

**Spinal stenosis:
update searches and screening
for
Universitätsklinikum Schleswig-Holstein/Campus Kiel**



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1. PROJECT OBJECTIVES

A key aim of the research project “Making SDM a reality” is to inform patients as part of shared decision making (SDM).

Kleijnen Systematic Reviews (KSR) Ltd has prepared an evidence report with a synthesis of the evidence of treatment options for spinal stenosis.

2. METHODS

LITERATURE SEARCHES

Literature searches were conducted to identify systematic reviews and evidence-based guidelines about spinal stenosis to update the 2018 evidence report.

The search strategies were developed specifically for each database and the keywords adapted according to the configuration of each database. Searches were limited by date range to update earlier searches: 2019-2021. Searches were not limited by language or publication status.

SEARCH SOURCES

Systematic reviews and guidelines

The following systematic review and health technology assessment specific databases were searched:

- Cochrane Database of Systematic Reviews (CDSR) (Wiley): issue 10 of 12, October 2021
- KSR Evidence (Internet) (<https://ksrevidence.com/>): 2019-2021
- Epistemonikos (Internet) (<https://www.epistemonikos.org/>): 2019-2021
- International HTA Database (INAHTA) (<https://database.inahta.org/>): 2019-2021

The following guidelines resources were searched:

- Guidelines International Network (GIN) (Internet) (<https://www.g-i-n.net/home>): 2019-2021
- NICE Evidence (Internet) (www.evidence.nhs.uk/): 2019-2021
- NICE Guidance (Internet) (<https://www.nice.org.uk/guidance>): 2019-2021
- ECRI Guidelines Trust (Internet) (<https://guidelines.ecri.org/>): 2019-2021
- Trip Database (<https://www.tripdatabase.com/>): 2019-2021
- Canadian Agency for Drugs and Technologies in Health (CADTH) (www.cadth.ca): 2019-2021

Full details of all search strategies are presented in Appendix 1.

Handling of citations

References identified from the searches were downloaded into EndNote bibliographic management software for further assessment and handling.

Supplementary searches

The bibliographies of included studies and review articles were also checked for additional relevant articles.

Prioritisation

During formal screening of titles and abstracts, studies were subject to a prioritisation process whereby the recency e.g., to most up-to-date clinical practice guidelines (CPG), methodological quality e.g., Cochrane systematic review (CSR), quality of the analyses per outcome (e.g., ratio of RCTs to observational studies), the number of included RCTs, the breadth of the timepoints reported etc. were considered to further prioritise which studies would be used to inform analyses. Studies were categorised into the following three categories: '1' = German, American, European or similar CPG; '2' = CSR or similar quality SR; '3' = potentially lower/other quality SR.

3. RESULTS

The original EBSCO searches were conducted on December 26, 2018; and of the 248 references screened, 40 studies were deemed eligible. In the current update, a total of 360 records were retrieved from the electronic literature searches (Appendix 1). After the removal of duplicate records 205 titles and abstracts were screened by two reviewers. Thirty-five records were found to be potentially eligible and were longlisted after a consensus. Of those, five were short-listed and included in the analyses (Table 1).¹⁻⁵ See also Table 2 for an overview of primary studies included in the identified SRs/CPGs.

UPDATE – Concluding Assessment by SHARE TO CARE Evidence Team (16/03/22)

Based on the update searches conducted by KSR Ltd in October 2021, we want to highlight the following aspects: Recommendations for the use of NSAIDs are somewhat ambiguous ranging from neither for nor against (Anderson et al., 2021) to clearly against them (Bussi res et al., 2021). The apparent discrepancy between these statements and the 2018 evidence report can be accepted as the current decision aid emphasises the need of individual medication upon consultation with the responsible medical staff. However, future update searches should reconsider this issue. While the 2018 evidence report declared a paucity of evidence for QoL-related outcomes, this update report yielded some results in terms of health-related QoL as well as emotional effects of LSS (Bussi res et al., 2021). More comprehensive evidence is warranted in order to make reliable conclusions. Eventually, the systematic review by Wei et al. (2021) suggests endoscopic decompression as an alternative and less invasive surgical approach.

Conclusion regarding the evidence report: No immediate update required. The present evidence report (December 28, 2018) remains valid until further notice.

Table 1 Evidence sources

Study/year	Evidence type	Primary studies	Number of studies	Intervention(s)	Comparator(s)	Outcome(s)	Date searched	Conclusions
Anderson 2021 ¹	SR	CPG	10	Multiple (surgery, injections)	Multiple (nonsurgical interventions, medicines)	Multiple	January 25, 2020	While the evidence underpinning the various types of interventions was similar, guidelines tended to endorse surgery and injections but not nonsurgical interventions and medicines.
Bussi�res 2021 ²	CPG	SR,RCT,OS	14	Nonpharmacological interventions	No or delayed treatment, placebo	Pain, disability, quality of life	June 6, 2019	“Safe and effective non-surgical management of lumbar spine stenosis should be on the basis of a plan of care tailored to the individual and the type of treatment involved, and multimodal care is recommended in most situations” “For patients with LSS and neurogenic claudication with or without LBP, we do not suggest the use of NSAIDs for any duration” “As patients with LSS often present with LBP, clinicians may want to consider a review of

Study/year	Evidence type	Primary studies	Number of studies	Intervention(s)	Comparator(s)	Outcome(s)	Date searched	Conclusions
								systematic reviews by Wong et al (2016) concluding that oral NSAIDs are more effective than placebo for nonspecific chronic LBP, but not for acute LBP. Guidelines generally advise prescribing oral NSAIDs at the lowest effective dose for the shortest time possible. Any potential benefits should be weighed against the risk of harm."
Liang 2020 ³	SR	OS	16	Surgery	Surgery	Complication, mortality, readmission, length of hospital stay	July 2019	"Our results revealed that the clinical improvement in pain and disability did not significantly differ according to age, although the patients aged 80 years or older had increased incidences of mortality and complication than younger patients"
Jacobi 2021 ⁴	SR	RCT	19	Nonpharmacologic therapies	Surgery	Pain, disability, physical capacity, physical activity	November 4, 2019	For patients with lumbar spinal stenosis, there is low- to moderate-quality evidence that manual therapy with supervised

Study/year	Evidence type	Primary studies	Number of studies	Intervention(s)	Comparator(s)	Outcome(s)	Date searched	Conclusions
						behaviour		exercises improves short-term walking capacity and results in small improvements in pain and symptom severity compared with self-directed or group exercise
Wei 2021 ⁵	SR	RCT	34	Decompression	Decompression plus fusion, endoscopic decompression, interspinous process spacer device, laminectomy, laminotomy, minimally invasive decompression, non-surgery, split spinous process decompression	Disability, pain intensity	October 10, 2019	“There were no significant differences among the different interventions in improving patients’ functions. Surgical interventions were better than non-surgical interventions in relieving pain but had a higher incidence of complications. Decompression plus fusion is not necessary for LSS patients. In addition, endoscopic decompression as a less invasive surgical method is a good choice for LSS patients.”
CPG = clinical practice guideline; OS = observational study; RCT = randomised controlled trial; SR = systematic review.								

Table 2 Overview of primary studies included in the identified SRs/CPGs

Study/year	Primary study(ies)	Reference (first author & journal)
Anderson 2021 ¹	CPG	1. Brouwers MC, Kho ME, Browman GP, et al. Development of the AGREE II, part 2: assessment of validity of items and tools to support application. CMAJ Canadian Medical Association Journal 2010;182(10):E472-8. 2. Boswell MV, Shah RV, Everett CR, et al. Interventional techniques in the management of chronic spinal pain: Evidence-based practice guidelines. Pain physician 2005;8(1):1-47. 3. Chou R, Qaseem A, Snow V, et al. Diagnosis and treatment of low back pain: a joint clinical practice guideline from the American College of Physicians and the American Pain Society. Ann Intern Med 2007;147(7):478-91. 4. Watters IWC, Baisden J, Gilbert TJ, et al. Degenerative lumbar spinal stenosis: an evidence-based clinical guideline for the diagnosis and treatment of degenerative lumbar spinal stenosis. Spine Journal 2008;8(2):305-10. 5. Chou R, Loeser JD, Owens DK, et al. Interventional therapies, surgery, and interdisciplinary rehabilitation for low back pain: an evidence-based clinical practice guideline from the American Pain Society. Spine (03622436) 2009;34(10):1066-77. 6. Manchikanti L, Boswell MV, Singh V, et al. Comprehensive evidence-based guidelines for interventional techniques in the management of chronic spinal pain. Pain physician 2009;12(4):699-802. 7. Manchikanti L, Abdi S, Atluri S, et al. An update of comprehensive evidence-based guidelines for interventional techniques in chronic spinal pain. Part II: guidance and recommendations. Pain physician 2013;16(2 Suppl):S49-283. 8. Kreiner DS, Shaffer WO, Baisden JL, et al. An evidence-based clinical guideline for the diagnosis and treatment of degenerative lumbar spinal stenosis (update). Spine J 2013;13(7):734-43. 9. Matz PG, Meagher RJ, Lamer T, et al. Guideline summary review: An evidence-based clinical guideline for the diagnosis and treatment of degenerative lumbar spondylolisthesis. Spine J 2016;16(3):439-48. 10. Rousing R, Jensen RK, Fruensgaard S, et al. Danish national clinical guidelines for surgical and nonsurgical treatment of patients with lumbar spinal stenosis. Eur Spine J 2019;28(6):1386-96. 11. Deer TR, Grider JS, Pope JE, et al. The MIST Guidelines: The Lumbar Spinal Stenosis Consensus Group Guidelines for Minimally Invasive Spine Treatment. Pain pract 2019;19(3):250-74.
Bussi�res 2021 ²	SR,RCT,OS	1. Ammendolia C, Cote P, Southerst D, Schneider M, Budgell B, Bombardier C, Hawker G, Rampersaud YR: Comprehensive nonsurgical treatment versus self-directed care to improve walking ability in lumbar spinal stenosis: A randomized trial. Arch Phys Med Rehabil 99:2408-2419, 2018. e2402 2. Ammendolia C, Stuber KJ, Rok E, Rampersaud R, Kennedy CA, Pennick V, Steenstra IA, de Bruin LK, Furlan AD: Nonoperative treatment for lumbar spinal stenosis with neurogenic claudication. Cochrane Database of Syst Rev 8:CD010712.

Study/year	Primary study(ies)	Reference (first author & journal)
		3. Chou R, Deyo R, Friedly J, Skelly A, Weimer M, Fu R, Dana T, Kraegel P, Griffin J, Grusing S: Systemic pharmacologic therapies for low back pain: A systematic review for an American College of Physicians Clinical Practice Guideline. <i>Ann Intern Med</i> 166, 2017. 480-448 4. 35. Enthoven WTM, Roelofs PDDM, Deyo RA, van Tulder MW, Koes BW: Non-steroidal anti-inflammatory drugs for chronic low back pain. <i>Cochrane Database Syst Rev</i> 5. Friedly JL, et al. A randomized trial of epidural glucocorticoid injections for spinal stenosis. <i>NEJM</i> 371:11-21, 2014 6. Kim H-J, Kim JH, Park YS, Suk K-S, Lee JH, Park MS, Moon S-H: Comparative study of the efficacy of limaprost and pregabalin as single agents and in combination for the treatment of lumbar spinal stenosis: A prospective, doubleblind, randomized controlled non-inferiority trial. <i>Spine J</i> 16:756-763, 2016 7. Machado GC, Maher CG, Ferreira PH, Day RO, Pinheiro MB, Ferreira ML: Non-steroidal anti-inflammatory drugs for spinal pain: A systematic review and meta-analysis. <i>Ann Rheum Dis</i>, 2017. 8. Liu K, Liu P, Liu R, Wu X, Cai M: Steroid for epidural injection in spinal stenosis: A systematic review and metaanalysis. <i>Drug Des Develop Ther</i> 9:707-716, 2015 9. Minetama M, Kawakami M, Teraguchi M, Kagotani R, Mera Y, Sumiya T, Nakagawa M, Yamamoto Y, Matsuo S, Koike Y, Sakon N, Nakatani T, Kitano T, Nakagawa Y: Supervised physical therapy vs. home exercise for patients with lumbar spinal stenosis: A randomized controlled trial. <i>Spine J</i> 19:1310-1318, 2019 10. Monticone M, Ferrante S, Teli M, Rocca B, Foti C, Lovi A, Brayda Bruno M: Management of catastrophising and kinesiophobia improves rehabilitation after fusion for lumbar spondylolisthesis and stenosis. A randomised controlled trial. <i>Eur Spine J</i> 23:87-95, 2014 11. Oka H, Matsudaira K, Takano Y, Kasuya D, Niiya M, Tonosu J, Fukushima M, Oshima Y, Fujii T, Tanaka S, Inanami H: A comparative study of three conservative treatments in patients with lumbar spinal stenosis: Lumbar spinal stenosis with acupuncture and physical therapy study (LAP study). <i>BMC Complement Altern Med</i> 18:19, 2018 12. Rodrigues LCL, Natour J: A double-blind, randomized controlled, prospective trial assessing the effectiveness of oral corticoids in the treatment of symptomatic lumbar canal stenosis. <i>J Negat Res BioMedicine</i> 13:13, 2014 13. Schneider MJ, Ammendolia C, Murphy DR, Glick RM, Hile E, Tudorascu DL, Morton SC, Smith C, Patterson CG, Piva SR: Comparison of non-surgical treatment methods for patients with lumbar spinal stenosis: A randomized clinical trial. <i>JAMA Netw Open</i> 2:e186828, 2019 14. 140. Yaksi A, Ozg € onenel L, € Ozg € onenel B: The efficiency of € gabapentin therapy in patients with lumbar spinal stenosis. <i>Spine</i> 32:939-942, 2007
Liang 2020 ³	OS	1. Deyo RA, Mirza SK, Martin BI, Kreuter W, Goodman DC, Jarvik JG (2010) Trends, major medical complications, and charges associated with surgery for lumbar spinal stenosis in older adults. <i>JAMA</i> 303(13):1259–1265

Study/year	Primary study(ies)	Reference (first author & journal)
		2. Lieber BA, Chiang V, Prabhu AV, Agarwal N, Henry JK, Lin D, Kazemi N, Tabbosha M (2016) Postoperative complications for elderly patients after single-level lumbar fusions for spondylolisthesis. <i>World Neurosurg</i> 91:149–153 3. Deyo RA, Hickam D, Duckart JP, Piedra M (2013) Complications following surgery for lumbar stenosis in a veteran population. <i>Spine (Phila Pa 1976)</i> 38(19):1695 4. Giannadakis C, Solheim O, Jakola AS, Nordseth T, Gulati AM, Nerland US, Nygaard P, Solberg TK, Gulati S (2016) Surgery for lumbar spinal stenosis in individuals aged 80 and older: a multicenter observational study. <i>J Am Geriatr Soc</i> 64(10):2011–2018 5. Rihn JA, Hilibrand AS, Zhao W, Lurie JD, Vaccaro AR, Albert TJ, Weinstein J (2015) Effectiveness of surgery for lumbar stenosis and degenerative spondylolisthesis in the octogenarian population: analysis of the Spine Patient Outcomes Research Trial (SPORT) data. <i>J Bone Joint Surg Am</i> 97(3):177 6. Ulrich NH, Kleinstück F, Woernle CM, Antoniadis A, Winklhofer S, Burgstaller JM, Farshad M, Oberle J, Porchet F, Min K (2015) Clinical outcome in lumbar decompression surgery for spinal canal stenosis in the aged population: a prospective Swiss multicenter cohort study. <i>Spine (Phila Pa 1976)</i> 40(6):415–422 7. Ciol MA, Deyo RA, Howell E, Kreif S (1996) An assessment of surgery for spinal stenosis: time trends, geographic variations, complications, and reoperations. <i>J Am Geriatr Soc</i> 44(3):285–290 8. Hayashi K, Matsumura A, Konishi S, Kato M, Namikawa T, Nakamura H (2016) Clinical outcomes of posterior lumbar interbody fusion for patients 80 years of age and older with lumbar degenerative disease: minimum 2 years' follow-up. <i>Glob Spine J</i> 6(7):665–672 9. Jansson K-Å, Blomqvist P, Granath F, Nemeth G (2003) Spinal stenosis surgery in Sweden 1987–1999. <i>Eur Spine J</i> 12(5):535–541 10. Kalanithi PS, Patil CG, Boakye M (2009) National complication rates and disposition after posterior lumbar fusion for acquired spondylolisthesis. <i>Spine (Phila Pa 1976)</i> 34(18):1963–1969 11. Lagman C, Ugiliweneza B, Boakye M, Drazin D (2017) Spine surgery outcomes in elderly patients versus general adult patients in the United States: a MarketScan analysis. <i>World Neurosurg</i> 103:780–788 12. Liao J-C, Chen W-J (2018) Surgical outcomes in the elderly with degenerative spondylolisthesis: comparative study between patients over 80 years of age and under 80 years—a gender-, diagnosis-, and surgical method-matched two-cohort analyses. <i>Spine J</i> 18(5):734–739 13. Machado GC, Maher CG, Ferreira PH, Harris IA, Deyo RA, McKay D, Li Q, Ferreira ML (2017) Trends, complications, and costs for hospital admission and surgery for lumbar spinal stenosis. <i>Spine (Phila Pa 1976)</i> 42(22):1737–1743

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		14. Murphy ME, Gilder H, Maloney PR, McCutcheon BA, Rinaldo L, Shepherd D, Kerezoudis P, Ubl DS, Crowson CS, Krauss WE (2017) Lumbar decompression in the elderly: increased age as a risk factor for complications and nonhome discharge. <i>J Neurosurg Spine</i> 26(3):353–362 15. Nanjo Y, Nagashima H, Dokai T, Hamamoto Y, Hashiguchi H, Ishii H, Kameyama Y, Morio Y, Murata M, Tanida A (2013) Clinical features and surgical outcomes of lumbar spinal stenosis in patients aged 80 years or older: a multi-center retrospective study. <i>Arch Orthop Trauma Surg</i> 133(9):1243–1248 16. Puvanesarajah V, Jain A, Shimer AL, Li X, Singla A, Shen F, Hassanzadeh H (2017) Complications and mortality following 1 to 2 level lumbar fusion surgery in patients above 80 years of age. <i>Spine (Phila Pa 1976)</i> 42(6):437–441
Jacobi 2021 ⁴	RCT	1. Hammerich A, Whitman J, Mintken P, Denninger T, Akuthota V, Sawyer EE, Hofmann M, Childs JD, Cleland J. Effectiveness of Physical Therapy Combined With Epidural Steroid Injection for Individuals With Lumbar Spinal Stenosis: A Randomized Parallel-Group Trial. <i>Arch Phys Med Rehabil.</i> 2019 May;100(5):797-810. 2. Schneider MJ, Ammendolia C, Murphy DR, Glick RM, Hile E, Tudorascu DL, Morton SC, Smith C, Patterson CG, Piva SR. Comparative Clinical Effectiveness of Nonsurgical Treatment Methods in Patients With Lumbar Spinal Stenosis: A Randomized Clinical Trial. <i>JAMA Netw Open.</i> 2019 Jan 4;2(1):e186828. 3. Kim K, Shin KM, Hunt CL, Wang Z, Bauer BA, Kwon O, Lee JH, Seo BN, Jung SY, Youn Y, Lee SH, Choi JC, Jung JE, Kim J, Qu W, Kim TH, Eldrige JS. Nonsurgical integrative inpatient treatments for symptomatic lumbar spinal stenosis: a multi-arm randomized controlled pilot trial. <i>J Pain Res.</i> 2019 Mar 28;12:1103-1113. 4. Koc Z, Ozcakar S, Sivrioglu K, Gurbet A, Kucukoglu S. Effectiveness of physical therapy and epidural steroid injections in lumbar spinal stenosis. <i>Spine (Phila Pa 1976).</i> 2009 May 1;34(10):985-9. 5. Ammendolia C, Côté P, Southerst D, Schneider M, Budgell B, Bombardier C, Hawker G, Rampersaud YR. Comprehensive Nonsurgical Treatment Versus Self-directed Care to Improve Walking Ability in Lumbar Spinal Stenosis: A Randomized Trial. <i>Arch Phys Med Rehabil.</i> 2018 Dec;99(12):2408-2419.e2. 6. Minetama M, Kawakami M, Teraguchi M, Kagotani R, Mera Y, Sumiya T, Nakagawa M, Yamamoto Y, Matsuo S, Koike Y, Sakon N, Nakatani T, Kitano T, Nakagawa Y. Supervised physical therapy vs. home exercise for patients with lumbar spinal stenosis: a randomized controlled trial. <i>Spine J.</i> 2019 Aug;19(8):1310-1318. 7. Delitto A, Piva SR, Moore CG, Fritz JM, Wisniewski SR, Josbeno DA, Fye M, Welch WC. Surgery versus nonsurgical treatment of lumbar spinal stenosis: a randomized trial. <i>Ann Intern Med.</i> 2015 Apr 7;162(7):465-73. 8. Malmivaara A, Slätis P, Heliövaara M, Sainio P, Kinnunen H, Kankare J, Dalin-Hirvonen N, Seitsalo S, Hernö A, Kortekangas P, Niinimäki T, Rönty H, Tallroth K, Turunen V, Knekt P, Härkänen T, Hurri H; Finnish Lumbar Spinal Research Group. Surgical or nonoperative treatment for lumbar spinal stenosis? A randomized controlled trial. <i>Spine (Phila Pa 1976).</i> 2007 Jan 1;32(1):1-8.

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		9. Slätis P, Malmivaara A, Heliövaara M, Sainio P, Herno A, Kankare J, Seitsalo S, Tallroth K, Turunen V, Knekt P, Hurri H. Long-term results of surgery for lumbar spinal stenosis: a randomised controlled trial. <i>Eur Spine J.</i> 2011 Jul;20(7):1174-81. 10. Ammendolia C, Rampersaud YR, Southerst D, Ahmed A, Schneider M, Hawker G, Bombardier C, Côté P. Effect of a prototype lumbar spinal stenosis belt versus a lumbar support on walking capacity in lumbar spinal stenosis: a randomized controlled trial. <i>Spine J.</i> 2019 Mar;19(3):386-394. 11. Aydin EO, Paker N, BUĞDAYCI D. Efficacy of pulsed electromagnetic field therapy in patients with lumbar spinal stenosis: A randomised controlled study. <i>Turkish Journal of Geriatrics.</i> 2018 Dec 31;21(4). 12. Cambron JA, Schneider M, Dexheimer JM, Iannelli G, Chang M, Terhorst L, Cramer GD. A pilot randomized controlled trial of flexion-distraction dosage for chiropractic treatment of lumbar spinal stenosis. <i>J Manipulative Physiol Ther.</i> 2014 Jul-Aug;37(6):396-406. 13. Marchand AA, Suitner M, O'Shaughnessy J, Châtillon CÉ, Cantin V, Descarreaux M. Feasibility of conducting an active exercise prehabilitation program in patients awaiting spinal stenosis surgery: a randomized pilot study. <i>Sci Rep.</i> 2019 Aug 22;9(1):12257. 14. Comer C, Redmond AC, Bird HA, Hensor EM, Conaghan PG. A home exercise programme is no more beneficial than advice and education for people with neurogenic claudication: results from a randomised controlled trial. <i>PLoS One.</i> 2013 Sep 30;8(9):e72878. 15. Goren A, Yildiz N, Topuz O, Findikoglu G, Ardic F. Efficacy of exercise and ultrasound in patients with lumbar spinal stenosis: a prospective randomized controlled trial. <i>Clin Rehabil.</i> 2010 Jul;24(7):623-31. 16. Homayouni K, Naseri M, Zaravar F, Zaravar L, Karimian H. Comparison of the effect of aquatic physical therapy and conventional physical therapy in patients with lumbar spinal stenosis (a randomized controlled trial). <i>Journal of Musculoskeletal Research.</i> 2015 Mar 14;18(01):1550002. 17. Pua YH, Cai CC, Lim KC. Treadmill walking with body weight support is no more effective than cycling when added to an exercise program for lumbar spinal stenosis: a randomised controlled trial. <i>Aust J Physiother.</i> 2007;53(2):83-9. 18. Whitman JM, Flynn TW, Childs JD, Wainner RS, Gill HE, Ryder MG, Garber MB, Bennett AC, Fritz JM. A comparison between two physical therapy treatment programs for patients with lumbar spinal stenosis: a randomized clinical trial. <i>Spine (Phila Pa 1976).</i> 2006 Oct 15;31(22):2541-9. 19. Passmore SR, Johnson MG, Aloraini SM, Cooper S, Aziz M, Glazebrook CM. Impact of Spinal Manipulation on Lower Extremity Motor Control in Lumbar Spinal Stenosis Patients: A Small-Scale Assessor-Blind Randomized Clinical Trial. <i>J Manipulative Physiol Ther.</i> 2019 Jan;42(1):23-33.

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		20. Ammendolia C, Côté P, Rampersaud YR, Southerst D, Schneider M, Ahmed A, Bombardier C, Hawker G, Budgell B. Effect of active TENS versus de-tuned TENS on walking capacity in patients with lumbar spinal stenosis: a randomized controlled trial. <i>Chiropr Man Therap</i>. 2019 Jun 19;27:24. 21. Comer CM, Johnson MI, Marchant PR, Redmond AC, Bird HA, Conaghan PG. The effectiveness of walking stick use for neurogenic claudication: results from a randomized trial and the effects on walking tolerance and posture. <i>Arch Phys Med Rehabil</i>. 2010 Jan;91(1):15-9.
Wei 2021 ⁵	RCT	1. T. Amundsen, H. Weber, H.J. Nordal, B. Magnaes, M. Abdelnoor, F. Lilleas, ^ Lumbar spinal stenosis: conservative or surgical management?: a prospective 10-year study, <i>Spine</i> 25 (11) (2000) 1424–1435. 2. K.Y. Hsu, J.F. Zucherman, C.A. Hartjen, T.F. Mehlic, D.A. Implicito, M.J. Martin, et al., Quality of life of lumbar stenosis-treated patients in whom the X STOP interspinous device was implanted, <i>J. Neurosurg. Spine</i> 5 (6) (2006) 500–507. 3. J.N. Weinstein, T.D. Tosteson, J.D. Lurie, A.N. Tosteson, E. Blood, B. Hanscom, et al., Surgical versus nonsurgical therapy for lumbar spinal stenosis, <i>N. Engl. J. Med</i>. 358 (8) (2008) 794–810. 4. P. Slati, A. Malmivaara, M. Heliovaara, P. Sainio, A. Herno, J. Kankare, et al., Long-term results of surgery for lumbar spinal stenosis: a randomised controlled trial, <i>Eur. Spine J.</i> 20 (7) (2011) 1174–1181. 5. L.L. Brown, A double-blind, randomized, prospective study of epidural steroid injection vs. the mild® procedure in patients with symptomatic lumbar spinal stenosis, <i>Pain Pract.</i> 12 (5) (2012) 333–341. 6. F. Puzzilli, R. Gazzeri, M. Galarza, M. Neroni, K. Panagiotopoulos, A. Bolognini, et al., Interspinous spacer decompression (X-STOP) for lumbar spinal stenosis and degenerative disk disease: a multicenter study with a minimum 3-year follow-up, <i>Clin. Neurol. Neurosurg.</i> 124 (2014) 166–174. 7. A. Delitto, S.R. Piva, C.G. Moore, J.M. Fritz, S.R. Wisniewski, D.A. Josbeno, et al., Surgery versus nonsurgical treatment of lumbar spinal stenosis: a randomized trial, <i>Ann. Intern. Med.</i> 162 (7) (2015) 465–473. 8. R.M. Benyamin, P.S. Staats, I. MiDas Encore, MILD® is an effective treatment for lumbar spinal stenosis with neurogenic claudication: MiDAS ENCORE randomized controlled trial, <i>Pain Physician</i> 19 (4) (2016) 229–242. 9. K.H. Bridwell, T.A. Sedgewick, M.F. O'Brien, L.G. Lenke, C. Baldus, The role of fusion and instrumentation in the treatment of degenerative spondylolisthesis with spinal stenosis, <i>J. Spinal Disord.</i> 6 (6) (1993) 461–472.

Study/year	Primary study(ies)	Reference (first author & journal)
		10. D. Grob, T. Humke, J. Dvorak, Degenerative lumbar spinal stenosis. Decompression with and without arthrodesis, <i>J. Bone Joint Surg.</i> 77 (7) (1995) 1036–1041. 11. A. Hallett, J.S. Huntley, J.N.A. Gibson, Foraminal stenosis and single-level degenerative disc disease: a randomized controlled trial comparing decompression with decompression and instrumented fusion, <i>Spine</i> 32 (13) (2007) 1375–1380. 12. Z. Ghogawala, J. Dziura, W.E. Butler, F. Dai, N. Terrin, S.N. Magge, et al., Laminectomy plus fusion versus laminectomy alone for lumbar spondylolisthesis, <i>N. Engl. J. Med.</i> 374 (15) (2016) 1424–1434. 13. P. Forsth, " G. Olafsson, ' T. Carlsson, A. Frost, F. Borgstrom, " P. Fritzell, et al., A randomized, controlled trial of fusion surgery for lumbar spinal stenosis, <i>N. Engl. J. Med.</i> 374 (15) (2016) 1413–1423. 14. F. Postacchini, G. Cinotti, D. Perugia, S. Gumina, The surgical treatment of central lumbar stenosis. Multiple laminotomy compared with total laminectomy, <i>The Journal of bone and joint surgery (British volume)</i> 75 (3) (1993) 386–392. 15. C. Thom'e, D. Zevgaridis, O. Lehet, H. Bazner, " C. Pockler-Sch " oniger, " J. Wöhrle, " et al., Outcome after less-invasive decompression of lumbar spinal stenosis: a randomized comparison of unilateral laminotomy, bilateral laminotomy, and laminectomy, <i>J. Neurosurg. Spine</i> 3 (2) (2005) 129–141. 16. H. Cavus_oglu, " O. Türkmenoglu, " R.A. Kaya, C. Tuncer, I. Colak, Y. Sahin, et al., Efficacy of unilateral laminectomy for bilateral decompression in lumbar spinal stenosis, <i>Turkish neurosurgery</i> 17 (2) (2007) 100–108. 17. D.-Y. Cho, H.-L. Lin, W.-Y. Lee, H.-C. Lee, Split-spinous process laminotomy and discectomy for degenerative lumbar spinal stenosis: a preliminary report, <i>J. Neurosurg. Spine</i> 6 (3) (2007) 229–239. 18. S.E. Celik, S. Celik, K. Goksu, " A. Kara, I. Ince, Microdecompressive laminotomy with a 5-year follow-up period for severe lumbar spinal stenosis, <i>J. Spinal Disord. Tech.</i> 23 (4) (2010) 229–235. 19. K. Watanabe, M. Matsumoto, T. Ikegami, Y. Nishiwaki, T. Tsuji, K. Ishii, et al., Reduced postoperative wound pain after lumbar spinous process-splitting laminectomy for lumbar canal stenosis: a randomized controlled study, <i>J. Neurosurg. Spine</i> 14 (1) (2011) 51–58. 20. S. Rajasekaran, A. Thomas, R.M. Kanna, A. Prasad Shetty, Lumbar spinous process splitting decompression provides equivalent outcomes to conventional midline decompression in degenerative

Study/year	Primary study(ies)	Reference (first author & journal)
		lumbar canal stenosis: a prospective, randomized controlled study of 51 patients, <i>Spine</i> 38 (20) (2013) 1737–1743. 21. X. Liu, S. Yuan, Y. Tian, Modified unilateral laminotomy for bilateral decompression for lumbar spinal stenosis: technical note, <i>Spine</i> 38 (12) (2013) E732–E737. 22. M. Usman, M. Ali, K. Khanzada, M. Ishaq, H. Naeem ul, R. Aman, et al., Unilateral approach for bilateral decompression of lumbar spinal stenosis: a minimal invasive surgery, <i>Journal of the College of Physicians and Surgeons–Pakistan : JCPSP</i> 23 (12) (2013) 852–856. 23. R.J. Mobbs, J. Li, P. Sivabalan, D. Raley, P.J. Rao, Outcomes after decompressive laminectomy for lumbar spinal stenosis: comparison between minimally invasive unilateral laminectomy for bilateral decompression and open laminectomy: clinical article, <i>J. Neurosurg. Spine</i> 21 (2) (2014) 179–186. 24. S. Ko, T. Oh, Comparison of bilateral decompression via unilateral laminotomy and conventional laminectomy for single-level degenerative lumbar spinal stenosis regarding low back pain, functional outcome, and quality of life - a Randomized Controlled, Prospective Trial, <i>J. Orthop. Surg. Res.</i> 14 (1) (2019) 252. 25. S. Ruetten, M. Komp, H. Merk, G. Godolias, Surgical treatment for lumbar lateral recess stenosis with the full-endoscopic interlaminar approach versus conventional microsurgical technique: a prospective, randomized, controlled study, <i>J. Neurosurg. Spine</i> 10 (5) (2009) 476–485. 26. M. Yagi, E. Okada, K. Ninomiya, M. Kihara, Postoperative outcome after modified unilateral-approach microendoscopic midline decompression for degenerative spinal stenosis, <i>J. Neurosurg. Spine</i> 10 (4) (2009) 293–299. 27. M. Komp, P. Hahn, S. Oezdemir, A. Giannakopoulos, R. Heikenfeld, R. Kasch, et al., Bilateral spinal decompression of lumbar central stenosis with the full-endoscopic interlaminar versus microsurgical laminotomy technique: a prospective, randomized, controlled study, <i>Pain Physician</i> 18 (1) (2015) 61–70. 28. B.H. Stromqvist, S. Berg, P. Gerdhem, R. Johnsson, A. Moller, T. Sahlstrand, et al., X-stop versus decompressive surgery for lumbar neurogenic intermittent claudication: randomized controlled trial with 2-year follow-up, <i>Spine</i> 38 (17) (2013) 1436–1442.

Study/year	Primary study(ies)	Reference (first author & journal)
		29. W.A. Moojen, M.P. Arts, W.C.H. Jacobs, E.W. van Zwet, M.E. van den Akker-van Marle, B.W. Koes, et al., Interspinous process device versus standard conventional surgical decompression for lumbar spinal stenosis: randomized controlled trial, <i>Br. Med. J.</i> 347 (2013) f6415-f. 30. G. Lønne, L.G. Johnsen, E. Aas, S. Lydersen, H. Andresen, R. Rønning, et al., Comparing cost-effectiveness of X-Stop with minimally invasive decompression in lumbar spinal stenosis: a randomized controlled trial, <i>Spine</i> 40 (8) (2015) 514–520. 31. S. Schmidt, J. Franke, M. Rauschmann, D. Adelt, M.M. Bonsanto, S. Sola, Prospective, randomized, multicenter study with 2-year follow-up to compare the performance of decompression with and without interlaminar stabilization, <i>J. Neurosurg. Spine</i> 28 (4) (2018) 406–415. 32. B. Meyer, J.C. Le Huec, Interspinous spacer (IPD) versus decompressive surgery (SDS) in degenerative lumbar spinal stenosis (DLSS) with neurogenic intermittent claudication (NIC), <i>Eur. Spine J.</i> 25 (2017) S317–S318. 33. A.E.Y. Azzazi, Dynamic stabilization using X-stop versus transpedicular screw fixation in the treatment of lumbar canal stenosis: comparative study of the clinical outcome, <i>Neurosurgery quartely</i> 20 (2010) 165–169. 34. R. Davis, J.D. Auerbach, H. Bae, T.J. Errico, Can low-grade spondylolisthesis be effectively treated by either coflex interlaminar stabilization or laminectomy and posterior spinal fusion? Two-year clinical and radiographic results from the randomized, prospective, multicenter US investigational device exemption trial: clinical article, <i>J. Neurosurg. Spine</i> 19 (2) (2013) 174–184.
CPG = clinical practice guideline; OS = observational study; RCT = randomised controlled trial; SR = systematic review.		

REFERENCES

- [1] Anderson DB, de Luca K, Jensen RK, Eyles JP, Van Gelder JM, Friedly JL, et al. A critical appraisal of clinical practice guidelines for the treatment of lumbar spinal stenosis. *Spine J* 2021;21(3):455-64.
- [2] Bussi res A, Cancelliere C, Ammendolia C, Comer CM, Zoubi FA, Ch tillon CE, et al. Non-surgical interventions for lumbar spinal stenosis leading to neurogenic claudication: a clinical practice guideline. *J Pain* 2021;22(9):1015-39.
- [3] Liang H, Lu S, Jiang D, Fei Q. Clinical outcomes of lumbar spinal surgery in patients 80 years or older with lumbar stenosis or spondylolisthesis: a systematic review and meta-analysis. *Eur Spine J* 2020;29(9):2129-42.
- [4] Jacobi S, Beynon A, Dombrowski S, Wedderkopp N, Witherspoon R, Hebert JJ. Effectiveness of conservative non-pharmacologic therapies for pain, disability, physical capacity, and physical activity behaviour in patients with degenerative lumbar spinal stenosis: a systematic review and meta-analysis. *Arch Phys Med Rehabil* 2021;102(11):2247-2260.e7.
- [5] Wei FL, Zhou CP, Liu R, Zhu KL, Du MR, Gao HR, et al. Management for lumbar spinal stenosis: a network meta-analysis and systematic review. *Int J Surg* 2021;85:19-28.

APPENDIX 1: SEARCH STRATEGIES

Shared Decision Making: Spinal stenosis update (EBSCO)

Table 3. Systematic reviews and guideline search results

Database	Dates	Results
CDSR	2019 - Issue 10, October 2021	3
KSR Evidence	2019-2021	94
Epistemonikos	2019-2021	94
INAHTA	2019-2021	1
NICE Evidence	01/01/2019 - 06/10/2021	42
NICE Guidance	2019-2021	1
GIN	2019-2021	0
ECRI	2019-2021	3
Trip	2019-2021	122
CADTH	2019-2021	0
Total		360
Total after de-duplication		205

Search strategies

Cochrane Database of Systematic Reviews (CDSR) (Wiley): Issue 10 of 12, October 2021
Searched: 6.10.21

#1 MeSH descriptor: [Spinal Stenosis] explode all trees 441
#2 ((spine* or spinal* or canal or lumbar* or lumbalis or cervic* or canalis or vertebra*) near/3 (stenosis or stenose*)):ti,ab,kw 1577
#3 ((stenosis or stenose*) near/3 back):ti,ab,kw 28
#4 (narrow* near/3 (spinal* or spine* or back* or lumbar* or canal)):ti,ab,kw 124
#5 #1 or #2 or #3 or #4 with Cochrane Library publication date Between Jan 2019 and Dec 2021, in Cochrane Reviews, Cochrane Protocols 3

KSR Evidence (Internet): Database last updated 6 October 2021

<https://ksrevidence.com/>

Searched: 6.10.21

1 (spine* or spinal* or canal or lumbar* or lumbalis or cervic* or canalis or vertebra*) near/3 (stenosis or stenose*) in All text 264 results
2 (stenosis or stenose*) near/3 back in All text 17 results
3 narrow* near/3 (spinal* or spine* or back* or lumbar* or canal) in All text 15 results
4 #1 or #2 or #3 in All text Date published: 2019 - 2021 94 results
Search run Wed Oct 06 2021

Epistemonikos (Internet): up to 6 October 2021

<https://www.epistemonikos.org/en/>

Searched: 6.10.21

(title:("spinal stenosis" OR "spine stenosis" OR "canal stenosis" OR "lumbar stenosis" OR "cervical stenosis" OR "canalis stenosis" OR "vertebral stenosis" OR "vertebra stenosis" OR "vertebrae stenosis" OR "low back stenosis" OR "lower back stenosis" OR "narrowing spinal" OR "narrowing spine") OR abstract:("spinal stenosis" OR "spine stenosis" OR "canal stenosis" OR "lumbar stenosis" OR "cervical stenosis" OR "canalis stenosis" OR "vertebral stenosis" OR "vertebra stenosis" OR "vertebrae stenosis" OR "low back stenosis" OR "lower back stenosis" OR "narrowing spinal" OR "narrowing spine")); Publication year: Custom year range: From 2019 To 2021; Publication Type: Systematic Review

Records retrieved 94

International HTA Database (INAHTA): up to 6 October 2021

<https://database.inahta.org/>

Searched: 6.10.21

```
1      "Spinal Stenosis"[mh] 22
2      "spinal stenosis" OR "spine stenosis" OR "canal stenosis" OR "lumbar stenosis" OR
      "cervical stenosis" OR "canalis stenosis" OR "vertebral stenosis" OR "vertebra stenosis" OR
      "vertebrae stenosis" OR "low back stenosis" OR "lower back stenosis" OR "narrowing spinal"
      OR "narrowing spine"      26
3      #2 OR #1      YEAR 2019 TO 2021      1
```

NICE Evidence Search (Internet): up to 6 October 2021

<https://www.evidence.nhs.uk/>

Searched: 6.10.21

Search terms	Results (Guidance; Systematic Reviews): 01/01/2019-06/10/2021
"spinal stenosis"	48
"spine stenosis"	2
"canal stenosis"	11
"lumbar stenosis"	5
"cervical stenosis"	6
"canalis stenosis"	0
"vertebral stenosis"	0
"vertebra stenosis"	0
"vertebrae stenosis"	0
"low back stenosis"	0
"lower back stenosis"	0
"narrowing spinal"	0
"narrowing spine"	0
Total retrieved	72
Total after removal of duplicates	58
Sifted for relevance	42

National Institute for Health and Care Excellence (NICE): Guidelines

<https://www.nice.org.uk/>

Searched: 6.10.21

**NICE Guidance; Conditions and diseases; Musculoskeletal conditions; Spinal conditions
2019-2021**

Guidance 0
Advice 0
Quality standards 0
Pathways 1

Total 1

**Guidelines International Network (GIN). International Guidelines Library (Internet): up to 6
October 2021**

<https://g-i-n.net/international-guidelines-library/>

Searched: 6.10.21

spinal stenosis
spine stenosis
canal stenosis
lumbar stenosis
cervical stenosis
canalis stenosis
vertebral stenosis
vertebra stenosis
vertebrae stenosis
low back stenosis
lower back stenosis
narrowing spinal
narrowing spine
2019-2021

0 records retrieved

ECRI Institute Guidelines Trust (Internet): up to 6 October 2021

<https://guidelines.ecri.org/>

Searched: 6.10.21

spinal stenosis
spine stenosis
canal stenosis
lumbar stenosis
cervical stenosis
canalis stenosis
vertebral stenosis
vertebra stenosis
vertebrae stenosis
low back stenosis

lower back stenosis
narrowing spinal
narrowing spine
2019-2021
3 records retrieved

Trip Database: up to 6 October 2021

<https://www.tripdatabase.com/>

Searched: 6.10.21

"spinal stenosis" OR "spine stenosis" OR "canal stenosis" OR "lumbar stenosis" OR "cervical stenosis" OR "canalis stenosis" OR "vertebral stenosis" OR "vertebra stenosis" OR "vertebrae stenosis" OR "low back stenosis" OR "lower back stenosis" OR "narrowing spinal" OR "narrowing spine"; in the Document; 2019, 2021

Guidelines: 122 records retrieved

Canadian Agency for Drugs and Technologies in Health (CADTH): up to 6 October 2021

<https://www.cadth.ca/>

Searched: 6.10.21

"spinal stenosis"
"spine stenosis"
"canal stenosis"
"lumbar stenosis"
"cervical stenosis"
"canalis stenosis"
"vertebral stenosis"
"vertebra stenosis"
"vertebrae stenosis"
"low back stenosis"
"lower back stenosis"
"narrowing spinal"
"narrowing spine"

Advanced Search; Project Line; Health Technology Assessment; 2019-2021

0 records retrieved