

Review of the literature: cervical radiculopathy. An update

Revisión de la literatura: actualización en radiculopatía cervical

Revisão da literatura: atualização sobre radiculopatia cervical

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ABSTRACT

Cervical radiculopathy is a dysfunction of a nerve root of the cervical spine. The seventh root (C7) is affected in 60% of cases and the sixth root (C6) in 25%. The cervical nerves are most commonly affected in our environment. Approximately 10% of the adult population had neck pain at some point in their lives. This prevalence is similar to the pain frequency, but very few patients with neck pain become disabled and less than 1% develop neurological deficit. Clinical disorders affecting the cervical spine can be categorized as those that primarily cause pain in the neck and most often cause limb pain and/or neurological dysfunction. The pathologies resulting in neck pain are cervical sprain, internal compression disc syndrome or discogenic pain, whiplash-type neck pain of neuropathic origins and myofascial pain. Disorders that cause symptoms predominantly in the extremities and/or neurological dysfunction include cervical radiculopathy and cervical spondylotic myelopathy. Factors associated with increased risk include heavy manual labor requiring lifting more than 25 pounds, smoking and driving or operating vibrating equipment. Less common causes include tumors of the spine, an extension of synovial cysts, synovial chondromatosis, arteritis and spinal infections. This article reflects contemporary concepts and review of the treatment for cervical radiculopathy from degenerative disorders through clinical trial in general practice until analysis in the department of surgical spine surgery through the evaluation of the findings of the updates in medical literature until May 2012. The objectives of this article allow for optimal diagnostic evaluation and determine the best clinical and surgical treatment for easier functional recovery.

Key word: cervical vertebrae, intervertebral disc displacement/complications, neck pain/etiology, radiculopathy/diagnosis.

RESUMEN

La radiculopatía cervical es una disfunción de una raíz nerviosa de la columna cervical. La séptima raíz (C7) se compromete en un 60% de los casos y la sexta (C6) en un 25%. A menudo, las raíces nerviosas cervicales son las más afectadas en nuestro medio. Aproximadamente el 10% de la población adulta ha tenido dolor en el cuello en algún momento de su vida. Esta prevalencia es similar al dolor lumbar, pero muy pocos pacientes con dolor cervical se incapacitan y menos del 1% desarrolla déficit neurológico. Los trastornos clínicos que afectan la columna cervical pueden ser categorizados como la causa principal del dolor en el cuello. Estos trastornos son los que

RESUMO

Radiculopatia cervical é a disfunção de uma raiz nervosa da coluna cervical. A raiz sétima (C7) está comprometida em 60% dos casos e (C6) 25%. Os nervos cervicais são mais frequentemente afetados em nosso meio ambiente. Aproximadamente 10% da população adulta têm dor no pescoço em algum ponto de suas vidas. Esta prevalência é igual à frequência da dor, mas em poucos pacientes com dor no pescoço se tornam inválidos e menos de 1% por cento desenvolvem um déficit neurológico. Distúrbios clínicos que afetam a coluna cervical podem ser classificados essencialmente como aqueles causados por

con mayor frecuencia causan dolor en las extremidades o disfunción neurológica. Las patologías que involucran dolor en el cuello son: esguince cervical, síndrome de compresión interna de disco o dolor discogénico, dolor cervical de tipo latigazo de origen neuropático y dolor miofascial. Los trastornos que de manera predominante causan síntomas en las extremidades o con disfunción neurológica incluyen la radiculopatía cervical y mielopatía cervical espondilótica. Los factores asociados con mayor riesgo son el trabajo manual pesado que requiere el levantamiento de más de 25 libras, el tabaquismo y conducir o utilizar equipo vibratorio. Otras causas menos frecuentes son los tumores de la columna vertebral, una ampliación de quiste sinovial, condromatosis sinovial, arteritis y las infecciones de la columna vertebral.

En este artículo se estudian los conceptos contemporáneos del tratamiento de la radiculopatía cervical mediante la evaluación de los hallazgos de la actualización en literatura clínica hasta mayo de 2012. Dichos hallazgos abarcan desde los desórdenes degenerativos hasta los análisis en el departamento de cirugía de columna, pasando por un estudio clínico en medicina general. Busca facilitar una óptima evaluación diagnóstica y determinar el mejor tratamiento clínico y quirúrgico para una recuperación funcional de mayor facilidad.

Palabras clave: vértebras cervicales, desplazamiento del disco intervertebral/complicaciones, dolor de cuello/etiología, radiculopatía/diagnóstico.

dor no pescoço e mais frequentemente causados por dor nos membros e / ou disfunção neurológica.

As patologias resultando em dor no pescoço são distensão cervical, síndrome de compressão interna do disco ou dor discogênica, a dor no pescoço tipo “chicote” de origem neuropática e miofascial. Os distúrbios que causam sintomas predominantemente nas extremidades e / ou disfunção neurológica incluem radiculopatia cervical e mielopatia espondilótica. Fatores associados com o aumento de risco incluem trabalho manual pesado exigindo levantar mais de 25 libras, tabagismo e dirigir ou operar equipamentos que vibram. As causas menos comuns incluem tumores da coluna vertebral, uma extensão do cisto sinovial, condromatose sinovial, artrite e infecções da coluna vertebral. Este artigo reflete conceitos contemporâneos e estuda o tratamento da radiculopatia cervical de doenças degenerativas desde o estudo feito em clínica geral até a análise no departamento cirúrgico de coluna vertebral através da avaliação dos resultados da atualização na literatura médica até maio de 2012. Os objetivos deste artigo permitem uma avaliação diagnóstica ideal e determinam o melhor tratamento clínico e cirúrgico para a recuperação funcional mais fácil.

Palavras-chave: vértebras cervicais, deslocamento / complicações do disco intervertebral, dor no pescoço / etiologia, radiculopatia / diagnóstico.

Recibido: 2012-08-24; aprobado: 2013-07-15

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DEFINITION

Degenerative disorders and natural cervical radiculopathy are neurological conditions characterized by dysfunction of a cervical spinal nerve, the roots of the nerve or both. It usually presents with pain in the neck and one arm, with a combination of sensory loss, loss of motor function, or reflex changes in the affected nerve-root distribution (1).

Cervical radiculopathy from degenerative disorders

Cervical radiculopathy from degenerative disorders can be defined as pain in a radicular pattern in one

or both upper extremities related to compression and/or irritation of one or more cervical nerve roots. Frequent signs and symptoms include varying degrees of sensory, motor and reflex changes as well as dysesthesias and paresthesias related to nerve root(s) without evidence of spinal cord dysfunction (myelopathy) (2, 3).

EPIDEMIOLOGY

In Latin America we do not find any studies, but population-based data from Rochester, Minne-

sota, indicates that cervical radiculopathy has an annual incidence rate of 107.3 cases per 100,000 men and 63.5 cases per 100,000 women, with a peak between 50 to 54 years of age (2). A history of physical application or trauma preceded the onset of symptoms in only 15 percent of cases. Another study from Sicily reported a prevalence of 3.5 cases per 1000 population (1-3).

Data on the natural history of cervical radiculopathy is limited (2,4-6). In the population-based study from Rochester, Minnesota, 26 percent of 561 patients with cervical radiculopathy underwent surgery within three months of the diagnosis (typically for the combination of radicular pain, sensory loss, and muscle weakness), whereas the remainder were treated conservatively (3-4). Recurrence, defined as the reappearance of symptoms of radiculopathy after a symptom-free interval of at least six months, occurred in 32 percent of patients during a median follow-up of 4.9 years. At the last follow-up, 90 percent of patients had normal findings or were only mildly incapacitated due to cervical radiculopathy (1-5).

ANATOMY

The cervical spine is comprised of seven vertebrae. The articulation between the occiput and the first cervical vertebra (the atlanto-occipital joint) allows for approximately one-third of flexion and extension and one-half of lateral bending of the neck. The articulation between the first and second cervical vertebrae (the atlantoaxial joint) allows for fifty percent of rotational range of motion. The articulations between the second and seventh cervical vertebrae allow for approximately two-thirds of flexion and extension, fifty percent of rotation, and fifty percent of lateral bending (6-8).

The most severe injuries and greatest wear and tear occur between C4 and C7. The nerve roots passing through the intervertebral foramina in these areas are C5, C6 and C7. Uncovertebral articulations (also known as joints of Luschka) are present in the C3-7 spinal segments, located on the posterolateral border of the intervertebral disc and in the anteromedial portion of the intervertebral foramen. These articulations are not true synovial joints, but

can hypertrophy associated with disc degeneration, and result in narrowing of the intervertebral foramen. This foraminal narrowing is a common cause of cervical radiculopathy (9, 10).

CAUSES AND PATHOPHYSIOLOGY

The most common cause of cervical radiculopathy (in 70 to 75 percent of cases) is foraminal encroachment of the spinal nerve due to a combination of factors, including decreased disc height and degenerative changes of the uncovertebral joints anteriorly and zygapophyseal joints posteriorly (i.e., cervical spondylosis) (7,8). In contrast to disorders of the lumbar spine, herniation of the nucleus pulposus is responsible for only 20 to 25 percent of cases (2). Other causes, including tumors of the spine and spinal infections, are infrequent. The mechanisms underlying radicular pain are poorly understood. Nerve root compression by itself does not always lead to pain unless the dorsal-root ganglion is also compressed. Hypoxia of the nerve root and dorsal ganglion can aggravate the effects of compression (10). Confirmation from the past decade of studies indicates that inflammatory mediators including matrix metalloproteinases, prostaglandin E₂, interleukin-6 and nitric oxide are released by herniated cervical intervertebral discs. These observations provide a rationale for treatment with anti-inflammatory agents. In patients with disc herniation, the resolution of symptoms with no surgical management correlates with attenuation of the herniation on imaging studies (2, 9-11).

SYMPTOMS

Cervical myelopathy tends to creep up on patients in most cases. It can result in subtle changes in the way their hands work. Patients may feel their hands are clumsier, notice they drop objects more often, experience difficulty buttoning their shirt or their handwriting may become worse. Patients may develop unsteadiness, requiring holding onto sturdy objects while walking (11). Their gait may become noticeably unstable. At times, they feel their brain does not know exactly where their legs are in time and space. In extreme cases, patients may develop more profound weakness and numbness in their arms and legs, and rarely, changes in

bowel or bladder control (2, 12). Cervical radiculopathy will manifest itself as pain traveling from the neck into a specific region of the arm, forearm or hand. In many instances, this will be accompanied by numbness in a similar distribution or weakness in specific muscles in the arm, forearm or hand (Table 1 Physical Findings) (13-15).

Disk level	Root	Pain distribution	Weakness	Sensory loss	Reflex loss
C4-C5	C5	Medial scapular border, lateral upper arm to elbow	Deltoid, supraspinatus, infraspinatus	Lateral upper arm	Supinator reflex
C5-C6	C6	Lateral forearm, thumb and index finger	Biceps, brachioradialis, wrist extensors	Thumb and index finger	Biceps reflex
C6-C7	C7	Medial scapula, posterior arm, dorsum of forearm, third finger	Triceps, wrist flexors, finger extensors	Posterior forearm, third finger	Triceps reflex
C7 T1	C8	Shoulder, ulnar side of forearm, fifth finger	Thumb flexors, abductors, intrinsic hand muscles	Fifth finger	-

Table 1. Physical findings associated with cervical radiculopathy (1, 8, 16)

WHAT IS THE NATURAL HISTORY?

The “natural history” of cervical radiculopathy depends in large part on how long the patient has had symptoms. In patients who present with very early symptoms, the prognosis is generally very good. Most of these patients will have complete resolution of their pain, numbness and weakness over a six to twelve week period (5, 14).

In patients who have had symptoms for a slightly longer period of time, the prognosis is less clear. Some patients will experience complete resolution of pain with (and, in some cases, without) limited medical intervention such as modification of activities, heat, ice, physical therapy or over-the-counter medications. Approximately one-third of these

patients will have some lingering degree of symptoms that they may be able to cope with. A small percentage will have symptoms that are unbearable and may need further treatment (16-18).

The “natural history” of clinically obvious cervical myelopathy is somewhat less predictable. The consensus is that patients with myelopathy will have progression of symptoms. What is not known is when the symptoms will progress, how much they will progress or how rapidly they will progress. Approximately 75 percent of patients will have step-wise deterioration in their function with stable periods in between episodes of deterioration. Twenty percent will have slow, steady deterioration, and another 5 percent will have rapid deterioration (15, 19).

DIAGNOSIS

There are no widely accepted criteria for the diagnosis of cervical radiculopathy. In most cases, the patient’s history and physical examination are sufficient to make the diagnosis. Typically, patients present with severe neck and arm pain (8, 20, 21). Although the sensory symptoms (including burning, tingling, or both) typically follow a dermatome distribution, the pain is more commonly referred in a myotomal pattern. For example, radicular pain from C7 is usually perceived deeply through the shoulder girdle with extension of the arm and forearm, whereas numbness and paresthesia are more commonly restricted to the central portion of the hand, the third digit, and occasionally the forearm. Subjective weakness of the arm or hand is reported less frequently (22-24). Holding the affected arm on top of the head or moving the head to look down and away from the symptomatic side often improves the pain, whereas rotation of the head or bending it toward the symptomatic side increases the pain (25, 26).

Guidelines developed by the Agency for Health Care Policy and Research for the assessment of low back pain may be applied to the patient with neck pain and radiculopathy (27-29). The presence of “red flags” in the patient’s history (including fever, chills, unexplained weight loss, unremitting night pain, previous cancer, immunosuppression,

or intravenous drug use) should alert clinicians to the possibility of more serious disease, such as a tumor or infection. Clinicians should also inquire about symptoms of myelopathy. These may occasionally be subtle (e.g., diffuse hand numbness and clumsiness which are often attributed to peripheral neuropathy or carpal tunnel syndrome, difficulty with balance and coordination, and sphincter disturbances presenting initially as urinary urgency or frequency rather than as retention or incontinence (30-32).

Cervical radiculopathy, an injury to one or more nerve roots, has multiple presentations. Symptoms may include pain in the cervical spine and/or upper extremity, paresthesia, weakness and hypoactive reflexes (33).

EXAMINATION (15, 34, 35)

History of present illness:

- › Age: spondylosis is often seen in persons 25 years of age or older. Symptoms of osteoarthritis usually do not appear until age 60 or older
- › Mechanism of injury: traumatic vs. non-traumatic/overuse
- › Previous episodes: how were they treated?
- › Pain: nerve root distribution vs. diffuse pain. Presence of headaches?
- › Medications: NSAIDs/muscle relaxants/narcotics/neuropathic pain medications/anti-depressants
- › Imaging studies: presence of degenerative joint/disc disease vs. acute changes or congenital anomalies

Social history:

- › Work activities/ergonomic set up/habits
- › Past medical history (PMH)
- › Sports/leisure pursuits
- › Rheumatological diseases
- › Presence of visual problems

Examination (physical/cognitive/applicable tests and measures/other):

- › Posture: assess for head in mid-line position, cervical lordosis, thoracic kyphosis, shoulder girdle symmetry, muscle hypertrophy or atrophy
- › Neurological Screen: resisted isometrics, sensation, DTRs, Babinski/ clonus if indicated, clear TMJ and shoulder, cervical AROM/PROM
- › Palpation: Joint Play/PIVM (Passive Intervertebral Motion) of the cervical and thoracic spine
- › Strength: neck flexors, back extensors, periscapular muscles as appropriate

Special tests:

- › Compression, Distraction, Vertebral artery, Alar ligament, Sharp purser test, Lhermitte's sign or Romberg for cervical myelopathy v. Hoffman's sign, Upper limb tension tests and/or tests for thoracic outlet syndrome as appropriate

EVALUATION

It is crucial to establish a diagnosis and determine the need for skilled services. Physical therapy services are indicated to reduce pain and inflammation, improve posture, normalize joint arthrokinematics, increase cervical AROM, cervical strength, improve body mechanics and work ergonomics (22).

LABORATORY STUDIES

Laboratory studies are of limited value and are not recommended. The erythrocyte sedimentation rate and C-reactive protein levels are elevated in many patients with spinal infection or cancer, but these tests are not sufficiently sensitive or specific to guide further evaluation (23-25).

IMAGING

Conventional radiographs of the cervical spine are often obtained, but their usefulness is limited (31).

This is due to the low sensitivity of radiography for the detection of tumors or infections, as well as its inability to detect disc herniation and the limited value of the finding of cervical intervertebral narrowing in predicting nerve-root or cord compression (26, 27).

Magnetic resonance imaging (MRI) is the approach of choice when imaging is pursued in patients with cervical radiculopathy (Figure 1, 2), but there are currently no clear guidelines regarding when such imaging is warranted (28-30). Reasonable indications include the presence of symptoms or signs of myelopathy, red flags suggestive of tumor or infection, or the presence of progressive neurological

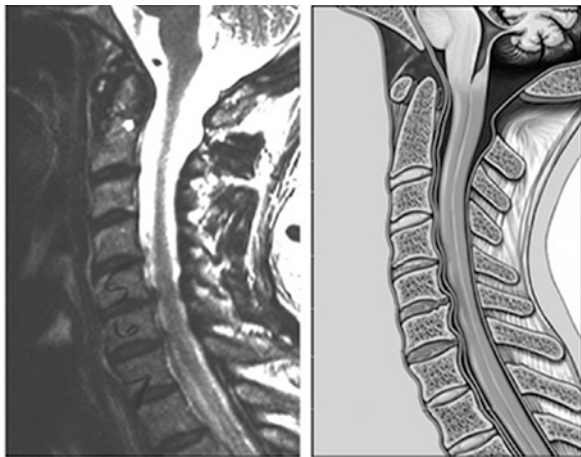


Figure 1: MRI patient with cervical radiculopathy and anatomic illustration (22)

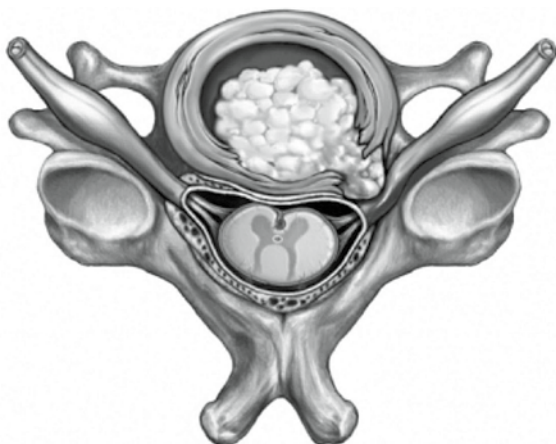


Figure 2: MRI patient with cervical radiculopathy and anatomic illustration (22)

deficits. For most other patients, it is appropriate to limit the use of MRI to those who remain symptomatic after four to six weeks of conservative treatment, particularly given the high frequency of abnormalities detected in asymptomatic adults, with disc herniation or bulging (57 percent of cases), spinal cord impingement (26 percent of cases) and cord compression (7 percent of cases) (5, 30, 33).

Computed tomography (CT) alone is of limited value in assessing cervical radiculopathy (35), but it can be useful in distinguishing the extent of bony spurs, foraminal encroachment or the presence of ossification of the posterior longitudinal ligament. The combination of CT with the intrathecal administration of contrast material (CT myelography) provides accuracy similar to and possibly superior to that of MRI, but its invasive nature makes MRI preferable in most cases (Figure 3, 4) (36, 37). Technetium and gallium bone scans are very seldom indicated, except in rare cases in which cancer or infection is suspected in multiple sites and MRI cannot be readily performed or is impractical (34-36).

MRI is suggested for the confirmation of correlative compressive lesions (disc herniation and spondylosis) in cervical spine patients who have failed a course of conservative therapy and who

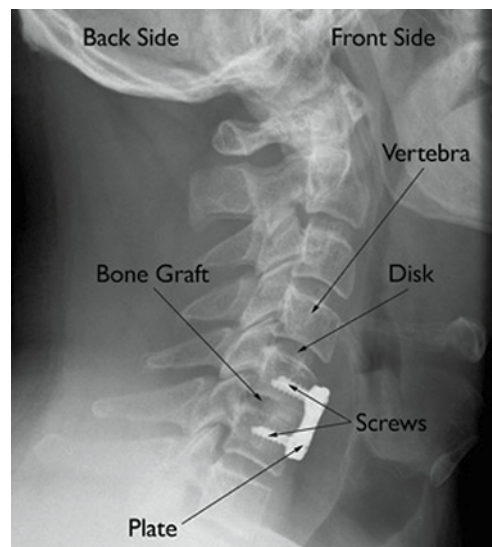


Figure 3. Anterior cervical discectomy and fusion: radiographic explain (36)

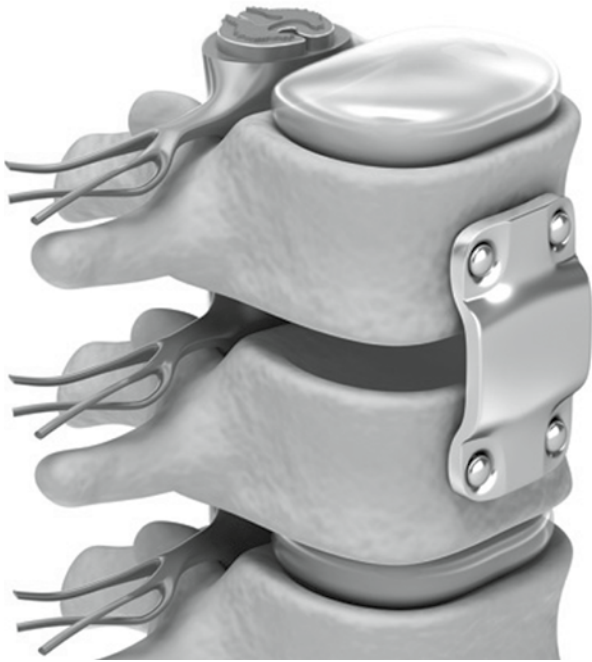


Figure 4. Anterior cervical discectomy and fusion: diagram of fixation (36)

may be candidates for interventional or surgical treatment (Figure 3,4) (36-38).

They show a metal plate and screws that are often used in spinal fusion to increase stability.

INDICATIONS FOR TREATMENT

1. Pain cervical spine and/or upper extremity, headache
2. Paresthesias
3. Upper extremity weakness
4. Limited cervical AROM
5. Limited function - concentration, sitting or driving tolerance, computer use, inability to sustain rotation, lifting and disturbed sleep.

CONTRAINDICATIONS / PRECAUTIONS FOR TREATMENT (39, 40)

1. Cervical instability/subluxation/fracture/ spondylolisthesis
2. Vertebral artery insufficiency
3. Osteoporosis/osteopenia

4. History of cancer- question of bony metastasis.

ASSESSMENT (6, 41)

Problem list (likely to include but not limited to):

5. Pain in cervical spine and or upper extremity/paresthesias
6. Impaired posture
7. Decreased cervical A/PROM
8. Decreased neck flexor, back extensor, and/or periscapular strength
9. Impaired function (refer to indications for treatment).

PROGNOSIS

Prognosis is dependent upon results of imaging studies, extent of involvement, chronicity of problem, irritability of symptoms and ability to find a relieving position. Patients with foraminal narrowing, disc herniation with compression of the thecal sac, spinal stenosis, spondylosis, or spondylolisthesis have biomechanical blocks to achieving normal arthrokinematics of the cervical spine, which may limit recovery. Patients with only pain and/or paresthesias have a better chance of recovery than patients with muscle weakness and atrophy. chronicity of radiculopathy will also affect outcome, whereas early treatment is correlated with greater rates of recovery.

Goals (5, 40-42)

To be met in 4 weeks:

10. Decrease pain and/or paresthesias
11. Independent management of pain, postural correction
12. Increase cervical A/PROM
13. Increase neck flexor, back extensor and/or periscapular strength

To be met in 4-8 weeks (43):

1. Independent home exercise program
2. Functional goals based on the severity of those functional limitations

Symptoms

Treatment planning / interventions:

The goal of the acute stage is to reduce pain and inflammation, improve postural ergonomics and to increase cervical A/PROM. Modalities such as ultrasound, moist heat, TENS and ice may be appropriate for pain management.

Soft tissue mobilization is appropriate for cervical spasm and/or trigger points. Cervicothoracic mobilizations are appropriate for reducing pain and increasing joint nutrition at grades I-II. Grades III-IV will address joint stiffness. Postural re-education, stretching and strengthening exercises are determined by the severity of the patient's symptoms. The patient may benefit from an ergonomic assessment.

Patient / family education (6, 44, 45)

1. Pain self-management techniques
2. Postural correction
3. Work ergonomics and body mechanics
4. Home exercise program

Recommendations and referrals to other providers

1. Physiotherapy (PCP)
2. Orthopedist
3. Rheumatologist
4. Neurologist
5. Physiatrist
6. Pain Management Clinic
7. Optometrist or Ophthalmologist if visual problems are present

Re-evaluation / assessment (46-48)

A brief re-evaluation should be performed at each visit to assess the efficacy of manual techniques. A formal re-evaluation should be performed within 30 days of initiating therapy, earlier if a patient has noticed a change in status or an intervention such as an epidural steroid injection (49).

Discharge planning

Criteria for discharge (50, 51)

1. Independent pain management
2. Improved postural awareness
3. Normal joint motion
4. Ability to perform home exercise program independently

SURGICAL THERAPY

There are several surgical options to treat radiculopathy. The type of surgery that is right for the patient depends on several factors, including (51-53):

- › The type of problem
- › The location of the problem
- › Preference of procedure
- › Experience of surgeon
- › Medical condition and history (such as prior neck surgery)

The type and location of the problem is the most important deciding factor. There are usually three types of procedures that can be done for cervical radiculopathy. These include anterior cervical discectomy and fusion, posterior cervical laminoforaminotomy and artificial disc replacement (53-54).

Anterior cervical discectomy and fusion (ACDF) (55-57)

Anterior cervical discectomy and fusion is the most common procedure for cervical radiculopathy. It restores alignment of the spine, maintains the space available for the nerve roots to leave the spine and limits motion across the degenerated spinal segment.

“Anterior” means that your surgeon will approach your neck from the front. The surgery involves operating from the front of the neck through a one to two inch incision along the neck crease. During the procedure, the problem disc is removed. The remaining area is stretched, so that the height is similar to what it was prior to the disc wearing out. A bone graft is then placed in the space where the disc was removed. This increases the space in

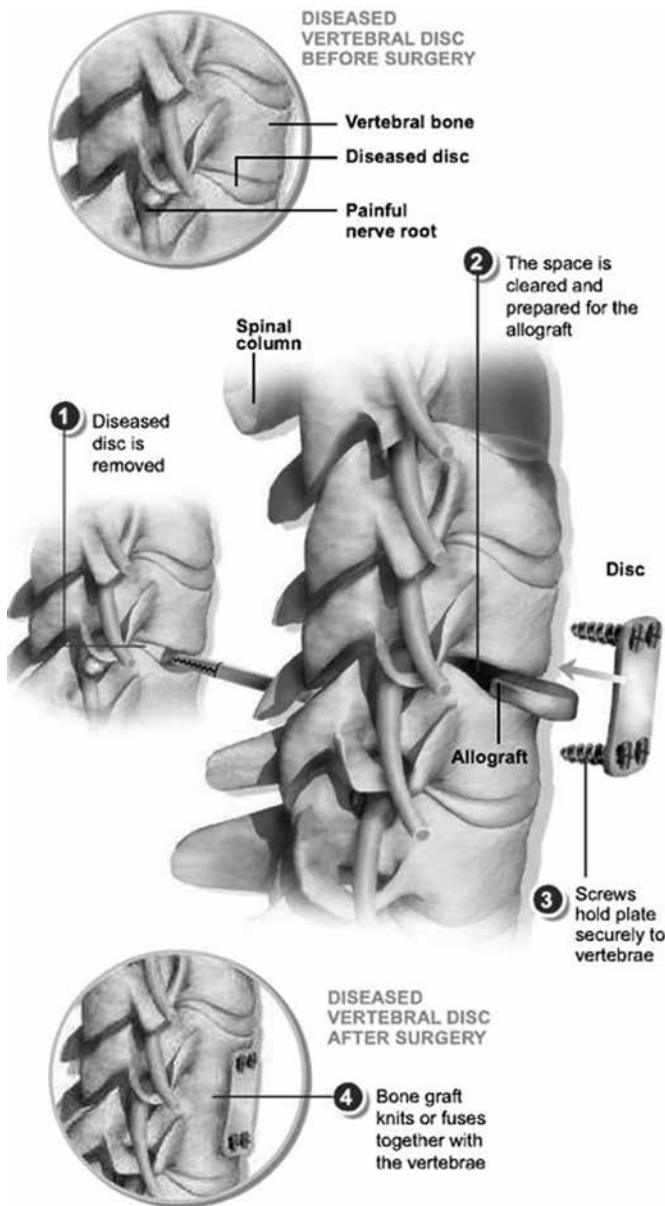


Figure 5. Anterior cervical discectomy & fusion: overview (61)

Description: this surgery removes a herniated or diseased disc and relieves neck and radiating arm pain caused by parts of the disc pressing on nerve roots. The surgeon performs this procedure through an incision on the front of the neck.

Step 1: The diseased or damaged disc is removed. As pressure is removed from the pinched nerve roots, pain is relieved.

Step 2: The space above and below the removed disc is cleared and prepared for a bone graft. The graft is placed between the vertebrae.

Step 3: The surgeon may screw a small metal plate over the area to hold the bones in place while the vertebrae heal.

Step 4: During the healing process, the bone graft knits together with the vertebrae above and below to form a new bone mass called a fusion.

the foramen for the nerve to leave the spine (58). After the bone graft is placed, the two vertebrae next to the removed disc are fused together. The fusion eliminates motion between the degenerated vertebrae. The goal is to lessen pain by limiting painful motion between vertebrae. It is primarily used to stimulate bone healing and help the vertebrae to fuse together into a solid bone (Figure 5, 6). A bone graft can be obtained from the patient's hip. This type of graft is called an autograft (53, 59, 60).

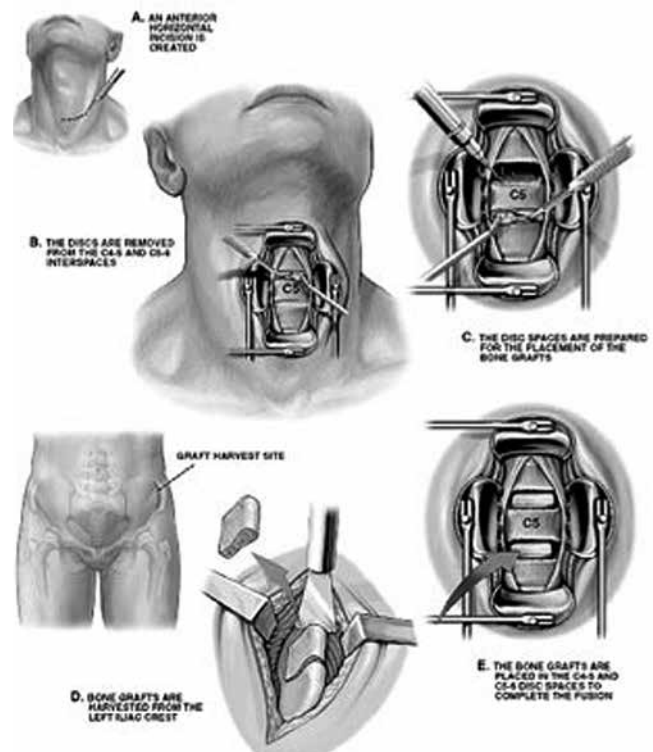


Figure 6. Anterior cervical discectomy & fusion: overview (61)

Harvesting a bone graft requires an additional incision along the hip and lengthens surgical time. Although autografts have been used with good results, some people may experience pain at the hip for several days. One alternative to harvesting a bone graft is using an allograft, which is cadaver bone. An allograft is typically acquired through a bone bank. The use of an allograft has grown because it avoids the risk of pain at the donor site. There are risks and benefits for both types of bone grafts, which the surgeon will discuss prior to surgery (4, 60).

Posterior cervical laminoforaminotomy

In posterior cervical laminoforaminotomy, the spine is approached from the back of the neck. A one to two inch incision is made along the midline of the neck. The parts of the bone that are compressing the nerve root are removed. If appropriate, the herniated disc is also removed from the back. Posterior cervical laminoforaminotomy avoids spinal fusion and has the potential for a quicker recovery. This surgery may not be an option for some patients depending on the type and location of the problem (61-63).

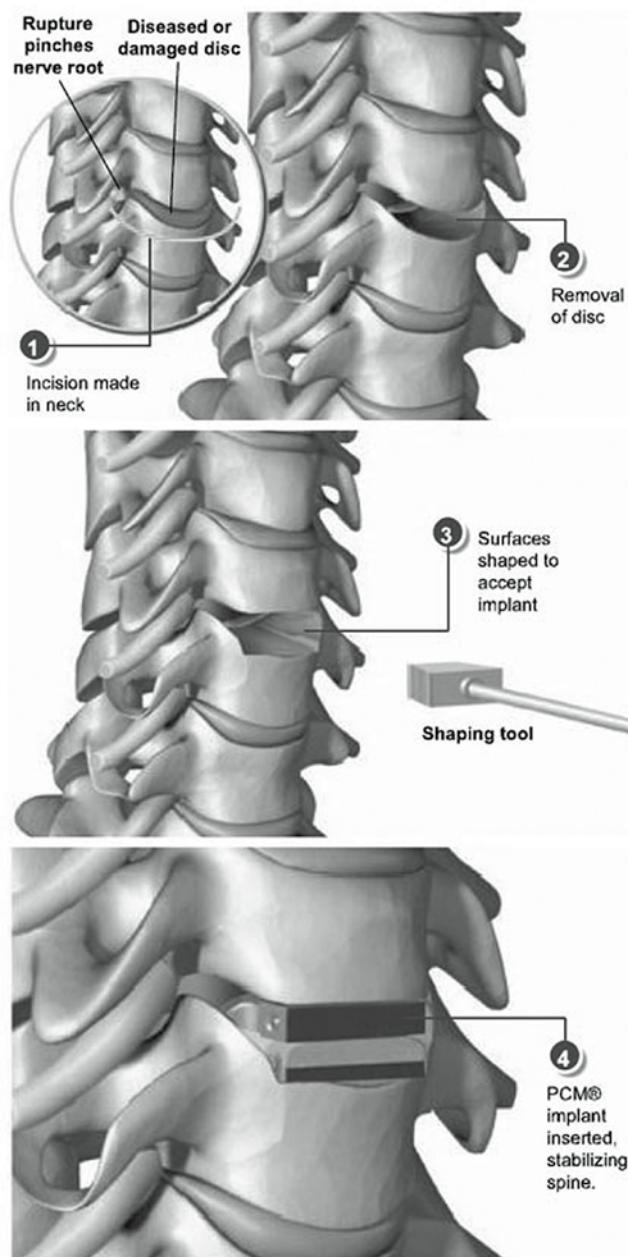
Artificial disc replacement (ADR)

Artificial disc replacement has recently received approval from the FDA, although long-term follow up is minimal. Similar to hip or knee joint replacements, disc replacement substitutes a mechanical device for an intervertebral disc in the spine. Artificial discs allow motion to continue after the degenerated disc is removed.

The artificial disc may restore the height between the vertebral bodies. It may also widen the passageway through which the nerve roots exit the spinal canal. The artificial disc can relieve pressure on facet joints and help to maintain the natural curvature of the cervical spine (64, 65).

The surgery is done from the front of the neck through a one to two inch incision created along the neck crease. The problematic disc is removed and an implant is inserted into the disc space. The implant is either composed entirely of metal or a combination of metal and plastic. It is designed to maintain the motion between the vertebral bodies (Figure 7).

The early results of the surgery appear promising, with results comparable to those of traditional surgeries. The motion is maintained, and there is a lower rate of problems at the disc levels above and below the implant. The long-term results are currently being researched. Depending on the type and location of the problem, artificial disc replacement may not be an option for some patients. There are risks and benefits with this procedure as with any surgical procedure (16, 64, 65).



A goal of this procedure is to relieve the pain caused by pinched nerves due to a damaged disc in the cervical spine. The diseased or damaged disc will be replaced with a specialized implant.

Step 1: The surgeon creates a small incision in the front of the neck to gain access to the spine.

Step 2: The diseased disc is removed from between the vertebral bodies.

Step 3: The surfaces of the vertebral bodies are cleared of all damaged disc tissue and shaped to accept the implant.

Step 4: The PCM® artificial disc is inserted into the space between the vertebrae and carefully tapped into place. The endplates are designed to bond tightly to the vertebral bodies, stabilizing the spine. The spinal fusion procedure uses a metal plate to connect the vertebrae above and below the removed disc.

Figure 7 Artificial cervical disc replacement, PCM: overview (61)

Risks of surgery

For most people, surgery can provide relief of symptoms and return to function with relatively low risks. The risks and benefits of surgery vary from person to person (66).

General risks

The potential risks for cervical spine surgery include:

- › Infection
- › Bleeding
- › Injury to the nerves or spinal cord
- › Reactions to anesthesia
- › Need for additional future surgery
- › Failure to relieve symptoms
- › Tear of the sac covering the nerves (dural tear)

Anterior cervical spine surgery and disc replacement surgery (66-68)

The potential risks with anterior cervical spine surgery and artificial disc replacement include:

- › Misplaced, broken, loosened plates, screws, or implants
- › Soreness or difficulty with swallowing
- › Voice changes
- › Difficulty breathing
- › Injury to the esophagus

The potential risks specific to anterior cervical fusion include:

- › Donor site pain (hip pain) if an autograft is used
- › Nonunion of vertebral body fusion (25)

REHABILITATION (53, 68-70)

After the surgery, it is typical to spend one or two days in the hospital and to start walking and eating on the first day. However, each patient's specific surgery experience will depend on their response to the surgery and the type of surgery received (for example, how many disc levels were involved).

Recovery and rehabilitation will be different for each person. Patient may need to wear a soft or rigid collar for a short period of time. Usually by four to six weeks post-surgery, patients can gradually begin to do range-of-motion exercises depending on healing. The physician may prescribe physical therapy during the recovery period to help restore function (69-73). Most people are able to return to full activities by three to four months after surgery, depending on the procedure. However, healing may take longer for some people, and recovery from complete spinal fusion (bones become solid) may take six to twelve months. The outcome from the surgery for cervical radiculopathy is generally very good. The majority of people return to normal lifestyles after recovery (74-77).

SUMMARY AND RECOMMENDATION

Patients who present with acute neck and arm pain suggestive of cervical radiculopathy, such as the woman described in the vignette, should be assessed first by a careful history taking and physical examination. In the absence of red flags suggesting infection, cancer or signs of myelopathy, it is reasonable to defer imaging and treat the patient's pain with analgesics (usually nonsteroidal anti-inflammatory drugs). MRI is indicated if substantial pain is still present four to six weeks after the initiation of treatment or if there are progressive neurological deficits.

Other options include cervical traction or transforaminal injections of corticosteroids, although the latter have potential risks, and neither approach has been well studied. It is reasonable to recommend a progressive exercise program once pain is under control although it remains to be seen whether such a program reduces the risk of recurrence. Surgery should be reserved for patients who have persistent and disabling pain after at least six to twelve weeks of nonsurgical management, progression of neurological deficits, or signs of moderate-to-severe myelopathy.

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