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Guideline update for the performance of fusion procedures for degenerative disease of the lumbar spine. Part 10: Lumbar fusion for stenosis without spondylolisthesis

Daniel K. Resnick, M.D.,[1] William C. Watters III, M.D.,[2] Praveen V. Mummaneni, M.D.,[3] Andrew T. Dailey, M.D.,[4] Tanvir F. Choudhri, M.D.,[5] Jason C. Eck, D.O., M.S.,[6] Alok Sharan, M.D.,[7] Michael W. Groff, M.D.,[8] Jeffrey C. Wang, M.D.,[9] Zoher Ghogawala, M.D.,[10] Sanjay S. Dhall, M.D.,[3] and Michael G. Kaiser, M.D.[11]

[1]Department of Neurosurgery, University of Wisconsin, Madison, Wisconsin; [2]Bone and Joint Clinic of Houston, Houston, Texas; [3]Department of Neurological Surgery, University of California, San Francisco, California; [4]Department of Neurosurgery, University of Utah, Salt Lake City, Utah; [5]Department of Neurosurgery, Icahn School of Medicine at Mount Sinai, New York, New York; [6]Center for Sports Medicine and Orthopaedics, Chattanooga, Tennessee; [7]Department of Orthopaedic Surgery, Montefiore Medical Center, Albert Einstein College of Medicine, Bronx, New York; [8]Department of Neurosurgery, Brigham and Women's Hospital, Boston, Massachusetts; [9]Department of Orthopaedic Surgery, Keck School of Medicine, University of Southern California, Los Angeles, California; [10]Alan and Jacqueline Stuart Spine Research Center, Department of Neurosurgery, Lahey Clinic, Burlington, and Tufts University School of Medicine, Boston, Massachusetts; and [11]Department of Neurosurgery, Columbia University, New York, New York

Lumbar stenosis is one of the more common radiographic manifestations of the aging process, leading to narrowing of the spinal canal and foramen. When stenosis is clinically relevant, patients often describe activity-related low-back or lower-extremity pain, known as neurogenic claudication. For those patients who do not improve with conservative care, surgery is considered an appropriate treatment alternative. The primary objective of surgery is to reconstitute the spinal canal. The role of fusion, in the absence of a degenerative deformity, is uncertain. The previous guideline recommended against the inclusion of lumbar fusion in the absence of spinal instability or a likelihood of iatrogenic instability. Since the publication of the original guidelines, numerous studies have demonstrated the role of surgical decompression in this patient population; however, few have investigated the utility of fusion in patients without underlying instability. The majority of studies contain a heterogeneous cohort of subjects, often combining patients with and without spondylolisthesis who received various surgical interventions, limiting fusions to those patients with instability. It is difficult if not impossible, therefore, to formulate valid conclusions regarding the utility of fusion for patients with uncomplicated stenosis. Lower-level evidence exists, however, that does not demonstrate an added benefit of fusion for these patients; therefore, in the absence of deformity or instability, the inclusion of a fusion is not recommended.
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Key Words • **stenosis** • **lumbar spine** • **neurogenic claudication** • **fusion** • **practice guidelines**

Recommendations

There is no evidence that conflicts with the previous recommendations published in the original "Guidelines for the performance of fusion procedures for degenerative disease of the lumbar spine."

Grade B

Surgical decompression is recommended for patients with symptomatic neurogenic claudication due to lumbar stenosis without spondylolisthesis who elect to undergo surgical intervention (Level II/III evidence).

Grade C

In the absence of deformity or instability, lumbar fusion has not been shown to improve outcomes in patients with isolated stenosis, and therefore it is not recommended (Level IV evidence).

Rationale

Lumbar stenosis, narrowing of the spinal canal as a

Abbreviations used in this paper: PLF = posterolateral lumbar fusion; ODI = Oswestry Disability Index; VAS = visual analog scale.

consequence of degenerative disease, is a common phenomenon associated with the natural process of aging that can lead to the clinical syndrome known as neurogenic claudication. Patients typically describe activity-related low-back and leg pain that worsens with prolonged standing or ambulation, compromising their quality of life. This is a relatively common disorder, particularly among the elderly, that can lead to significant disability. In the absence of an associated spinal deformity or instability, symptoms of neurogenic claudication typically respond to decompression in patients whose presentation and general health warrant operative intervention. The inclusion of lumbar fusion in the surgical management of this patient population is unclear.

Literature Search

The National Library of Medicine was searched from July 2003 to December 2011 using the Internet-based search engine PubMed with the following search terms: ((("Lumbosacral Region"[MeSH] OR "Lumbar Vertebrae"[MeSH]) AND "Spinal Fusion"[MeSH]) OR "lumbar fusion"[All Fields] OR ("lumbar"[title] AND "fusion"[title])) AND ("Spinal Stenosis"[MeSH] OR stenosis[title]). The search was limited to the English language and human subjects. A total of 174 references were retrieved. The Cochrane database was also searched using the same search terms, and no additional references were identified. The titles and abstracts of these references were reviewed, and papers dealing with basic science or patients presenting with spondylolisthesis or degenerative scoliosis were excluded, as were case reports, editorials, and nonstructured reviews. Thirty-six references were identified that provide either background information or new data regarding the role of fusion in patients with stenosis without spondylolisthesis or scoliosis. Studies providing comparative data between fusion and nonfusion procedures serve as the scientific foundation of this review and are summarized in Table 1.

Scientific Foundation

The benefits of surgical decompression for lumbar stenosis, coupled with a fusion in the presence of radiographic instability or spondylolisthesis, have been well documented. Malmivaara et al. conducted a randomized clinical trial evaluating the effectiveness of surgical versus nonsurgical intervention in 94 patients with mild to moderate symptoms of neurogenic claudication due to spinal stenosis.[8] Although the investigators performed a power analysis to determine sample size, the number of patients included in each cohort did not meet the predetermined threshold. Objective validated outcome instruments were used to assess clinical status prior to surgery and at 6, 12, and 24 months after surgery. At the discretion of the treating surgeon, 10 of the 50 patients in the surgical cohort underwent fusion, with or without instrumentation, because of the presence of spondylolisthesis. Patients who were treated surgically had statistically significant clinical improvements in the Oswestry Disability Index (ODI) and visual analog scale (VAS) compared with those treated nonoperatively, which persisted over the study period. Study limitations, however, did exist, including small sample size, heterogeneity of the patient population and surgical intervention, and unblinded assessment of clinical and radiographic outcome. Due to these limitations, the paper was downgraded to Level II evidence, supporting surgical decompression as an effective modality for patients with mild to moderate symptoms of neurogenic claudication due to lumbar stenosis. Because of the small number of patients undergoing fusion, no valid comparison between decompression and decompression with fusion can be performed.

Athiviraham and Yen performed a prospective cohort study in a group of 125 patients comparing operative to nonoperative management for neurogenic claudication due to lumbar stenosis.[1] Patients with isolated stenosis underwent lumbar decompression, while those with an associated spondylolisthesis underwent fusion. Overall outcomes were substantially improved in both surgical groups compared with the nonsurgical cohort. Due to several study design limitations, including small sample size and potential for selection bias, this investigation provides Level III evidence in support of operative intervention for the treatment of spinal stenosis.

Despite the evidence supporting the utility of lumbar fusion for patients presenting with spondylolisthesis or radiographic instability, there remains considerable debate with respect to patients presenting only with stenosis. Although clinical success has been documented in patients undergoing both decompression and fusion for stenosis, the majority of these studies are based on a compromised study design and provide low levels of evidence. Grivas et al. performed a retrospective review of 23 patients who were treated with decompression and fusion with or without instrumentation for neurogenic claudication due to lumbar stenosis.[4] Five of the 23 patients had an associated spondylolisthesis. The authors found that all patients showed improvements on the 36-Item Short Form Health Survey, with the instrumented group showing a greater improvement. This case series provides Level IV evidence that improved outcomes can be achieved with decompression and fusion in the lumbar stenosis population, but it does not provide any evidence regarding the relative benefit of fusion in addition to decompression.

Gu et al. performed a retrospective review of 81 patients who underwent surgery for neurogenic claudication due to lumbar stenosis.[5] Forty-three patients were treated with decompression and posterolateral lumbar fusion (PLF), and 38 were treated with decompression and instrumented PLF. All patients were subsequently treated with 3–4 weeks of bed rest followed by gradual mobilization. Both groups of patients improved, and there were no differences in outcomes between the groups at a mean follow-up of 6.2 years. Both groups included a fair number of patients with spondylolisthesis or radiographic evidence of instability. While there were no overall differences between the groups with regard to the presence or absence of spondylolisthesis or radiographic instability preoperatively, the authors stated that they preferred to use instrumentation in younger or more active patients. The overall success rate was just over 70% in both groups.

TABLE 1: Lumbar fusion for stenosis without spondylolisthesis: summary of evidence*

Authors & Year	Description	Level of Evidence	Results	Conclusion
Malmivaara et al., 2007	Randomized controlled trial comparing surgical intervention w/ nonsurgical intervention in a group of pts w/ moderate symptoms of neurogenic claudication. A power analysis based on a presumed 15-point difference on the ODI was performed, as was an intent-to-treat analysis.	II for decompression vs nonop intervention in pts w/ moderate symptoms.	94 pts randomized w/ minimal crossover & loss to follow-up. Pts treated w/ decompression did statistically & clinically significantly better than those treated nonoperatively. Fusion was reserved for 10 pts w/ concomitant spondylolisthesis.	Decompression is an effective treatment for neurogenic claudication due to LSS. Fusion is appropriate in pts w/ coexisting spondylolisthesis.
Trouillier et al., 2004	Retrospective series of 85 pts undergoing surgery for LSS & followed for a mean of 79 mos. Pts were treated w/ minimal decompression, extensive decompression, or decompression & instrumented fusion depending on radiographic findings.	IV: Retrospective series of pts treated w/ decompression w/ or w/o fusion.	79 of 85 pts were followed, & all 3 groups exhibited improved symptoms. Those treated w/ more minimal surgical procedures tended to do better; however, there was a significant incidence of late instability in the extensive decompression w/o fusion group.	Decompression is effective for relieving symptoms of neurogenic claudication. Fusion is appropriate in cases where there is preop or intraop evidence of instability.

* LSS = lumbar spinal stenosis; pts = patients.

This paper does not address the issue of fusion versus no fusion in the lumbar stenosis population without deformity or instability.

Jansson et al. performed a retrospective review of 9664 operations performed for lumbar stenosis in the Swedish population with 10-year follow-up and reported a reoperation rate of 11%.[6,7] Eighty-nine percent of patients were treated with laminectomy alone, and 11% were treated with laminectomy and fusion with or without instrumentation. They noted that reoperation rates were lower in patients who had undergone a fusion in addition to decompression as opposed to decompression alone. Because the data were drawn from an administrative database and because no information is provided regarding why the patients were selected for fusion versus nonfusion procedures, the study does not provide useful information with regard to the benefit of fusion as an adjunct to decompression for lumbar stenosis without deformity or instability.

Rampersaud et al. performed an interesting study comparing benefits measured by standard health utility indexes between patients treated with surgery (decompression with or without fusion) for lumbar spinal stenosis or with joint arthroplasty of the hip and knee.[9] The authors found that benefits were comparable or superior in the group treated for lumbar stenosis over 2 years. Patients with spondylolisthesis were included in the stenosis group. While no differences were detected between the fusion and nonfusion subgroups of patients who underwent surgery for lumbar stenosis, differences in selection criteria make a direct comparison impossible. This paper provides Level IV evidence regarding the relative effectiveness of surgery for neurogenic claudication due to lumbar stenosis but does not provide useful information regarding the utility of fusion in patients without deformity.

Trouillier and colleagues performed a retrospective review of 85 patients who underwent surgery for neurogenic claudication.[11] Patients were treated with minimal decompression, extensive decompression, or extensive decompression and instrumented fusion. Surgical decision making was dependent on the severity of stenosis, as determined by preoperative myelography, and/or the presence of instability, defined either on preoperative imaging or during intraoperative assessment. Patient response was measured utilizing validated outcome measures, including the ODI and VAS, for a mean follow-up period of 79 months. All patients improved; however, patients with less extensive surgery tended to do better. Six of 16 patients with extensive decompressions without fusion developed radiographic evidence of instability, defined as greater than 5-mm translation on dynamic radiographs. The paper provides Level IV evidence on the effectiveness of decompression for symptoms of neurogenic claudication and supports the role of fusion in cases in which there is preoperative radiographic or intraoperative evidence of iatrogenic instability.

Yamashita et al. studied the relationship between functional disability, patient satisfaction, and walking ability in a cohort of 77 patients who were treated with decompression with or without fusion.[13] They found that patients improved in all outcomes measures but that patient satisfaction was not always tied to functional improvement as defined by the ODI. Persistent difficulty in walking was associated with lower patient satisfaction. Patients were chosen for fusion based on the preoperative diagnosis of spondylolisthesis, so no comparison between decompression alone or decompression plus fusion can be made.

Zouboulis and colleagues performed a prospective evaluation of a group of 41 patients who were treated with laminectomy and instrumented fusion for stenosis.[14] The

patient group was mixed and contained patients with normal alignment, scoliosis, spondylolisthesis, and multilevel disease. Overall, functional outcomes were improved over a mean of 3.7 years. Ninety-five percent of patients reported satisfactory results; however, 3 patients required further stabilization surgery during the follow-up period. This paper provides Level IV evidence that decompression and fusion provides benefit to some patients with lumbar stenosis, but it does not provide useful evidence regarding the role of fusion in patients without deformity or instability.[14]

Previous structured reviews of the literature have been performed using a variety of methodologies. Resnick et al., Gibson and Waddell, Watters et al., and Chou et al. all reviewed the available literature and all concluded that in the absence of deformity or instability, the performance of lumbar fusion was not associated with improved outcomes compared with decompression alone.[2,3,10,12]

Summary

Recent publications continue to support the role of surgical intervention over nonoperative management strategies for the treatment of symptomatic lumbar stenosis. For those patients presenting with uncomplicated lumbar stenosis, the literature has consistently demonstrated a beneficial role of lumbar decompression.

To date, there have been no high-quality studies comparing the efficacy of simple decompression with decompression and fusion in patients presenting with stenosis without an associated degenerative deformity. The majority of studies are compromised by a heterogeneous cohort of patients with respect to presenting diagnosis and a lack of standardized surgical approaches. Formulating valid conclusions comparing decompression with decompression and fusion is therefore impossible. In fact, the true effect of lumbar fusion for uncomplicated stenosis cannot be determined since most, if not all, of these studies reserve lumbar fusion for those patients presenting with stenosis and an associated spondylolisthesis.

Key Issues for Future Investigation

It seems highly unlikely that a well-designed investigation will be conducted or is required to compare the efficacy of lumbar decompression with decompression and fusion in patients presenting with uncomplicated lumbar stenosis. It seems more plausible that creation of prospective patient registries will allow the identification of a specific subgroup of patients presenting with routine lumbar stenosis that may benefit from the inclusion of a lumbar fusion. Once this profile is established, a more comprehensive well-designed comparative study could be conducted to determine the true treatment effect of lumbar fusion.

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Address correspondence to: Michael G. Kaiser, M.D., Columbia University, Neurological Surgery, The Neurological Institute, 710 W. 168th St., New York, NY 10032. email: mgk7@columbia.edu.