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CHAPTER 5

Treatment of Axial Neck Pain

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b0010 **CHAPTER PREVIEW**

s0015 p0110 **CHAPTER SYNOPSIS:** The complete understanding of axial neck pain remains elusive. Its causes are multifactorial, and the commonly prescribed treatments are largely nonspecific. Surgical intervention remains controversial but potentially viable. Its overall modest outcomes success is predicated on the lack of a clear understanding of the source of pain. This chapter provides an update on the options and limitations of nonoperative therapies, spinal injection therapies, and surgical intervention.

s0020 **IMPORTANT POINTS:**

u0105 • It largely remains unknown whether an optimal nonoperative therapy exists, including its efficacy, timing, duration, and cost-effectiveness, in providing symptom relief in the treatment of axial neck pain.

u0110 • Indications for surgery include disabling neck pain not alleviated by nonoperative therapies, strict adherence to selecting the right patient, selecting the right level(s), and selecting the right operation.

p0130 Axial neck pain affects 10% of the general population at any given time. About 15% of the population experiences persistent or chronic neck pain, with 5% becoming disabled.[1,2] Although neck pain has been regarded as self-limiting and benign, it continues to consume a substantial proportion of health care resources.[3]

p0135 Neck pain is considered a multifactorial disorder with many possible causative factors. Structures known capable to transmit pain include intervertebral discs, nerve root dura, facet joints, fascia, and muscles.[4] No historical features and examination findings exist that can reliably implicate a specific anatomic structure as a source to axial neck pain.[5,6] Imaging studies have also been unreliable in identifying the source of axial neck pain.[7,8] Similarly, anatomic provocation studies have demonstrated patterns of pain referral with similar character and distribution.[9,10] The majority of patients with neck pain are hence readily categorized as having a "nonspecific" problem.

p0140 Although uncommon, specific and sometimes serious causes of neck pain require special attention. Radiculopathy is commonly associated with neck pain as the dominant complaint, particularly if the nerve root compressive lesion occurs at an upper cervical level, C3 or C4.[11] Potentially serious problems include myelopathy, intraspinal or extraspinal tumor, fracture, or infection. Hence, a careful and skilled examination with cognizance of the presence of any ominous, albeit sometimes subtle, red flag findings is critical before making the recommendation of a nonoperative treatment program for a patient with axial neck pain.

NONOPERATIVE MANAGEMENT s0025

p0145 In the majority of cases of axial neck pain, noninvasive treatment modalities are the mainstay of care. In a long-term study with a 5-year average follow-up, Gore et al.[12] report 68% of patients treated without surgery experienced symptom improvement, with 43% being pain free. Persistent moderate-to-severe pain was reported in 32% of the patients. Severe initial symptoms and specific event-related injury correlated with unsatisfactory outcome, whereas the presence of degenerative changes, sagittal diameter of the spinal canal, degree of cervical lordosis, and any interval change of these measures were not of any value in predicting outcome.

p0150 Generally, nonoperative measures are initially recommended by the primary care physician. It largely remains unknown whether an optimal treatment measure exists, including its efficacy, timing, duration, and cost-effectiveness in providing symptom relief in the treatment of neck pain irrespective of specific cause. The many treatments available also carry trade-offs between potential benefit and harmful effects, with no treatment clearly identified as safer than any other.[13] Fortunately, most patients do experience symptom improvement with only rare harmful effect, regardless of the therapy selected.[14]

Advice and Patient Education s0030

p0155 When first presenting with benign nonspecific neck pain, most patients are concerned with whether they should avoid certain activities, and whether their underlying problem is

going to worsen. It is now generally accepted that no increased risk for injury or worsening of pathology exists regardless of the patient's normal routine activity, including simple exercising, and reassurance is a key factor in initiating a treatment program. Practical advice should consist of having the patient avoid the pain-provoking activity whereas maintaining a normal level of nonvigorous activity during a period of symptom exacerbation. A short period of rest may be helpful, but strict bed rest should be discouraged. Patient education should emphasize self-care, proper posture and body mechanics, and judicious and progressive exercise. In a randomized, controlled trial (RCT), Klaber et al.[15] found that advice toward self-care alone was as effective when compared with physical therapy consisting of simple advice, physical modalities, mobilization, and exercise.

s0035 Medical Therapy

p0160 Most common medications used in the treatment of axial neck pain are over-the-counter analgesics, nonsteroidal anti-inflammatory drugs (NSAIDs), narcotic analgesics, muscle relaxants, and antidepressants. Despite their ubiquitous use, a paucity of clinical trials remains on the efficacy and comparative safety of any of these medications in patients with axial neck pain.

s0040 Over-the-Counter Analgesics

p0165 Ideally, acetaminophen or acetylsalicylic acid should be tried as a first-line course of pharmacotherapy in mild-to-moderate neck pain, given their relatively safe side-effect profiles compared with NSAIDs and opiates. Many patients, however, find these medications inadequate in providing pain relief and require a second-line therapy. Indeed, a study comparing acetaminophen with diclofenac in the treatment of hip or knee pain found acetaminophen as an inferior treatment.[16] Although the side effects are uncommon, they are not without consequence including gastric ulcer and dyspepsia.

s0045 Nonsteroidal Anti-inflammatory Drugs

p0170 If inflammation is the true underlying mechanism of a person's neck pain, regardless of the structural pathology, NSAIDs, with their analgesic and anti-inflammatory effect, should provide benefit. Indeed, NSAIDs are the most common line of drug therapy advised despite a lack of data demonstrating superior efficacy over other forms of pharmacotherapy in treating neck pain. This contrasts with extensive evidence supportive for the use of NSAIDs for acute and chronic low back pain (LBP). A meta-analysis of NSAID efficacy in patients with acute LBP has demonstrated greater short-term effect as compared with placebo.[17] Evidence of greater efficacy of NSAIDs in chronic LBP, however, was not found.

p0175 No strong data indicate a substantial difference in efficacy between the classes of NSAIDs. Anecdotally, variation in response commonly occurs with the different classes of NSAIDs. Therefore, if a lack of effect is seen with one NSAID, another one from a different class could be tried.

p0180 If the patient responds positively to an NSAID, it becomes imperative to monitor for adverse gastrointestinal, renal, or cardiovascular effects. Patients at risk, or those demonstrating an adverse effect, should have their NSAID discontinued and an alternative therapy considered.

s0050 Opiates

p0185 Currently, no available study is determining the efficacy of opiates in the management of chronic neck pain. Nevertheless, a few recent studies on the use of opioids in other pain disorders are worth mentioning. A double-blind, placebo-controlled study of oxycodone for treating osteoarthritis found it superior in providing pain relief and improved sleep,[18] and guidelines support their use in such patients.[19] In contrast, a recent systematic review found no conclusive evidence that opiates are effective in the long-term (>16 weeks) treatment of chronic back pain.[20] Bartleson[21] has found no additional improvement in function or rehabilitation in patients with LBP taking opiates. A large epidemiologic study in Denmark found that patients treated with opiates for chronic pain had greater levels of pain, poor self-rated health, increased levels of unemployment, lack of leisure-time physical activity, greater use of health care, and a lesser quality of life.[22] Also, an inherent loss of efficacy occurs at the same time as increasing side effects over time.[23]

p0190 From a practical view for patients with moderate-to-severe pain, judicious and short-term use of opiates may be necessary. Patients should first demonstrate a lack of response to nonopiate therapy and evidence of significant underlying cervical spondylosis. If used, they should be prescribed with a strict time frame and combined with a progressive, function-oriented rehabilitation program. If improvement with opiates is not observed within 2 to 3 weeks, they should be discontinued.

s0055 Muscle Relaxants

p0195 Spasms of the pericervical musculature are commonly associated with an acute exacerbation of axial neck pain, regardless of the underlying causative factor. No randomized studies have been reported on the use of muscle relaxants for axial neck pain. In patients with LBP, they have been reported to decrease muscle spasm and tenderness, improve range of motion, improve activities of daily living, improve pain-disturbed sleep, and have an additive effect of symptom improvement when combined with an NSAID.[24–26] These effects are greatest within the first week after initiating their use with a waning efficacy thereafter. They do not hasten a more rapid functional recovery; commonly cause adverse effects, including sedation, dry mouth, or both; and carry a risk for physical dependence.[27]

p0200 If considered, muscle relaxants are best used in the presence of palpable muscle spasm and as a short-term adjunct to an analgesic. They should be limited to no more than 2 to 4 weeks.

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s0060 ### Antidepressants

p0205 No studies are specific to the treatment of neck pain demonstrating efficacy of antidepressants. Studies of antidepressants on chronic LBP have demonstrated a modest improvement in pain severity in comparison with placebo, but insignificant differences in functional status.[28,29] Common side effects include dry mouth, dizziness, drowsiness, weight gain, sexual dysfunction, and cardiac conduction abnormalities.

p0210 Antidepressants should be considered as an adjuvant in the medical treatment of neck pain. Application of them is best in patients who demonstrate a depressive component to their pain problem or as an aid in patients with sleep difficulty, or both.

s0065 ## Physical Therapy

s0070 ### Therapeutic Exercise

p0215 Therapeutic exercises involve the active treatment of physical dysfunction or injury with the intention to restore normal function. Therapeutic exercises used by physical therapists include cervicothoracic stabilization and strengthening, stretching, and relaxation techniques. Dynamic endurance and isometric strength training in women with chronic or recurrent neck pain yielded better pain and disability outcomes at 1-year follow-up compared with a control group given advice on exercise.[30] The long-term benefits can be maintained by continuing training as infrequently as twice a week. Stretching and aerobic exercises alone proved to be a much less effective form of training than strength training. In another study with long-term follow-up (1–2 years), strengthening exercises alone or in combination with spinal manipulation therapy resulted in significantly better pain and disability outcomes than the use of manipulation alone.[31]

s0075 ### Physical Modalities

p0220 A plethora of adjunctive physical modalities are commonly used by the physical therapist, including diathermy, ultrasound, transcutaneous electrical nerve stimulation, electrical muscle stimulation, hydrotherapy, and traction. Despite their accepted and ubiquitous use, a recent best-evidence synthesis of the literature (1980–2006) examining such passive modalities alone or in combination with medications did not demonstrate improved pain and disability outcomes in the treatment of subacute or chronic neck pain when compared with other modalities, usual care from a general practitioner, mobilization, or sham intervention.[32]

s0080 ## Manual Therapies

p0225 Manual therapy consists of hands-on mobilization of the neck within its normal range of motion. A best-evidence review of four RCTS has consistently demonstrated that mobilization or exercise sessions alone or in combination with analgesics had better pain and disability outcomes in the short term (4–13 weeks) in subjects with subacute or chronic neck pain when compared with usual care provided by a general practitioner, pain medications, or self-care advice.[32] Differences between the groups, however, lose significance at longer-term follow-up (3–12 months). In the same review, four other RCTs were evaluated that showed cervical spine manipulation alone or with advice and home exercises not associated with greater pain or disability reduction in the short or long term when compared with mobilization with or without traction, strengthening exercises, or manipulation.

p0230 In a recent systematic review of 13 RCTs, neck exercises with the addition of cervical mobilization or manipulation, or both, as a multimodal application has proved beneficial for pain relief, functional improvement, and global perceived effect for subacute and chronic mechanical neck disorders.[33] The evidence did not favor mobilization, manipulation, or both without exercise. In addition, exercise alone provided less patient satisfaction than exercise plus manipulation.

s0085 ## Soft Collars

p0235 Using a soft collar with the neck in mild flexion may help alleviate acute pain and muscle spasm. It may also provide a feeling of security while the patient naturally resolves his or her symptoms. In a recent best-evidence synthesis, soft collars were found to have either no or less benefit when compared with active therapies, rest, or usual care prescribed by a primary care physician.[32]

s0090 ## Spinal Injections

p0240 Spinal injections are also frequently tried as a form of minimally invasive therapy for axial neck pain. Structures injected include facet joints, nerve roots via the neuroforamen, and the epidural space via interlaminar placement. Pain relief lasting longer than the known, relatively short duration of action of local anesthetics and steroids is commonly reported in observational studies. However, higher quality scientific data has failed to demonstrate much evidence that such injections provide significant relief of pain or disability long term.

s0095 ### Epidural Steroid Injections

p0245 No randomized evaluations of cervical epidural steroid injections, translaminar or transforaminal, in managing axial neck pain have been reported. In one comparative trial, epidural injection of methylprednisolone and lidocaine demonstrated superior pain relief and function compared with intramuscular injection of the same agents at 4-week and 1-year follow-up in patients with chronic neck pain with radiation into the arm.[34]

s0100 ### Facet Joint Injections

p0250 The facet or zygapophysial joints are paired diarthrodial articulations, with each joint receiving a dual nerve supply consisting of medial branch nerves derived from the dorsal primary rami of the two adjacent nerve root levels above

and below each joint. They have been shown to be a source of pain in the neck, and referred pain in the head and upper extremities.[10,35] Focal injections into the joint (Figs. 5–1 and 5–2), or nerves that supply a particular joint, have been scrupulously studied as a diagnostic test. Single injections are subject to a high number of false-positive results. The joint or nerve block should consist of local anesthetic with near or complete relief of pain, and compared with injection of a placebo with minimal or no relief of pain on a separate occasion, to make diagnostic injection testing specific.[36] Based on placebo-controlled diagnostic blocks, facet joints have been implicated as responsible for spinal pain in 54% to 67% of patients with neck pain.[37,38] Placebo-controlled blocks, however, may be impractical and, indeed, unethical in a clinical setting. An alternative test determined to have good validity is the comparative block technique, which utilizes local anesthetics of known different duration placed in the same joints/ medial branch nerves at separate settings.[39,40] A recent systematic review of comparative local anesthetic injections or medial branch blocks has determined strong evidence in sensitivity, specificity, false-positive rates, and predictive value in the utility of diagnosing facet arthropathy as a source of neck pain.[41]

f0010 **FIGURE 5–1.** Lateral view of C23 facet joint injection with arthrogram.

f0015 **FIGURE 5–2.** Anteroposterior view of C23 facet joint injection with arthrogram.

p0255 Limited evidence exists that facet joint injections provide any substantial therapeutic benefit in patients with neck pain. In a controlled trial of intra-articular injection of local anesthetic versus local anesthetic with steroid, Barnsley et al.[42] note no appreciable long-term difference. This study was performed on patients whose origin of neck pain was posttraumatic after a whiplash injury, and thus may not be applied across a heterogenous population. In a randomized, double-blind, controlled trial using comparative, controlled diagnostic blocks of cervical medial branch nerves in the treatment of chronic neck pain, Manchikanti et al.[43] found significant reduction in pain relief, functional status, and psychological status up to 12 months compared with baseline measurements with procedures repeated 3.4 and 3.8 times, respectively. No difference was found between patients receiving local anesthetic injections alone compared with patients receiving local anesthetic combined with steroid. They conclude that therapeutic cervical medial branch blocks can be repeated at 3- to 4-month intervals to provide ongoing benefit.

Cervical Facet Denervation

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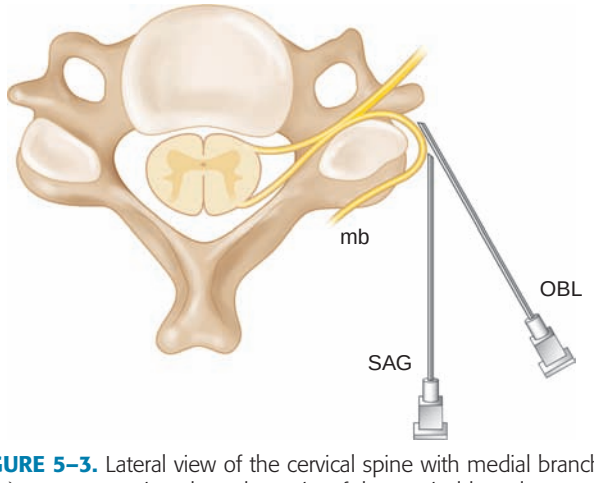
p0260 If facet blocks have determined facet arthropathy as a substantial component to a patient's neck pain complaints, the patient may be a candidate for a cervical facet denervation procedure. In this procedure, a radiofrequency needle is placed tangentially, along the waist of the anterolateral aspect of the cervical lateral mass, where the medial branch nerves are readily accessible and identified (Figs. 5–3 and 5–4).

p0265 Cervical facet denervation provides long-term pain relief through radiofrequency denaturation of the medial branch



f0020 **FIGURE 5–3.** Lateral view of the cervical spine with medial branch (mb) nerves coursing along the waist of the cervical lateral masses. Note radiofrequency needle placement tangentially along the nerve in parasagittal (SAG) and oblique (OBL) planes.

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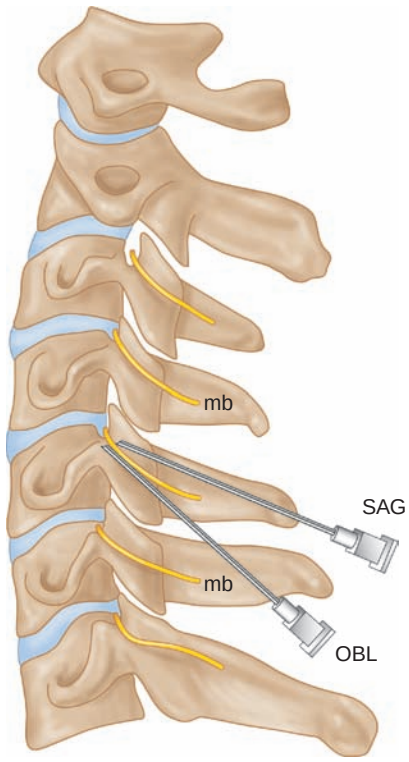

f0025 **FIGURE 5–4.** Axial view of the cervical spine with medial branch (mb) nerve coursing along the waist of a cervical lateral mass. Note radiofrequency needle placement tangentially along the nerve in parasagittal (SAG) and oblique (OBL) planes.

nerves supplying a painful joint. In a controlled study of patients with chronic neck pain (mean duration, 34 months), 24 patients were identified to have cervical facet arthropathy with the use of a double-blinded, placebo-controlled, local anesthetic block technique.[44] Criteria for a positive diagnosis required complete relief of symptoms after injection of local anesthetic on two different occasions, and no pain relief with the injection of normal saline. Of these patients who met the diagnostic criteria, all underwent a subsequent blinded procedure. The treatment group underwent a radiofrequency lesioning of the medial branch nerves corresponding to the painful joint(s), whereas the control group underwent similar placement of the electrodes but without lesioning. Criteria for a positive therapeutic response consisted of complete pain relief and the restoration of all four activities of daily living that the patient indicated as restricted before the procedure. At 6-month follow-up, 63% (n = 7) of the treated group and 12% (n = 1) of the control group remained pain free with resolution of their disorder-specific disability. The median time to return of 50% or greater of the preoperative level of pain was 9 months in the treatment group and 8 days in the control group ($P = 0.04$). All patients who were pain free at 3 months showed significant improvement of psychological distress testing compared with their testing results before the procedure. Only 1 patient whose pain remained present at 3 months showed improvement in psychological distress. A subsequent follow-up study concluded that patients can expect 9 months to 2 years of complete relief of pain after an initial procedure and 5 months to 1.5 years after repeat procedures.[45] Recently, Husted et al.[46] have reported that patients after an initial successful radiofrequency denervation procedure had a 95% success rate after a repeat procedure with a mean duration of 9 months. Boswell et al.[47] have systematically evaluated medial branch neurotomy results in randomized and observational studies, and concluded that there was moderate evidence for short- and long-term relief of facet-based neck pain. On the other hand, in a systematic review, Niemistö et al.[48] have determined only limited evidence that radiofrequency denervation had a positive short-term effect on the treatment of cervical facet joint pain.

p0270 Potential adverse effects are rare. They include transient, rarely permanent numbness in the cervical region, radiculitis, and slight loss of muscle strength of the upper extremity. Permanent complications are rarely reported.

SURGICAL MANAGEMENT

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The most important point to be emphasized in the handling of patients with mechanical disorders of the cervical spine is that operation is rarely required. However, a small percentage of patients become severely and chronically disabled by pain, which is amenable to judicious operation. In the treatment of these patients there are three main considerations: the selection of the right patient, the selection of the right level or levels, and the selection of the right operation.[49]

Au4

p0280 Oddly enough, these words first written in 1969 by Simmons and Bhalla[49] are still echoed in the literature today. With considerable controversy remaining regarding operative intervention in axial neck pain, acceptable indications include severely incapacitating pain caused by cervical degenerative disc with good clinical examination, imaging, and provocative discography correlation; presence of upper cervical radiculopathy (C3 or C4) that mimics axial neck pain; and disabling neck pain caused by pseudoarthrosis from previously attempted fusion.

p0285 To offer a surgical intervention that provides an appropriate chance of success, one must be able to accurately diagnose axial neck pain. As noted previously, clinical examination and imaging rarely provide conclusive evidence of the source of pain generation. An increase in interest in optimizing treatment outcomes has created interest in diagnostic injections as a screening tool for surgical intervention. The literature of the diagnostic capacity of these injections as they relate to surgical outcomes unfortunately remains quite scant.

p0290 Recently, Cohen and Hurley[50] reviewed the ability of diagnostic spinal injections to predict surgical outcomes. No data remain on the use of diagnostic cervical facet joint injections and their utility for surgical decision making. Cervical selective nerve root injections have been utilized as a method of determining the level of a painful radicular component with good surgical correlation.[51,52]

Au1 p0295 Although the debate continues regarding cervical PD as a concise and valid tool in determining the presence of cervical disc(s) as a source to a patient's neck pain complaints, the literature is even less robust when evaluating its validity using surgical results as the defining outcome. Based on Cohen and Hurley's[50] review of the available studies (12 retrospective and 1 observational), surgical success rates were reported to be about 75% to 80% at intermediate to long-term follow-up when preoperative provocative discography was utilized in diagnosing the source of neck pain. In contrast, reported success rates in patients receiving a fusion for the treatment of axial neck pain without discography had a more varied response, ranging from 30% to 90%, with most reporting around 60%. The authors[50] remark that a pattern exists whereby "higher surgical success rates tend to be reported when discography is used as a screening tool." Limitations of the available data include a lack of studies with cohort groups of patients who did not undergo discography, flawed methodology, nonstandard outcome measures, and varied follow-up periods.

p0300 In reviewing relevant studies, Kikuchi et al.[53] have evaluated surgical outcomes of 138 patients who underwent preoperative discographic screening with subsequent anterior discectomy with fusion for axial and radicular pain. They have found that 80% of the patients had no to mild discomfort that did not interfere with work at 1-year follow-up. In a control cohort that underwent cervical fusion without discographic screening, only 60% had favorable outcomes. In another retrospective analysis, Zheng et al.[54] compares the value of cervical magnetic resonance imaging (MRI) versus discography in selecting the level for discectomy and fusion. All 55 patients in their study had a diagnosis of cervical discogenic pain with failure of a minimum of 6 months conservative care. All underwent preoperative MRI and discography (C3-4 through C6-7) followed by computed tomography, and received an anterior cervical discectomy and fusion (ACDF) using Simmons' keystone technique, with a minimum of 2 year of follow-up (range, 2–7 years). Positive discography was found in 79 levels: 63% of dark discs, 45% of speckled discs, 59% of small herniated discs, and 59% of torn discs. Based on their criteria for abnormal cervical disc morphology of MRI, 100 levels could be the source of pain. Of the 79 discs exhibiting positive discogram findings, only 58 of these appeared abnormal on MRI. Successful fusion was achieved in 95% of patients with an overall satisfactory result in 76% of patients. They determined that MRI had a relatively high false-positive rate (51%) and false-negative rate of 27%. In our opinion, this spared 21 discs that may have been potentially operated on if only MRI had been used for diagnosis, and defined the ability of discography to accurately identify symptomatic discogenic sources of pain.

p0305 With the advent of motion-sparing technology, it is now possible to treat cervical pathology whereas preserving the functional movement of the spinal segment. Although no studies have undertaken to specifically assess the use of total disc replacement in the treatment of discogenic neck pain, several positive trends have been shown when arthroplasty is used for other cervical pathologies. Recently, Sasso et al.[55] reported findings of a multicenter IDE study comparing outcomes of Bryan disc cervical disc arthroplasty with ACDF in the treatment of single-level cervical disc pathology. A total of 115 patients with single-level, symptomatic, cervical radiculopathy, or myelopathy who did not respond to nonoperative management were randomized to receive either a total disc replacement or instrumented ACDF. Both groups experienced similarly significant decreases in mean Neck Disability Index at the 12- and 24-month follow-up periods, but there was a significantly larger decrease in the mean Neck Pain Score for the arthroplasty patients compared with the fusion patients (72 before surgery to 18.5 after surgery vs. 72.8 before surgery to 35.6 after surgery, respectively). Although the noted resolution of neck pain has created a great deal of outside interest for further study, it must be emphasized that all of these patients had neurologic abnormalities with or without neck pain. No conclusion could be drawn whether improvement in neck pain would occur in those with only preoperative axial neck pain. Au2

p0310 In summary, axial neck pain follows a natural course of good outcomes when conservative management is used. With the use of medication, physical therapy, and nonsurgical interventions, patients can expect to achieve good results 79% of the time. In those patients with unsuccessful responses to extensive nonoperative management, surgical treatment with good-to-excellent outcome can be achieved so long as there is strict adherence to selecting the right patient, selecting the right level(s), and selecting the right operation.

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