VOLUME 74 | ISSUE 4 | OCTOBER - DECEMBER 2023

REVIEW

Surgical versus non-surgical treatment of degenerative lumbar spondylolisthesis: systematic review of randomized control trials.

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ABSTRACT

Background: The best management for degenerative spondylolisthesis patients is still controversial. Low-grade spondylolisthesis without neurologic deficits used to be treated non-surgically as a first-line. Many studies stated that in patients with degenerative spondylolisthesis with or without spinal stenosis, surgery had superior outcomes. The aim of this systematic review was to describe the effectiveness of surgery versus conservative treatment for lumbar degenerative spondylolisthesis.

Methods: A comprehensive literature search was performed for relevant studies in Medline, EMBASE, CINAHL, Scopus, Centre for Review and Dissemination databases and Cochrane databases were searched. The search included English studies, and all conservative and surgical interventions were included.

Results: Two studies met the inclusion criteria. The number of patients was 650 (355 treated with surgical intervention and 295 treated conservatively). Surgery was found to be more effective than conservative care in the two studies.

Conclusion: Patients with lumbar degenerative spondylolisthesis treated with surgery had significantly better results in pain and function compared with patients treated with nonoperative treatment.

The study is retrospectively registered.

Level of evidence: II

Keywords: spondylolisthesis, degenerative, surgical treatment, conservative treatment, systematic review.

Introduction

The degenerative spondylolisthesis is displacement of one vertebra over the other, associated with degenerative changes (1-3). The pathological process is started with disc degeneration, with narrowing of the disc space and settling of the motion segment leading to "micro instability" and vertebral slippage (4,5). This is followed by degenerative changes, as osteophyte formation, ligamentous hypertrophy, and facet arthrosis (6).

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VOLUME 74 | ISSUE 4 | OCTOBER - DECEMBER 2023

The optimal management for patients with degenerative spondylolisthesis is controversial. Patients with low-grade spondylolisthesis without neurologic deficits could be treated non-surgically primarily (7). This includes restriction of activities, bracing, anti-inflammatory medications, epidural steroid injections, and physical exercises that may help to reduce pain and strengthen spinal musculature to restore range of motion and stabilize the spine (8-10). For diagnosis and treatment of lumbar degenerative lumbar spondylolisthesis, North American Spine Society (NASS) guidelines in 2014 were inconclusive about the role of nonoperative medical/interventional therapies. Most of the studies denoted that the main indication for surgical treatment of degenerative lumbar spondylolisthesis is symptomatic spinal stenosis associated with low-grade spondylolisthesis in patients who have been refractory to conservative treatment (11). Also, many studies mentioned that in patients with degenerative spondylolisthesis with or without spinal stenosis, surgery had superior outcomes (12).

Management of degenerative spondylolisthesis are difficult when applying evidence-based guidelines, because of the few reports of high quality that compare conservative and operative management within the study population. Even in an expert panel survey including more than 30 questions concerned with the management of degenerative lumbar spondylolisthesis, no questions had consistent Level I evidence to support any recommendation, and half of the questions had insufficient evidence (13,14).

Clear evidence about the best treatment for patients with degenerative spondylolisthesis are not available in the literature. This systematic review summarizes the current literature on the nonsurgical and surgical management of lumbar degenerative spondylolisthesis aimed to determine the effectiveness of treatment for lumbar degenerative spondylolisthesis.

Method

Inclusion Criteria and Study Selection

The published studies were systematically reviewed according to the following criteria: prospective randomized control studies in patients older than 18 years with degenerative lumbar spondylolisthesis of at least 3 months duration with prospectively collected SF-36 and ODI scores and minimum follow-up period of 24-months for surgically and non-surgically treated patients. Editorials, comments, case reports, and conference papers were excluded.

Electronic Literature Database

Systematic search was conducted in MEDLINE, EMBASE, CINAHL, Scopus, Centre for Review and Dissemination databases and the Cochrane Collaboration Library for literature published from January 1965 through December 2021. only studies published in English language were considered. The following search terms were used to find relevant literature specific to the topic: "degenerative lumbar spondylolisthesis" OR "lumbar degenerative spondylolisthesis"), (nonoperative OR nonoperative management OR operative versus nonoperative OR conservative treatment OR observation OR observational treatment) AND (operation OR surgical treatment OR surgery OR fusion OR reduction OR fixation OR in situ fusion OR operative procedures) AND (Spondylolisthesis).These results were filtered to include only clinical trials, prospective analyses, and studies in English and with human subjects, yielding 2532 results. Manuscripts involving basic research, case reports, editorials, and nonstructured reviews were excluded. Titles and abstracts were reviewed to identify studies that held (1) comparative data and (2) a population of patients with degenerative lumbar spondylolisthesis. A total of 43 studies were found relevant by title and abstract alone. After full text reviews and searching the reference sections of these studies, only 2 randomized control studies were included in the present review (Figure 1).

Quality Assessment

The Newcastle–Ottawa quality assessment scale (NOS scale) was used to assess the quality of the included studies (15). The scale assigns a maximum of 8 points for case-control studies and 9 points for cohort studies. Validity scores of NOS- Scale were

VOLUME 74 | ISSUE 4 | OCTOBER - DECEMBER 2023

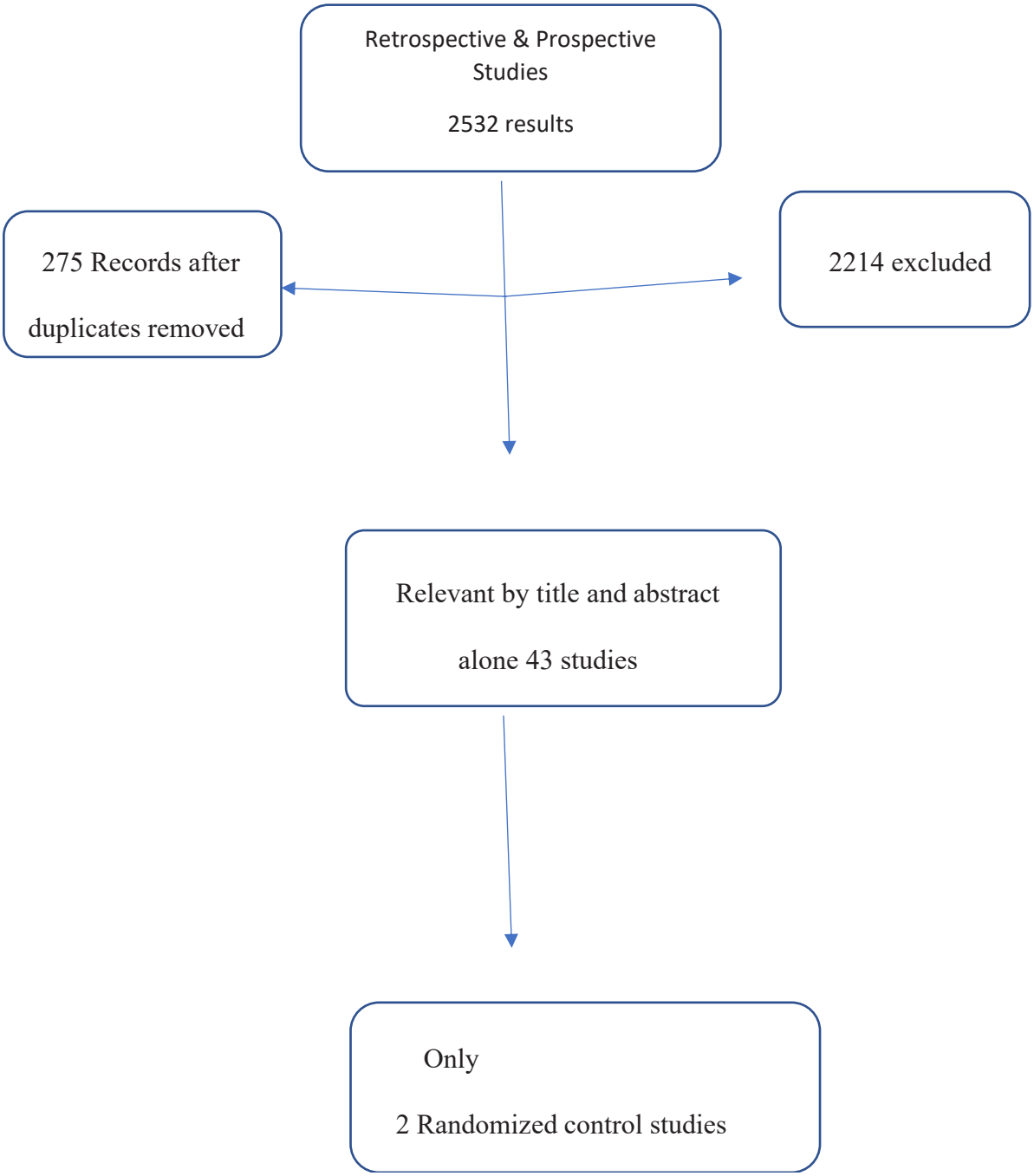

Figure 1- Flow diagram of the study selection

evaluated as follows: 8 to 9, high quality; 6 to 7, medium quality; 5, low quality.

Data Collection

Data extraction was done. Details describing each study and results on effectiveness in promoting the outcomes of interest extracted from papers included in the review using the standardized data extraction tool from the Joanna Briggs Institute-MAStARI. In addition to extraction of the results for outcomes relevant to the review question and specific objectives, the information extracted included details

VOLUME 74 | ISSUE 4 | OCTOBER - DECEMBER 2023

about populations, and the interventions method, of the included studies.

Results

Search Results

Initially, 2532 articles were found during search strategy. Forty-three articles remained for screening based on the inclusion criteria after reviewing the titles and abstracts. Of these 43 articles, 25 full text articles were selected for further evaluation. Twenty-one manuscripts were excluded after reviewing full-texts. Finally, 4 eligible articles were identified.

Four publication (two studies) only fulfill the inclusion criteria (17-20). The number of patients was 650 (295 treated conservatively and 355 treated with surgical intervention). One study was cross sectional study while the other was divided into randomized control trial and observational cohort study. Both studies scored as being of high quality, although the sample size of one of them was small (17).

The mean age of patients included in the studies ranged between 56 and 66 years. Imaging had documented lumbar degenerative spondylolisthesis in all the participants. The percentage of females was larger than males in the two studies (66% to 78%).

The follow up period ranged from 3 to 8 years.

The non-surgical management

In the first study (17), only 20 (46.5%) patients were treated conservatively. Sixty percent of the patients were grade 1 spondylolisthesis while 40% were grade 2 according to Meyerding's classification (21). L4-5 level was involved in 40% of the patients while L5-S1 level was involved in 60%. Two patients (10%) had good outcomes, 10 patients (50%) had regular outcome and eight patients (40%) had a poor outcome (according to Fischgrund's criteria (22). The average VAS score was 8 for the back and 6 for the leg. Results on SF-36 function score showed a mean of 35 (Standard Deviation: 24). On the ODI scale (the Oswestry Disability Index), the mean was 46 (Standard Deviation: 21). No complications occurred. Progression of the slippage from grade 1 to grade 2 occurred in two patients (10%).

In the second study (18-20), 192 patients (32%) were assigned to nonoperative treatment. L3-4 level was involved in 8% and L4-5 was involved in 92%. Back pain bothersomeness (22) was 4.1 while Leg pain bothersomeness (22) was 4-3. SF-36 was 36.9. ODI was 36.5 (18.8%). Of those patients assigned to nonoperative care, 54% underwent surgery by 2 years and 46% underwent surgery between 4 and 8 years.

Surgical management

In the first study (17), 23 patients were included (53,5%). Forty eight percent of the patients were grade 1 spondylolisthesis while 52% were grade 2. The affected levels were as follow: L3-L4:(5%), L4-L5:(43%), L5-S1:(43%), and L4-S1:(9%). According to Fischgrund criteria, nine patients (39%) had excellent outcomes, 10 patients (44%) good outcome, four patients (17%) regular outcome and no patients (0%) had a poor outcome. The VAS score was 4 for the back and 3 for the leg. SF-36 function score showed 77 (Standard Deviation: 16). ODI was 17 (Standard Deviation: 14). Two cases of infection were detected successfully treated with antibiotics. Progression of the slippage from grade 1 to grade 2 occurred in two patients (9%).

In the second study (18-20), 409 patients were included (68%). L3-4 level was involved in 10% of cases while L4-5 level was involved in 90%. Back pain bothersomeness was 4.4 while Leg pain bothersomeness was 4.6. SF-36 was 31.6 and ODI was 43.9 (Table 1).

Discussion

Degenerative lumbar spondylolisthesis is an anterior displacement of one vertebra over the subjacent vertebra, associated with degenerative changes. Progression of slip correlates with the activities that require repetitive forward movements of the spine. Progression of clinical symptoms does not correlate with progression of the slip.

Evidence-based decision-making is needed for management of the medical conditions and especially required for conditions that required surgical interference. Recommendations can be strong when high level evidence is available. A few studies com-

VOLUME 74 | ISSUE 4 | OCTOBER - DECEMBER 2023

pared surgical and conservative treatment of lumbar degenerative spondylolisthesis patient (24,25). The debate about surgical versus nonoperative interventions for the treatment of degenerative spondylolisthesis always present.

Although many studies have been published on the results of various treatment methods for lumbar degenerative diseases, clear conclusions are difficult to draw because of differences in patient inclusion criteria, fusion technique, nonoperative treatment regimen, and clinical outcome measures used to determine success. The few randomized controlled trials directly comparing surgical and nonsurgical treatments have been criticized for the variations in treatment regimens used within the studies and the number of crossovers (26-30).

Surgery is usually recommended for treatment of patients with symptomatic low-grade degenerative spondylolisthesis with spinal stenosis whose symptoms have been not improved to a trial of non-surgical treatment (31-36).

In the treatment of degenerative spine disorders, the Medical Outcomes Study Short Form SF-36 (SF-36) and the Oswestry Disability Index (ODI) are widely used to measure treatment outcomes. The SF-36 measures the health-related quality of life, allowing comparison across disease and treatment groups. The ODI is an outcome measure specific to lumbar degenerative disorders.

The results of this analysis of collected SF-36 and ODI data revealed the problems in designing trials to determine the efficacy of treatments for symptomatic lumbar degenerative conditions. Many studies did not report important characteristics of their patients's samples, which make a difficulty to compare the results of those studies with other studies. Some studies did not mention the diagnostic indication for treatment, other studies collected ODI data but did not report them and some studies had very short follow up of less than 12 months.

Two studies included in this systematic review. The first study (17) showed the results of the cross-sectional study that showed better scores for back VAS, leg VAS, SF-36 function score and ODI scales were attained by the surgical treatment group with significant statistical difference. In the surgical group, 83% of patients rated their general health post treatment as excellent or good compared with 10% of patients in the nonoperative group. However, the surgical procedure was associated with a higher number of complications. The second study (18-20) was multicenter study compared patients with degenerative spondylolisthesis associated with vertebral canal stenosis treated nonoperatively or surgically.

A large number of articles are available in the literature comparing nonoperative and surgical management of patients with lumbar stenosis, but these studies included patients with a broad diagnosis of degenerative lumbar spondylosis, lumbar disc herniation, spondylolisthesis and vertebral stenosis (37).

Overall, the outcomes of nonoperative and operative management of patients with spondylolisthesis depend on patient selection and effective surgical management. Operative treatment provides significant benefits for patient outcomes and improved quality of life. However, the heterogeneity of selected patients for surgical intervention remains a limitation of published studies.

Conclusion

Patients with lumbar degenerative spondylolisthesis treated with surgery had significantly better results in pain and function compared with patients treated with nonoperative treatment.

VOLUME 74 | ISSUE 4 | OCTOBER - DECEMBER 2023

Table 1- Results of the two included studies.

Author	Type of study	Surg/Non	VAS (Back)	VAS (Leg)	SF-36	ODI
Corredor (2015)	Cross-sectional 23/20	4/8	3/6	77/35	17/46	
Wenstein (2007)	Prosp. Random. 159/145					
[2 ys follow up]	Observant. Coh. 173/130					
Weinstein (2009) [4ys follow up]						
Abdu (2018)				33/ 25	42/22	
[Weinstein 8 ys follow up]						

REFERENCES

1. Chung CC, Shimer AL. (2021): Lumbosacral Spondylolysis and Spondylolisthesis - Clin Sports Med, 40(3), 471-490
2. Lafian AM, Torralba KD. (2018): Lumbar Spinal Stenosis in Older Adults- Rheum Dis Clin North Am.,44(3),501-512
3. Jacobsen S, Sonne-Holm S, Rovsing H, et al. (2007): Degenerative lumbar spondylolisthesis: an epidemiological perspective: the Copenhagen Osteoarthritis Study - Spine (Phila Pa 1976),32(1),120–125
4. Bydon M, Alvi MA, Goyal A. (2019): Degenerative Lumbar Spondylolisthesis: Definition, Natural History, Conservative Management, and Surgical Treatment - Neurosurg Clin N Am., 30(3), 299-304
5. Sengupta Dilip K, Herkowitz Harry N. (2005): Degenerative spondylolisthesis: review of current trends and controversies - Spine (Phila Pa 1976),30(6 Suppl), S71–S81
6. García-Ramos CL, Valenzuela-González J, Baeza-Álvarez VB, Rosales-Olivarez LM, Alpízar-Aguirre A, Reyes-Sánchez A. (2020): Lumbar degenerative spondylolisthesis II: treatment and controversies - Acta Ortop Mex.,34(6), 433-440
7. Samuel Andre M, Moore Harold G, Cunningham Matthew E. (2017):Treatment for degenerative lumbar spondylolisthesis: current concepts and new evidence - Curr Rev Musculoskelet Med,10(4), 521–529
8. Puntumetakul R, Saiklang P, Tapanya W, Chatprem T, Kanpittaya J, Arayawichanon P, Boucaut R. (2021): The Effects of Core Stabilization Exercise with the Abdominal Drawing-in Maneuver Technique versus General Strengthening Exercise on Lumbar Segmental Motion in Patients with Clinical Lumbar Instability: A Randomized Controlled Trial with 12-Month Follow-Up- Int J Environ Res Public Health, 23;18(15),7811
9. Wang Y, Huang K. (2022): Research progress of diagnosing methodology for lumbar segmental instability: A narrative review - Medicine (Baltimore), 7;101(1), e28534 doi: 10.1097/MD.0000000000028534
10. Kneis S, Bruetsch V, Dalin D, Hubbe U, Maurer C. (2019): Altered postural timing and abnormally low use of proprioception in lumbar spinal stenosis pre- and post- surgical decompression - BMC Musculoskelet Disord., 1;20(1),183
11. Dunn AS, Baylis S, Ryan D. (2009): Chiropractic management of mechanical low back pain secondary to multiple-level lumbar spondylolysis with spondylolisthesis in a United States Marine Corps veteran: a case report - J Chiropr Med, 8(3),125–130
12. Birkmeyer NJ, Weinstein JN, Tosteson AN, et al. (2002): Design of the Spine patient outcomes research trial (SPORT)- Spine (Phila Pa 1976), 27(12),1361–1372
13. Matz PG, Meagher RJ, Lamer T, et al. (2016): Guideline summary review: an evidence-based clinical guideline

VOLUME 74 | ISSUE 4 | OCTOBER - DECEMBER 2023

for the diagnosis and treatment of degenerative lumbar spondylolisthesis - Spine J,16(3), 439–448
14. Hendrickson NR, Kelly MP, Ghogawala Z, et al. (2018): Operative management of degenerative spondylolisthesis: a critical analysis review - JBJS Rev, 6(8), e4.
15. Wells GA, Shea B, O'Connell D, et al. (2001):The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in metaanalyses - Available at: http://www.ohri.ca/programs/clinical_ epidemiology/oxford.htm.
16. Van Tulder M, Furlan A, Bombardier C, Bouter LM, Deyo PA, Shekelle PG. (2003): Updated method guidelines for systematic reviews in the Cochrane Collaboration Back Review Group. Cochrane Library, Issue 4. Oxford: Update Software
17. Jose Alfredo Corredor, Fernando Flores de Araújo, Rodrigo Góes de Mendonça, et al. (2016): Nonoperative versus operative treatment of patients with degenerative spondylolisthesis - Coluna/Columna.,15(1), 33-35 http://dx.doi.org/10.1590/S1808-185120161501153514
18. James N. Weinstein, Jon D. Lurie,Tor D. Tosteson, Brett Hanscom, et al. (2007): Surgical versus Nonsurgical Treatment for Lumbar Degenerative Spondylolisthesis - N Engl J Med., 356 (22), 2257–2270 doi:10.1056/NEJMoa070302
19. James N. Weinstein, Jon D. Lurie,Tor D. Tosteson, Wenyan Zhaoet al. (2009):Surgical Compared with Nonoperative Treatment for Lumbar Degenerative Spondylolisthesis Four-Year Results in the Spine Patient Outcomes Research Trial (SPORT) Randomized and Observational Cohorts - J Bone Joint Surg Am., 91,1295-1304 doi:10.2106/JBJS.H.00913.
20. William A. Abdu, Olivia A. Sacks, Anna N.A. Tosteson, et al. (2018): Long-Term Results of Surgery Compared With Nonoperative Treatment for Lumbar Degenerative Spondylolisthesis in the Spine Patient Outcomes Research Trial (SPORT) – SPINE, 43(23), 1619–1630
21. Xu F, Tian Z, Fu C, Yao L, Yan M, Zou C, Liu Y, Wang Y. (2020): Mid-lumbar traumatic spondyloptosis without neurological deficit: A case report and literature review - Medicine (Baltimore), 99(12), e19578 doi: 10.1097/MD.0000000000019578
22. Fischgrund JS, Mackay M, Herkowitz HN, Brower R, Montgomery DM, Kurz LT. 1997 Volvo Award winner in clinical studies. (1997): Degenerative lumbar spondylolisthesis with spinal stenosis: a prospective, randomized study comparing decompressive laminectomy and arthrodesis with and without spinal instrumentation - Spine (Phila Pa 1976), 22(24), 2807-2812
23. Wei FL, Zhou CP, Liu R, et al. (2021): Management for lumbar spinal stenosis: A network meta-analysis and systematic review - Int J Surg., 85,19-28
24. Bridwell KH, Sedgewick TA, O'Brien MF, Lenke LG, Baldus C. (1993): The role of fusion and instrumentation in the treatment of degenerative spondylolisthesis with spinal stenosis - J Spinal Disord, 6, 461–472
25. Herkowitz HN, Kurz LT. (1991): Degenerative lumbar spondylolisthesis with spinal stenosis. A prospective study comparing decompression with decompression and intertransverse process arthrodesis - J Bone Joint Surg Am., 73, 802–808
26. Brox JI, Reikeras O, Nygaard O, et al. (2006): Lumbar instrumented fusion compared with cognitive intervention and exercises in patients with chronic back pain after previous surgery for disc herniation: a prospective randomized controlled study – Pain,122 (1–2), 145–155
27. Brox JI, Sorensen R, Friis A, et al. (2003): Randomized clinical trial of lumbar instrumented fusion and cognitive intervention and exercises in patients with chronic low back pain and disc degeneration – Spine, 28(17),1913–1921
28. Fairbank J, Frost H, Wilson-MacDonald J, Yu LM, Barker K, Collins R. Spine Stabilization Trial Group. (2005): Randomized controlled trial to compare surgical stabilization of the lumbar spine with an intensive rehabilitation programme for patients with chronic low back pain: the MRC spine stabilization trial – BMJ, 330(7502),1233.
29. Fritzell P, Hagg O, Wessberg P, Nordwall A. (2002): Swedish Lumbar Spine Study Group. Chronic low back pain and fusion: a comparison of three surgical techniques: a prospective multicenter randomized study from the Swedish lumbar spine study group – Spine,27(11),1131–1141
30. Fritzell P, Hagg O, Wessberg P, Nordwall A. (2001):

VOLUME 74 | ISSUE 4 | OCTOBER - DECEMBER 2023

Swedish Lumbar Spine Study Group. 2001 Volvo Award Winner in Clinical Studies: lumbar fusion versus nonsurgical treatment for chronic low back pain: a multicenter randomized controlled trial from the Swedish Lumbar Spine Study Group – Spine, 26(23), 2521–2532, discussion 2532–2534

31. Gaetani P, Aimar E, Panella L, et al. (2006): Functional disability after instrumented stabilization in lumbar degenerative spondylolisthesis: a follow-up study - Funct Neurol, 21, 31–37
32. Ghogawala Z, Benzel EC, Amin-Hanjani S, et al. (2004): Prospective outcomes evaluation after decompression with or without instrumented fusion for lumbar stenosis and degenerative grade I spondylolisthesis - J Neurosurg Spine,1, 267–272
33. Kornblum MB, Fischgrund JS, Herkowitz HN, Abraham DA, Berkower DL, Ditkoff JS. (2004): Degenerative lumbar spondylolisthesis with spinal stenosis: a prospective long-term study comparing fusion and pseudarthrosis – Spine,29, 726–733, discussion 733–734
34. Pratt RK, Fairbank JC, Virr A. (2002):The reliability of the Shuttle Walking Test, the Swiss Spinal Stenosis Questionnaire, the Oxford Spinal Stenosis Score, and the Oswestry Disability Index in the assessment of patients with lumbar spinal stenosis – Spine, 27, 84–91
35. Stucki G, Daltroy L, Liang MH, Lipson SJ, Fossel AH, Katz JN. (1996): Measurement properties of a self-administered outcome measure in lumbar spinal stenosis – Spine, 21, 796–803
36. Holmes C, Elder BD, Ishida W, Perdomo-Pantoja A, Locke J, Cottrill E, Lo SL, Witham TF. (2020): Comparing the efficacy of syngeneic iliac and femoral allografts with iliac crest autograft in a rat model of lumbar spinal fusion - J Orthop Surg Res., 15(1), 410
37. Jacobs WC, Rubinstein SM, Koes B, van Tulder MW, Peul WC. (2013): Evidence for surgery in degenerative lumbar spine disorders - Best Pract Res Clin Rheumatol. 27(5), 673-684

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