Adult herniated cervical disc: surgical treatment

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Conflict of interests
None.

Description of the evidence collection method
In order to elaborate this guideline, the following primary and secondary electronic databases were consulted: MEDLINE (1966-2009), Cochrane Central Register of Controlled Trials, – CENTRAL, Embase (1980-2010), and Lilacs (1982-2010). The search was based on real clinical settings, and MeSH terms/descriptors and the following isolated terms were used: Intervertebral Disk Displacement; Discectomy, Percutaneous; Discectomy; Percutaneous, Cervical Vertebrae; Adult; Surgical Fixation Devices; Orthopedic Fixation Devices; Arthroplasty; Surgical Procedures, Operative; Outcome Assessment; Pain Measurement. The articles were selected after critical evaluation on the strength of scientific evidence by specialists from the participant societies, and the best publications were used for the recommendations. The recommendations were elaborated after a discussion within the group. The entire guideline was reviewed by an independent group specialized on evidence-based clinical guidelines.

Degrees of recommendation and strength of evidence

A: Experimental or observational studies of higher consistency.

B: Experimental or observational studies of lesser consistency.

C: Case reports (non-controlled studies).

D: Opinions without critical evaluation, based on consensus, physiological studies, or animal models.

Objective

This guideline is targeted primarily at rheumatologists, orthopedists, physiatrists, neurologists, and neurosurgeons in order to provide orientation for the indication of surgical procedures for adult patients bearing cervicobrachialgia with radiculopathy by herniated cervical disc at one level, from C3 to C7, with no clinical signs of mielopathy resistant to clinical treatment.

Introduction

Generally, radiculopathy, as a result of cervical intervertebral disc prolapse, occurs between the third and the fourth decade of life, during the initial phases of intervertebral disc degeneration, when it is possible to observe fissures on the annulus fibrosus circumference. The disruption of the annulus fibrosus leads to the occurrence of hernias, which may be contained, non-contained, extruded subligamentous, or transligamentous and sequestrated. The inflammatory process and the intervertebral disc fragment, positioned in the central-lateral portion adjacent to the cervical nervous root, result in cervicobrachialgia distributed by the dermatome corresponding to the nervous root. Some patients may present paresis and/or decline of the deep osteotendinous reflex of the muscle corresponding to the involved level. Surgery is a treatment option for patients who do not respond to clinical measures after an adequate period of time (two to three months), or those who present impossible to treat pain and/or progressive neurological dysfunction[1](**A**)[2-4](**D**). The present surgical treatment options include anterior discectomy, anterior discectomy with anterior graft with or without instrumentation, posterior foraminotomy with or without posterior microdiscetomy, and arthroplasty.

1. When are the anterior or posterior approach indicated?

In 1955 and in 1959, Robinson, Smith, and Cloward introduced a direct anterior approach (with a longitudinal incision along the anterior border of the sternocleidomastoid muscle), which made possible a significantly reduced

incidence of lesions on nerve root and spinal cord inflicted during the laminectomy[5,6](**C**)[7,8](**D**). The advantages of the anterior approach become evident, as it was easily performed, promoted a large exposure, and the decompression associated with stabilization could be obtained in only one surgery.

Over the last four decades, many variations and modifications of the technique have been described. At present, there are several surgical treatment options for the anterior approach. They include simple discectomy; discectomy and arthrodesis with autologous or homologous strut-graft; discectomy and intersomatic spacer (metallic, biological, and polymers) with and without arthrodesis; discectomy and bone inductors; discectomy and arthrodesis with and without plates; and arthroplasty[9,10](**C**)[11](**D**).

Anterior discectomy and posterior microdiscectomy can be indicated with similar functional results in lateral hernias. In hernias with a central component, anterior discectomy is the most indicated and studied option in clinical trials for removing cervical prolapsed intervertebral disc[12](**B**).

Recommendation

Treatment for cervical herniated disc, in the absence of modular compression, is clinical; surgical intervention is indicated for patients who have failed on the adequate clinical treatment after two to three months or have presented refractory pain and/or progressive neurological dysfunction. Anterior discectomy is indicated for central hernias, and both options (posterior and anterior approach) are valid for lateral hernias.

2. Is the percutaneous technique (percutaneous cervical nucleoplasty) indicated in cases of adult cervical herniated disc?

Nucleoplasty is a minimally invasive technique in which the intervertebral disc is not removed. Using energy from a specific radiofrequency, it was developed as an alternative to conventional surgical treatment, in case of clinical treatment failure, for cervical and lumbar contained herniated discs, and in selected cases of lumbar degenerative disc (painful discopathy). As it is a minimally invasive treatment, it aims at the ablation of the pulpous core in a controlled mode, by means of percutaneous device insertion into intervertebral disc, resulting in the reduction of the intradisc pressure[13](**C**)

Available data on this therapeutic modality are still insufficient; however, some studies indicate that the technique, besides presenting relative safety, is associated with favorable functional outcomes[14-16](**B**). In an observational cohort study, including individuals with an average age of 51 years (SD ± 10 years), bearing cervical contained herniated disc, identified through computed tomography and/or magnetic resonance imaging (MRI) (31% of patients presented cervical herniated disc between C5-C6), submitted to percutaneous cervical nucleoplasty and followed-up for a mean period of 12 months, a significant improvement was observed in the visual analog scale (VAS) pain scores in the 1st, 2nd, 3rd, and 12th months of follow-up when compared to the values obtained in the pre-surgical period. The absence of cases of cervical instability was also observed (defined as angular displacement ≥ 11° or horizontal displacement ≥ 3 mm) after percutaneous surgery. Thus, there were favorable functional outcomes (as analyzed by VAS) in patients submitted to percutaneous cervical nucleoplasty; however, the study didn't have a control group for comparison and more consistent conclusions[17](**B**).

Recommendation

The available evidences regarding the effectiveness of nucleoplasty are limited, and there are no randomized controlled clinical trials comparing it to other surgical modalities. Nucleoplasty is not recommended for routine treatment in these patients.

3. Regarding the functional outcomes, is there any difference when comparing simple discectomy (SD) and discectomy followed by arthrodesis (FD) with bone graft?

Anterior cervical discectomy (ACD) is many times used for treating cervicobrachialgia with radicular symptoms presenting variations between simple discectomy (SD) and discectomy with arthrodesis (FD) with or without the use of intersomatic devices, associated or not with a plate for maintenance of the intervertebral disc height and of the vertebral alignment.

A randomized clinical trial analyzing patients bearing cervical herniated disc, with surgical indication and submitted to SD or FD, obtained better surgical results in the follow-up periods of three and 12 months. The results were quantified as excellent and good (Odom I and II), considering those submitted to SD compared to those submitted to FD (87% versus 61% and 87% versus 68%, respectively for three and 12 months)[12](**B**).

3a. When analyzing surgical success rates, are there differences in the comparison among simple discectomy (SD), discectomy followed by intervertebral fusion (FD), and discectomy with intervertebral fusion and instrumentation (DIF)?

Vertebral instrumentation is a generic term used for surgical procedures that use screws, intersomatic devices (spacers), plates, and rods to stabilize the spinal column. Instrumentation and fusion are used to provide stability to the

spinal column or to correct a deformity, as in the case of a degenerative disc disease causing instability or progressive scoliosis, which is the cause of deformity.

There are a few prospective and randomized studies on this therapeutic modality, making it difficult to determine whether using titanium spacer after discectomy presents superior results, in respect to surgical success rates, when compared to SD in treating cervical root compression[18](**B**).

A clinical trial included individuals (average age of 45 years) symptomatic for at least six weeks for cervical root compression and with surgical planning of anterior approach ar just one level, randomized for SD or discectomy, followed by use of titanium spacer. After surgical treatment, an absence of significant differences on evaluation was observed in the follow-up of three and 12 months, by means of Odom scale and success rates. This difference remained non-significant even after 24 months follow-up, in which 86% of patients submitted to discectomy followed by the use of a titanium spacer demonstrated persistence of good surgical results, in comparison with of 76% of those patients submitted to SD[19](**A**).

At present, anterior surgical interventions for the treatment of cervicobrachialgia associated with radicular symptoms may vary between SD and FD, with or without the use of intersomatic devices. Therefore, the need for intervertebral fusion after performing ACD remains a controversial issue.[20-23](**C**).

In a randomized study including individuals (average age of 43 years) presenting cervical radiculopathy with symptoms related to involvement of only one cervical level, with no clinical improvement after drug treatment, and clinical diagnosis confirmed by imaging exams (radiography and MRI) submitted to SD, FD with or without instrumentation (DIF or FD), it was observed that after 12 and 24 months of follow-up, surgical approach (regardless of the technique used) resulted in an improvement of algic state as compared to pre-surgical approach, according to the results of the McGill pain questionnaire (MPQ), with no significant difference among groups (92% of patients submitted to SD, 93% to FD, and 100% to DIF presented absence of radicular pain on superior limb [p = 0.36]). Regarding cervical pain, it was absent in 83%, 80%, and 73%, of patients submitted to SD, FD, and DIF, respectively (p = 0.33); no significant difference among groups was demonstrated[24](**A**).

Another randomized clinical study analyzing the intensity of cervicalgia in the post-surgical period of patients submitted to SD and DIF observed, after twelve months of follow-up, a significant improvement of the algic state (superior limb), in both surgical approaches; however, a significant improvement for cervical pain clinical picture was observed only in those patients submitted to DIF[25](**B**).

3b. When analyzing cifone and fusion rates in the post-surgical period, are there differences in the comparison among SD, FD, and DIF?

The most used surgical approach in the treatment of degenerative disc disease is discectomy with or without fusion of the two adjacent vertebral bodies. The objectives of surgical treatment can be summarized as follows: obtaining decompression (involves removal of intervertebral disc or osteolytic structures of compressed neural elements), restoring of alignment (repair of height of disc space and height of neural foramen), and stability of cervical spine (elimination of movement).

Evaluating the radiographic outcomes from patients submitted to SD, DIF, or FD, obtained by cervical spine radiographic images in anteroposterior, profile, and oblique views, along with flexion and extension profile, it was observed that lower fusion rates were present in individuals submitted to SD (three months after surgery, the fusion rates observed for FD and DIF were 60% and 73%, respectively, to the detriment of none concerning FD). After 24 months follow-up, the fusion rates observed were as follows: 93%, 100%, and 67% for FD, DIF, and SD respectively[24](**A**).

In respect to the loss of lordosis and increase in kyphosis (characterized as an angle ≥ 5° among fused segments), it was observed that deformity was frequent in patients submitted to SD when compared to other surgical approaches (75% of patients submitted to SD demonstrated the presence of kyphosis in the 3rd post-surgical month, which persisted in the 24 month follow-up period; p = 0.07). There was no significant difference in segmental alignment in patients submitted to FD and DIF[24](**A**).

In another randomized study, in a 48 months follow-up period, it was observed, by radiographic evaluation, that bone fusion was obtained in almost all cases (90% of SD and 100% of FD and DIF). It was also observed that a slight kyphosis (observed as an angle from 0° to 4° among segments) was identified in all groups; was reported as the highest frequency in patients submitted to SD, however, with no statistical difference (62.5% to SD, 40% to FD, and 44% to DIF[26])(**B**).

Patients who underwent arthrodesis by use of a spacer statistically presented a better result in the short and medium term when compared to SD, according to return to work, radicular pain, and Odom criteria. The average for kyphosis was 24.2º after SD, 3.3º after FD, and 2.7º after using DIF. The use of plate did not change functional outcome[27](**B**).

Recommendation

When indicating surgical decompression, anterior discectomy is recommended, which can be associated with intersomatic arthrodesis and with use of intersomatic spacer.

However, it is currently not possible to state that the results regarding instrumentation should be better since the intersomatic spacer option could be from autologous illiac bone graft with no implants.

4. When should arthroplasty be indicated?

Arthroplasty, a new technology for treatment in this setting, aims at preserving the movement in local discectomy and anterior decompression. This movement, theoretically, reduces degenerative articular disease in the levels adjacent to the operated level.

In comparison to FD, arthroplasty performed in patients with radiculopathy or myelopathy secondary to cervical herniated disc, in one level, resistant to clinical measures of treatment, demonstrated better functional outcome after 24 months of follow-up, when analyzed by the neck-related dysfunction index (Neck Disability Index - NDI), showing reduction equal to or higher than 15 points in NDI scores as compared to the pre-surgical period (86% versus 78% for arthroplasty and discectomy followed by fusion, respectively, p = 0.025). However, the randomized process does not allow for definite conclusions. There are no conclusions regarding the adjacent degenerative process to the operated level, after using both techniques[28](**B**).

Functional improvement is similarly maintained in both groups after 48 months of follow-up, with some measures favoring arthroplasty, such as a reduction ≥ 15 points in NDI scores, when compared to the pre-surgical period (93.3% *versus* 82.4% for arthroplasty and discectomy followed by fusion, respectively)[29](**B**). Up to 24 months of follow-up, there is no difference among the main outcome measures focused on patients – VAS, cervicobrachialgia (NDI), and quality of life (SF-36) – between fusion and prosthesis. The non-blinded evaluation by the researcher demonstrates that there is a greater need for resurgeries in patients submitted to fusion (8.5% *versus* 1.8%; p = 0.03); and also that 89.9% of patients submitted to arthroplasty are not in need of narcotics or muscle relaxers at the end of the 24 months of follow-up, compared to 81.5% submitted to fusion (p < 0.05)[30](**B**). A lower possibility for adjacent symptomatic degenerative process in patients who underwent prosthesis implants in this follow-up period was not observed. In other words, there is still a lack of evidence as to the real existence of lower symptomatic degenerative adjacent process, after cervical prosthesis as compared to fusion after two years from surgery[31,32](**A**).

Recommendation

Arthroplasty is not recommended as a routine in this clinical setting.

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