



The Operative Efficacy of Decompression and Fixation Surgery for Degenerative Lumbosacral Spondylolisthesis: A Single Institutional Study

Aurangzeb Kalhoro*, Kashif Ahmed, Abdul Sattar Hashim

Neurospinal Cancer Care Institute, Karachi – Pakistan

Article Info

Corresponding Author
Aurangzeb Kalhoro
Neurospinal Cancer Care Institute, Karachi – Pakistan
Email: draurangzebkalhoro@gmail.com

Date Received: Nov 16, 2023
Date Revised: April 18, 2024
Date Accepted: Aug 23, 2024

Abstract

Objective: To assess the results of lumbar decompression and lumbar stabilization for spondylolisthesis.

Methodology: A retrospective study was designed and included a record of six years. We included 84 patients with Spondylolisthesis. The Meyerding classification was utilized to classify the extent of vertebral slippage in spondylolisthesis. In the case of spondylolisthesis, we did a decompression and pedicle screw fixation. Z score formula was applied to compare the two preoperative and postoperative outcomes in ODIs and report significant result.

Result: The mean age of the patients in the study was 49.79 ± 8.11 years. There were 48 (57.14%) male patients and 36 (42.85%) female patients. Spondylolisthesis occurred at L3-L4 in 11 (13.1%) cases. Among the patients, 72 (85.7%) had moderate, 8 (9.5%) had severe, and 4 (4.7%) had mild ODI. Postoperatively, 69 (95.8%) patients experienced substantial improvement in ODI. Top of Form.

Conclusion: In patients with a mild to moderate Oswestry Disability Index before surgery, the surgical technique provides superior clinical outcomes and improvement.

Keywords: spondylolisthesis, spinal degenerative disease, pedicle screw

*This article may be cited as:
Kalhoro A, Ahmed K, Hashim AS. The operative efficacy of decompression and fixation surgery for degenerative lumbosacral spondylolisthesis: A single institutional study. J Postgrad Med Inst 2024;38(3):190-95. <http://doi.org/10.54079/jpmi.38.3.3358>*

Introduction

Spondylolisthesis can be defined as the sliding of a vertebra relative to the overlying one caused by structural and degenerative changes. This is a state in which one vertebra slides over the one above or below due to structural and degenerative abnormalities. Its growth is influenced by facet joint anatomic orientation or hypertrophy, disc degeneration and ligament hyperlaxity. Decompression, which may require a particular surgical technique, is the most often used operational treatment. Only decompression may accelerate slippage, resulting in further deterioration of the state. As a result, lumbar fusion and fixation are advised for spine stabilization and prevention of future deterioration.¹ The success rate of posterior decompression for lumbosacral spondylolisthesis reduction, alignment, and fixation can be assessed through the Oswestry Disability Index (ODI) as an outcome measure. Reduction with decompression proves beneficial in spondylolisthesis cases, with the ODI serving as a predictive factor for the outcome. Timely treatment involving decompression and fixation, guided by ODI scores, is crucial as spondylolisthesis can deteriorate over time. This underscores the importance of achieving adequate decompression rather than aiming for complete reduction.^{2,3} Dynamic X-rays involving flexion and extension postures are necessary for accurately grading spondylolisthesis, despite the potential discomfort they may cause. Decompression alone may not adequately address the issue, leading to the debate over the efficacy of fusion and fixation as surgical treatments for degenerative spondylolisthesis. Evaluation of parameters for decision-making and the selection of surgical procedures is essential. Spondylolisthesis, a common clinical condition, manifests with symptoms such as low back pain, radiculopathy, and neurological involvement.⁵ Spondylolisthesis treatment options encompass both conservative and surgical approaches. Surgical intervention becomes necessary when severe instability, advanced grades of spondylolisthesis, and neurological impairments exceed the scope of conservative management.⁶ The current study rationale was focused to assess the clinical outcome of decompression and lumbar stabilization for degenerative spondylolisthesis. We evaluated the effectiveness of pedicle screws lumbar spinal fixation plus decompression laminectomy in patients with symptomatic lumbar spondylolisthesis.

Methodology

Research Design and Setting:

A six-year retrospective research was designed at the (February 2016 to June 2022). We included 84 patients with Spondylolisthesis.

Inclusion & Exclusion Criteria:

Patients of both genders, aged between 25 to 70 years,

having spondylolisthesis Grade I, II, III, or IV with a clinical history of back pain, walking difficulties, and refractive to medication were included, while the patient with a history of spinal trauma, spinal lesion, previous history of spinal surgery patients was excluded from this study.

Data Collection:

All patients' demographics and clinical information such as pre/postoperative ODI (Oswestry disability index), lumbar levels, Meyerding classification Spondylolisthesis grades, VAS (visual analog scores), and complications were recorded routinely as per ward protocol. To classify the extent of vertebral slippage in spondylolisthesis, the Meyerding classification was utilized.

Surgical Procedure:

Pedicle Fixation and Decompression in Spondylolisthesis

All patients who fulfilled the criteria were selected for surgery after fitness. Patients were shifted to the operation theater, after anesthesia, placed in a prone position; images were done through the C arm for confirmation of the spinal area of his thesis. The incision was made, the muscles were separated, the pedicle screw was fixed, reduction and alignment were done and checked through the C arm; if the patient had hypertrophic (determined by pre-op MRI lumbar spine) ligament, and discs, then laminectomy, discectomy, and fusion were done according to protocol.

The final image was checked and the wound was closed in layers. See Figure 1

Statistical Analysis:

All data was processed in SPSS version 25. Z score formula was applied to compare the two preoperative and postoperative outcomes (good and fair) in ODIs and report the significant result with the p-values. A p-value < 0.050 was marked as a significant value.

Results

Gender and Age Distribution:

The mean calculated age of the patients was 49.79±8.11 years. 8.33% of patients were 54 years and 7.14% of patients were 43 years. The lower age limit was 32 years, and the upper limit was 64 years for enrolled patients. There were 48(57.14%) male and 36(42.85%) female patients.

Spondylolisthesis Grades and Lumbar Levels:

As per Meyerding Classification, 5(5.95%) patients with Grade I, 53(63.09%) patients had Grade II, and 26(30.95%) patients with Grade III Spondylolisthesis. L3-L4 Spondylolisthesis was reported in 11(13.09%) patients, L4-L5 was reported in 30(35.71%) patients and L5-LS1 was reported in 43(51.2%) patients.

Distribution of Lumbar Levels in Spondylolisthesis:

Out of 84 patients in the study, 13.1% spondylolisthesis occurred at L3-L4, out of which 91% were grade II, and 9.1% were grade I, according to Meyerding's classification of spondylolisthesis. There were no patients with Grade III spondylolisthesis. L4-L5 spondylolisthesis was found in 35.7% of patients, with 56.6% of patients in grade II and 33% in grade III. There were only 10% in grade I. 51% of 84 patients had L5-S1 spondylolisthesis, most patients (62.8%) had Grade II and 35% had Grade III spondylolisthesis. Only a minority of 2.3% had Grade I defects. See Table 1.

Preoperative and Postoperative ODI and Grade-Wise Distribution:

Preoperatively, patients had mild, moderate, or severe pain. 72 patients out of 84 had moderate, eight patients had severe, and four patients had mild Oswestry disability index (ODI). Postoperatively, 69 (95.8%) patients had a substantial improvement in ODI. 46(66.6%) had Grade II spondylolisthesis. Three patients (4.2%), only had a minor improvement postoperatively. There

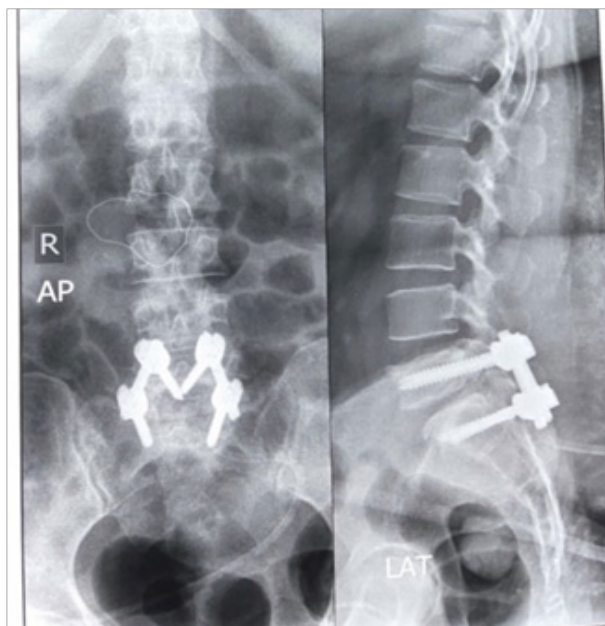


Figure 1. The X-ray shows lumbosacral fusion in the AP and lateral views.

was no patient with a poor outcome in the moderate ODI preoperative group. In the group with severe ODI, out of 8 patients, 2 had good outcomes, 4 had fair, and 2 had poor outcomes postoperatively. Four patients out of 84 had mild ODI, all of them had a good postoperative outcome. Two (50%) of them with Grade II and 2(50%) with Grade III spondylolisthesis. None of the 4 of them had a poor outcome with mild ODI. See Table 2.

Patients with moderate pain and who underwent surgery had the best outcome (95.8%) and improvement in their ODI after surgery. P-value (<0.00001) was quite low and highly significant. Patients who had a severe disability before the operation and underwent surgery did not fare as well as the moderate ODI group. Their higher P-value (0.406) also stands against the surgical intervention. Patients with milder pain also fared well after surgery. The P-value (0.043) was also significant.

Pre/Postoperative VAS:

Mean preoperative VAS was 7.69±0.89, with a minimum 5 and maximum of 9. 40% of patients were having VAS:8 and 32% were having VAS: 7. Mean postoperative VAS was 3.92±0.75, with a minimum 3 and maximum of 6. 50% were having VAS:4 and 29.76% were having VAS: 3.

Complications:

Three (3.57%) patients reported infection in males. Nerve injury was observed in three (3.57%) patients, among them, one female patient with L5-LS1 (Grade III) listhesis fared poorly after surgery. A male patient who had nerve injury also did not fare well after surgery. He had L4-L5 (Grade II) listhesis. Another female patient with L5-S1 (Grade II) had only a fair outcome after surgery.

Discussion

Spondylolisthesis typically occurs in individuals aged in their forties and fifties, with a higher prevalence among males. The primary symptom is back discomfort, which worsens during walking and prevents prolonged standing. Posterior fixation, whether performed with or without interbody fusion, yields excellent outcomes.⁷ The present study highlighted the outcome of surgical

Table 1. Distribution of Lumbar Levels in Spondylolisthesis (n= 84).

Level	Meyerding Classification (Spondylolisthesis grades)		
	I	II	III
L3-L4 n=11(13.1%)	1(9.1%)	10(90.9%)	0(0%)
L4-L5 n =30 (35.7%)	3(10%)	17(56.6%)	10(33.3%)
L5-S1 n=43(51.2%)	1(2.3%)	27(62.8%)	15(34.9%)
Total=84	5(100%)	54(100%)	25(100%)

Table 2. Preoperative and Postoperative ODI (Oswestry disability index) and Grade Wise Distribution

ODI (preoperative)	ODI (postoperative)	Z score and p-value	Meyering Classification		
			Grade I	Grade II	Grade III
Moderate n=72 (85.7%)	Good n= 69 (95.8%)	Z=10.28 p<0.00001*	2(2.9%)	46(66.6%)	21(30.4%)
	Fair n= 3 (4.2%)		1	2(66.6%)	0
	Poor n= 0		0	0	0
Severe n=8 (9.5%)	Good n=2(25%)	Z=-0.83 p=0.406	1(12.5%)	0	1(12.5%)
	Fair n=4(50%)		1(12.5%)	2(25%)	1(12.5%)
	Poor n=2(25%)		0	1(12.5%)	1(12.5%)
Mild n=4 (4.7%)	Good n=4(100%)	Z=2.02 p=0.043*	0	2(50%)	2(50%)
	Fair n=0		0	0	0
	Poor n=0		0	0	0

*Significant result

fixation with decompression in patients with spondylolisthesis of the lumbosacral spine in 84 patients. The surgery was greatly rewarding to patients who had a moderate Oswestry disability index before surgery. Of the 84 patients, 72 (96%) had a good outcome after surgery and all of the eight patients with low Oswestry disability index (before surgery) had a good outcome. Those four patients who initially presented with a severe disability index did not get a fair outcome after surgical decompression and fixation for degenerative spondylolisthesis. Mean postoperative VAS score was improved in the majority of the patients. 3.5% of patients reported infection or nerve injury as complications.

The most common surgical therapy involves decompression of the lower lumbar spine, which may require a specific surgical approach. However, decompression alone can potentially result in further slippage, causing discomfort or severe neurological symptoms. As a result, lumbar spine fusion and screw fixation play a crucial role in stabilizing and minimizing delayed degener.²

Apart from being traumatic spondylolisthesis, in cases of degenerative lumbar conditions and lumbar infective diseases, the posterior decompression and fixation procedure have markedly effective results.^{8,9}

Compression of the dural sac or nerve root is responsible for symptoms in lumbar spinal stenosis resulting from degenerative spondylolisthesis. Other techniques, such as posterior lumbar fusion and posterior pedicle-based dynamic stabilization, are also utilized to improve prognosis. Nevertheless, the selection of a surgical approach for lumbar spinal stenosis due to degenerative spondylolisthesis remains a subject of controversy, particularly concerning the use of instrumen-

tation, owing to the limited availability of prospective, randomized research.¹⁰

It was observed that at 1 and 5 years after surgery, additional instrumentation for low-grade (30%) degenerative spondylolisthesis did not yield superior outcomes compared to decompression alone. Lumbar spine stenosis, a complex degenerative condition, has been a subject of extensive debate, particularly regarding the impact of spinal instability on the results of decompression surgery. The question of whether fusion for stenosis or instability alone is beneficial remains a matter of ongoing debate, with less than satisfactory findings. This issue extends to lumbar isthmic spondylolisthesis, lumbar degenerative conditions, and spinal fractures.¹¹

Lumbar spinal stenosis, often associated with degenerative spondylolisthesis, is a common disorder among the elderly and multilevel degenerative disease with decompression than fixation requires a longer stay plus decompression can have a margin of complication as compared to fixation alone.^{12,13}

The researchers measured the pain and function of the patients using scales for back pain, leg discomfort, and disability. They also checked the degree of slippage and the curve of the lower spine. They found that the posterior pedicle screw fixation with reduction system (PPSFr) group had better results than the open transpedicular screw fixation (OTPSF) group in both aspects. The posterior pedicle screw fixation with reduction system (PPSFr) group reduced the slippage more than the OTPSF group. The pain scores were similar for both groups, but the PPSFr group had lower disability scores at the end. The study concluded that posterior pedicle screw fixation with reduction with PLIF was more effective than open transpedicular screw fixation (OT-

PSF) with posterior lumbar interbody fusion (PLIF) for treating lower spine problems. The study suggested that lowering the slippage was important for keeping the spine curve stable. The surgical strategy of reducing the slipping vertebra in lumbar spondylolisthesis is still disputed. The author evaluated the effectiveness of a percutaneous reduction fixation device compared to conventional open pedicle screw fixation after posterior decompression and interbody fusion.¹⁴

In symptomatic degenerative lumbar spondylolisthesis cases, the primary surgical approach involves posterior decompression coupled with instrumented posterolateral fusion. This procedure effectively alleviates nerve compression and stabilizes the spine. Nonetheless, its applicability varies due to individual variations in overall health and sagittal alignment. Consequently, when devising a treatment plan, it is crucial to account for these factors, as they significantly impact both short-term and long-term surgical outcomes. A study of¹⁴ patients examined the effectiveness of transpedicular fixation in reducing back pain caused by degenerative spondylolisthesis. The results showed that transpedicular fixation was a reliable, simple, and beneficial procedure for spondylolisthesis patients who sought pain relief. It also facilitated the fusion of the vertebrae and enhanced the patients' neurological status.¹⁵ According to a study, patients with lumbar spondylolisthesis who underwent decompression and fusion surgery experienced significant improvement in all patient-reported outcomes, regardless of the degree of slippage reduction.¹⁶

Conclusion:

Patients with back pain, numbness, and difficulty walking due to spondylolisthesis can significantly benefit from safe and effective spine stabilization. Skilled surgical intervention reduces blood loss, operative time, and complication rates while preserving posterior alignment. Expert hands guiding the procedure ensure a smoother recovery and restored functionality, alleviating the burden of their condition and enhancing their quality of life.

Recommendations:

The surgical procedure offers better clinical results and improvement in those patients who have mild to moderate Oswestry Disability Index in the pre-operative period. Most of these patients had a very good outcome, and their pain substantially abated. Patients who have a severe ODI before surgery do not show improvement. Those with a mild to moderate ODI with any grade of degenerative lumbar spondylolisthesis should be offered surgical decompression and fixation. However, little is known regarding the impact of individual or institutional features on the choice of a treatment option or operation, such as the surgeon's specialty, age or credentials, or the educational standing of the hospital.

This data might be used in future studies to investigate the most often used surgical techniques, address clinically used inclusion criteria, and possibly establish an agreement on standard therapy. The limitation is that the literature view can be used in the future; we need to compare our study with a fusion of lumbar spine and decompression stand-alone.

References

1. Shen Z, Guan X, Wang R, Xue Q, Zhang D, Zong Y, Ma W, Zhuge R, Liu Z, He C, Guo L. Effectiveness and safety of decompression alone versus decompression plus fusion for lumbar spinal stenosis with degenerative spondylolisthesis: a systematic review and meta-analysis. *Annals of Translational Medicine*. 2022 Jun;10(12). doi: 10.21037/atm-22-2208
2. Tahir M, Rehman L, Bokhari I, Ahmed SI, Afzal A. Surgical Outcome of Decompression and Fixation of Degenerative Lumbosacral Spondylolisthesis Surgery in Pakistani Population. *Cureus*. 2019 Aug 26;11(8). DOI: 10.7759/cureus.5493
3. Rousseau MA, Lazennec JY, Bass EC, Saillant G. Predictors of outcomes after posterior decompression and fusion in degenerative spondylolisthesis. *European Spine Journal*. 2005 Feb;14:55-60. DOI:10.1007/s00586-004-0703-7
4. Smith J. Moving beyond the neutral spine: stabilizing the dancer with lumbar extension dysfunction. *Journal of Dance Medicine & Science*. 2009 Sep;13(3):73-82. <https://doi.org/10.1177/1089313X0901300302>
5. Strube P, Putzier M, Siewe J, Eicker SO, Dreimann M, Zippeilius T. To fuse or not to fuse: a survey among members of the German Spine Society (DWG) regarding lumbar degenerative spondylolisthesis and spinal stenosis. *Archives of Orthopaedic and Trauma Surgery*. 2019 May 1;139:613-21. DOI:10.1007/s00402-018-3096-5
6. Angachekar D, Deshpande S, Gudhe M, Samal N, Khan S, Gupta S. Clinical and functional outcome analysis of posterior decompression and spinal fusion surgery in the management of lumbar and sacral listhesis: A prospective cohort study. *Journal of Datta Meghe Institute of Medical Sciences University*. 2020 Jul 1;15(3):407-13. DOI: 10.4103/jdmimsu.jdmimsu_245_20
7. Iqbal N. Pedicle Screw Fixation with Decompression: The Ultimate Solution for Medically Intractable Spondylolistheses. *Ophthalmology Update*. 2020 Oct 1;18(4).
8. Hassan S, Kalhoro A, Rehman L, Panezai AS, Javeed F. Transpedicular Fixation via Posterior Approach for Dorsal and Lumbar Spine Tuberculosis. *Pakistan Journal Of Neurological Surgery*. 2022 Mar 31;26(1):39-45.
9. Panezai AS, Kalhoro A, Khan SH, Javed F, Rehman L. LUMBAR STENOSIS IN SYMPTOMATIC BACKACHE PATIENTS OF MORE THAN 50 YEARS AGE. *Journal of Postgraduate Medical Institute*. 2021 Jun 30;35(2):114-8.
10. Inose H, Kato T, Yuasa M, Yamada T, Maehara H, Hirai T, Yoshii T, Kawabata S, Okawa A. Comparison of decompression, decompression plus fusion, and decompression plus stabilization for degenerative spondylolisthesis: a prospective, randomized study. *Clinical Spine Surgery*. 2018 Aug 1;31(7):E347-52. doi: 10.1097/BSD.0000000000000659

11. Sharif S, Shaikh Y, Bajamal AH, Costa F, Zileli M. Fusion surgery for lumbar spinal stenosis: WFNS spine committee recommendations. *World Neurosurgery: X*. 2020 Jul 1;7:100077. doi.org/10.1016/j.wnsx.2020.100077
12. Sun W, Xue C, Tang XY, Feng H, Yuan F, Guo KJ, Zhao J. Selective versus multi-segmental decompression and fusion for multi-segment lumbar spinal stenosis with single-segment degenerative spondylolisthesis. *Journal of Orthopaedic Surgery and Research*. 2019 Dec;14:1-6. https://doi.org/10.1186/s13018-019-1092-2
13. Ferrero E, Guigui P. Current trends in the management of degenerative lumbar spondylolisthesis. *EFORT open reviews*. 2018 May 21;3(5):192-9. DOI: https://doi.org/10.1302/2058-5241.3.170050
14. Heo DH, Jang JW, Lee JK, Park CK. Slippage reduction of lumbar spondylolisthesis using percutaneous pedicle screw with reduction fixation system after interbody fusion: A comparison with traditional open fusion and pedicle screw fixation. *Journal of Clinical Neuroscience*. 2019;67:156-62. https://doi.org/10.1016/j.jocn.2019.05.040
15. Ishaq M, Khan M, Ahmed A, Ali G. Surgical Outcome of Transpedicular Fixation for Degenerative Spondylolisthesis in Terms of Relief from Backache. *Pakistan Journal Of Neurological Surgery*. 2021 Oct 16;25(3):406-13. DOI: https://doi.org/10.36552/pjns.v25i3.592
16. Chan AK, Mummaneni PV, Burke JF, Mayer RR, Bisson EF, Rivera J, Pennicooke B, Fu KM, Park P, Bydon M, Glassman SD. Does reduction of the Meyerding grade correlate with outcomes in patients undergoing decompression and fusion for grade I degenerative lumbar spondylolisthesis?. *Journal of Neurosurgery: Spine*. 2021 Sep 17;36(2):177-84.. DOI link: https://doi.org/10.3171/2021.3.SPINE202059