EDITORIAL

Minimally invasive spinal surgery and spinal stenosis**Paul M. Arnold, MD**

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SURGICAL management of degenerative lumbar stenosis has been well defined for several decades. Patients presenting with neurogenic claudication and corresponding imaging data have typically been offered decompressive laminectomy. This procedure is well described, with very predictable outcomes and low complication rates. Generally speaking, appropriately selected patients undergoing open surgery for lumbar stenosis attain significant pain relief.

The convergence of several demographic trends, including financial pressures and an aging population with increased comorbidities, have motivated surgeons to improve patient outcomes, decrease costs, and minimize surgical trauma. Because of improved operative techniques, as well as a better understanding of the underlying pathology, patients who would not have been candidates even a few years ago are now undergoing surgery. Many of these procedures are now being performed via minimally invasive techniques.^{2,4,5}

The evolution of minimally invasive spine surgery has touched all aspects of lumbar spine pathology. Application of this technology has influenced the treatment of lumbar tumors, trauma, and deformity. Operative management for degenerative disease of the lumbar spine has also benefited from these advances, including interbody fusion and the percutaneous placement of pedicle screws. Outcomes of some of these procedures are now equivalent and perhaps exceed those of open surgery.

The study by Alimi et al. extends this concept to the management of lumbar stenosis.¹ One hundred ten patients, either without spondylolisthesis or with stable Grade I or II spondylolisthesis, underwent minimally invasive tubular laminectomy. These patients experienced significant improvement in all outcome metrics, including the Oswestry Disability Index, visual analog scale, and Macnab's criteria. Follow-up was adequate, and complica-

tion rates were low. The reoperation rate requiring fusion at the same level was 3.5%. The authors concluded that minimally invasive laminectomy is an effective surgical tool for managing lumbar stenosis, with less blood loss and a shorter hospital stay.

While these results are intriguing, further analysis of the data reveals some concerns. The study is retrospective, with no intent to compare various decompressive procedures. Little information regarding preoperative surgical indications is provided, and there are no data on which patients underwent an open operation during the same time frame. In addition, patients with instability on preoperative flexion/extension films were excluded from the study.

The overall reoperation rate in this study was 13%, which was not significantly lower than rates reported for open laminectomy and implied that 1 out of every 8 patients required a second surgery. The mean duration of hospital stay was 2.2 days, and more than half of the patients went home either on the day of surgery or on the first postoperative day. These findings are certainly encouraging; however, they also mean that a significant percentage of patients were hospitalized for 3–5 days after surgery. Only 3.5% of patients with stable spondylolisthesis required a subsequent fusion; however, the mean postoperative follow-up was only 2 years, and some patients may have delayed instability.

Despite these shortcomings, it appears that minimally invasive lumbar laminectomy has a place in the management of lumbar stenosis. Another recent study, a randomized trial comparing minimally invasive unilateral laminectomy for bilateral decompression to standard laminectomy, showed the minimally invasive procedure to be as effective as open surgery in terms of outcome measures, with a shorter postoperative recovery time.³

The current study highlights both the potential and current reality of minimally invasive lumbar surgery for

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degenerative stenosis. Larger prospective studies with long-term follow-up are required to definitively show the superiority of this intervention.

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Response

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We thank Dr. Arnold for his interest and for raising important points regarding this case series of patients with lumbar spinal stenosis (LSS) treated using minimally invasive laminectomy. Currently in our practice, all patients with 1- to 2-level disease are treated through tubes, and open surgery is reserved for most, but not all, patients with 3 or more diseased levels. For our study, the indication for surgery consisted of radiographic evidence of significant LSS, along with the presence of corresponding clinical symptoms, including neurogenic claudication and low-back pain.

Current guidelines recommend fusion for all patients presenting with LSS and concomitant spondylolisthesis.³ Such patients are considered to have a higher risk of developing instability following open decompressive surgery. In the current study, we postulated that through minimally invasive laminectomy, fusion might be avoided in a subgroup of patients who bore a lower risk of developing instability. Accordingly, we excluded patients with evident instability on preoperative flexion/extension films and those who presented with strong, dominant mechanical back pain. The main takeaways for this study were that minimally invasive laminectomy resulted in similar outcomes in patients with and without preoperative spondylolisthesis and that routine fusion may not be indicated in all patients with spondylolisthesis.

We completely agree with Dr. Arnold that the current study is limited because of its retrospective design and lack of a comparison group. However, our study provides a strong argument to revisit the role of fusion in patients with Grade I spondylolisthesis and LSS. Current guidelines are based on an open and more disruptive surgical technique that may add iatrogenic instability in patients already at risk for instability due to the underlying pathology. It is our belief that a well-planned, well-conducted study comparing minimally invasive laminectomy to traditional open laminectomy in patients with LSS and spondylolisthesis would show a long-term advantage for the minimally invasive procedure, with fewer delayed fusion revisions in the minimally invasive group. However, given published delayed fusion rates of up to 37% after open laminectomy for LSS with Grade I spondylolisthesis,¹ it will probably be difficult to perform such a prospective multicenter trial (regardless of the difficulties that randomization of the surgical technique would add). Therefore, the best evidence that we may be able to realistically obtain will come from larger prospective cohort studies with longer-term follow-ups and perhaps from biomechanical cadaver studies.⁴

In addition, more work needs to be done in defining the adequate role of tubular minimally invasive laminectomies in patients with lumbar stenosis given radiological parameters other than spondylolisthesis, such as facet joint anatomy, disc height, foraminal compression, and spinal canal morphology.² We are currently studying the quality of contralateral versus ipsilateral decompression via a unilateral approach.

Despite its limitations, the current study suggests minimally invasive laminectomy is an effective alternative procedure in the management of LSS. Performing fusion procedures in every patient with LSS and spondylolisthesis clearly cannot be a viable strategy going forward given the aging population and attempts to control health care costs. As our minimally invasive technologies, such as percutaneous endoscopic surgery and tubular surgery, continue to evolve, we should keep an open mind and critically evaluate if alternative treatment options in this ever-growing patient population become available.

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