



Evidence-Based Physical Medicine and Rehabilitation Strategies for Patients with Cervical Radiculopathy Due to Disc Herniation

Disk Herniasyonuna Bağlı Servikal Radikülopatili Hastalarda Kanıta Dayalı Fiziksel Tıp ve Rehabilitasyon Stratejileri

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Abstract

When neck pain is accompanied with radiating arm pain in addition to motor, sensory, or reflex changes resulting from nerve root compression or irritation, it is defined as cervical radiculopathy. The aim of this narrative review is to overview recent evidence regarding the effectiveness of physical medicine and rehabilitation strategies with a holistic approach in the management patients with cervical radiculopathy resulting from disc herniation and to provide evidence-based recommendations on the management.

Key Words: Neck pain, radiculopathy, rehabilitation, conservative treatment

Özet

Sinir kökü kompresyonu veya irritasyonu nedeni ile motor, duyuşal veya refleks deęişikliklerin eşlik ettięi, kola yayılan ağrı ile beraber boyun ağrısının varlığı ise servikal radikülopati olarak tanımlanır. Bu derlemenin amacı, disk hernisi sonucu oluşan servikal radikülopatili hastaların tedavisinde fiziksel tıp ve rehabilitasyon yaklaşımlarının etkinliği ile ilgili son gelişmeleri bütünsel bir yaklaşımla gözden geçirmek ve tedavi konusunda kanıta dayalı tıp önerileri geliştirmektir.

Anahtar Kelimeler: Boyun ağrısı, radikülopati, rehabilitasyon, konservatif tedavi

Neck pain, affecting 4.82% of the world population in 2010, ranks second after low back pain among musculoskeletal disorders as one of the leading causes of years lived with disability, with a contribution of 33.6 million years (1). The 12-month prevalence of neck pain is reported to vary from 1.7% to 11.5%, and it is known to cause activity limitations (2). When neck pain is accompanied with radiating arm pain in addition to motor, sensory, or reflex changes resulting from nerve root compression or irritation, it is defined as cervical radiculopathy (3). Cervical radiculopathy results from herniated cervical discs in about 20% to 25% of the cases (4). The incidence of cervical radiculopathy due to disc herniation was calculated as 0.055 per 1000 person-years by the Bone and Joint Decade 2000-2010 Task Force on Neck Pain (2), who proposed to classify radicular neck pain as

Grade III with significant disability (5). Individuals with Grade III neck pain may have significant difficulties in functioning, along with activity limitations and participation restrictions, including limitations in doing housework and leisure activities, as well as restrictions in work participation/employment (6). It is generally agreed that focusing on functioning and encouraging activity and participation is a reasonable approach in the treatment of neck pain and its sequelae (7). Therefore, physical medicine and rehabilitation strategies, well known to focus on functioning (8), may play an important role in the management of Grade III neck pain. Furthermore, although Grade III neck pain may occasionally require more invasive approaches, such as surgical interventions, the paucity, unclarity, and inconclusiveness of evidence for the better effectiveness of surgical interventions for

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the management of cervical radiculopathy when compared to conservative management in the long term (9,10) justify the use of conservative treatment approaches/physical medicine and rehabilitation strategies as the preferred first-line treatment option in the management of this disabling condition.

The aim of this narrative review is to overview recent evidence regarding the effectiveness of physical medicine and rehabilitation strategies with a holistic approach in the management of patients with cervical radiculopathy resulting from disc herniation and to provide evidence-based recommendations on the management. This narrative review is intended to serve as an aid for clinicians for adapting conservative treatment options to the needs of their specific patients based on the available evidence.

Physical medicine and rehabilitation interventions in radicular neck pain and their evidence base

Educational interventions

Regarding evidence for the effectiveness of educational interventions in the rehabilitation of individuals with neck pain, contrary to low back pain, for the treatment of which there is a wide variety of educational interventions with demonstrated beneficial effects (11), a Cochrane review failed to provide any strong evidence for the effectiveness of such a very important physical medicine and rehabilitation intervention in neck pain with or without radiculopathy (12). However, recent evidence coming from a randomized controlled trial of 2012 [Jadad score (13): 4] suggested favorable effects of education on the cervical spine and appropriate advice on posture and activities, such as pushing, pulling, and lifting added to home exercise instructions with comparable effects to that of spine manipulation in patients with acute and subacute neck pain, about one-fourth of whom having pain radiating to the upper extremity (14).

Given the findings showing significantly worse ratings of individuals with cervical radiculopathy on questionnaires assessing fear avoidance beliefs and kinesiophobia than the healthy individuals (15), indicating potential activity limitations due to fear of pain, there is a rationale for the implementation of behavioral therapies in the treatment of patients cervical radiculopathy due to disc herniation. In line with this notion, a study showed that a type of cognitive behavioral approach, termed graded exposure in vivo treatment, aiming at restoration of function, activities of daily living, and return to work rather than reducing pain, was useful in reducing pain-related fear in patients with work-related upper extremity pain in general and not specifically in those with cervical radiculopathy (16). Additionally, two recent randomized controlled trials (Jadad scores: 4 and 5) provided some evidence of effectiveness of cognitive behavioral treatments combined with a physical therapy program consisting of mostly exercises in terms of long-term sickness absence and pain, disability, and quality of life in combined groups of neck pain patients with no exclusion criteria for radicular findings (17,18).

Exercise

Unfortunately, evidence-based exercise options are not many in the management of discogenic neck pain with radicu-

lar findings. A recent Cochrane review found low-quality evidence for the beneficial effects of neck strengthening exercise for immediate pain relief but not for function in acute neck pain patients with cervical radiculopathy (19). Another systematic review evaluating the effects of exercises in office workers with neck pain (with no definite exclusion criteria for discogenic neck pain) advocated muscle strengthening or muscle endurance exercises (20). The most recent systematic review confirmed the short- and intermediate-term pain-relieving effects of therapeutic exercise in patients with nonspecific chronic neck pain in general (21). A recent exercise trial for neck pain patients, including those with pain radiating to the upper extremity, yielded similar results in terms of pain relief in the short term and global perceived effect, with supervised neck and upper body strengthening exercise (the intensity of which was individualized to the specific patient) with and without cervical and thoracic spine manipulation using high-velocity, low-amplitude thrust techniques (22). It should be noted that a variety of exercises, such as functional exercises, aerobic exercise, and swimming, have been trialed in a very recent cross-sectional pilot trial including patients with cervicobrachial syndrome, with recommendations regarding careful control of the dose of therapeutic exercises (23). An important point is that there is a great need for high-quality studies to demonstrate the effectiveness of various types of exercises in the treatment of neck pain, particularly for neck pain and associated radiculopathy.

Workplace interventions/ergonomics

Neck pain is known to be associated with activity limitations in around 11.0% to 14.1% of workers each year, with risk factors mainly related to the work and the workplace, such as the high demand of work, lack of social support, posture at work, and inconvenient workstations for computer users (24). While a systematic review found low-quality evidence regarding significantly better effectiveness of an ergonomic intervention, such as a chair with a curved or flat seat pan or an arm board for pain reduction, when compared with no ergonomic intervention (25), a Cochrane review on the efficacy of workplace interventions in workers with neck pain was not able to provide conclusive evidence to support or refute pain-relieving effects of workplace interventions; however, this Cochrane review showed some favorable effects of these interventions on sick leave in the intermediate term (26). The beneficial effects of ergonomic interventions in full work time computer users with work-related upper extremity musculoskeletal disorders, including those with neck and arm symptoms, have recently been shown in a randomized controlled trial (Jadad score: 4). A set of ergonomic interventions comprising two 90-minute ergonomic training lessons, an ergonomic training booklet, and teaching of workplace adjustments based on ergonomic risk factors after a workplace evaluation and subsequent monthly checking of the maintenance of these adjustments was used. This office ergonomics program led to significant favorable changes in symptom characteristics in terms of the intensity, duration, and frequency as well as in function and health-related quality of life over 6 months when compared with the control group not receiving any ergonomic

intervention (27). Therefore, it seems that there is an important role for ergonomic interventions for improving functioning in a major life, area that is work.

Physical agents

Physical modalities discussed below are widely used in the treatment of neck pain.

Transcutaneous electrical nerve stimulation (TENS)

A Cochrane review on electrotherapeutic modalities for neck pain found that TENS was more effective than sham TENS based on very low-quality evidence in combined groups of patients with neck pain with or without radicular findings (28).

Therapeutic ultrasound

The Philadelphia Panel guideline of 2001 revealed no demonstrated benefit of ultrasound in chronic neck pain and no data on ultrasound for acute neck pain (29). While there are no systematic reviews published thereafter evaluating the efficacy of therapeutic ultrasound in neck pain, recent randomized controlled trials provided some evidence for the efficacy ultrasound in patients with neck disorders. A combination of therapeutic ultrasound, infrared radiation, and an exercise program for the correction of forward head posture was used in a randomized controlled trial (Jadad score: 4) in patients with cervical spondylotic radiculopathy, where the group with the exercise program showed significantly better reduction in pain and improvement in electrophysiologic parameters. The improvement of pain also in the ultrasound and infrared group after 10 weeks of treatment in this study may have implications on possible beneficial effects of ultrasound (30). A study comparing groups of patients receiving cervical spine isometric exercises + TENS + therapeutic ultrasound and patients receiving sham ultrasound in addition to the former two therapies in patients with neck pain without the exclusion criteria for discogenic neck pain showed similar effects in both groups regarding some functioning properties, such as concentration, reading, sleep, car driving, and work, therefore not supporting any additive value of ultrasound (31). It is obvious that the findings of these two studies do not allow us to make positive recommendations on the usefulness of ultrasound in the treatment of cervical radiculopathy; nevertheless, they encourage us to conduct high-quality research to reveal the efficacy of ultrasound in neck pain patients.

Low-level laser therapy

An earlier systematic review provided evidence for the efficacy of low-level laser therapy in individuals with neck pain, indicating pain reduction right after the treatment in those with acute pain and in the long term (22 weeks) in those with chronic pain. However, this review excluded studies evaluating patients with neck pain and associated radiculopathy (32). On the other hand, a very recent systematic review and meta-analysis of 2013 included one study of acute neck pain with radiculopathy and was not able to derive a positive conclusion on neck pain reduction, with low-level laser producing a non-statistically significant mean difference of 4.35 mm on a 100-mm VAS scale when compared with the placebo group (33,34). Nonetheless, the study evaluated revealed statistically significant differences

between the intervention and placebo groups regarding arm pain, neck flexion, and extension and neck disability, pointing to the potential beneficial effects of laser on neck function (33).

Pulsed electromagnetic fields

While pulsed electromagnetic field therapy was more effective than placebo for the treatment of neck disorders based on very low-quality evidence in a Cochrane review of 2009 (28), a recent randomized controlled trial (Jadad score: 3) did not support this finding, showing no significant pain- or disability-reducing effects of pulsed electromagnetic field therapy when added to a neck balance system in patients with Grade II neck pain (35) that is, patients without any signs of symptoms of major structural pathology (5). The effect of pulsed electromagnetic fields in patients with Grade III neck pain remains to be investigated.

Non-invasive brain stimulation techniques

Neuromodulation techniques, such as cranial electrotherapy stimulation, have also been used in the treatment of neck pain. However, a Cochrane review pointed to the lack of effectiveness of cranial electrotherapy stimulation in patients with neck pain (36).

Injection therapies

Epidural steroids

Epidural steroid injections are used to a great degree for the management of spinal pain, including low back pain and neck pain due to disk herniation. The route of administration of epidural steroids may be either interlaminar or transforaminal for the cervical spine (37). Regarding cervical interlaminar epidural steroid injections, a systematic review pointed to significant short-term and long-term effects for neck and arm pain relief based on level II-1 evidence, short-term pain-relieving evidence coming from randomized controlled trials, and evidence for long-term pain relief coming from mostly low-quality observational studies. There is a strong recommendation for interlaminar epidural steroid injections; however, the level of recommendation is 1C, pointing to the possibility of a change of the recommendation in the presence of future higher-quality evidence (38). A more recent systematic review revealed good evidence for the effectiveness of cervical interlaminar steroids combined with local anesthetics in patients with herniated disc and associated radiculopathy (39). Regarding cervical transforaminal epidural steroid injections, while there is a lack of systematic reviews, case series or retrospective studies suggested improvement in pain and disability associated with cervical radiculopathy resulting from disc herniation, either with image guidance using a lateral approach or with a CT-guided technique using a posterior approach (based on poor evidence) (40-42). Physicians must be aware of the complications of cervical transforaminal epidural injections, which may include vasovagal or hypersensitivity reactions, skin rashes, headaches, transient global amnesia, pain or weakness, paresthesias, and peripheral neuropraxia as minor complications and brain or spinal cord infarction and edema (that may even cause death), seizures, cortical blindness, high spinal anesthesia, and bleeding as major complications reported in the literature (43).

Botulinum toxin

While two Cochrane reviews of 2007 and 2011 revealed no superiority of botulinum toxin A intramuscular injections when compared with saline injections in patients with neck pain with or without radiculopathy for improvement of pain and disability at 4 weeks based on moderate evidence (44), another systematic review and meta-analysis provided very low-quality evidence indicating significant neck pain-reducing effects of botulinum toxin A when combined with analgesics and therapeutic exercise (45).

Ozone

Intradiscal ozone injections have been used for the treatment of herniated cervical discs with favorable influences on pain (46). There are also grounds to consider paravertebral ozone injections in patients with herniated discs, taking into consideration its protective effects against protein oxidation and regulatory effects of cellular redox balance in disc herniations (47). However, there is a need for high-quality randomized controlled trials for the evidence-based recommendation of ozone injections, either intradiscally or using the paravertebral route.

Cervical collars

The most recent systematic review on conservative treatment for cervical radiculopathy thoroughly examined the use of cervical collars and pointed to the promising effects of combined use of a collar and physiotherapy in the short term but not that of a collar alone (48).

Traction

Two systematic reviews were not able to provide conclusive evidence to recommend or to refute cervical traction for pain reduction and improvement of function in patients with chronic radicular neck pain, due to the low quality of relevant randomized controlled trials. A considerable number of randomized controlled trials (approaching to 10) that were evaluated in these systematic reviews clearly point to the common use of this modality in the management of radicular neck pain (48,49). Therefore, a number of factors, such as the selection of the appropriate patient who is likely to benefit from cervical traction, appear to be important. A group of researchers identified five clinical criteria: age at 55 years or over, reporting of peripheralization with C4-C7 mobility tests, positivity of shoulder abduction test, positivity of upper extremity tension test, and positivity of neck distraction test that might influence successful outcomes for cervical traction; having four of these criteria increases the success probability of cervical traction to 94.8% (50).

Manual therapies

Massage

The Ottawa Panel guideline of 2012 demonstrated that therapeutic massage, including Swedish massage and fascial or connective tissue massage, was effective in relieving acute neck pain for the short term and in improving pain, tenderness, and range of motion in sub-acute and chronic neck pain (51). However, none of the five high-quality randomized controlled trials evaluated in this guideline involved participants with neck pain with

radicular signs, except for one study, where only one patient with a herniated disc (who underwent a spinal fusion surgery) was included among other patients with neck pain of mostly traumatic origin receiving traditional Chinese therapeutic massage (52). Similarly, a more recent systematic review and meta-analysis of 2013 pointed to the significant immediate effects of various forms of massage when compared to inactive therapies (53). This systematic review (53) evaluated the same trials in the Ottawa Panel guideline (51) plus three more randomized controlled trials, only one of which included adolescents with cervical spondylotic radiculopathy who received tuina massage (54). Therefore, the potential benefits of massage for patients with cervical radiculopathy due to disc herniation and its safety should be interpreted cautiously.

Manipulation and mobilization

Manipulation or mobilization techniques are commonly used in the management of discogenic neck pain. There are a number of systematic reviews evaluating the efficacy of these techniques in individuals with neck pain with or without radicular findings. A Cochrane review of 2010 revealed evidence of similar effectiveness of either cervical manipulation or cervical mobilization immediately after application in terms of pain and also provided evidence on the beneficial effects of thoracic manipulation in terms of both pain and function in combined groups of patients with neck pain (12). Another systematic review focusing on cervical radiculopathy and not on the combination of patients with neck pain with or without radicular findings suggested the effectiveness of manual therapy approaches, such as thrust and non-thrust manipulation or mobilization of cervical and/or thoracic spine combined with exercise, on favorably improving pain, ROM, function, and disability (55). Finally, a more recent systematic review focusing on studies including patients with confirmed or suspected cervical radiculopathy and not the combination of patients with neck pain with or without radicular findings supported the cautious use of high-velocity low-amplitude thrust manipulation (56).

The effectiveness of mobilization and manipulation in comparison with physical modalities in patients with neck pain with or without radicular symptoms was addressed in a systematic review. When compared to short wave diathermy, mobilization and manipulation were found to produce better improvement in pain and greater satisfaction in patients with acute neck pain in the short and intermediate term based on moderate-quality evidence, adding exercise and advice enhancing patient satisfaction and global perceived effect. The combination of mobilization and manipulation and physical modalities when compared with placebo, education, cervical collars, exercise, ultraviolet radiation, direct galvanic current, ultrasound, and massage was not found to produce any difference in terms of pain reduction, improvement in function, or global perceived effect in patients with acute, subacute, or chronic neck pain (57). What the findings of this systematic review imply, in line with the previous systematic review (55), is that the seemingly best combination of mobilization and manipulation is with exercise and advice and not with other physical modalities. Another systematic review

comparing mobilization and manipulation techniques with exercise pointed to minimal beneficial effects of these techniques, in comparison to exercise, relevant to pain and function (58).

As a very important point for physicians which is the justification of the treatment approach they apply, a very recent systematic review pointed to the lack of reliable and valid clinical criteria for determining which patients would need manipulation for neck pain (59). As a useful base for making decisions whether to apply or for which individuals to consider thrust manipulation, an attempt has been performed to identify those who would potentially benefit from manipulation. Among the four clinical criteria, duration of symptoms less than 38 days, expectation of the helpfulness of manipulation, a 10° or more difference of cervical rotation range of motion between sides, and provocation of pain with posteroanterior spring test, the presence of three or four criteria was found to improve the probability of success of thrust manipulation from 39% to 90% in patients with neck pain complaints without the exclusion of discogenic neck pain, but with the exclusion of them with two or more positive nerve root compression signs (60). Regarding safety of cervical manipulation, which is also a very important issue, a systematic review reported no serious adverse events resulting from the use of cervical manipulation except for minor ones, including transient neurological deficits and an increase in neck pain. The findings of this review can not be interpreted in the way that there are no adverse events, since 44 studies were found not to have reported adverse events (61).

Complementary and alternative medicine treatments

Acupuncture

A systematic review and meta-analysis involving studies of cervical radiculopathy demonstrated significant effects of acupuncture for short-term pain relief (62).

Herbal medicine

Herbal medicine is known to be incorporated in rehabilitation approaches (63). The efficacy of herbal medications in patients with chronic neck pain with or without radicular symptoms has been addressed in a Cochrane review. Compound Qishe tablets were found to have pain-relieving effects superior to placebo or Jingfukang based on low-quality evidence, and a topical herbal medicine, Compound Extractum Nucis Vomicae (a topical medicine), was found to produce pain reduction more than diclofenac diethylamine emulgel (64).

Conclusion

Neck pain with radicular findings is associated with significant disability that may interfere with activities of daily living and participation in the society. Although radicular low back pain is widely studied in the literature (65), this is not the case for discogenic neck pain with associated radiculopathy. Evidence obtained from systematic reviews and some individual randomized controlled trials favors the use of neck-strengthening exercise, ergonomic interventions, TENS, low-level laser therapy, epidural steroid injections, cervical collars with physical therapy, spinal manipulation with or without exercise, acupuncture, and probably massage and traction. While botulinum toxin A and ozone

show promise for the treatment of discogenic neck pain, the recommendation for these can not be made at the moment due to lack of evidence obtained from randomized controlled trials. Other physical medicine and rehabilitation approaches with potential beneficial effects based on theory and reasoning, such as therapeutic ultrasound, pulsed electromagnetic fields, and non-invasive brain stimulation techniques, need to be investigated more to recommend or refute these modalities in the treatment of cervical radiculopathy resulting from disc herniation.

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