

Editorial

Interspinous ligamentoplasty

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Lumbar spinal stenosis is a common cause of low-back pain and neurogenic claudication in the adult population. Moreover, degenerative spondylolisthesis accounts for a substantial proportion of lumbar spinal stenosis in this age group. Spinal fusion has become the established operative treatment for unstable degenerative spondylolisthesis.² However, there are several disadvantages and issues related to posterior instrumented fusion including adjacent-segment degeneration, pseudarthrosis, and other potential complications.^{7,8} In light of these issues, surgeons have developed an increasing interest in examining alternative approaches to lumbar fusion, which is the basis of the article on interspinous ligamentoplasty by Hong et al.³ in this issue of the *Journal of Neurosurgery: Spine*.

Adjacent-segment disease after lumbar fusion has been well documented in the literature and the awareness of this complication among our community is high. Its incidence ranges in some studies from 25 to 40% with the radiographic incidence approaching 100% and the symptomatic incidence nearly 25%.⁵ Of particular relevance to the article by Hong et al., Ghiselli et al.¹ reported only 3% symptomatic caudal adjacent-segment disease for single-level fusion at L4–5 after a mean follow-up of 7.3 years. Hong et al. had an adjacent-segment disease incidence of 4% (1 case out of 23), which is comparable to the rate following single-level fusion at the same level.

The above-mentioned issues have provided the impetus for spine surgeons to examine new devices, including dynamic implants. A number of semirigid implant designs have been developed to improve segmental stability, unload posterior elements, and restrict painful motion while otherwise enabling movement. The aim is to attempt to reestablish the “neutral zone” of spinal motion where the range of displacement occurs with force-free motion, as elucidated by White and Panjabi.⁹ So far, the

most studied interspinous device, the X-STOP has only provided us with short- and medium-term results.^{10–12}

The concept of interspinous ligamentoplasty (ILP) was first introduced by Senegas.⁶ A modified technique was first reported by authors from the same institution as Hong and colleagues (Wooridul Spine Hospital) in 2005.⁴ Conceptually, ILP restricts flexion of the lumbar spine with augmentation of the interspinous and supraspinatus ligaments. Intuitively, this should limit translation in cases of degenerative spondylolisthesis.

The article by Hong et al.³ in this issue is essentially a case series, in which the authors performed their modified ILP in 32 patients (following up 23 patients or 72%) who had Grade 1 spondylolisthesis at L4–5 and were symptomatic for spinal stenosis and in whom conservative management for at least 6 months had failed. Only patients who exhibited sagittal listhesis with central canal stenosis and lateral recess stenosis were included in the study. All other forms of spinal stenosis that were associated with scoliosis, lateral translation, severe disc collapse, or foraminal stenosis were excluded. A control group of 18 patients who underwent bilateral laminotomies was also included, although this group was not prospectively defined and the extent of matching is not clear.

The follow-up assessments were made with outcome scores based on the Oswestry Disability Index (ODI) and visual analog scale (VAS) scores, as well as radiological measurements. The mean duration of follow-up was just over 5 years, which qualifies as medium-term results. The clinical outcome showed improvement in the ODI as well as the VAS. Radiological analysis showed consistent improvement in lordosis but there was increased slippage as well as disc collapse, although the latter 2 radiological outcomes did not appear to affect the clinical outcome. What appears to be most significant is that the canal area was increased postoperatively at the referenced level of L4–5. This is obviously a result of the decompression that was performed. It is therefore not proven that ILP is superior to a formal decompression laminectomy, and it is not known if the positive clinical outcome was contributed by a combination of ILP and the decompression, or if decompression alone would have been adequate. It is thus wise not to over-interpret the clinical outcomes of this paper.

With regard to complications related to ILP, the au-

thors reported only 3 complications in their series of 23 cases. Revisions were for infection (1 case) and increased instability (1 case). The only patient with adjacent-segment disease was treated conservatively.

Although the results reported by Hong et al.³ are promising in terms of outcome scores in the short to medium term, a well-designed randomized controlled trial is needed to validate the findings. For instance, decompression itself might have been effective enough to achieve improvement in the ODI and VAS scores for patients with spinal stenosis with Grade 1 spondylolisthesis, as mentioned above. Without a rigorously defined control group, it is unwise to infer a treatment effect of ILP beyond what is seen with conventional decompression. It is also not known if the patients were selected with any bias, as it is unclear whether the 23 patients were consecutive consultations for spinal stenosis symptoms with Grade 1 spondylolisthesis. Nonetheless, the authors do indicate that the surgical procedures represent a consecutive operative series.

Technically speaking, the soft-tissue procedure requires manual tensioning, and reproducibility in each patient is questionable; this is in contrast to the situation with other interspinous spacers like the Device for Intervertebral Assisted Motion (DIAM) or X-STOP—devices that are manufactured by machinery, with specifications being more controlled. As with all soft-tissue tensioning procedures, long-term performance remains an issue. On the other hand, the most important value of the ILP is perhaps its less invasive nature. No bridges are burned in this procedure, and bail-outs are possible, with fusion being the most likely rescue maneuver for failure.

With the state of spinal fusion becoming an established “art” in spine surgery, we are still pushing the barriers everyday, hoping for simpler solutions for this “age-old” problem. Interspinous ligamentoplasty appears to show promising clinical outcome results in the short to medium term, but only very specifically for patients with spinal stenosis with Grade 1 spondylolisthesis without any other deformities. It is less invasive than a formal fusion, and revisions are less taxing. But does newer mean better? Only time and further well-designed clinical trials will tell.

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Response

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We appreciate Drs. Fehlings and Chua for giving us an opportunity to address the new and challenging issue of ILP in the treatment of degenerative spondylolisthesis. Spine fusion with instrumentation has been found to result in adjacent-segment degeneration as time goes by, and dynamic stabilization has been developed to avoid this late complication. Some dynamic stabilizing devices have been used to treat degenerative spondylolisthesis, but postoperative stability could not be guaranteed when accompanied by preoperative instability because the biomechanical characteristics of many interspinous devices do not prevent hypermotion during flexion in a destabilized lumbar segment, except the Wallis and Locker devices, which can limit flexion.^{2,4} Interspinous ligamentoplasty was modified from Senegas and colleagues’ technique,¹ and a biomechanical study using a similar technique has been performed by Voydeville et al.,³ showing restoration of segmental motion and the neutral zone in injured segments.

Interspinous ligamentoplasty was performed along with decompressive laminotomy, and we agreed with Drs. Fehlings and Chua that it is unclear if the positive clinical outcome could be contributed to decompression alone. Because of concerns about postoperative instability, the decision to use decompression alone is a difficult one in cases involving patients with degenerative spon-

dylolisthesis and mild instability who are not candidates for fusion surgery because of their general condition. In the present study, ILP showed better stability than laminotomy alone (as performed in the Control Group), and radiological instability was significantly less in the ILP Group (13%) than the Control Group (50%) at the final follow-up. Adjacent-segment disease in the ILP Group was relatively less than after fusion surgery, according to the generally reported incidence. Because instability at the level of the index surgery and adjacent-segment disease can be complications after ILP and fusion, respectively, a comparative study between ILP and fusion surgery is needed to see which surgery is better for the treatment of unstable degenerative spondylolisthesis.

The ILP procedure is relatively easy to perform and it is less invasive than fusion, but as mentioned in the editorial, manual tensioning can vary according to the surgeon's technique. We tried to get a normal lordotic angle of the index segment when securing the artificial ligament, and tension may be different in each case. We admit that standardization and maintenance of tensioning

is still an issue and to draw a more confident conclusion, a prospective randomized study will be needed. Again, we thank Drs. Fehlings and Chua for their thoughtful editorial comments on our study. (DOI: 10.3171/2009.12.SPINE09759)

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