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Posterior Surgery for Cervical Myelopathy: Laminectomy, Laminectomy with Fusion, and Laminoplasty

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Posterior decompression of the spinal cord is often used in patients with multilevel cervical myelopathy. In particular, those with appropriate sagittal alignment to allow cord drift-back away from anterior causes of cord compression (osteophytes, bulging discs, herniated discs, ossification of the posterior longitudinal ligament) after release of the posterior structures (lamina, ligamentum flavum) are the best candidates for a posterior procedure. Neurologic outcomes are similar with anterior or posterior approaches in the properly chosen patient. Laminectomy, laminectomy and fusion, and laminoplasty are potential posterior approaches. Laminoplasty has the advantages of better preserving alignment than laminectomy while maintaining motion and avoiding fusion related complications. Patients with painless myelopathy and neutral to lordotic alignment are the best candidates for laminoplasty.

KEYWORDS laminoplasty, laminectomy, cervical spine, myelopathy, laminectomy and fusion, decompression, posterior surgery

Considerable debate exists regarding the optimal surgical approach for treating multilevel cervical myelopathy.[1,2] Proponents of anterior surgery cite as advantages the ability to directly remove the majority of compressive pathologies encountered in the cervical spine (eg, disc herniations, ventral osteophytes, ossification of the posterior longitudinal ligament [OPLL]), the muscle-sparing dissection that results in minimal postoperative pain, and the ability to correct and decompress the cord over kyphotic lesions. Indeed, if myelopathy arises from one or two segments, the supremacy of an anterior approach is difficult to argue. However, when three or more segments are involved, higher complication rates associated with anterior surgery, particularly fusion-related problems seen with long strut grafts used to reconstruct multilevel corpectomies, make posterior options more attractive.

Posterior-based operations—such as laminectomy, laminectomy and fusion, and laminoplasty—possess their own set of advantages. First, because indirect decompression of anterior pathology is performed, posterior surgeries are often technically easier to perform than anterior corpectomies, particularly in patients with severe stenosis or OPLL that requires resection. Accordingly, all challenges associated with graft carpentry to reconstruct the anterior column are avoided. Second, posterior decompression allows the surgeon to more rapidly decompress multiple segments than is possible with a multilevel anterior decompression. This may be critical in treating debilitated patients who cannot undergo lengthy surgery. Third, motion-preserving posterior operations like laminoplasty allow cord decompression without necessitating fusion and its attendant complications. Fourth, because fusion is not routinely necessary with some posterior procedures like laminoplasty, segments at future risk can be decompressed without substantially increasing patient morbidity. With a laminoplasty, for example, a C3-C7 decompression is routinely performed, even if the majority of the stenosis is more localized. In contrast, if an anterior approach were used, the surgeon might hesitate to decompress and fuse a mildly or moderately stenotic level for fear of increasing the number of complications and morbidity, thereby leaving the patient vulnerable to subsequent symptoms at that adjacent level in the future.

Posterior surgery is not appropriate for all myelopathic patients, however, and it clearly has its drawbacks. It is associated with extensive posterior muscle denervation and a less cosmetic scar. Additionally, since most of the pathology caus-

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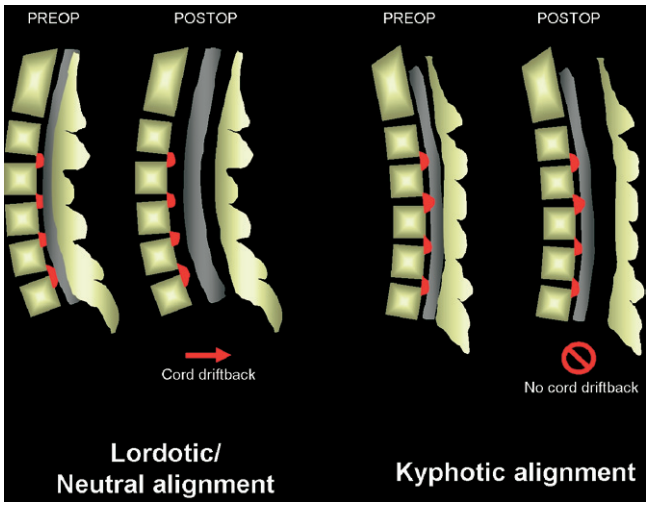

Figure 1 Spinal cord drift-back following posterior decompression. If the sagittal alignment is lordotic or neutral (left), the dural sac and cord can drift posteriorly away from the anterior compressive lesions (disc herniations, osteophytes, OPLL) after removal of the posterior tethers (lamina, ligamentum flavum). However, if the alignment is kyphotic (right), drift-back does not occur, and decompression from the anterior compressive elements will not reliably occur. The ventral aspect of the cord will remain compressed by the anterior structures despite removal of the posterior tethers. (Color version of figure is available online.)

ing cervical myelopathy is anterior to the spinal cord, posterior procedures decompress the spinal cord by allowing the cord to drift posteriorly from the anterior lesions following release of the posterior tethers (eg, laminae and ligamentum flavum). Although such posterior drifting of the spinal cord reliably occurs in a lordotic or neutral cervical spine, it may not occur in the setting of significant kyphosis. Thus, the indications for performing posterior decompression are limited to those cases in which the overall sagittal alignment is conducive to cord drift-back: neutral or kyphotic alignment (Fig. 1).

In this article, we examined the role of posterior decompression procedures—laminectomy, laminectomy and fusion, and laminoplasty—in the treatment of multilevel cervical myelopathy.

Laminectomy Alone

Before the popularization of anterior cervical spine surgery, laminectomy was the most common approach to decompression for multilevel myelopathy. Currently, however, laminectomy alone for the treatment of cervical myelopathy is less frequently performed due to its numerous downsides and because better alternatives exist. Postlaminectomy kyphosis can occur after laminectomy and lead to recurrent myelopathy if the cord becomes draped over the kyphos (Fig. 2). The true incidence of postlaminectomy kyphosis in the adult population is unknown, but estimates range from 11 to 47%.[3,4] The kyphosis can be a source of not only deformity but also neck pain from muscular fatigue. In a comparative study of laminectomy and laminoplasty, 34% of patients undergoing laminectomy developed postoperative kyphosis or swan neck deformity versus only 7% after laminoplasty.[5] In addition, a laminectomy with an overly aggressive facetectomy can result in iatrogenic spondylolisthesis and can potentially lead to pain and neurologic compromise. A postlaminectomy membrane may develop postoperatively and can lead to dynamic compression of the spinal cord over time.[6] Even in the absence of a symptomatic postlaminectomy membrane, revision surgery can be more tedious, difficult, and risky due to the presence of exposed and unprotected dura.

Skip laminectomy is a modified procedure that was designed to limit posterior muscle trauma and neck pain, with the hope of also limiting postoperative kyphosis. With this procedure, two consecutive stenotic levels are decompressed via a standard laminectomy of the lamina between the stenotic levels, combined with a partial laminectomy of the lower adjacent vertebra. Thus, a C3-7 decompression can be achieved by laminectomy of C4 and C6, with partial laminectomies and flavum resection at other levels. At the "skipped" lamina (C3, C5, and C7 in this example), the muscular attachments to the spinous processes are left intact, thereby helping to preserve sagittal alignment and limit postlaminectomy kyphosis. Two-year follow-up data demonstrated similar neurologic outcomes with skip laminectomy as with

Figure 2 Postlaminectomy kyphosis and instability. This patient had a previous anterior fusion at C6-7 with a good clinical outcome but subsequently underwent cervical laminectomy and developed worsening neck pain and extremity symptoms with neck extension and was unable to hold her head upright without using her hands to support her chin. Note both the kyphosis and the spondylolisthesis at C4-5.