

Spinal Stenosis: What Outcome Should be Expected? Review the Latest Evidence Using the Assessment of Multiple Systematic Reviews Appraisal Tool (AMSTAR)

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Abstract

Lumbar spine stenosis is a degenerative osteoarthritic change. The common presentations are pain in the lower extremities, weakness, numbness, and neurogenic claudication. The management of lumbar spine stenosis is controversial. The aim of this review is to evaluate the best evidence-based management for the patients with moderate severity degenerative lumbar spine stenosis with radiculopathy. The review included the evidence-based reports relevant to lumbar spinal stenosis and their management (nonsurgical and surgical), with no restriction on patient's age or gender. The exclusion criteria were all case series, cohort, and Level V evidence. The relevant references of the systematic reviews and meta-analysis were considered. The quality of the literature was performed using the assessment of multiple systematic reviews appraisal tool. Six systematic reviews were considered in our review for further analysis. The majority of the reports showed the preferable outcome of the surgical intervention over conservative therapy regarding leg pain and disability. The complication rate from decompressive surgical intervention was estimated at 18%. Minimal invasive surgery had a preferable outcome in preventing iatrogenic spondylolisthesis. The epidural injections were effective. Calcitonin therapy had no significance. Similarly, there was no supportive evidence for physical therapy regarding the long-term outcome. The management decision depends on the severity of the stenosis through the clinical and the radiological finding to improve the outcome

Keywords: Decompression, lumbar, spine stenosis, spondylolisthesis

INTRODUCTION

Lumbar spinal stenosis is a degenerative process of the lumbar spine characterized by narrowing of the intraforaminal vertebral spaces and the spinal canal due to degenerative osteoarthritic changes, spondylolisthesis, and degenerative scoliosis, leading to compression on the nerve and vessels of the corresponding level.^[1-4] The common presentations in lumbar spinal stenosis are pain in the lower extremities, weakness, numbness, and neurogenic claudication in 85% of cases.^[3,5] The patients' typical age is 60 years and older.^[2] It is the most common cause of spinal surgery in elderly patients of incidence about 1.4/1000 in the USA in 2009 and about 0.9/1000 in the Netherlands in 2007.^[4,6] However, the management of lumbar spinal stenosis is controversial^[7] as the first-line management in mild-to-moderate lumbar stenosis is conservative, whereas in moderate lumbar spinal stenosis with radiculopathy, surgery was suggested to be the first-line management.^[2,8,9]

The most common components of the conservative therapy are physiotherapy, acupuncture, exercise, nonsteroidal anti-inflammatory agents (NSAIDs), and epidural injections with or without steroids which are considered the most common performed therapy.^[10] The complication risks from epidural injections are no less than surgery with the doubt of their effectiveness.^[11,4,12-16] However, interspinous spacers have their advantages as a minimal invasive therapy with less intraoperative complication and their disadvantages of high

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reoperation rates and failure rates with high cost.^[5,17] The aim of this review is to evaluate the best evidence-based management for the patients with moderate severity degenerative lumbar spinal stenosis with radiculopathy due to facet and ligamentum flavum hypertrophy and their outcomes in improving pain and disability.

LITERATURE SEARCH STRATEGY

The review included the evidence based reports relevant to lumbar spine stenosis and their management (nonsurgical and surgical). The non surgical management included injections therapy, physiotherapy and rehabilitation. The surgical management included the microdecompression and open laminectomy. There were no restrictions on patient's age or gender. The exclusion criteria were all case series, cohort, and Level V evidence.^[18-20]

The literature search was performed using the Cochrane Library, PubMed, CINAHL, and Web of Science database. Words used were "treatment," "management," "lumbar spinal stenosis," "non-operative," "conservative," "Decompression," "Surgery," "laminectomy," "Epidural," "Injection," "Physiotherapy," "nonsurgical," "spacer." The time limitation was for the last 5 years; English and German language literatures were included. The abstracts were scanned and the relevant articles were reviewed after collecting them in the EndNote. The relevant references of the systematic reviews and meta-analysis were considered. The quality of the literature was performed using the assessment of multiple systematic reviews (AMSTAR) appraisal tool [Table 1].

The initial search activity showed 173 articles. After reviewing the abstracts, the duplicated studies and the studies which were not relevant were excluded in our review. Finally, six systematic reviews were considered in our review for further analysis case.

DISCUSSION

Table 1^[21] shows an instrument, "assessment of multiple systematic reviews." The AMSTAR tool for critical appraisal the systematic reviews is a validated and well-known tool as it is used most frequently in the assessment of the methods' quality;^[22] for this reason, it is used to evaluate the quality of the systematic reviews which have been used in this review.

The systematic review and meta-analysis from Manchikanti *et al.*^[10] shows no risk of bias according to the AMSTAR score of systematic reviews. Because of the controversy about the effectiveness of epidural injections, the authors in this systematic review and meta-analysis assessed the effect of three different injections: steroid with saline, local anesthetic alone, and steroid with local anesthetic. Moreover, the study compared its work with the agency of the health care and quality research in the USA. The authors accepted the noninferiority when the lower limit of CI dropped to <10%, and only when there was 20% of changes in pain. 39 RCTs were included in the study and few different studies were excluded from the meta-analysis because of their methodology. There were Five studies included more than 740 patients (treated with steroid and saline) have been compared with other five studies included more than 700 patients (treated with local anesthetics). Furthermore, there were Three studies included 400 patients (treated with combination of steroid and local anesthetic) have been compared in their study. Finally, there were Seven trials have been assessed independently (treated with different types local anesthetics). There were some limitations Manchikanti's study. Firstly, the study was limited to the short term outcome. Secondly, they did not assess the type and the severity of the stenosis. As a result, the study shows the effectiveness of steroid with local anesthetics in the treatment of the patients with lumbar stenosis and radiculopathy.

Another systematic review by Kovacs *et al.*^[8] revealed the superiority of the surgery over the conservative therapy in

Table 1: The systematic reviews which were critically appraised using the assessment of multiple systematic reviews tool

Number	AMSTAR questions	Ammendolia	Jarrett	Zaina	Kovacs	Manchikanti	May
1	Was an "a priori" design provided?	Yes	Yes	Yes	Yes	Yes	Yes
2	Was there duplicate study selection and data extraction?	Yes	Yes	Yes	Yes	Yes	Yes
3	Was a comprehensive literature search performed?	Yes	Yes	Yes	Yes	Yes	Yes
4	Was the status of publication (i.e., grey literature) used as an inclusion criterion?	Yes	Yes	Yes	Yes	Yes	?
5	Was a list of studies (included and excluded) provided?	Yes	Yes	Yes	Yes	Yes	Yes
6	Were the characteristics of the included studies provided?	Yes	Yes	Yes	Yes	Yes	Yes
7	Was the scientific quality of the included studies assessed and documented?	Yes	Yes	Yes	No	Yes	Yes
8	Was the scientific quality of the included studies used appropriately in formulating conclusions?	Yes	Yes	Yes	No	Yes	Yes
9	Were the methods used to combine the findings of studies appropriate?	Yes	Yes	Yes	Yes	Yes	Yes
10	Was the likelihood of publication bias assessed?	Yes	Yes	Yes	No	Yes	Yes
11	Was the conflict of interest included?	Yes	Yes	Yes	No	Yes	?
	Score	11/11	11/11	11/11	7/11	11/11	9/11

?: Cannot answer, AMSTAR: Assessment of multiple systematic reviews

cases of radiculopathy and neurogenic claudication, especially when the last fail between 3 and 6 months. The outcome measures were pain, disability, and daily activity. However, the study was with low risk of bias according to the AMSTAR score of systematic reviews. The study's "aim was to compare the effectiveness of all types of surgical methods in lumbar spinal stenosis with all forms of the conservative therapy and to evaluate the available information to create indication criteria for the management. The strengths of this systematic review were as follows: first, the authors included in their studies five RCTs of more than 900 patients which they were all recommended according to the Cochrane Back Review Group. Second, the follow-up period was between 2 and 10 years. Moreover, the observational and nonrandomized trials were excluded and, finally, the low variety of the study's locations as they were conducted in USA and Scandinavian. However, the study had some limitations such as there were a large crossover rate, the studies which considered to be of high quality were unclear with the criteria used, as the sample number of each study was small and the statistical methods were not clearly identified and many factors that might be significant as the patient's past medical history, the type and severity of the stenosis.

Further study from Zaina *et al.*^[23] provided a high-quality systematic review in the Cochrane database of systematic reviews with no risk of bias according to the AMSTAR score of systematic reviews. The study compared the efficacy of surgery with all variable conservative therapy in the treatment of lumbar spinal stenosis. The outcomes which considered in this study were pain, disability, and life activity. Moreover, the complications and the long-term outcome for more than 5 years were also viewed. The population included were all over 18 years old and the average 59 years old and there was no sex limitation. The outcome measures used to assess the population were Roland-Morris Disability Questionnaire (RMQ), Oswestry Disability Index (ODI), numerical rating scale, Zurich Claudication Questionnaire, and visual analog scale. Furthermore, the assessment for risk of bias used was Furlan 2009, which is a reliable and valid tool to evaluate the spine systematic reviews.^[24] The standardized mean difference (SMD) was of 95% confidence interval for the studies which used different instruments. Moreover, the heterogeneity of the studies was assessed by Chi-square test. However, about 75% of the RCTs used in the study were of high-quality design and low risk of bias, as 5 RCTs of more than 600 patients met the criteria and they were included in the study; nearly half of the participants were the control group as conservative. The follow up period (up to 10 years) was a strength for the study. The limitations were only one of these studies was blinded and had low risk of bias,^[25] and the rest were considered of high risk of bias. Moreover, there were no standard outcome measure tools due to crossover and there was no standard conservative therapy. Despite the lack of high-quality evidence for both interventions, the authors concluded that the conservative therapy had lower risk of

complications compared with the surgical intervention and there was no superiority of either intervention.

Jarrett *et al.*^[9] introduced a high-quality systematic review with no risk of bias according to the AMSTAR score of systematic reviews. The authors analysed the base land exercise effectiveness in the management of lumbar spinal canal stenosis. However, there was no study compared this type of conservative management with decompression surgical intervention. Likewise, the aim of this study was to define this last issue.

The data search was between 2000 and 2011 and included only the patients with lumbar spinal stenosis who were diagnosed clinically and radiologically. In Jarrett *et al* study, 1,099 participants in 13 studies were included. In these 13 studies, there were two RCTs and five clinical trials of level III evidence. The patients with other conditions such as spondylolisthesis or other spinal conditions were excluded. The SMD of 95% of confidence interval was considered. The effect sizes were 0.56 for the conservative in 24-month follow-up and 0.63 for surgery in the same follow-up period as the effect sizes are between 0.4 and 0.8. The study preferred surgery upon the conservative therapy, especially in the functional outcome aspects for both managements. However, there were no highly evidence-based studies supported the best exercise.

Ammendolia *et al.*'s^[3] study is a systematic review with no risk of bias. The study's goal was to evaluate the best intervention that improves walking in patients with lumbar spinal stenosis and neurogenic claudication due to this pathology. The criterion used in the assessment was the Cochrane Back Review Group, and the GRADE system in evaluating the short, intermediate and long term outcomes. The results showed in three RCTs (77 patients) that calcitonin was not better than placebo. Moreover, both prostaglandin and Vitamin B12 improve walking in 79 patients and 152 patients, respectively. In a trial included 53 patients, physiotherapy was not significant compared to transaminar epidural injections. However, epidural injections showed only short term improvement in their study. Finally, surgical approaches show no difference in improving walking.

The systematic review from May *et al.* showed high quality and relatively low risk of bias according to the AMSTAR score of systematic review.^[26] The aim of the review was to investigate and compare decompression versus all nonsurgical methods to provide the best outcome in the treatment of lumbar spinal canal stenosis. The authors tend to use the PEDro scale to evaluate the literature. They included other literatures in other languages such as German, Japanese, and Finnish. 27 studies with different follow-up periods (short, intermediate and long), nonsurgical management (physical therapy, calcitonin therapy, epidural injection, NSAID and placebo) were included and NSAID. Meta-analysis was not carried out because of the heterogeneity of the included reports. The results show better outcome in the surgical interventions in a follow-up period of 6 months to 10 years and most of the patients were more satisfied compared to the nonsurgical therapy. However,

the epidural injection provided some benefits compared to other conservative management. The overall finding was the superiority of the decompression surgery over all types of the nonsurgical therapy. However, there was a lack of Level I evidence and studies that evaluate the effectiveness of the conservative therapy.

The reliability and validity of the outcome measures which used in the evaluation of the spinal management are debatable, for the RMQ and the ODI. A systematic review and meta-analysis^[27] in addition to several reports worldwide^[28,29] did not confirm the validity of these assessment tools, especially in the nonspecific lower back pain.

May *et al.*^[26] used the Zurich Claudication Questionnaire. They demonstrated the validity and reliability of this Questionnaire worldwide in the assessment of patients conservative and surgical outcomes.

Macedo *et al.*^[2] reported in their systematic review many types of physical therapy which included TENS, massage, strengthen exercise, aerobic exercise, ultrasound, and heat pack. They had demonstrated no superiority of any type of physical therapy. Moreover, Whitman *et al.*^[30] in their RCT reported no significant difference in physical therapy exercise with manual therapy in both long- and short-term outcomes. Lurie and Tomkins-Lane^[4] reported the low-quality effectiveness of all types of physiotherapy which included exercise (all types), spinal manipulation, and pain relieving treatment. Physical therapy was even less effective than acupuncture and has no significant effect in the long-term outcome.^[31-33]

The majority of the reports showed the preferable outcome of the surgical intervention over the conservative therapy regarding leg pain and disability.^[4,8,9,12-16,26] However, surgical intervention and physiotherapy could not improve walking in patients suffered neurogenic claudication,^[3] and at the same time, they showed good results when they were treated with prostaglandin and Vitamin B12. A high-quality evidence in the Cochrane database^[23] showed no superiority of either intervention, although the complication risks were less with the conservative therapy. Furthermore, the complication rate from decompressive surgical intervention was estimated of about 18% in a prospective study in 2010.^[34] However, minimal invasive surgery or preserving laminectomy had a preferable outcome in preventing one of the most important postoperative complications, the iatrogenic spondylolisthesis due to postoperative instability.^[35] Other evidence illustrated the effectiveness of the epidural injections with steroid and local anesthetics in the management of mild-to-moderate lumbar spinal canal stenosis,^[10,36-38] especially in cases without neurogenic claudication or disability. Moreover, calcitonin therapy had no significance in therapy.^[26,39]

CONCLUSION

The management decision depends on the severity of the stenosis. The majority of the available evidence showed the superiority of surgery despite their possible complication, as it

provided the better long-term outcome for pain and disability. Treatment with prostaglandin and Vitamin B12 suggested better outcome regarding neurogenic claudication. Epidural injections provided improvement in the short-term outcomes for patients presented without disability. Physical therapies and calcitonin have no advantages.

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Conflicts of interest

There are no conflicts of interest.

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