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The Role for Cervical Arthroplasty for Symptomatic Cervical Stenosis: Indicated for a Single-Level Cervical Disc Herniation Causing Stenosis with Myelopathy

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Cervical myelopathy can be successfully treated by artificial disk replacement; however, it is extremely important to understand the appropriate indications. The suitable situation is quite narrow—a focal disc herniation without retrovertebral compression, without significant facet pathology, and without multilevel stenosis. It is critical to recognize the contraindications for cervical arthroplasty. The vast majority of patients with myelopathy are not candidates for cervical arthroplasty due to multilevel pathology or significant degeneration.

KEYWORDS cervical spine, myelopathy, artificial disc replacement, herniated nucleus pulposus

The surgical treatment options for cervical myelopathy have traditionally included standard decompression and fusion procedures from an anterior, posterior, or combined approach. A motion-sparing strategy has been available for the posterior operation (at least partially with laminoplasty); however, we have not had the option of decompressing the spinal cord from an anterior approach while allowing motion to occur at the operative segment. This has changed with the recent introduction of cervical arthroplasty devices. Cervical artificial disc replacement now allows us the possibility of treating cervical myelopathy with an anterior decompression and motion-preservation procedure. The questions we must answer now are "is this reasonable?" and "what is the role of this device?" The data generated in the literature thus far do prove that it is a reasonable approach that may be considered in the treatment of cervical myelopathy and the best indication is a focal large central disc herniation in a young person with no significant degenerative changes including the facet joints (Fig. 1).

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Myelopathy and Motion

Is There a Fundamental Reason to Restrict Motion After Cervical Decompression?

There has been an underlying concern regarding continued motion in the cervical spine at a decompressed level that is awaiting spinal cord recovery. The conventional wisdom is that neural tissue responds differently in a moving versus a stable environment and that spinal cord recovers best in a stable environment. This concept is best articulated by Henderson and coworkers,[1] who described a stretch-associated injury in cervical spondylotic myelopathy. They proposed that static compression is not the only factor responsible for spinal cord dysfunction. They believe strain (spinal cord stretch) and shear forces are also extremely important features of this dynamic process. They cite the fact that, during normal motion, significant axial strains occur in the cervical spinal cord and that the spinal cord stretches 24% of its length, which causes local spinal cord strain. This strain can exceed the material properties of the cord and cause transient or permanent neurological injury. They conclude that stretch and shear forces generated within the spinal cord seem to be important factors in the pathogenesis of cervical spondylotic myelopathy.[1]

When trying to understand this concept and how it relates

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Figure 1 Large central disc herniation at C5-6 with compression of the spinal cord causing myelopathy as demonstrated on the T2 sagittal MRI.

to taking care of patients with cervical myelopathy, it appears to be most important in the patient with multilevel anterior pathology who undergoes posterior decompression with a markedly reduced or absent lordotic sagittal alignment (Fig. 2). In this scenario, the spinal cord is continuing to stretch in flexion as it moves over the anterior osteophytes. This concept is also in play in multilevel pathology in a patient who undergoes anterior decompression and fusion of only the most significant compressive lesion. Although the segment is fused at one level, the spinal cord continues to undergo strain as it stretches over the residual pathology at the adjacent segments. In the situation of a large focal central disc herniation causing myelopathy without compression of the spinal cord at any other level, this motion-causing strain concept seems to be less of a concern as long as the disc herniation is completely removed from an anterior approach. Inserting an artificial disc and allowing normal motion and sagittal alignment will not place excess stretch on the spinal cord.

Additional evidence that motion by itself is not a detriment to spinal cord recovery after decompression is the outcomes seen after laminoplasty and laminectomy for cervical myelopathy. Laminectomy without fusion is certainly a motion-preserving technique for treating cervical myelopathy. This procedure can be utilized for very specific indications as long as instability is not produced and excellent sagittal alignment (lordosis) is present. The poor outcomes after laminectomy stem from the mechanical deformity that may occur that subsequently causes further spinal cord compromise. It is rare that spinal cord deterioration occurs after laminectomy as long as mechanical stability and cervical lordosis is maintained. Laminoplasty is a technique that allows partial motion preservation. Satisfactory neurologic outcomes are routine with this procedure despite the lack of rigid immobilization of the spinal column and cord. As with laminectomy, poorer outcomes with laminoplasty are due to me-

Figure 2 Multilevel stenosis with nearly absent lordosis demonstrated on the T2 sagittal MRI.