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Commentary: Lumbar Laminoplasty for Resection of Myxopapillary Ependymoma of the Conus Medullaris: 2-Dimensional Operative Video

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In this video abstract, the authors[1] present a case of intradural, extramedullary myxopapillary ependymoma resection via lumbar laminoplasty. While many spine surgeons would have chosen conventional laminectomy as their surgical corridor, laminoplasty was utilized in this case to preserve the posterior elements in an effort to avoid kyphotic deformity in the future. While the microsurgical aspect of intradural spine tumor surgery is well known to most neurosurgeons, the theoretical benefits of lumbar laminoplasty over laminectomy warrant detailed discussion.

The significance of posterior tension band in biomechanical support has been illustrated extensively in the literature. The posterior ligament complex provides tension constraint during flexion, support for fascia and muscle in all body positions, and restraint during extension.[2,3] Spine surgeons have become more cognizant of the role of posterior tension band and of the unfavorable postoperative outcome when its role is ignored. To illustrate, Kaptain et al[4] reported that 21% patients who underwent multilevel cervical laminectomy eventually developed kyphotic deformity. For this reason, the World Federation of Neurosurgical Society (WFNS) recommends surgeons to consider laminoplasty or addition of fusion instead of isolated laminectomy decompression for 3+ levels to address cervical spondylotic myelopathy.[5] The comparative advantage of laminoplasty over laminectomy is also reported for intramedullary tumor. A single-institution review of 144 laminectomy and 22 laminoplasty cases for intramedullary spinal cord tumor demonstrated that patients who underwent laminectomy were 6 times more likely to develop kyphosis compared to the laminoplasty cohort (5% vs 30%).[6]

Although there is no formal guideline from an organized society regarding lumbar laminoplasty, several study findings suggest that posterior tension band in thoracolumbar spine surgery is also crucial in maintaining biomechanical stability. Papagelopoulos et al[7] reported that 28% of patients under the age of 30 yr developed spinal deformity after multilevel thoracolumbar laminectomy. Similarly, a study by Mulin et al[8] demonstrated that 54% of patients had instability as evidenced by the dynamic lateral image after laminectomy.

To preserve the posterior tension band, various lumbar laminoplasty techniques have been highlighted in spine literature. Kakiuchi et al[9,10] described a spinous process splitting technique to preserve paraspinal muscle attachment and posterior ligament complex with good outcome at both 8 and 12 yr after surgery. Menku et al[11] presented a laminoplasty technique utilizing laminar osteotomy for intraspinal surgery with subsequent replacement using a drill and miniplates, which is technically similar to the surgery described in this video manuscript. The comparative clinical benefit of lumbar laminoplasty over conventional laminectomy was also demonstrated in a small randomized controlled trial by Watanabe et al,[12] which utilized a spinous process splitting technique. Although this randomized study showed that patients who underwent laminoplasty had less pain, the authors did not present a radiographical assessment of kyphotic progression in both cohorts. Also, despite the seemingly favorable outcome from laminoplasty reported in literature, it is important to note the potential author bias in these studies as surgeons who have a great deal of experience and familiarity with lumbar laminoplasty are likely to publish these studies, and the result may not be generalizable to most surgeons.

Two important technical points to be considered in this video manuscript are complete dissection of the entire paraspinal muscle attachment and the disruption of posterior tension band at the T12-L1 and L2-L3 levels.

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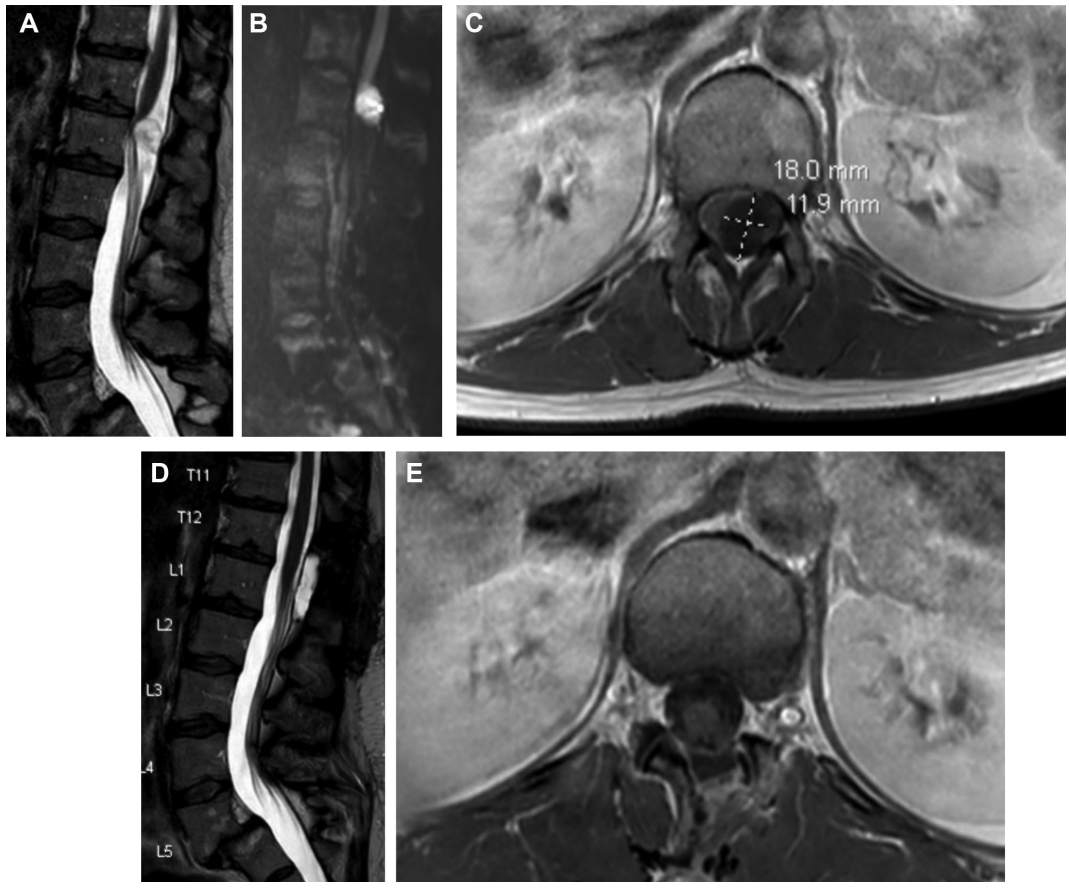

FIGURE. *A 42-yr-old female referred to our clinic for progressive lower back pain with magnetic resonance imaging (MRI) illustrated by* **A**, *sagittal T2,* **B**, *sagittal DWI, and* **C**, *axial post contrast T1 MRI. Left-sided T12 and L1 hemilaminectomy with undercutting of spinous process was performed to obtain an adequate surgical corridor for gross-total resection. Postoperative MRI demonstrated gross-total resection as shown by* **D**, *sagittal T2 and* **E**, *axial postcontrast T1 MRI images.*

Unlike the spinous process splitting technique, complete paraspinal muscle dissection is unavoidable for creating an adequate operative window for intradural tumor removal. Also, there is probably additional structural support compared to isolated laminectomy as the L1-L2 posterior complex was not disrupted, but the detachment of the T12-L1 and L2-3 ligamentous complex from the rest of the thoracolumbar spine is not addressed in this manuscript. Menku et al[11] solved this problem by repairing the interspinous ligament with PDS 1.0 suture following laminoplasty, although there is no way to objectively assess the additional benefit of repairing the interspinous ligament.

One easy solution to provide strong structural support for the posterior complex is utilizing posterolateral fusion. However, we believe that the authors made the correct choice of avoiding fusion in a young male patient who has a high chance of developing adjacent segment disease with a small fusion construct at the thoracolumbar junctional zone. However, laminoplasty does not fully circumvent this pathology. A review of 73 lumbar laminoplasties with 2- to 13-yr follow-up demonstrated that 11% of patients developed adjacent segment disease.[13]

Another way to address intradural, extramedullary spinal cord tumor while preserving the posterior ligament complex is with unilateral hemilaminectomy. Basheer et al[14] presented a case where multifocal thoracic ventral pilocytic astrocytoma was addressed via unilateral hemilaminectomy combined with undercutting the base of spinous process for additional exposure. This technique obviates resecting the interspinous ligament and therefore minimizes the disruption of physiologic posterior tension band. As an example, we have an illustrative case of extramedullary epidermoid resection in a young female at the conus medullaris level utilizing unilateral hemilaminectomy with a spinous process undercutting technique (Figure). However, a unilateral approach is arguably more challenging compared to wide laminectomy in obtaining a sufficient operative window

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despite the additional space gained by undercutting of spinous process.

In addition to biomechanical support, lamina flap offers potential advantages over traditional laminectomy, including restoration of bony protection, better cosmetic results, avoidance of postlaminectomy epidural scarring, decreased incidence of epidural hematoma, and decreased risk of pseudomeningocele formation.[6,12] However, there is no objective evidence behind these theoretical benefits, and more studies are needed.

We would like to commend the authors[1] for sharing the lumbar laminoplasty techniques in addressing intradural tumor. This video and narrative description is informative to spine surgeons who are unfamiliar with lumbar laminoplasty. While lumbar laminoplasty is becoming increasingly more popular among select surgeons, its superiority over conventional laminectomy is not generalizable based on current evidence. Also, unlike the surgery for degenerative disease, surgeons should choose the most comfortable approach to them in gaining a wide enough window to facilitate maximal, safe resection for intradural tumor.

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