing rHBMP-2 (Infuse, Medtronic). To halt the spondylolisthesis of the PSO segment, we performed a second-stage anterior spinal fusion surgery a few weeks later: L2–3 and L3–4 anterior lumbar interbody fusion with titanium cages (Devex, DePuy Spine) filled with rib autograft and rhBMP-2 and supplemented with an anterior screw rod fixation (Expedium Anterior, DePuy Spine).

At the 2-year follow-up from the index deformity surgery, the patient had achieved a solid fusion (Fig. 4). His latest VAS leg pain score was 3 out of 10, and his back pain score was 3 out of 10. His latest SF-36 scores were 32.1 for PCS and 25.5 for MCS. He is now able to ambulate more than a mile.
The early morbidity of PSO has been well documented in the literature. We present a rare, delayed complication of spondylolisthesis of a PSO segment associated with pseudarthrosis (at L3–4) resulting in bilateral rod fracture. Because of the progressive spondylolisthesis of the PSO segment, revision surgery required not only a revised posterior fusion but also an anterior interbody fusion to secure the PSO segment to the adjacent vertebrae.

During a PSO procedure, surgeons pivot the osteotomy closure on the junction of the vertebral body with the ALL. Such pivoting may result in compromise of the ALL. It is important to note that in a PSO, spine surgeons remove all the posterior ligamentous structures and posterior bony elements. Only the ALL and adjacent intervertebral discs remain to prevent a spondylolisthesis of the PSO segment. If the ALL is torn, the PSO segment may be predisposed to spondylolisthesis. Circumferential fusion of the spine or the use of more rigid instrumentation of the spine may be considered in patients with a mobile anterior column.

Patients should be closely monitored for evidence of ALL failure and spondylolisthesis of a PSO segment. In cases in which the integrity of the ALL is suspected of being compromised and in which spondylolisthesis of the PSO segment begins, the situation may be salvaged early on with an anterior interbody fusion to secure the PSO segment to the surrounding vertebrae prior to posterior rod fracture.

Compromise of the ALL can occur during closure of a PSO. The ALL is the main structure that prevents spondylolisthesis of the PSO segment. If the ALL is compromised, spondylolisthesis of the PSO can occur and result in pseudarthrosis and rod fracture. To prevent this problem, surgeons should watch for signs of progressive spondylolisthesis of the PSO segment and salvage this problem with an early anterior interbody fusion to secure the PSO segment to the surrounding vertebrae.
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References


Address correspondence to: Praveen V. Mummaneni, M.D., Department of Neurological Surgery, University of California, San Francisco, 505 Parnassus Avenue, Room M-780, San Francisco, California 94143. email: vmum@aol.com.