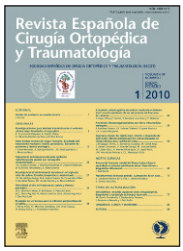
Rev esp cir ortop traumatol. 2010;**54(5)**:314-320

Revista Española de Cirugía Ortopédica y Traumatología

www.elsevier.es/rot



REVIEW ARTICLE

Cervical Disc Hernia

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Received May 25, 2010; accepted May 25, 2010

KEYWORDS
Disc hernia;
Spinal column;
Pain;
Disc prosthesis;
Arthrodesis

Abstract
Cervical disc hernias are reviewed, their prevalence, pain, clinical diagnosis and further tests required to give the most appropriate treatment. The natural history of cervical disc herniation is benign, with a good response to conservative treatment. The surgical indication is conservative treatment failure and a primary or secondary motor neuron lesion. Surgery has good results with a low complications rate, there being no evidence that it gives better results than any of the available options.

PALABRAS CLAVE
Hernia disco;
Columna cervical;
Dolor;
Prótesis discal;
Artrodesis

Hernia de disco cervical

Resumen
Se revisan las hernias de disco cervical, su prevalencia, el dolor, el diagnóstico clínico y las pruebas complementarias necesarias para realizar el tratamiento más adecuado. La historia natural de las hernias de disco cervicales es benigna, con una buena respuesta al tratamiento conservador. La indicación de cirugía es el fracaso tratamiento conservador y la lesión de primera o segunda motoneurona. La cirugía presenta buenos resultados con una escasa tasa de complicaciones, no existiendo una evidencia que demuestre mejores resultados con ninguna de las opciones disponibles.

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1888-4415/$ - see front matter

Introduction

There are few papers dealing with the epidemiology of cervical disc hernias, particularly if we compare them with those on lumbar pathology. The prevalence of cervicalgia over a lifetime has been estimated at around 70% although there are only 2 studies published[1,2] and the annual prevalence ranges between 26% in the Swedish population,[3] and 67% or 40% in the Finnish population depending on whether or not there is depression.[4]

Considering symptomatic cervical hernias to be those coursing with radiculopathy,[5] cervical disc hernias are more frequent in the fourth and fifth decades of life (45%) and the most frequent location is at the level of C6-C7 (60%), followed by C5-C6 (20%) and C4-C5; the C7 root is the most affected.[6,7] In a populational study in Rochester, Minnesota, USA, the prevalence of cervical radiculopathy was 107.3 men and 63.5 women per 100,000 inhabitants, of which 5.5% were due to cervical disc hernias.[6]

In a retrospective study on patients consulting for cervicalgia or cervicobrachialgia and ending up with a diagnosis of CDH, Kelsey et al.[8] showed associated factors to include heavy working activities, smoking, male gender and participation in water sports. Nonetheless, it is possible to observe asymptomatic cervical disc hernias in 10% of individuals under 40 years of age and up to 5% of those over 40[6,7,9]. Boden et al.,[9] in 63 asymptomatic individuals, showed anomalies in 19% of cases.

Table 1 Signs leading to suspicion of infectious or tumoural processes

	Signs or symptoms
Tumoural pathology	Age > 50 y
	History of cancer
	Weight loss
	Night pain
	Toxic syndrome
Infectious pathology	Fever
	Parenteral drug abuse or a history of it
	History of urinary or cutaneous infection
	Age > 50 y

Pain in Cervical Disc Hernias

Cervical disc hernias may originally affect both roots and the spinal cord, depending on their location. Nonetheless, the compression a root on its own does not always cause pain. Most of the knowledge available in this field stems from studies on lumbar hernias: Smyth and Wright[10] showed that, if a nerve is subjected to chronic inflammatory changes, even minimal deformities can cause pain. In addition, it is known that the stimulation of peripheral layers of the disc ring may cause pain and compression or oedema may trigger radicular pain.[11] In lumbar hernias, the material of the nucleus pulposus in contact with the root may make it sensitive and stimulate it biochemically to the point of triggering radicular pain[12] and inflammation mediators (metalloproteinases, PG-E_2, IL-6, nitric oxide) are released in cervical disc hernias[13] warranting anti-inflammatory treatment when there is pain in a discal hernia.

Diagnosis

The first thing is to rule out or suspect, depending on the case history, what has become known in lumbar pathology as *red flags* or signs revealing a risk of suffering a tumoural or infectious pathology requiring urgent action[14] (table 1).

The most usual clinical manifestation is cervicalgia or cervicobrachialgia with dysesthaesias and weakness or not of a motor pair of the upper limbs, involvement of the first motor neuron and clinical signs of cervical myelopathy or a combination of all these. Between 80% and 100% present clinical signs of cervical pain irradiated by an arm, with or without involvement of a muscle pair or paresthaesias, generally without any triggering cause.[14,15] The distribution of pain and paresthaesias are not always anatomically localized as defined in the classical manuals as several roots may present a similar distribution of pain.[14,15] Occasionally, the pain may follow an atypical distribution, with pain referring to a breast or the chest (pseudo-angina) (table 2).

The levels most frequently affected are C6-C7 and C5-C6. Odom et al.,[14] in a series of 246 cases, show the involvement of the C7 root, due to a lesion in disc C6-7, in 70% of cases, and the involvement of root C6, due to a lesion in disc C5-6, in 24%. Nonetheless, Lundsford et al.[7] described 48% of cervical disc hernias in C5-C6 and 37% in C6-C7 in 334 patients.

Table 2 Motor and sensory distribution of the roots most commonly affected

Level	Root	Motor	Sensitivity	Reflexes
C4-C5	C5	Deltoid and biceps	Shoulder, inter-scapular	Biceps
C5-C6	C6	Biceps and carpal extensors	Radial face of the forearm, thumb and forefinger	Biceps and styloradial
C6-C7	C7	Triceps, finger extensors	Ring finger	Triceps
C7-T1	C8	Intrinsic finger and carpal extensors, flexors	Small finger and hypotenar region	Cubito-pronator

Overall, the clinical signs have little sensitivity in the examination, capable only of detecting the compression level in 50%of cases.[16] Patients with a clinical presentation of myelopathy are extremely variable, with first motor neuron involvement, alteration reflexes of the midline (plantar cutaneous reflex in extension, positive Hoffman), L'Hermitte's sign, increase in basis for sustentation and spastic gait, mictional alterations, widespread weakness and clumsiness in the upper limbs, with characteristic signs in the hands, such as ulnar leak in the fingers or difficulty closing or opening the hand and multiple signs that fall outside the scope of this article.[17]

Complementary Examinations

When evaluating imaging tests, there must be agreement between the clinical findings and the image of the cervical disc hernias, even though there are asymptomatic patients with images indicating hernia of the cervical disc[9] and we lack accurate clinical algorithms to determine the diagnostic criteria and a precise sequence of examinations in patients with cervical disc hernias. The literature refers to the order in which the complementary examinations should be carried out but do not give precise indications about when a particular study is indicated depending on progress or clinical changes.[18]

X-rays should be used as the initial examination, although some authors have questioned their usefulness in young patients without any history of trauma.[19,20] They are useful to rule out signs of instability, especially in cases of rheumatoid arthritis or spondylarthritis anchylopoetica or to detect signs suggesting infection or tumour. They are usually normal or only allow detection of signs suggesting spondylosis.

Except for signs suggesting tumoural or infectious lesion in patients beginning with a motor lesion, whether in the first or second motor neuron, other examinations are not initially indicated. In the cases described or where the initial treatment fails, the study should be extended[21] with MNR[21,22]

Figure 1 Hernia of disc C3-C4 with signal changes at the medullar level suggesting glyosis and myelopathic lesion.

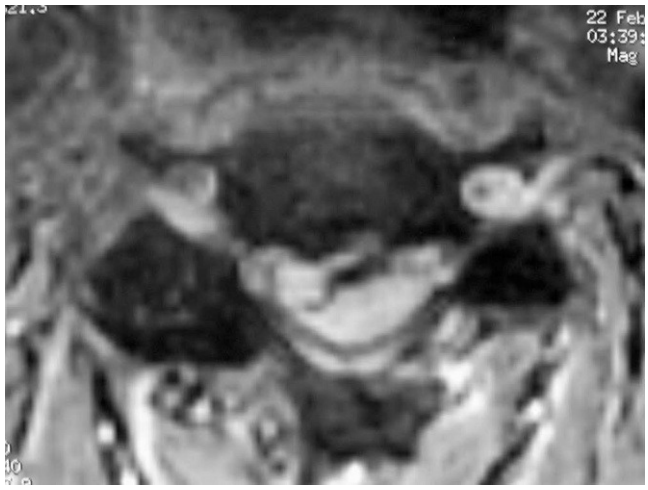

Figure 2 Extruded hernial fragment compromising the foramen.

to obtain multi-planar images delimiting the vertebral anatomy, the cerebrospinal fluid, medullar or radicular compression images and soft tissues (figs. 1 and 2).

CT scans, with contrast or myelographic scans, have shown a high correlation with MNR and surgical findings[23] but are only indicated in those cases where MNR is contraindicated, as with those fitted with pacemakers.

The indications for electrophysiological studies do not enjoy any consensus as the sensitivity and specificity of these tests is low.[24] Vohanka and Dvorak[24] analyzed the sensitivity of different neurophysiological tests in patients with hernia of cervical discs or stenosis of the canal and correlated the findings with the MNR or CT images that were subsequently not confirmed during surgery. EMG studies only showed a specificity of 30% in patients with radiculopathy but without any motor deficit. SEP or MEP studies showed a mean sensitivity of 55%and MEP studies as many as 75%of false negatives. In 53% of patients with objective findings of radicular compression SEP gave a false negative and only 59%presented signs of denervation on the EMG. This high incidence of false negative means that electrophysiological studies are hard to reproduce in order to confirm clinical findings.

An electrophysiological study would be indicated to exclude distal nerve pathology, verify motor involvement in patients who may be uncollaborative in the examination due to inhibition regarding pain or gain, in order to document the prior muscular status in the event of re-interventions and when the clinical and radiological findings are contradictory in order to rule our the indication of surgery.[25]

Treatment

Conservative

The efficacy of conservative treatment in cervical disc hernias has not received attention as cervical disc hernias

have been arbitrarily more often subjected to surgery than hernias of lumbar discs,[26] even allowing for extruded hernias as an absolute indication for surgical treatment.[26] There are few studies comparing the efficacy of conservative and surgical treatment[27] although there is little literature on the outcomes of conservative treatment.[26-28]

Conservative treatment achieves good results in 80-90% of the series and there are no treatment protocols or any systematic approach to the various therapeutic options that should, on the other hand, be specifically assessed with regard to their efficacy.[26]

Although numerous non-surgical techniques have been put forward for the treatment of cervicobrachialgia secondary to a disc hernia, there are few that have been shown to be effective. Those that have aroused most research in the last decade are the epidural administration of corticosteroids, whether by the interlaminar or transforaminal route, and pulsed radiofrequency of the ganglion of the dorsal root.

Epidural Infiltration

Two approaches are used in the administration of epidural corticosteroids for the treatment of lower back pain, the interlaminar and the transforaminal routes.

- Interlaminar approach
  Three studies meet the inclusion criteria.[29] Castagnera et al.[30] obtained the relief of pain in 78%of patients with a mean duration of 43 months, diminishing the dosage of painkillers and allowing them to return to work. The addition of morphine to epidural corticosteroids did not improve these results. The main limitation was the small sample of patients (14 in the group with corticosteroids and 10 in the group with associated morphine).
  Stav et al.[31] treated 25 patients with epidural corticosteroids and lidocaine and 17 with the same medication administered in the musculature at the back of the neck. In the first group, 68% of patients had an improvement in sustained pain after a year, versus 11.8% in the second group. In addition, this relief was associated with an increase in mobility, a reduction in the amount of analgesics taken and return to work. For their part, Pasqualucci et al.[32] compared the administration of corticosteroids by means of infiltrations versus their infusion through an epidural catheter. The improvement in pain after 6 months was maintained in 74% of the patients treated with a catheter and in 58% of those treated with infiltrations.
  Although all these studies present the same limitations of small sample size and not using fluoroscopy to confirm the adequate placement in the epidural space, a recent systematic review[29,33] concluded with a II-1 level of evidence and a 1-C level of recommendation, the same as for short-term lumbar radiculopathy, but superior to long-term lumbar radiculopathy (2-B).
- Transforaminal approach
  Bush et al.[28] showed that the transforaminal administration of epidural corticosteroids guided by fluoroscopy improved pain in 68 patients who did not require subsequent surgery. Nonetheless, there are no randomized studies proving their efficacy and numerous complications have been reported. In the survey conducted by Scanlon et al.,[34] 16 vertebrobasilar infarcts, 12 cervical-medullar infarcts and 2 combined cerebromedullar infarcts. The mechanisms habitually involved were embolism due to the intra-arterial injection of particulate corticosteroids and the perforation of the vertebral artery causing dissection or thrombosis and inducing a vasospasm.

Pulsed Radiofrequency of the Dorsal Root Ganglion

The application of pulsed radiofrequency of the dorsal cervical root ganglion was mooted by Van Kleef et al.[35] for the treatment of radicular pain of cervical origin. The only clinical trial[36] showed that the NNT in the group which received pulsed radiofrequency, was 1.1 after 3 months, versus an NNT of 3 in the placebo group; after 6 months the NNT values were 1.6 and 6 respectively. Although additional studies are required, pulsed radiofrequency of the dorsal root ganglion may be a procedure indicated in patients with chronic treatment-resistant cervicobrachialgia.

Surgical Treatment

The failure of conservative treatment, the progression of the motor lesion or medullar involvement are the indications for surgical treatment of cervical disc hernias. Depending on the series, this occurs in 10 20%of patients.[5,13,21,26,37] The aim of surgery on cervical disc hernias is the exeresis of the herniated disc and the descompression of nerve structures.[13] The published results are good or excellent in between 80% and 95% of cases, with a rate of complications ranging between 0 and 5%of patients.[37]

When the clinical signs are solely axial pain, the failure of conservative treatment is not a clear indication for surgery. Cervicalgia surgery has unforeseeable outcomes, with a 65%rate of good or excellent results, so this indication must be considered with caution.

The failure of conservative treatment in brachialgias is grounds for surgery but the time for surgery is not defined and has to be established for each patient, depending on their tolerance for pain, social and socio-economic factors. The risk in these cases is the development of central sensitization conditions that entail worse outcomes in the case of late surgery. The limit is generally considered to be 6 weeks, although other authors extend it to 3 months. The recommendation in these patients is to reach a consensus based on the imaging tests, examinations and electromyographic studies before considering any surgery.[13,21,37]

When the cervical disc hernia begins with involvement of the first motor neuron, surgery must be indicated early on. The prognosis of surgery for cervical myelopathy is linked to the degree of involvement, the duration of its course, gender and age. In view of the potential catastrophic evolution of cervical myelopathy, particularly if starting in young patients; after diagnosis and definition of the lesion using imaging tests, these patients must be sent for surgery. Consideration should be given to conservative treatment only in those patients with minimal neurological involvement in the hope of re-absorption of the cervical disc hernia, always under strict supervision and indicating surgery in the case of impairment.

Figure 3 Characteristic image of C5-C6 instrumented arthrodesis.

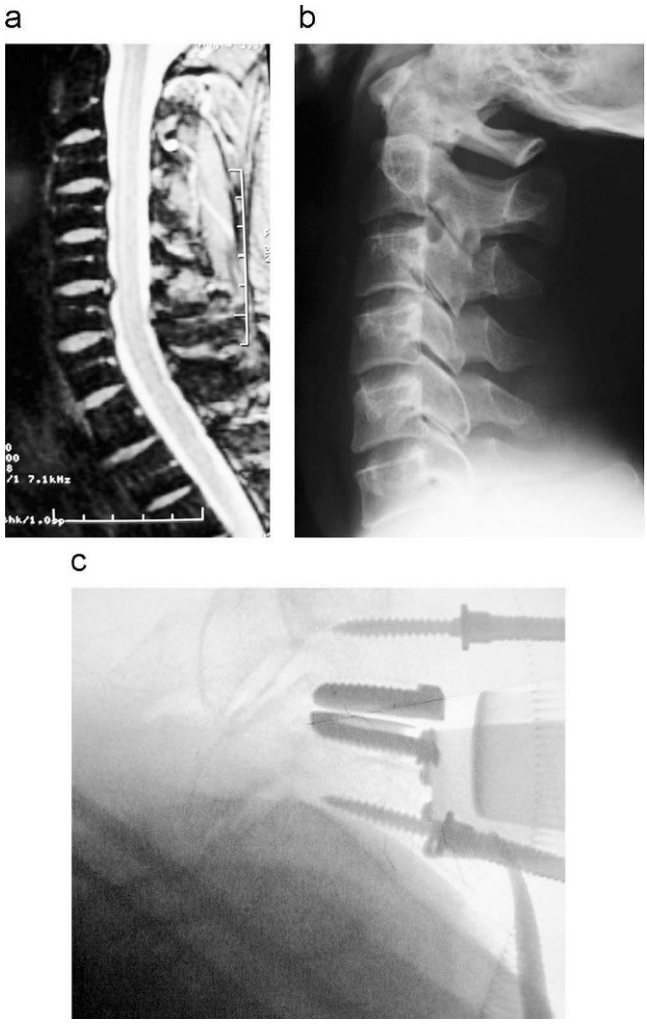

Figure 4 a) Discal hernia compromising the root. b) The X-rays show moderate changes in spondylosis. c) Placement of the disc prosthesis.

If an impairment is documented in the neurological examination, consideration must also be given to a surgical indication. There are no prospective series documenting the resilience of the nervous function. Empirically, the intensity of the compression and the duration of the lesion diminish the resilience of the nervous function.[37] Surgical treatment is indicated in those patients with serious or progressive involvement. Indication is more difficult in cases with moderate or mild motor involvement that remains stable with conservative treatment; in these cases the outcome of the surgery is quite unpredictable.

The surgical options are grouped into fusion techniques and arthrodesis-free techniques with very short-term results. The reference treatment continues to be discectomy and arthrodesis[6] (fig. 3) although the short-term outcomes with discectomy and total disc prosthesis are similar (fig. 4).

Arthrodesis has given excellent results and has therefore been considered to be the reference technique for the treatment of cervical disc hernia, with 95% of fusions and 85-95% of good and excellent results. Classically, an autologous crest graft was used for the arthrodesis, however since 25% of complications in the donor site with pain or infection has led to the use of allografts, with lower percentages of fusion (up to 90%) but with the same clinical results. Subsequently, the outcomes with PEEK (Poly-ether-ether-ketone) synthetic spacers together with bone inducers with consolidation results of up to 100% with the same clinical outcomes.

Hilibrand et al.[38] associated arthrodesis with discopathies and pathologies of the adjacent segments, the reason for a re-intervention rate albeit a controversial subject. To avoid the problems on adjacent discs, preserve mobility and recover function in patients with cervical disc hernias, multiple total disc prosthetic implants (Prestige®, Bryan® and Pro-Disc®) have been developed with clinical results, two years on, similar to those found with arthrodesis.[5,39,40]

Posterior foraminotomy is an option in radiculopathies due to cervical disc hernia. This technique will improve radicular pain without requiring arthrodesis. It might be indicated in highly lateral cervical disc hernias. Nonetheless, the results published with this technique are not as favourable as with arthrodesis.

Complications

The rate of complications published is low and the complications inherent to the approach and release are medullar lesion (less than 1%), radicular lesion (2-3%), recurrent lesion of the nerve (0.2-2%), perforation of the

oesophagus (less than 1%) and leaks of cerebrospinal fluid (0.1-0.2%). For their part, the complications inherent to arthrodesis are related to the graft donor site, which amount to 25%, or instrumentation (5%). A complication rate of 2% has been reported with regard to total disc prostheses, and 3% for re-interventions.[40]

Evolution and Prognosis of Treatments

There is little information about the natural course of cervical disc hernias as the few studies that exist do not separately consider the diagnosis of cervical disc hernias but focus on epidemiological aspects of cervical radiculopathy or cervical myelopathy of any origin. There is evidence of good prognosis with cervical radiculopathy, with a tendency towards resolution with conservative treatment[21,28,41] although there have been reports of up to 50% of patients with persistence of radicular pain for 15 years after receiving conservative treatment.[40]

Maigne and Deligne[27] followed the course of 22 patients with radiculopathy secondary to cervical disc hernia and treated conservatively. In 20 of them, the cervical disc hernia disappeared or became smaller at the one-year follow-up. Bulkier hernias, migrated sagitally or laterally seem to have a greater tendency to resolution.[28,41] This resolution seems to be related to the phagocytic activity of macrophages and a subsequent revascularization process.

It seems that radiculopathy patients with surgical treatment improve after 3 months but display the same results after a year, with pain intensity, function and depression or mood state being the factors impacting the results.[42]

With regard to surgical treatment, a similar effect has been suggested for both total disc prosthesis and arthrodesis[6,40,42,43] but we do not know the long-term outcomes and so cannot be certain that the total disc prosthesis reduces illness in adjacent segments, maintains mobility in the long-term or better long-term results.

Most of the patients respond to conservative treatment, and there are cases of regression of the herniated fragment.[28] Around 20% of the patients require surgery when conservative treatment fails or a neurological lesion appears, with a high percentage of good short-term outcomes, regardless of the techniques used.

In a prospective study of 103 patients, Peolsson and Peolsson[44] performed a linear regression study of different factors in an attempt to predict the final outcome; they demonstrated that neither the radiographic findings nor the surgical technique were predictive factors for the final outcome, with the Neck Disability Index (NDI) as the variable best predicting the final result. Tobacco negatively impacted the final outcome while male gender has a positive influence on it. Anderson et al.,[39] in a series of 488 patients assessed retrospectively, found high values on the NDI indicative of a poor prognosis, as well as advanced age and labour litigation. Both studies highlighted the fact that neither the radiographic findings nor the findings in the clinical examination, except for the degree of incapacity measured by the NDI, were of any noteworthy value vis-à-vis the definitive prognosis.

Conclusions

Symptomatic cervical disc hernias usually appear between the 4th and 6th decades of life, with a slight predilection for male gender. The diagnosis is usually clinical and radiographic, with electrophysiological data being of scant relevance.

Imaging tests are highly sensitive but their specificity is low, with the correlation between clinical signs, examination findings and MNR images of fundamental important when indicating treatment, particularly surgery.

The natural course of cervical disc hernias is benign, with good response to conservative treatment in 80-90% of patients. The indication for surgery is the failure of conservative treatment and lesions of the first or second motor neuron.

Surgery presents equally good results con a low rate of complications, without any evidence that shows better results with any of the options currently available.

Conflict of interests

The authors declare that they have no conflict of interests.

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