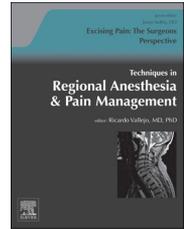


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## Surgical treatment of cervical radiculopathy

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### ABSTRACT

Cervical radiculopathy can be a disabling condition for patients. Pain, paresthesia, and motor deficit may occur. Although there are ample treatment options for these patients, surgery may be necessary. The goal of this article is to discuss the diagnosis of cervical radiculopathy and outline surgical indications. Surgical options are discussed in detail. Anterior and posterior approaches will be reviewed along with the advantages of each. Hopefully this article enables the reader to look at cervical radiculopathy through the eyes of a surgeon and aid in determining appropriate care. Understanding the surgical anatomy may also allow a pain management specialist to focus his or her treatment directly on the offending pathology and optimize nonsurgical care, as well.

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Cervical radiculopathy leads to neck and radiating arm pain or numbness in the dermatomal distribution of the involved nerve root. The radicular pain can also be accompanied by motor or sensory disturbances. Common clinical findings of cervical radiculopathy include arm pain or neck pain, scapular or periscapular pain, paresthesias, weakness, or abnormal deep tendon reflexes in the arm.<sup>1</sup> Although the causes of radiculopathy are varied; spondylosis or disk herniations cause nearly 70% of cases.<sup>2</sup> Most patients with cervical radiculopathy have a self-limited course. Usually, the symptoms resolve spontaneously over a variable length of time without specific treatment.<sup>1</sup> Approximately one-third of patients presenting with cervical radiculopathy have persistent symptoms.<sup>3</sup> Patients with intractable radicular pain unresponsive to greater than 6 weeks of conservative management, motor weakness, progressive neurologic deficit, signs of myelopathy, or instability of the spine should be referred to a surgeon.<sup>4</sup> Surgical intervention is suggested for the rapid relief of symptoms of cervical radiculopathy from these disorders when compared with conservative treatment.

Surgical intervention for cervical radiculopathy can be achieved from a posterior or anterior approach to the spine, depending on the site of nerve root compression. Early operations of the cervical spine were performed from a posterior approach, and it is still used today in

certain situations.<sup>5</sup> Several pathologic conditions can be addressed by the posterior approach. This approach is useful for laterally located disc herniations and foraminal stenosis, secondary to spondylosis of the uncovertebral or facet joint.<sup>6</sup>

The most common surgical procedure is the posterior foraminotomy (PF). This procedure is performed through a posterior incision on the neck. The neck muscles are dissected away from the spine. A small amount of bone is removed over the affected nerve root, in addition to any hypertrophied ligament or synovium that may contribute to nerve compression.<sup>7</sup> In cases of an anterior osteophyte, this also allows for indirect decompression of the nerve root. Additionally, this approach is effective for removal of foraminal disk herniations. The posterior approaches also avoid the need for discectomy and fusion. The literature describes between 75% and 98% positive outcomes.<sup>8</sup> Surgical indications and contraindications have been listed in the following sections.

### Indications for posterior cervical foraminotomy

- Cervical foraminal stenosis with symptoms that correlate to the affected nerve root documented on computed tomography, magnetic resonance imaging, or myelogram

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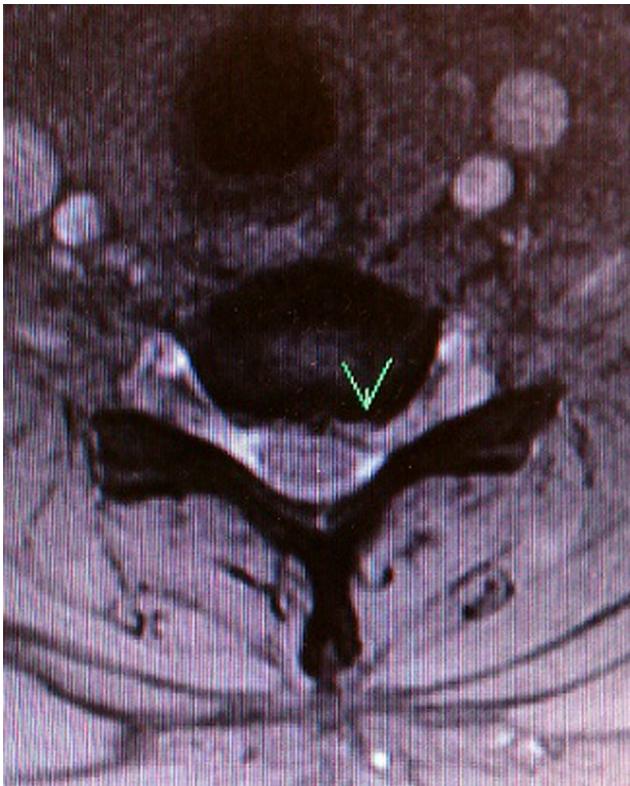
- Symptoms refractory to conservative treatments
- No myelopathy

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### Contraindications for PF

- Significant kyphosis or mechanical instability at the level to be addressed
- Signs or symptoms of cervical myelopathy
- Spinal cord compression on imaging studies
- Local skin infections
- Symptoms not referable to pathology seen on imaging
- Significant anteriorly located disk herniation compressing the nerve root

Posterior techniques have concerns of greater patient discomfort due to postoperative neck pain, longer hospital stays, and postlaminectomy deformities. Patients with evidence of cord compression secondary to cervical stenosis may require a full decompression and a mere foraminotomy would not be sufficient to adequately treat the pathology. Frequently, the choice of an anterior or posterior approach is a matter of surgeon preference and experience. In the last several decades, there has been a swing of the pendulum to the more commonly used anterior approach (Figure 1).



**Fig. 1 – A cervical disc herniation at the C6-7 level. This patient presented with a left C7 radiculopathy. Owing to the laterality, this disc herniation could be removed by either an anterior or a posterior approach. This particular patient was treated with an anterior cervical discectomy and fusion.**

The anterior approach to disc disease of the cervical spine was developed in the 1950s.<sup>9</sup> Anterior cervical discectomy and fusion (ACDF) is the preferred technique for addressing central disc herniations, bilateral radicular symptoms from osteophytes, or large lateralized disc herniations that may not be adequately or safely treated via a posterior approach.<sup>10</sup> The anterior approach provides adequate decompression in cases of myelopathy and cord compression. ACDFs typically have good outcomes with relief of symptoms in up to 90% of patients with radiculopathy.<sup>11</sup>

This procedure is performed with an incision placed off the midline of the anterior neck. Dissection is carried through a corridor between the carotid sheath, laterally, and trachea and esophagus, medially, to allow access the cervical spine.<sup>12</sup> A discectomy is then performed, and removal of disk herniations and osteophytes is completed to decompress the affected nerves or central canal or both. The potential disadvantage of fusion is worsening of adjacent-level degeneration.<sup>13,14</sup> Surgical indications have been listed in the following section.

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### Indications for ACDF

- Degenerative disk disease
- Spondylosis, soft disk herniation, degenerative deformity, and spinal stenosis
- Instability
- Trauma and posttraumatic deformity
- Neoplasia
- Infection (ie, due to epidural abscess)

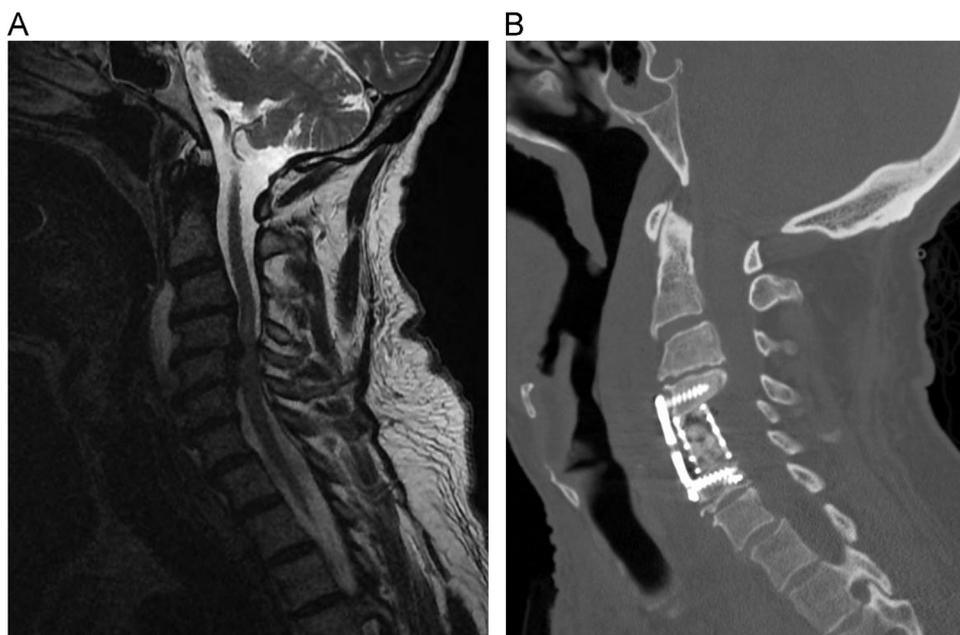
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### Relative contraindications for ACDF

- Previous neck surgery
- History of neck radiation
- Symptoms inconsistent with imaging studies

When comparing both the techniques (ACDF vs PF) for the treatment of cervical radiculopathy, it is imperative to realize that anterior decompression (ACDF) typically involves fusion of the adjacent vertebrae whereas posterior decompression (PF) does not. The posterior approach is a motion-sparing technique that maintains spinal alignment and does not require a fusion.<sup>8</sup> This may, in theory, reduce the incidence of adjacent-level degeneration. The anterior approach has known complications such as recurrent laryngeal nerve injury and dysphagia. However, these complications are usually temporary. No matter which technique is used, careful consideration of the patient's symptoms and imaging findings will determine the most appropriate approach.

The current guidelines suggest that either ACDF or PF for the treatment of single-level degenerative cervical radiculopathy secondary to foraminal soft disc herniation achieve comparably successful clinical outcomes.<sup>1</sup> Patients with myelopathy or cord compression most likely require an anterior decompression. It is also recommended that surgical intervention should be considered for the rapid relief of



**Fig. 2 – (A)** The MRI of a 62-year-old man presenting with myelopathy and frequent falls. He also had left-sided shoulder pain and deltoid weakness, suggestive of a C5 radiculopathy. The sagittal T2 image reveals cervical stenosis at the C4-5 and C5-6 levels as a result of disc protrusions and thickening of the posterior longitudinal ligament. He underwent a surgical procedure via an anterior approach to the spine. **(B)** Postoperative CT. The surgical procedure was a C4-5 and C5-6 discectomy with C5 corpectomy. A titanium mesh cage was used for anterior support along with anterior plating. Postoperatively, his strength and gait were dramatically improved. His ambulation was also more stable. CT, computed tomography; MRI, magnetic resonance imaging.

symptoms of cervical radiculopathy from degenerative disorders when compared with medical or interventional treatment (Figure 2).

The complication rates for cervical surgery are quite low. However, there is potential morbidity associated with any surgery. Therefore, consideration must be given to the relative risks and expected benefit before embarking on surgery for problems other than persisting severe pain or progressive motor deficit. The published results of surgery for cervical radiculopathy are surprisingly favorable, with many series reporting good or excellent outcome in more than 90% of patients with either approach.<sup>6,8</sup> Although such figures seem high, they can likely be achieved in well-selected patient groups.

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