Current Techniques in the Management of Cervical Myelopathy and Radiculopathy

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KEYWORDS

• Minimally invasive • Posterior • Foraminotomy • Cervical

KEY POINTS

- Patients with radiculopathy caused by a lateralized osteophyte or disc herniation without cord compression, evidence of instability, or those for whom an anterior approach is contraindicated, are candidates for minimally invasive cervical discectomy or foraminotomy (MICD/F).
- Minimally invasive decompression of cervical stenosis (MIDCS) may be offered to patients who have less than 3 levels of disease, lack evidence of instability, and have normal cervical lordosis.
- In addition to equivalent efficacy, MICD/F and MIDCS offer the advantages of reduced blood loss, length of stay, postoperative pain, and muscle spasm; preservation of motion segments; and decreased risk of iatrogenic sagittal plan deformity.

INTRODUCTION

Several degenerative abnormalities of the cervical spine can be successfully treated with posterior decompressive techniques.[1–4] Although anterior cervical procedures represent a well-established treatment for cervical disc herniation, posterior cervical laminoforaminotomy consistently shows symptom improvement of 90% to 97%[3,5–8] for patients with foraminal stenosis or lateral disc herniation. Likewise, posterior decompression with either laminectomy or laminoplasty for patients with myelopathy from cervical stenosis shows clinical improvement in 62.5% to 83% of cases.[4,9,10] Posterior decompressive procedures avoid the complications associated with anterior approaches such as esophageal injury, recurrent laryngeal nerve paralysis, dysphagia, and adjacent-level disease after fusion.[11–14]

Although standard open approaches are effective, minimally invasive approaches have been developed to avoid the extensive subperiosteal stripping of paraspinal musculature that can result in significant postoperative pain, muscle spasm, and dysfunction in 18% to 60% of patients.[4,11,15,16] Furthermore, preoperative loss of lordosis combined with long-segment decompression can contribute to the risk of sagittal plane deformity,[17–20] a known complication that often obliges fusion at the time of decompression. The use of a posterior fusion technique increases operative time, blood loss, surgical risk, and early postoperative pain, and potentially contributes to adjacent-level disease.

The principal tenet of minimal-access techniques is to reduce approach-related morbidity. To this end, the advent of muscle-splitting tubular retractor systems and associated instruments have allowed for the application of minimally invasive techniques to posterior cervical decompressive procedures.[16,21] Minimally invasive cervical discectomy/foraminotomy (MICD/F) was first described in a cadaver model, and has subsequently been shown to have clinical efficacy equal to that of open procedures in addition to having less blood loss, shorter hospital stay, and decreased postoperative pain.[7,22–27]

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Whereas the goal of MICD/F is nerve-root decompression, minimally invasive decompression of cervical stenosis (MICDS) is performed with the aim of decompressing the spinal cord. MICDS is a familiar modification of minimally invasive techniques that have been applied extensively to the lumbar spine.[28] By preserving much of the normal osteoligamentous anatomy of the cervical spine, the MIDCS procedure reduces the risk of postlaminectomy kyphosis and avoids the need for prophylactic posterior fusion.[4,19,29] The use of minimally invasive laminoplasty has been reported with positive results, although investigators have encountered technical difficulties and prolonged operative times.[30,31]

PREOPERATIVE PLANNING

A preoperative radiographic evaluation follows a detailed history and physical examination, and should include magnetic resonance imaging (MRI) or postmyelographic computed tomography (CT), and anteroposterior (AP), lateral, and flexion/extension cervical radiographs. Preoperative electromyography (EMG) and nerve conduction studies may also assist in the neurologic localization of specific radiculopathy. Those patients with radicular symptoms that correlate with electrophysiologic and radiographic findings may be well suited for MICD/F, depending on the underlying pathologic profile. **Fig. 1**A shows a lateralized disc herniation without spinal cord compression on preoperative MRI scan. By contrast, **Fig. 1**B shows moderate cord and nerve-root compression arising from a herniated disc. The former would be an ideal candidate for MICD/F, whereas MICDS or an anterior approach would be safer and more effective in the latter. Regardless of the abnormality, whether a soft disc or an osteophyte, it must be lateralized without significant canal stenosis to be amenable to MICD/F. MIDCS may be indicated for patients presenting with myelopathy or myeloradiculopathy caused by central spondylotic stenosis (eg, ligamentum flavum or facet hypertrophy). Those patients with moderate canal stenosis, normal cervical lordosis, primarily posterior disease, and without instability may be considered for MIDCS or traditional laminectomy or laminoplasty.[29,32,33]

EQUIPMENT

- Gardner-Wells tongs with traction or other head fixation device
- Microscope or endoscope (with compatible camera)
- Tubular retractor system
- Minimally invasive spinal instruments (including microcurettes and 1-mm and 2-mm rongeurs)
- High-speed drill
- Intraoperative fluoroscopy

PATIENT POSITIONING

General endotracheal anesthesia is induced with fiberoptic intubation utilized in patients with chronic spinal cord compression. If the patient is placed in the sitting position a precordial Doppler may be used to monitor for air embolism, although the risk of air embolism is very low. Foley catheterization is generally not needed. Routine perioperative antibiotics are administered, as is an intravenous corticosteroid at the surgeon's discretion. Paralytic agents are minimized after induction to allow for physical intraoperative feedback of nerve-root irritation. The patient is placed in Gardner-Wells tongs or Mayfield head holder, and placed prone on a Jackson table with the

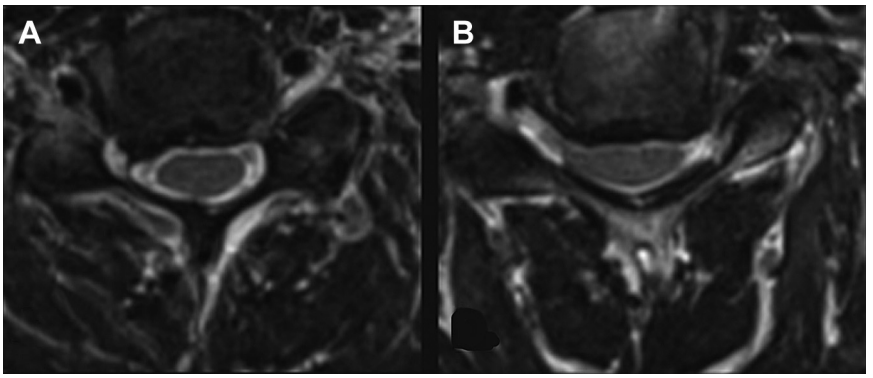

Fig. 1. Axial T2-weighted magnetic resonance imaging (MRI) scans of the cervical spine demonstrate (*A*) laterally herniated disc to the right with compression of the exiting nerve root and (*B*) a centrally located disc/osteophyte causing both spinal cord and nerve-root compression.