

# Cervical Radiculopathy



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## KEYWORDS

• Cervical radiculopathy • Neck pain • Shoulder pain • Spurling test

## KEY POINTS

- Evaluation of shoulder pain should prompt examination of the cervical spine.
- Patient history and physical examination are often sufficient to make a diagnosis of cervical radiculopathy.
- Always correlate radiologic findings with clinical findings.
- A multimodal treatment approach may help to alleviate symptoms.

## INTRODUCTION

Neck and shoulder pain are common presenting complaints for primary care providers, sports medicine physicians, and orthopedists. Shoulder pain may be a referred symptom of cervical pathology. The age-adjusted incidence of cervical radiculopathy is 83 per 100,000 persons, making it less common than lumbar radiculopathy.<sup>1</sup> In a recent study of United States military personnel, female gender and white race were implicated as potential risk factors.<sup>2</sup> Cigarette smoking, axial load bearing, and prior lumbar radiculopathy may also predispose patients to cervical radiculopathy.<sup>3</sup>

Nerve roots C6 and C7 are most commonly affected. Radicular pain develops as inflammatory mediators, changes in vascular response, and intraneural edema combine in response to nerve compression. Spondylosis resulting in foraminal encroachment causes 70% of cases. Decreased disk height or degenerative changes of the uncovertebral joints anteriorly or zygapophyseal joints posteriorly are common contributors. Disk herniation is not seen as frequently in cervical radiculopathy compared with lumbar radiculopathy.<sup>1</sup> Compression alone does not necessarily lead to radicular pain unless the dorsal root ganglion is affected.<sup>4</sup>

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## PATIENT PRESENTATION

Symptoms related to radiculopathy tend to be unilateral. This is particularly true of neck pain relating to cervical radiculopathy. Bilateral symptoms are more consistent with arthritis of the cervical spine. Radiation of pain depends on the involved nerve root. The absence of radiating symptoms does not eliminate cervical radiculopathy as a potential diagnosis. Presenting pain may be isolated to the shoulder. Pain is not always the presenting complaint, because sensory or motor deficits may present without pain.

Certain modifying factors are consistent in cervical radiculopathy. Activities that decrease the size of the neural foramen, such as extension and rotation to the affected side, exacerbate symptoms. Abducting the shoulder tends to alleviate symptoms.

Distribution of sensory and motor deficits may overlap with other neuropathic conditions, including carpal tunnel syndrome or ulnar nerve entrapment. Although these conditions may coexist in some patients, an appropriate physical examination can help differentiate the level at which the nerve is affected.

History should include questions to determine if there are signs or symptoms of myelopathy. Problems with manual dexterity (dropping objects and difficulty writing) are symptoms of myelopathy. Examination findings consistent with myelopathy include upper motor neuron signs, such as Hoffmann sign, Babinski sign, hyperreflexia, and clonus. Differentiation between radicular and myelopathic symptoms is critical, because the latter is caused by spinal cord compression, which is best relieved with surgical decompression. Therefore, this is an important distinction to make.

Red flags should also be evaluated in the history, because they may suggest other diagnoses. Symptoms, such as fevers, chills, unexplained weight loss, night pain, previous cancer, immunosuppression, and intravenous drug abuse, are not associated with radiculopathy. The presence of these symptoms is more suggestive of malignancy or infection. Other factors of the history that make a diagnosis of cervical radiculopathy less likely include age younger than 20 or older than 50 years, constant and progressive signs and symptoms, neck rigidity without trauma, dysphasia, altered consciousness, and central nervous signs and symptoms.<sup>5</sup>

Systemic disorders should also be considered potential causes. Down syndrome is associated with atlantoaxial instability. Heritable connective tissue disorders carry an increased risk of ligament laxity.

## PHYSICAL EXAMINATION

Findings vary depending on the level of nerve root involved. Evaluation should include neck range of motion, with careful observation of movements that result in worsening symptoms. Neurologic examination of the upper extremities should include motor testing at the shoulders, elbows, wrists, and hands to assess for any weakness and sensory testing of all dermatomes to assess for variations. Reflex testing should be considered abnormal when there is asymmetry between the affected and unaffected side. Any deficits noted can help to determine the compressed nerve root (**Table 1**).

Provocative testing must also be included. Spurling test is designed to exacerbate encroachment of exiting nerve roots by decreasing the dimensions of the foramen. The patient is asked to extend and laterally rotate the neck to the suspected side while the provider applies an axial load. A positive test recreates radiating pain. Equivocal tests are notable for discomfort only. Recent studies have shown this test to be highly sensitive (95%) and specific (94%).<sup>6</sup> Shoulder abduction sign, where the arm is raised above the head, should alleviate or relieve symptoms of cervical radiculopathy. Cervical traction should produce similar effects.

Table 1 Patterns of cervical radiculopathy				
Root	Pain Distribution	Motor Abnormalities	Sensory Deficits	Reflexes
C4	Lower neck and trapezius	N/A	Cape distribution	N/A
C5	Neck, shoulder, lateral arm	Deltoid, elbow flexion	Lateral arm	Biceps
C6	Neck, radial arm, thumb	Biceps, wrist extension	Radial forearm, thumb	Brachioradialis
C7	Neck, dorsal forearm, long finger	Triceps, wrist flexion	Dorsal forearm, long finger	Triceps
C8	Neck, medial forearm, ulnar digits	Finger flexors	Medial forearm, ulnar digits	N/A

### DIAGNOSTIC TESTS/IMAGING STUDY

History and physical examination are often enough to diagnose cervical radiculopathy. Laboratory studies are expected to be normal in cervical radiculopathy. These studies should be ordered if other etiologies are more clinically suspicious.

Radiography, to include anteroposterior lower cervical and neutral lateral views, may be indicated for patients with suspected cervical radiculopathy. Loss of the normal cervical lordosis, osteophyte formation, and neuroforaminal narrowing responsible for symptoms can be observed ([Fig. 1](#)).



**Fig. 1.** Loss of the normal cervical lordosis, osteophyte formation, and neuroforaminal narrowing responsible for symptoms can be observed in the radiography.

For patients with normal radiography who fail a nonoperative course of treatment, additional diagnostic studies should be considered. MRI is the preferred modality to evaluate for disk herniations with or without nerve root compression (**Fig. 2**). MRI findings should be correlated with clinical findings, because both false-positive and false-negative rates are high.<sup>7</sup> CT may be used in patients with contraindications to MRI, such as pacemakers or stainless steel hardware. If nerve entrapment at the carpal or cubital tunnel is suspected, electromyography should be pursued.

### DIFFERENTIAL DIAGNOSIS

The differential for neck and shoulder pain is broad, including diagnoses related to neurologic, cardiac, infectious, and musculoskeletal causes. A summary of the differential diagnosis is provided in **Table 2**.

Malignancy that may result in presenting symptoms similar to cervical radiculopathy include, but are not limited to, schwannoma, osteochondromas, Pancoast tumors, thyroid tumors, esophageal tumors, lymphomas, and carcinomatous meningitis.<sup>8,9</sup>

### TREATMENT

Pain relief, improvement of neurologic function, and prevention of recurrence are the treatment objectives. Nonoperative treatment modalities for cervical radiculopathy have not been compared in large-scale, randomized control trials. Recommendations are based on current available evidence, including case series and anecdotal experience. Patient preference and potential compliance should be considered when making treatment decisions.<sup>4</sup>



**Fig. 2.** MRI is the preferred modality to evaluate for disk herniations with or without nerve root compression.

<b>Condition</b>	<b>Characteristics</b>
Cardiac pain	Radiating upper extremity pain, typically to left shoulder and arm
Cervical spondylotic myelopathy	Difficulties with manual dexterity, gait changes, bowel or bladder dysfunction, upper motor neuron findings
Complex regional pain syndrome/reflex sympathetic dystrophy	Pain and tenderness of the extremity out of proportion with examination, skin changes, vasomotor fluctuations, dysthemia
Entrapment syndromes	Weakness and sensory deficits consistent with median or ulnar nerve distributions, direct stimulation of nerve recreates symptoms
Herpes zoster (shingles)	Dermatomal radicular pain associated with reactivation of viral infection
Malignancy	Consider with presence of red flag symptoms, intra- and extraspinal tumors, presentations vary depending on primary tumor
Parsonage-Turner syndrome	Acute onset of upper extremity pain, usually followed by weakness and sensory disturbances
Rotator cuff impingement	Pain and weakness in the shoulder and lateral arm
Thoracic outlet syndrome	Lower brachial plexus nerve root dysfunction due to compression by vascular or neurogenic causes

## PHARMACOLOGIC TREATMENT OPTIONS

Pharmacotherapy may be helpful in the management and relief of symptoms. The effectiveness of medications is extrapolated from their effectiveness in the treatment of lumbar radiculopathy and low back pain. As discussed previously, however, the etiology behind radiculopathy is not typically the same in both locations.

Nonsteroidal anti-inflammatory drugs (NSAIDs) may help alleviate symptoms in the acute setting. A 2-week trial at a therapeutic dose can be effective in relieving symptoms or reducing pain to a degree that other treatment modalities can be better tolerated. These medications make a good choice for first-line therapy, because they are readily available and affordable. Appropriate considerations should be made when suggesting NSAID treatment, including patient age, medication interactions, and other comorbidities.<sup>10</sup>

Muscle relaxants, including cyclobenzaprine (Flexeril) and tizanidine (Zanaflex), may help alleviate neck pain caused by increased muscle tension at insertion sites.<sup>8</sup> These medications are most effective in the acute setting. Their long-term use in treatment of cervical radiculopathy is unclear.

Tramadol may provide significant relief of neuropathic pain based on systematic review findings.<sup>11</sup> This makes it useful in managing acute exacerbations of cervical radiculopathy.

Oral steroids, in particular dose packs, are often used to manage acute episodes. High-quality evidence to support this practice is, however, lacking.<sup>12</sup> In addition, recurrent use of oral steroids can lead to avascular necrosis, hyperglycemia, weight gain, and mood swings. The degree to which oral steroids improve symptoms may be an indicator for further treatment with corticosteroid injection. Another systematic review suggests that tricyclic antidepressants and venlafaxine (Effexor) may provide

moderate relief of radicular pain in patients who have declined surgery or continue to have pain after surgical intervention.<sup>13</sup>

Studies on neuropathic pain suggest opioids may be an effective treatment course for up to 8 weeks. These findings are not specific to cervical radiculopathy, and there is insufficient evidence to support their use beyond a 2-month period.<sup>13,14</sup>

## NONPHARMACOLOGIC TREATMENT OPTIONS

Many modalities beyond pharmacotherapy exist for the treatment of cervical radiculopathy. A short course of immobilization has been suggested to reduce symptoms in the inflammatory phase, although this has not been proved beneficial.<sup>8,12,15,16</sup>

Traction may be performed at home or in conjunction with physical therapy and manipulation. Distracting the neural foramen leads to decompression of the nerve root and improvement in symptoms. This modality works best when acute muscular pain has subsided. It should be avoided in patients with signs of myelopathy. Insufficient evidence exists to support the use of traction, especially in the home setting.<sup>17</sup>

Physical therapy helps restore range of motion and strengthen neck musculature. Doing this alleviates pain and prevents recurrence. Early on in the treatment of cervical radiculopathy, gentle range-of-motion and stretching exercises may be combined with additional modalities, including heat, ice, and electrical stimulation. As pain improves, isometric strengthening, active range-of-motion, and resistance exercises may be added as tolerated.<sup>12,15</sup>

Manipulative therapy lacks high-quality evidence to support its use in the long-term management of cervical radiculopathy. There is evidence, however, to suggest short-term benefit.<sup>15,18</sup> Manipulative therapy is not without risk. Rare complications include worsening radiculopathy, myelopathy, and spinal cord injury.<sup>12</sup>

Cervical steroid injections may also be considered in the management of cervical radiculopathy. These procedures should be performed under radiographic guidance. Patients who are good candidates for this modality include those with confirmed pathology by advanced imaging (MRI or CT) who had improvement while taking and after completing an oral steroid dose pack. Injections may consist of translaminar or transforaminal epidurals or selective nerve blocks. Evidence suggests that corticosteroid injection may lead to short-term, symptomatic improvement of radicular symptoms.<sup>12,19–23</sup> Retrospective and prospective studies show up to 60% of patients with relief of radicular symptoms and neck pain and return to usual activity.<sup>4,19</sup>

## SURGICAL TREATMENT OPTIONS

Surgery may relieve intractable symptoms of cervical radiculopathy in appropriate patients. Evidence is lacking to guide optimal timing of surgical intervention.<sup>4</sup> The presence of myelopathy, as discussed previously, is a sign of spinal cord compression and an indication for surgery.

Emotional and cognitive factors should be considered when addressing treatment decisions for cervical radiculopathy. Patient expectations, postoperative limitations, and job satisfaction are areas that should be discussed prior to choosing an intervention course.<sup>24–36</sup>

Surgical intervention should be reserved for patients with radiographic evidence of nerve compression on MRI or CT with corresponding signs and symptoms, persistence of symptoms despite 12 weeks of nonoperative management, or progressive or functionally important motor deficit.<sup>4</sup> Various techniques exist, including anterior and posterior approaches, but evidence comparing them is lacking. A majority of patients have substantial relief of their symptoms. Complications are uncommon

but may include iatrogenic injury of the spinal cord, nerve root injury, recurrent nerve palsy, esophageal perforation, and failure of instrumentation.<sup>4</sup>

There is a lack of high-quality evidence comparing nonoperative and surgical intervention in the treatment of cervical radiculopathy.

## SUMMARY

Cervical radiculopathy is a commonly seen condition across many patient populations. It results from the compression of a cervical nerve root as it exits the neural foramen. Presentation may include pain, weakness, and sensory deficits. This diagnosis should be considered for all patients presenting with neck and shoulder pain. A thorough history and physical examination are often sufficient for diagnosis. Radiologic studies are often helpful to confirm cervical radiculopathy.

There is no high-quality evidence comparing medical and surgical interventions. Nonoperative treatment is the first course, unless there are signs of myelopathy. If patients fail to improve with nonoperative treatment or exhibit progressively worsening symptoms, surgical intervention should be considered.

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