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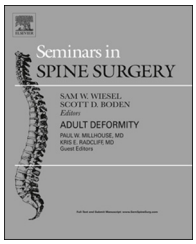

Nonoperative management of cervical disc herniations: An evidence-based approach

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ABSTRACT

This article aims to review the available evidence in support of the various nonoperative treatment options for cervical disc herniations. There is a lack of evidence to support most medications, modalities, and acupuncture. There is good evidence to support the use of anticonvulsants and antidepressants for the treatment of neuropathic pain that can be related to cervical disc herniations. Physical therapy and manual therapy have been shown to help improve acute and chronic neck pain. Cervical epidural steroid injections, using an interlaminar approach, have been shown to provide short and long-term relief in pain related to cervical disc herniation.

1. Introduction

Cervical disc herniations are a common cause of neck pain and disability. The initial management of neck pain with or without radiculopathy caused by a cervical disc herniation is usually non-surgical. There are numerous conservative care options to consider with various degrees of scientific evidence to support their use. One major challenge in examining the available literature on neck pain is that the diagnosis of a cervical disc herniation is often not made clear. In addition, the conservative treatment of neck and low back pain is very similar, but there is much more literature assessing nonoperative treatment options for low back pain. Assuming there are no signs of myelopathy or a progressive neurological deficit on exam, most patients and clinicians will choose a combination of conservative care options before considering surgical intervention. The severity of pain and impairment on function may dictate the need for stronger medications and interventional procedures.

2. Pharmacotherapy

The initial management of neck or arm pain caused by a cervical disc herniation involves the use of medications for symptom relief. Although the role of pharmacotherapy in the management of cervical disc herniations has been inadequately addressed in the literature, various medications are widely used in both the acute and chronic states. The options include non-steroidal anti-inflammatory drugs (NSAIDs), acetaminophen, oral corticosteroids, muscle relaxants, anticonvulsants, antidepressants, topical agents, and opioids. The widespread use of these medications necessitates an in-depth look into each drug classes.

3. NSAIDs

Although no standard treatment regimen exists for cervical disc herniations, many physicians consider NSAIDs the first-line agents in the treatment of neck pain. The goal is to provide adequate pain relief in order to foster participation in a rehabilitation program.[1] Treatment strategies include use of NSAIDs for several weeks as needed for pain relief. Although there is no evidence for their use specifically in the treatment of cervical disc herniations, NSAIDs have been shown to be effective in treating low back pain. A Cochrane review looked at 65 trials, of which close to half were considered high quality, where NSAIDs were found to be effective for short- and

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long-term relief in acute and chronic low back pain.[2] No similar study has been done for neck pain.

NSAIDs inhibit both cyclooxygenase 1 and 2 (COX-1 and COX-2) thereby preventing the synthesis of prostaglandins and thromboxanes, which have been implicated in the pain response in cervical radiculopathy.[3] It is believed that the selective inhibition of COX-2 provides both anti-inflammatory and analgesic effects while minimizing deleterious effects on the gastrointestinal tract. Celecoxib (Celebrex) is a selective COX-2 inhibitor that may be used in patients at risk for peptic ulcers and has been shown to have less gastrointestinal toxicity.[4] Although a patient's response to various NSAIDs may be different, there is good evidence that there is no difference in efficacy within the drug class.[5] Regardless of the NSAID used, patients on long-term treatment should be monitored for kidney, liver, and gastrointestinal toxicity. Clinicians may consider prescribing an H2 blocker or proton pump inhibitor (PPI) in conjunction with an NSAID in patients with gastrointestinal side effects. Caution should also be used in patients with cardiovascular disease, as NSAIDs have been associated with an increased relative risk of stroke and myocardial infarction.[6,7]

Acetaminophen is a mild analgesic medication that is not typically classified as an NSAID but does exhibit weak anti-inflammatory properties. There is no good evidence to support its use in neck pain related to cervical disc herniation, however, it is a commonly used alternative to over the counter NSAIDs and does not cause gastrointestinal irritation. Caution should be taken when prescribing acetaminophen as it can cause liver toxicity and overdoses can be fatal. Dosages should not exceed 3000 mg a day and are taken in divided doses approximately every 6–8 h. It is important to inform patients that acetaminophen is often found in combination with other narcotic medications (oxycodone and hydrocodone) as well as over the counter cold medications.

4. Muscle relaxants

Muscle relaxants refer to a group of medications, with different mechanisms of action, which alter muscle tone and function. Spasms occur as a result of increased tension at muscle insertion sites causing a buildup of anaerobic byproducts. Muscle relaxants are often used in patients with muscle spasms, muscle pain, and stiffness.[8] They reduce pain and local tenderness and can help increase range of motion. A common sideeffect is somnolence. This may be limiting to some patients but useful in patients with disturbed sleep secondary to painful musculoskeletal conditions. Bornstein and Korn[8] performed two randomized control trials with over 1000 patients of which one-third were patients with acute spasms in the cervical region. They found that cyclobenzaprine 5 and 10 mg three times a day (TID) had significantly higher patient rated impression of change of symptoms, medication helpfulness and relief from neck pain. Additionally, they found that 5 mg dosing was as effective as 10 mg dosing with less sedation.

The criticism of many studies looking at this class of drugs is poor methodology. Despite the lack of good-quality studies, some evidence indicates non-benzodiazepine muscle relaxants are moderately effective in providing short-term relief of up to 2 weeks.[8] Daytime sedation can be very limiting for some patients. Methocarbamol and metaxalone are often used as less sedating alternatives, but there is limited evidence of their effectiveness.[9,10] Although muscle relaxants are used for acute and chronic management of patients with cervical disc herniation, there is no evidence in the literature that shows that they alter the natural history. However, there is evidence that shows the combination of NSAIDs with muscle relaxants is better than an NSAID alone at improving pain relief in acute low back pain with muscles spasms.[11]

5. Anticonvulsants and antidepressants

Anticonvulsants such as gabapentin and antidepressants such as tricyclics and selective serotonin–norepinephrine-reuptake inhibitors (SSNRIs) are commonly used to treat chronic neuropathic pain syndromes. They are also used in patients who have cervical radicular pain. There is no evidence in the literature that addresses their use in the treatment of symptomatic cervical disc herniations. There is some evidence to suggest that tricyclic and serotonergic antidepressants have an analgesic effect independent of their antidepressant properties and reduce chronic pain.[12] It was found that serotonin-containing neurons in the raphe nuclei send descending fibers to the gray matter at all levels of the spinal cord.[13,14] Furthermore, the analgesic effect of morphine and electrical stimulation on the raphe nuclei was hampered by a serotonin antagonist P-chlorophenylalanine.[15] These findings suggest serotonin acts on descending pathways exerting its nociceptive effect.

Duloxetine (Cymbalta), an SSNRI, is FDA approved for major depressive disorder, neuropathic pain associated with diabetic peripheral neuropathy, generalized anxiety disorder, fibromyalgia, and chronic musculoskeletal pain. A recent systematic review and meta-analysis on pharmacotherapy for neuropathic pain found strong recommendations for the use of tricyclic antidepressants, serotonin–noradrenaline reuptake inhibitors, gabapentin (Neurontin), and pregabalin (Lyrica) as first-line agents in the treatment of neuropathic pain.[16] Common side effects include sleepiness, dizziness, headaches, depression, weight gain, and lower extremity edema.

6. Oral corticosteroids

Oral corticosteroids are commonly used in the setting of acute neck pain with or without radiculopathy from a cervical herniated disc. They are often prescribed as a Medrol dosepak or tapering dose of prednisone over 6–12 days. In one study, 13 out of 22 patients whose pain was inadequately treated for 6–10 weeks with a combination of NSAIDS, manual/mechanical traction and strengthening exercises got relief from a single week of oral steroid taper.[1] A recent case series of patients with cervical disc herniation with neck and radicular arm pain that failed NSAIDs and anticonvulsant therapy showed significant improvement with oral mini-pulse therapy (i.e., tapering the dose of betamethasone over 16 days).[17]

Despite positive results from a few case series, their use has not been shown to alter the clinical course of patients suffering from a cervical herniated disc and symptoms of radiculopathy. Furthermore, significant side effects of hyperglycemia, insomnia, irritability, and sometimes osteonecrosis make it an unfavorable option. Despite the lack of evidence to support its use in cervical disc herniations, corticosteroids are commonly prescribed in acute cases of neck pain with or without radiculopathy.

7. Opioids

Opioids are used for their analgesic effect in patients who have moderate to severe pain from cervical disc herniations. A recent meta-analysis and systematic review on neuropathic pain recommends tramadol as a second-line agent and stronger opioids (particularly oxycodone and morphine) as a third-line agent.[16] Tramadol, a mild narcotic, may have properties that affect serotonin and norepinephrine reuptake and has been reported to cause transient serotonin syndrome in case studies when used in conjunction with a selective serotonin reuptake inhibitor.[18] A previous systemic review suggests that opioids may be effective in the treatment of pain of up to 8 weeks.[19] Caution should be taken in using narcotics for long-term treatment because of their addictive and abuse potential. Common side effects include itching, nausea, dizziness, drowsiness, and constipation. In addition, chronic use can lead to the development of tolerance and the need for escalating doses to maintain analgesia, further increasing the incidence of adverse effects.

8. Topical medications

Topical medications are commonly prescribed for a variety of musculoskeletal complaints, including neck pain and cervical radiculopathy. There is no evidence to support their use in patients with cervical disc herniation. In a recent systematic review on pharmacotherapy for neuropathic pain in adults, a weak recommendation was made for Lidocaine patches as second-line therapy for neuropathic pain.[16] Because Lidocaine patches are generally safe to use, they are a reasonable option to consider for patients with cervical radiculopathy.

9. Modalities

9.1. *Cervical collar*

For patients with acute neck pain secondary to radiculopathy, a short course of immobilization with a cervical collar may reduce neck and arm pain. This modality is thought to diminish inflammation around an irritated nerve root.[20] The warmth provided by wearing the collar may be therapeutic according to some. In a randomized controlled trial looking at patients with less than 1 month of symptoms comparing cervical semi-hard collar with no treatment, those in the treatment group had significantly greater reduction in arm and neck pain versus the control group.[21] The patients were advised to wear the collar during the day for 3 weeks. Many clinicians believe that prolonged use more than 2 weeks should be avoided to prevent cervical muscle atrophy and would contend with 3 weeks of use in the aforementioned trial. In summary, there may be some limited utility of cervical collar in acute cervical herniated disc with radicular symptoms.

9.2. *Other modalities*

Transcutaneous electrical nerve stimulation (TENS), heat and cold, ultrasound, and electrotherapies are commonly used in the treatment of musculoskeletal pain. The effectiveness of these therapeutic options is controversial; however, they are relatively safe making them a reasonable option as an adjunct to conservative strategies. Melzac and Wall[22] described the gate control theory of pain, which serves as the basis for TENS. Their role is to provide pain relief in order to allow better tolerance of physical therapy, home exercises and participation in activities.[23] A Cochrane review of physical treatments for mechanical neck pain concluded that there is insufficient evidence from clinical trials to support the use of these modalities.[24]

10. Physical therapy

Physical therapy (PT) is the mainstay of conservative treatment in managing patients with painful cervical disc herniations with or without radiculopathy. Results of systemic reviews support the use of combined mobilization, manipulation, and exercise in acute and chronic neck pain.[25] Exercises used by physical therapists include isometric neck strengthening, neck and shoulder stretching, back and inter-scapular strengthening, posture exercise, and aerobic exercise. Isometric exercises with neck flexion and extension can be done during the acute phase to strengthen paravertebral muscles.[26] Patients with chronic neck pain often have weak neck musculature and cervical strengthening exercises have been shown to decrease pain and increase neck range of motion.[27,28]

Highland et al.[29] used a MedX cervical extension machine to measure the strength and range of motion changes as subjects underwent an 8-week training course, which included stretching and strengthening exercises. All the diagnostic groups, including those with herniated discs, had significant gains in average strength. These patients also reported significant reduction in their perception of pain as a result of the program with the majority of patients returning to work. A randomized controlled trial, comparing exercise, spinal manipulation, or a combination of the two, supports the finding of the aforementioned study with MedX.[30] This study showed that greatest gains were made in strength, ROM, and flexion endurance. The results were less favorable for pain, neck disability index, and general health status.

A common problem in patients with neck pain from all causes is poor posture. A head-forward position with rounded shoulders is a routine finding on inspection of patients with neck pain. Chin tucks are used to improve head and neck

posture.[26] Shoulder shrugs and rolling are done to relieve neck muscle tension. Upper-body and back exercises improve stability of the spine. No studies have compared the effectiveness of the different exercises.[42]

Kuijper et al.[21] looked at patients with a recent diagnosis of radicular pain comparing PT with a focus on mobilization and stabilization of the cervical spine and a home exercise program. The treatment group underwent physical therapy twice a week for 6 weeks, while the control group continued daily activities without specific intervention. The patients who did physical therapy had significant reductions in neck and arm pain on a visual analogue scale compared to the patients who did not get any intervention. A cohort study that looked at an individualized approach to PT using clinical decision-making algorithms to decide on which type of treatment to give a patient also showed positive results.[31] Despite the lack of firm guidelines to strongly support a specific combination of exercises, PT remains first-line treatment for patients with cervical herniated disc who present with neck pain and/or radicular symptoms not requiring surgery.

11. Injections

Cervical radicular pain occurs commonly in the adult population with an annual incidence of 83 per 100,000. Conservative treatment options are the mainstay of treatment with the natural progression of cervical radicular pain being favorable with only 20–30% of patients requiring surgery.[32] A common reason for cervical radiculopathy is a cervical disc herniation. Multiple mechanisms have been described to explain the cause of pain. Direct compression of the nerve root by the disc is one explanation. A second mechanism is leaching of chemical irritants, such as metalloproteinase, interleukin-6, prostaglandin E2, and nitric oxide, from the disc that inflames the nerve root.[33] Epidural injection of corticosteroids is a common practice for the treatment of cervical radicular pain. Epidural injections are a treatment option offered to patients prior to surgery barring any progressive neurological deficits or contraindications to the procedure. Advanced imaging with MRI or CT is the standard of care prior to proceeding with an injection to confirm the presence and location of a disc herniation and to rule out other causes that would contraindicate an injection including but not limited to malignancy, infection, or severe spinal stenosis with spinal cord compression.

Epidural injection of corticosteroids can be performed using two approaches, interlaminar and transforaminal (Figs. 1 and 2). The interlaminar approach is the more frequently utilized technique. The procedure is most commonly performed at the C6–7 and C7–T1 interspace due to a larger epidural space improving safety. Fluoroscopy is becoming standard of care due to a high rate of false loss of resistance, intravascular injection seen on live fluoroscopy, and avoidance of accidental intrathecal injection due to dural puncture. Serious complications are rare with the interlaminar approach, but include spinal cord trauma, epidural hematoma, infection leading to epidural abscess, and subdural/subarachnoid injection.[34]

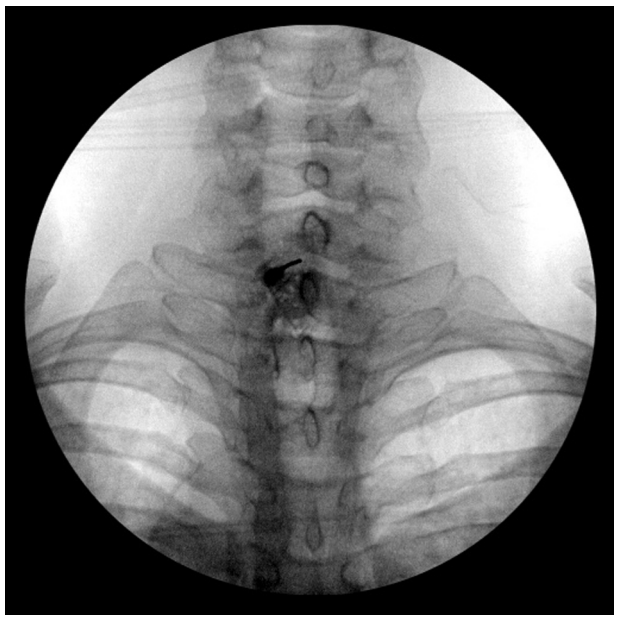

Fig. 1 – Cervical interlaminar epidural steroid injection. The placement of the needle is between the C7 and T1 lamina into the epidural space.

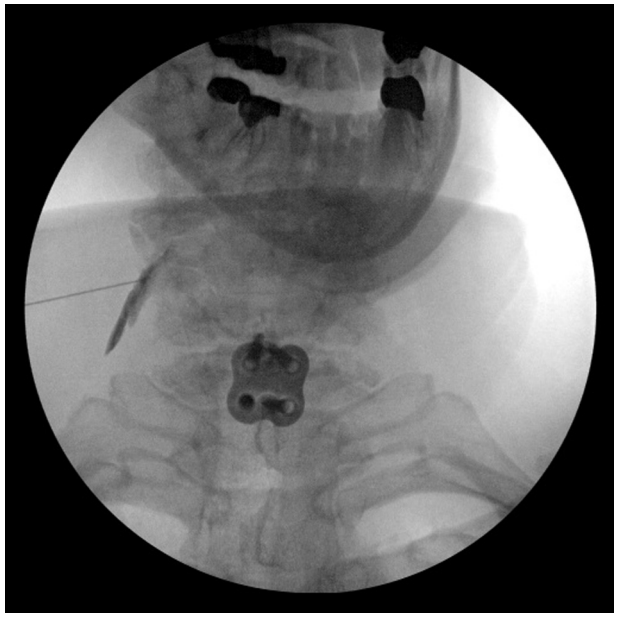

Fig. 2 – Cervical transforaminal epidural steroid injection. The needle is placed adjacent to the C5–6 foramen. Injection of the dye preceding the steroid injection shows the outline of the exiting C6 nerve and ensures that the needle is not in the vertebral artery.

The effectiveness of cervical interlaminar epidural steroid injections has been shown in multiple randomized controlled trials. Stav et al. performed a randomized controlled trial comparing interlaminar epidural injection of local anesthetic and methylprednisolone versus intramuscular injection of local anesthetic. Subjects in the treatment group showed significant improvement in pain, decreased pain medicine consumption, and higher return to work rates.[35] Diwan et al.

performed a systematic review with 7 out of 32 studies included for analysis with the primary outcome being short-term pain improvement up to 6 months and long-term pain improvement greater than 6 months. They concluded there was good evidence to support the injection of anesthetic and steroid, while the evidence was fair for injection of local anesthetic alone.[36] Limitations of the studies include small sample size, lack of true placebo group due to emerging evidence that injection of local anesthetic alone improves pain outcomes, and lack of fluoroscopy utilization.

Transforaminal epidural injections have been utilized for both therapeutic and diagnostic purposes prior to surgery. Anderberg et al. performed a prospective study on 30 patients with two-level degenerative disc disease seen on MRI ipsilateral to the patient's radicular symptoms. Selective nerve root block (SNRB) was performed at both levels using fluoroscopic guidance and injection of local anesthetic with 18 patients responding at one level and 11 responding at two level. There was no correlation between the injection level showing maximum pain improvement and the level of most significant pathology on MRI or neurologic findings. The authors concluded that SNRB may be a helpful tool in addition to physical exam and MRI findings in treatment planning for patients with two-level degenerative disc disease.[37]

There is a paucity of literature showing therapeutic benefit of cervical transforaminal epidural steroid injections with all being prospective or retrospective studies. Theoretically, the transforaminal approach delivers a potent dose of corticosteroids in close proximity to the pathologic nerve root and disc herniation thereby increasing effectiveness. However, there are no randomized, controlled trials looking at the benefit of transforaminal injections or comparing effectiveness head to head with interlaminar injections. Lin et al. performed a retrospective study of 70 patients who underwent a trial of transforaminal epidural injections prior to surgery with the main outcome being avoidance of surgery. They showed 44 of 70 (63%) patients opted out of surgery.[38] The limitations of this retrospective study are lack of a control group and lack of a validated outcome measure. Multiple other prospective studies showed transforaminal epidural injections given to patients opted out of surgery after treatment.[34] These studies all had a small sample size, lack of control group, and avoidance of surgery was the main outcome measured. Persson and Anderberg performed a prospective study on 140 patients with cervical radicular pain who underwent a series of 3 transforaminal epidural injections spaced three weeks apart. They showed >50% improvement in pain in 49% of patients with improved neck disability index between responders and non-responders.[39]

Cervical transforaminal epidural steroid injections have been scrutinized recently due to the risk of serious and potentially fatal complications. Scanlon et al. recently surveyed 287 physicians and identified 78 complications with 30 major complications reported including 16 vertebrobasilar infarcts, 12 spinal cord infarcts, and 2 combined (brain/spinal cord) infarcts.[40] In all, 13 of these cases resulted in death. Mechanisms of injury were related to direct trauma to the vertebral artery, vertebral artery dissection, or intra-arterial injection of a particulate steroid leading to distal infarction in the brain or spinal cord. Arterial spasm is another mechanism attributed to spinal cord infarction. Other serious complications reported include seizures, high spinal anesthetic block, and cortical blindness.[40]

Multiple methods to improve the safety of transforaminal injections have been described with the most common being aspiration for blood prior to injection, using live fluoroscopy during contrast injection, and switching to a non-particulate steroid such as dexamethasone. Other techniques often employed include digital subtraction angiography, minimizing manipulation of the needle with the use of extension tubing, blunt-tip needles, and injecting a test dose of anesthetic prior to corticosteroid injection.[34] With the lack of high-quality evidence regarding the benefit of transforaminal epidural injections and the risk of serious and potentially fatal complications, there needs to be a frank discussion with the patient prior to proceeding.

12. Manual therapy

Cervical radiculopathy is commonly treated with conservative measures.[41] Manual therapy includes spinal manipulation/mobilization and spinal traction. Murphy et al.[42] performed a prospective observational cohort study on 35 patients with the treatment focusing on spinal manipulation and neural/spinal mobilization with disability and pain as the main outcomes measured. A total of 77% of patients had significant improvement at a follow-up 3 months after treatment ended. Limitations to this study include lack of a control arm, no randomization, and use of multiple other treatment modalities including traction, medications, and epidural injections. Gross et al.[43] performed a systematic Cochrane review of spinal manipulation and mobilization for the treatment of neck pain. They showed moderate-quality evidence that manipulation and mobilization showed similar benefits in regard to improved pain, function and patient satisfaction at follow-up. There was low-quality evidence that manipulation improved outcomes over a control. Current data does not show a significant difference between spinal manipulation and mobilization over the favorable natural progression of cervical radicular pain. Also, spinal manipulation is not without its risks. There are multiple case reports of serious complications following cervical spine manipulation that cause spinal cord or brain injury. Injury or occlusion of the vertebral, carotid or radicular artery, epidural hematoma, fracture, or blunt trauma to the spinal cord at a stenotic level are a few mechanisms of injury. Prescreening with MRI would reduce the risk in cases with severe stenosis, infection, or malignancy.[44]

Traction is another commonly used manual therapy for the treatment of cervical disc herniation.[41] Traction can be employed manually or mechanically. Traction is thought to be helpful by unloading the structures of the spine including the discs, muscles, ligaments, and neural elements. Some believe that it helps with adhesions of the dural sleeve or relieve nerve root compression within the foramina. In addition, negative pressure inside the disc during traction may result in size reduction of the disc hernation.[45] Jellad et al. performed a prospective randomized study with 3

groups of 13 patients. One group underwent physical therapy and manual traction, second group underwent physical therapy and mechanical traction, and the third group underwent physical therapy alone.[46] Cervical pain, radicular pain, and disability were superior in the traction groups combined with physical therapy compared to physical therapy alone. Multiple other case studies have been performed showing effectiveness, but limitations in these studies include small sample size, lack of control group, and validated outcomes not measured.[45,47] Despite the lack of high-quality evidence, traction appears to be a safe treatment for cervical radicular pain secondary to disc herniation.

13. Acupuncture

Acupuncture is commonly used to treat painful conditions. Acupuncture is growing in popularity as patients suffering with pain seek out alternative treatments. The mechanism of acupuncture remains unclear. Some believe that stimulation of the paraspinal muscles stimulate the posterior ramus of the spinal nerve creating reflex inhibition of the radicular pain. Others believe that increased blood flow may play a role.[48] A study showed that acupuncture to the lumbar spine increased blood flow to the sciatic nerve in animals.[49] Acupuncture is considered safe with few major complications including nerve damage and pneumothorax. Minor side effects include injection site discomfort, bruising, and local infection.

Nakajima et al.[48] recently published a case series of 15 patients suffering with cervical radicular pain of at least 3-month duration caused by cervical spondylosis or cervical disc herniation. Acupuncture treatments were performed once weekly for 4 weeks into the cervical paraspinal muscles with pain and NDI as the primary outcomes measured after 4 treatments and at a 4-week post-treatment. They showed significant reduction of both pain and NDI in the majority of patients except for 2 patients with arm paresthesias that did not improve following treatment. Limitations to this study include small sample size, lack of a control group, and a short follow-up time period. Controlled trials are needed to make a more accurate assessment on acupuncture's efficacy for cervical disc herniations.

14. Conclusion

There are numerous conservative care options for managing pain related to cervical disc herniations. The evidence to support the use of medications and modalities in treating cervical disc herniations is lacking but a combination of NSAIDs, muscle relaxants, and sometimes, oral corticosteroids is still considered standard of care. There is good evidence to support the use of anticonvulsants such as gabapentin and pregabalin as well as the SSNRI, duloxetine, in the treatment of neuropathic pain. These medications are commonly prescribed for cervical radicular pain secondary to disc herniation. There is evidence to support the use of physical therapy, mobilization, and manipulation in treating neck pain with or without radicular symptoms; however, it is not clear what combination of exercises or manual therapy works best. There is strong evidence to support the use of cervical epidural steroid injections using an interlaminar approach. Transforaminal epidural steroid injections have low-quality evidence of efficacy with greater potential for a catastrophic event. Cervical traction may provide short-term relief in pain from cervical disc herniation but the evidence to support its use is weak. Acupuncture is considered as a reasonable and safe option for treating cervical disc herniations, but controlled trials are needed to support its use.

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