

Irreducible L5/S1 Spondyloptosis in Over 20 Years After Neglected Trauma Treated with Modified Grob's Technique – Case Report

Adam Bębenek , Maciej Dominiak, Grzegorz Karpiński, Bartosz Godlewski 

Department of Orthopaedics and Traumatology with Spinal Surgery Ward, Scanmed – St. Raphael Hospital, Cracow, Poland

Correspondence: Adam Bębenek, Department of Orthopaedics and Traumatology with Spinal Surgery Ward, Scanmed – St. Raphael Hospital, Cracow, Poland, Email bebenek.adam.24@gmail.com

Introduction: Spondyloptosis, characterized by complete slippage of the upper vertebral body relative to the lower vertebral body, is an exceedingly rare condition. Typically, it occurs as a result of a high-energy injury and is promptly managed. It is uncommon for a patient to present to a spinal surgery unit several decades after the initial incident.

Case Report: In this case report, we describe the case of a 62-year-old man who experienced a lumbosacral injury from a fall twenty years prior to seeking treatment. The patient had multiple comorbidities, including obesity and internal medicine conditions. He presented with severe back pain radiating to the lower extremities, accompanied by significant neurogenic claudication and lower extremity weakness. Imaging studies revealed spondyloptosis at the L5/S1 level, along with bony fusion and spinal canal stenosis at the L3/L4 level.

Conclusion: The patient underwent surgical intervention using Grob's direct pediculo-body fixation technique. The postoperative period was uneventful, and over the course of one year of follow-up, the patient experienced a resolution of symptoms and significant improvement in functional capacity.

Keywords: spondyloptosis, vertebrae slippage, spondylolisthesis, Grob's technique

Introduction

Spondyloptosis, a pathological condition characterized by the complete slip of an overlying vertebral body off the underlying one, is commonly classified as grade 5 spondylolisthesis with a slip exceeding 100% according to the classification introduced by H.W. Myerding in 1938.¹ The most prevalent locations for spondyloptosis are the L5/S1 and L4/L5 levels.^{2,3} This condition leads to a state of extreme instability within the affected vertebral segment, accompanied by associated disorders of the vertebral canal. Notably, the manifestation of symptoms associated with root or spine compression varies depending on the specific level of slippage. Spondyloptosis is typically the result of high-energy trauma and necessitates urgent surgical intervention, as delay in treatment may further exacerbate the condition.⁴⁻⁸ It is uncommon for patients to present to a spinal surgery unit several decades after the initial traumatic event. In this context, we present a noteworthy case report of a patient who experienced sacrolumbar spine trauma over two decades ago and subsequently underwent surgical intervention involving spinal canal decompression and posterior lumbosacral fusion utilizing a modified Grob's method.

Report of the Case

A 62-year-old individual with obesity (BMI 37.1 kg/m²) was admitted to the authors' spinal surgery unit due to the presence of severe pain in the lumbosacral region, which radiated to the lower extremities (Visual Analog Scale [VAS] score of 6 out of 10). Additionally, the patient experienced severe neurogenic claudication (14 points on the N-CLASS scale⁹) and exhibited weakness in the lower limbs (MRC scale: 4). No reports of bowel or bladder control loss were noted. The Oswestry Disability Index (ODI) score was 48%, indicating a state of severe disability.¹⁰

The magnetic resonance imaging (MRI) examination performed on the patient revealed findings consistent with complete spondylolisthesis (spondyloptosis) at the L5/S1 level. The MRI showed distortion of the vertebral bodies, with the L5 vertebral body displaced anteriorly to the S1 vertebral body. Additionally, critical stenosis of the spinal canal and intervertebral foramina was observed. (Figure 1) Prior to the surgery, a preoperative computed tomography (CT) scan was conducted, providing further information. In addition to the previously mentioned findings, the CT scan revealed a significant degree of bone fusion (union) in the L5/S1 region. Furthermore, the transverse dimension of the dural sac at the L4/L5 level was measured to be 15×9 [mm] (Figure 2).

The surgical intervention consisted of decompression of the dural sac through laminectomy at the L3-S1 levels and stabilization of L3, L4, and L5-S1. Transpedicular screws were routinely inserted at the L3 and L4 levels. However, due to the significant bone fusion between L5 and S1, which hindered the reduction of spondyloptosis at this level, transpedicular screws were inserted using Grob's technique, passing through the fused L5 and S1 vertebrae. Following stabilization, spinal canal decompression was performed, and the screws were connected to a connecting rod for further support and stability.

The postoperative course was uneventful, without any complications. A CT scan conducted 24 hours after the surgery confirmed the accurate positioning and secure anchorage of the screws. This imaging assessment provided reassurance regarding the stability and integrity of the surgical construct (Figure 3).

To enhance the comprehensibility of the case report, we compiled tomographic images that illustrate the placement of the screws. By consolidating these images, we aimed to provide a clearer visual representation of the precise positioning and alignment of the screws within the spinal structure (Figure 4).



Figure 1 Preoperative MRI - T2 TSE: (A) – midline sagittal plane, (B) – plane tangential to the L3/L4 disc (marked with the red line in the (A)).

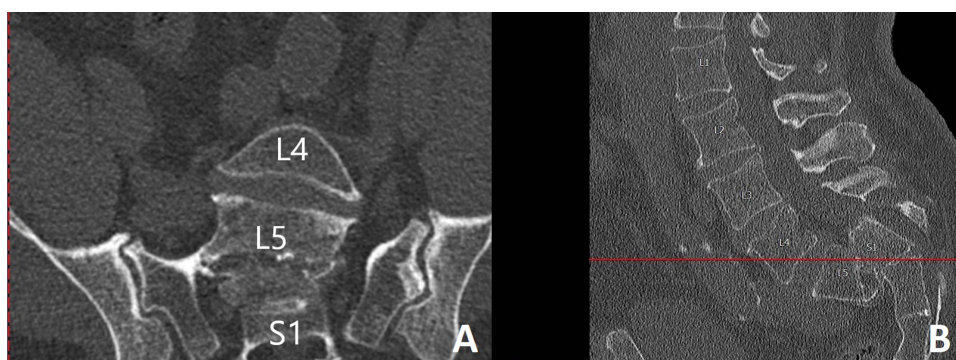


Figure 2 Preoperative computed tomography scan: (A) – axial plane at the level marked with the red line in the (B), (B) – midline sagittal plane.

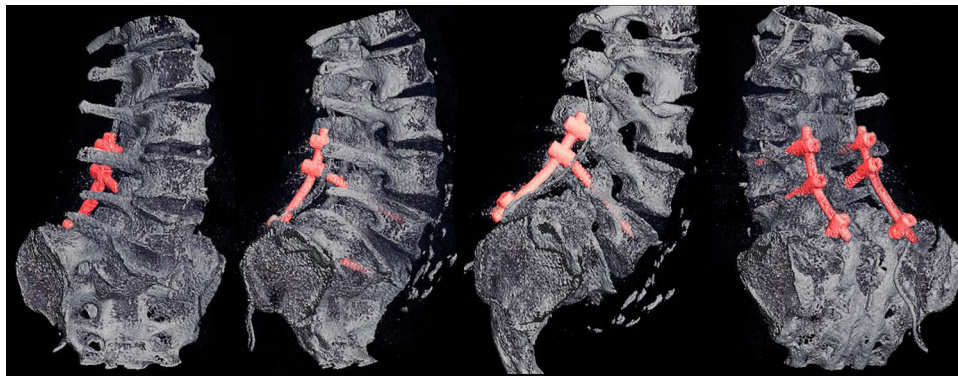


Figure 3 The 3D render of CT scan performed 24h after the surgery.



Figure 4 Combined tomographic images showing screw placement.

Within 24 hours of the procedure, the patient regained the ability to walk. The previously experienced weakness in the lower extremities and neurogenic claudication were resolved. Following a favorable recovery, the patient was discharged in good overall condition after 72 hours. A digital radiograph obtained four weeks post-surgery revealed the accurate positioning of the screws, indicating successful alignment and stability. (Figure 5) At the four-month postoperative assessment, the patient's Oswestry Disability Index (ODI) improved to 34%, indicating a significant reduction in disability. Prior to the surgery, the patient experienced nighttime pain disturbances, but after the procedure, he achieved uninterrupted sleep. The patient's mobility has notably improved, enabling him to walk distances of up to 4 km without significant difficulties. However, he does report occasional paresthesias in his toes. Overall, the patient's functional outcomes have significantly improved, demonstrating the positive impact of the surgical intervention.

Discussion

Spondyloptosis is a highly uncommon condition characterized by the complete displacement of a vertebral body in relation to the underlying vertebra. According to the classification introduced by Henry Meyerding, it can be classified as grade V spondylolisthesis, indicating a displacement of more than 100%. This severe form of spondylolisthesis involves the complete anterior translation of the affected vertebral body, resulting in significant instability and functional



Figure 5 Postoperative radiological image of the lumbosacral section obtained 1 month after the surgery.

impairment. The rarity of this condition underscores its exceptional nature within the spectrum of spinal disorders.¹ Spondyloptosis manifests with various symptoms, including lower back pain, sciatica, neurogenic claudication resulting from spinal canal stenosis, compression of nerve roots leading to motor weakness, impaired or abolished reflexes, sensory disturbances, as well as sphincter dysfunction symptoms such as urinary and fecal incontinence.^{11–14}

While there have been numerous studies focusing on the pathomechanism and management of spondylolisthesis, the management of spondyloptosis, specifically, remains a challenge due to its rarity.^{11,12,15–18} Spondyloptosis is a condition that typically arises from high-energy trauma and is characterized by complete vertebral slippage. Despite the availability of literature on spondylolisthesis and its treatment modalities, there are no clear guidelines specifically tailored for spondyloptosis management. This further highlights the exceptional nature of this condition.^{5–7,19} In our presented case report, the situation is particularly unusual as the patient experienced an injury, resulting from a fall, more than two decades prior to the onset of symptoms. During that time, the patient neglected to seek a diagnosis and treatment due to minor ailments. It is worth noting that complete vertebral slippage most commonly occurs at the lumbosacral level, with less frequent involvement of the lumbar region.²⁰

In the case we presented, the patient experienced severe low back pain that radiated to the lower limbs, along with weakness in the lower extremities and neurogenic claudication, which manifested after approximately 100 steps. Based on our assessment, these complaints were attributed to the stenosis of the spinal canal and intervertebral foramen at the L3, L4, L5, and S1 levels as observed in the imaging studies. These symptoms had a substantial negative impact on the patient's quality of life.

The management of spondyloptosis typically necessitates surgical intervention involving decompression, reduction, and stabilization techniques.¹⁵ In our presented case, the spinal canal was decompressed through laminectomies performed at the L3-S1 vertebrae levels, followed by transpedicular stabilization at those segments. The routine insertion of polyaxial screws at the L3 and L4 levels was accompanied by the utilization of Grob's direct pediculo-body fixation technique for stabilization at the L5-S1 level.²¹

It should be noted that the chosen technique may appear subject to debate when compared to methodologies described by other researchers. Nevertheless, none of the techniques reported in the literature completely addressed the requirements of our specific case. The Gaines and Nichols method, involving a two-stage reduction of spondyloptosis with anterior vertebrectomy at the L5 level during the initial stage and subsequent reduction and stabilization from L4 to S1 during the second stage, is acknowledged for its effectiveness.^{13,22} However, this method exerts a significant toll on the patient's overall condition and is predominantly intended for younger individuals - Gaines described his method on patients whose average age was 22 years. In our case, considering the patient's age (62 years), high body mass index (37.1 kg/m²), and comorbidities, the risks associated with the anterior approach outweighed the potential benefits.

An alternative technique under consideration was sacral dome osteotomy, a posterior approach involving the removal of a fragment of the sacrum adjacent to the inferior terminal lamina of the L5 vertebra prior to reducing L5 over S1.²³

This technique has demonstrated efficacy according to previous reports.^{15,18,24} Regrettably, we were unable to utilize this approach in our case due to extensive bony fusion between L5 and S1, likely resulting from detachment of the proximal part of the S1 shaft. This finding aligns with observations made by other investigators.¹⁴

The Grob technique of direct pediculo-body fixation, which we employed, represents an effective treatment option for advanced spondylolisthesis at the L5-S1 level.²¹ In Grob et al study, patients undergoing this technique reported experiencing neurogenic claudication and pain, with some individuals manifesting symptoms of radiculopathy. However, no postoperative neurological deficits were detected, and symptoms resolved in all treated patients. Notably, the mean age of the study participants was 54 years (ranging from 35 to 77 years), and the mean intraoperative blood loss was relatively low, with an average of 360 mL (ranging from 100 to 800 mL).²¹ In contrast, alternative techniques described in the literature primarily targeted much younger patient populations (approximately 22 years of age)^{13,14,22,25} and were associated with higher blood loss (approximately 2 liters).^{23,26,27} Authors combined In our case, we combined Grob's method with dural sac decompression and transpedicular stabilization at the L3-L5/S1 levels. Although this approach entails a higher risk of pseudarthrosis compared to stabilization with reduction, the procedure exhibited fewer intra- and postoperative complications and appeared to be a safer and more suitable choice for our patient.¹⁵

Following the surgical intervention, the patient was able to ambulate 24 hours postoperatively, demonstrating a notable improvement in gait. Additionally, the previously experienced neurogenic claudication completely resolved, and there was a notable increase in lower limb strength. The patient's pain levels, as assessed using the Numeric Rating Scale (NRS), decreased from 6 to 2 points, indicating a substantial reduction in pain intensity. Subsequent diagnostic imaging confirmed the satisfactory placement of the screws. Remarkably, within a span of two months after the surgery, the patient fully regained functional capacity.

Conclusions

Based on our findings and experience, we firmly assert that the utilization of the Grob's technique in conjunction with decompression and stabilization represents an efficacious and secure approach for managing spondyloptosis in older individuals. The combined procedure provides a comprehensive treatment strategy that addresses the underlying pathology, promotes spinal stability, and alleviates associated symptoms. By employing this approach, we have witnessed positive outcomes in terms of clinical improvement, functional recovery, and postoperative complications. Consequently, we advocate for the consideration of this combined technique as a viable option for the management of spondyloptosis in the geriatric population.

Ethics Approval

In this instance, institutional approval was not necessary to publish the case details.

Consent for Publication

The patient provided written informed consent for the publication of their case details and accompanying images.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Meyerding HW. Spondylolisthesis as an etiologic factor in backache. *J Am Med Assoc.* 1938;111(22):1971–1976. doi:10.1001/jama.1938.02790480001001
2. Schär RT, Sutter M, Mannion AF, et al. Outcome of L5 radiculopathy after reduction and instrumented transforaminal lumbar interbody fusion of high-grade L5–S1 isthmic spondylolisthesis and the role of intraoperative neurophysiological monitoring. *Eur Spine J.* 2017;26(3):679–690. doi:10.1007/s00586-017-4964-3
3. Li Y, Hresko MT. Radiographic analysis of spondylolisthesis and sagittal spinopelvic deformity. *J Am Acad Orthop Surg.* 2012;20(4):194–205. doi:10.5435/JAAOS-20-04-194
4. Yamaki VN, Morais BA, Brock RS, Paiva WS, De Andrade AF, Teixeira MJ. Traumatic lumbosacral spondyloptosis in a pediatric patient: case report and literature review. *Pediatr Neurosurg.* 2018;53(4):263–269. doi:10.1159/000488766
5. Cabrera JP, Yankovic W, Luna F, et al. Traumatic spondyloptosis of L3 with incomplete neurological involvement: a case report. *Trauma Case Rep.* 2019;24. doi:10.1016/j.tcr.2019.100248
6. Akesen B, Mutlu M, Kara K, Aydinli U. Traumatic lumbosacral spondyloptosis: a case report and review of the literature. *Glob Spine J.* 2014;4(1):059–062. doi:10.1055/s-0033-1357082
7. Gabel BC, Curtis E, Gonda D, Ciacci J. Traumatic L5 posterolateral spondyloptosis: a case report and review of the literature. *Cureus.* 2015;7(6). doi:10.7759/cureus.277
8. Pizones J, Izquierdo E, Núñez A, Sánchez-Mariscal F, Zúñiga L, Álvarez-González P. Posterior transpedicular fibular grafts and interferential screws for the surgical treatment of L5–S1 spondyloptosis: case report of four patients with 8.5 years' follow-up. *Spine Deform.* 2013;1(4):306–312. doi:10.1016/j.jspd.2013.05.012
9. Genevay S, Courvoisier DS, Konstantinou K, et al. Clinical classification criteria for neurogenic claudication caused by lumbar spinal stenosis. The N-CLASS criteria. *Spine J.* 2018;18(6):941–947. doi:10.1016/j.spinee.2017.10.003
10. Fairbank JCT, Pynsent PB. The Oswestry disability index. *Spine.* 2000;25(22):1.
11. Shafi B, Beiner JM, Grauer JN, Kwon BK, Vaccaro AR. Lumbar Spondylolisthesis. In: *Core Knowledge in Orthopaedics: Spine.* Elsevier Inc.; 2005:157–171.
12. Fredrickson BE, Baker D, McHolick WJ, Yuan HA, Lubicky JP. The natural history of spondylolysis and spondylolisthesis. *J Bone Joint Surg Am.* 1984;66(5):699–707. doi:10.2106/00004623-198466050-00008
13. Gaines RW, Nichols WK. Treatment of spondyloptosis by two stage L5 vertebrectomy and reduction of L4 onto S1. *Spine.* 1985;10(7):680–686. doi:10.1097/00007632-198509000-00015
14. Yue WM, Brodner W, Gaines RW. Abnormal spinal anatomy in 27 cases of surgically corrected spondyloptosis: proximal sacral endplate damage as a possible cause of spondyloptosis. In: *Spine.* Vol. 30. Lippincott Williams and Wilkins; 2005.
15. Beck AW, Simpson AK. High-grade lumbar spondylolisthesis. *Neurosurg Clin N Am.* 2019;30(3):291–298. doi:10.1016/j.nec.2019.02.002
16. Harris IE, Weinstein SL. Long-term follow-up of patients with Grade-III and IV spondylolisthesis. Treatment with and without posterior fusion. *J Bone Jt Surg.* 1987;69(7):960–969. doi:10.2106/00004623-198769070-00002
17. Kreiner DS, Baisden J, Mazanec DJ, et al. Guideline summary review: an evidence-based clinical guideline for the diagnosis and treatment of adult isthmic spondylolisthesis. *Spine J.* 2016;16(12):1478–1485. doi:10.1016/j.spinee.2016.08.034
18. Kunze KN, Lilly DT, Khan JM, et al. High-Grade spondylolisthesis in adults: current concepts in evaluation and management. *Int J Spine Surg.* 2020;14(3):327–340. doi:10.14444/7044
19. Amesiya R, Orwotho N, Nyati M, Mugarura R, Mwaka ES. Traumatic spondyloptosis of the lumbar spine: a case report. *J Med Case Rep.* 2014;8(1):453. doi:10.1186/1752-1947-8-453
20. Xu F, Tian Z, Fu C, et al. Mid-lumbar traumatic spondyloptosis without neurological deficit: a case report and literature review. *Medicine.* 2020;99(12). doi:10.1097/MD.00000000000019578
21. Grob D, Humke T, Dvorak J. Direct pediculo-body fixation in cases of spondylolisthesis with advanced intervertebral disc degeneration. *Eur Spine J.* 1996;5(4):281–285. doi:10.1007/BF00301335
22. Gaines RW. L5 vertebrectomy for the surgical treatment of spondyloptosis: thirty cases in 25 years. In: *Spine.* Vol. 30. Lippincott Williams and Wilkins; 2005.
23. Pennington Z, Ahmed AK, Goodwin CR, Westbrook EM, Sciubba DM. The use of sacral osteotomy in the correction of spinal deformity: technical report and systematic review of the literature. *World Neurosurg.* 2019;130:285–292. doi:10.1016/j.wneu.2019.07.083
24. Min K, Liebscher T, Rothenfluh D. Sacral dome resection and single-stage posterior reduction in the treatment of high-grade high dysplastic spondylolisthesis in adolescents and young adults. *Eur Spine J.* 2012;21(SUPPL. 6):785–791. doi:10.1007/s00586-011-1949-5
25. Roca J, Ubierna MT, Cáceres E, Iborra M. One-stage decompression and posterolateral and interbody fusion for severe spondylolisthesis: an analysis of 14 patients. *Spine.* 1999;24(7):709–714. doi:10.1097/00007632-199904010-00019
26. Bodin A, Roussouly P. Sacral and pelvic osteotomies for correction of spinal deformities. *Eur Spine J.* 2014;24(1):72–82. doi:10.1007/s00586-014-3651-x
27. Kalra K, Kohli S, Dhar S. A modified Gaines procedure for spondyloptosis. *J Bone Jt Surg.* 2010;92(11):1589–1591. doi:10.1302/0301-620X.92B11.24382

International Medical Case Reports Journal

Dovepress

Publish your work in this journal

The International Medical Case Reports Journal is an international, peer-reviewed open-access journal publishing original case reports from all medical specialties. Previously unpublished medical posters are also accepted relating to any area of clinical or preclinical science. Submissions should not normally exceed 2,000 words or 4 published pages including figures, diagrams and references. The manuscript management system is completely online and includes a very quick and fair peer-review system, which is all easy to use. Visit <http://www.dovepress.com/testimonials.php> to read real quotes from published authors.

Submit your manuscript here: <https://www.dovepress.com/international-medical-case-reports-journal-journal>