EXPERT REVIEWS

Therapeutic options for cervicogenic headache

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The term cervicogenic headache (CeH) describes a syndrome originating from the cervical spine. There are a variety of therapeutic approaches used for the management of CeH, but scientific evidence of their effectiveness is scarce. No medication drug has proven to be effective. The evidence for greater occipital nerve blocks, cervical nerve blockades, facet joint injections and surgical procedures is limited. Several physical therapy interventions are proposed for CeH, with spinal manipulation and soft tissue interventions being the most commonly used. However, the lack of solid evidence of positive effects and risks of serious complications for spinal manipulation should be considered in favor of other physical therapy interventions associated with less risk. The inconsistent results in the literature can be related to the fact that maybe not all therapeutic interventions are appropriate for all patients with CeH or maybe not all patients with CeH will benefit from particular interventions.

Keywords: cervicogenic headache • headache • manual therapy • neck • nerve blocks • physical therapy

The idea that headaches may originate in the cervical spine or the adjacent soft tissues has been discussed over decades, and still is a matter of debate. The term cervicogenic headache (CeH) was first introduced in 1983 by Sjaastad *et al.* to describe a headache syndrome that was believed to originate from the cervical spine [1]. Early descriptions characterized CeH as a unilateral or mainly unilateral headache, starting posteriorly but advancing to the frontal area, usually accompanied by ipsilateral arm discomfort, reduced cervical range of motion and mechanical precipitation of attacks. A positive effect of anesthetic blockades on the symptomatic side was said to be confirmatory. Nevertheless, there has been some controversy regarding whether the signs and symptoms of neck involvement represent a true cervical source for head pain. CeH has to be differentiated from other headaches, particularly migraine, tension-type headache or hemicrania continua. In the clinical setting, there is considerable overlap among these headaches, and no consensus exists on a definite diagnosis of CeH. This situation can be related to the fact that different diagnostic criteria have emerged over time [2–4]. Diagnostic criteria of CeH have been recently revised and modified in the third edition of the International Classification of the Headache Disorders (11.2. Headache attributed to disorders of the neck – 11.2.1 CeH; **Box 1**) [5].

Precise estimates of incidence and prevalence of CeH differ according to the populations included and the diagnostic criteria used in epidemiological studies. The most accepted prevalence for CeH, using clinical criteria for diagnosis, ranges from 1 to 4.1% of the general population, without a clear predominance of males or females [6–8]. However, Knackstedt *et al.* observed that the prevalence of CeH was 0.17% in the general population with a female preponderance [9].

The neuroanatomical basis for CeH seems to be located in the trigeminocervical nucleus caudalis of the spinal gray matter at C1–C3 levels [10]. In this nucleus, nociceptive afferents from the upper cervical spinal nerves converge onto second-order neurons that also receive afferents from the first division of the trigeminal nerve, via the trigeminal nerve spinal tract [11]. The topographic arrangement of the trigeminocervical nucleus caudalis allows the interchange of nociceptive information of the upper cervical spinal nerves and the ophthalmic division of the trigeminal nerve, which explains that the pain from a cervical source may be referred to the forehead, temple or orbit. Therefore, every cervical structure innervated by the trigeminocervical nucleus caudalis (joints, muscles, nerves, ligaments, dura) can

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Box 1. Diagnostic criteria for cervicogenic headache (according to the International Classification of Headache Disorders†).

Description

Headache caused by a disorder of the cervical spine and its component bony, disc and/or soft tissue elements, usually but not invariably accompanied by neck pain

Diagnostic criteria

- Any headache fulfilling criterion C
- Clinical, laboratory and/or imaging evidence of a disorder or lesion within the cervical spine or soft tissues of the neck, known to be able to cause headache
- Evidence of causation demonstrated by at least two of the following:
  - Headache has developed in temporal relation to the onset of the cervical disorder or appearance of the lesion
  - Headache has significantly improved or resolved in parallel with improvement in or resolution of the cervical disorder or lesion
  - Cervical range of motion is reduced and headache is made significantly worse by provocative maneuvers
  - Headache is abolished following diagnostic blockade of a cervical structure or its nerve supply
- Not better accounted for by another ICHD-3† diagnosis

†The International Classification of Headache Disorders, 3rd Edition (beta version) [5].

be implicated in the genesis of CeH [12]. However, Knackstedt did not find specific changes in MRI of craniovertebral structures in patients with CeH [13]. Some authors have also suggested that proinflammatory mediators, for example, cytokines, IL-1 β and TNF-α can be involved in the pathophysiology of CeH [14–16].

Many treatments have been proposed for CeH, but only few of them have been tested in randomized controlled trials, and even fewer have proven effective [17]. This is particularly important since it seems that CeH does not improve over time in contrast to other secondary headaches [18], so better therapeutic management of this headache would be clinically important. The current paper will discuss the medical and physical therapy options for the therapeutic management of patients with CeH.

Medical interventions for cervicogenic headache

Patients with CeH may be treated by different health care professionals (neurologists, rheumatologists, anesthetists, physical therapists, orthopedic surgeons and neurosurgeons). In each case, the recommended treatment seems more dependent on the particular specialty of the professional in-charge of the patient than the research supporting it [19].

The existence of a wide range of therapies without clear effectiveness can be, in part, a product of an inconclusive understanding of the underlying pathology of CeH. Moreover, diagnostic criteria have changed over time, so the selection of patients has shown marked variations between different studies. Commonly used treatment options include medications, nerve blocks or local injections of anesthetics, physical therapy and surgery [20].

Oral medications

Individuals with CeH normally take analgesics or anti-inflammatory drugs to mitigate the pain [21]. Some patients are also prescribed antidepressants, antiepileptics or muscle relaxants [10,21]. However, none of these drugs have been rigorously studied in controlled trials, so none of them has demonstrated efficacy for CeH [10,22]. In fact, when used as the only mode of treatment, medications do not generally provide substantial pain relief.

Drug responses may help differentiate CeH from other similar headaches. Unlike hemicrania continua, CeH does not show an absolute response to indomethacin [23]; unlike migraine, CeH does not respond to ergots or triptans [24,25].

Botulinum toxin injections

Botulinum toxin type A injections in the cervical muscles have been apparently helpful in some patients [26]. However, a recent randomized controlled trial did not demonstrate a beneficial effect of onabotulinum toxin type A in CeH [27]. In fact, to date, there is no sufficient evidence supporting a clinically relevant or a statistically significant effect of botulinum toxin injections in patients with chronic neck pain associated with or without associated CeH [28].

Greater occipital nerve blocks

Anesthetic blockades of the greater occipital nerves (GONs) are commonly used in CeH, both for diagnosis and treatment. However, the scientific evidence for their efficacy is limited, since the majority of studies are small or noncontrolled [29]. Naja *et al.* [30] were able to demonstrate efficacy in a double-blind, controlled trial with follow-up of 2 weeks. Fifty patients diagnosed with CeH were randomly divided into two groups that received injections of either an anesthetic mixture or placebo over the greater and lesser occipital nerves. Anesthetic blocks were significantly effective in reducing pain parameters. Furthermore, in an open study, the same authors found that repeated injections with the active drug could get longer periods of remission [31]. In a series of 28 patients with CeH, Inan *et al.* [32] found that the therapeutic effect obtained with GON blockades was similar to that achieved by blocking the C2/C3 nerves. In addition, several noncontrolled observational studies have reported favorable responses in over 70% of

patients receiving occipital nerve blocks either with anesthetics alone or with anesthetics plus corticosteroids [33–36]. Headache relief is already apparent in the first few minutes, which can support the diagnosis of CeH [34,36]. However, occipital nerve blocks can also arrest other headaches different to CeH, such as occipital neuralgia, cluster headache or migraine [37,38]. Baron *et al*. found that a wide spectrum of cervically mediated symptoms including neck range of motion, headache, neck pain and dizziness could respond to this procedure, and that certain examination findings might help to predict benefit from GON blockades [39].

Cervical nerve blockades, facet joint injections & epidural steroid injections

CeH may also be treated with anesthetic blockades of the cervical nerves (C1–C3) and/or facet joint injections [40]. Indeed, in a retrospective study, Narouze et *al*. found that lateral atlantoaxial (C1/C2) intra-articular corticosteroid injections could provide short-term analgesia lasting up to a few months in patients with atlantoaxial joint pain [41]. A chart review by Zhou *et al.* also showed that fluoroscopically guided C1/C2 and C2/C3 facet joint injections and C2–C3 spinal rami blocks with anesthetics and corticosteroids were effective and well tolerated for the treatment of CeH [42]. Martelletti *et al.* found that epidural steroid injection into the epidural cervical space at C6–C7 or C7–T1 level [43] was effective at short (12 h) and medium (4 weeks) terms [44] but not at long term [45] for the relief of pain in patients with CeH.

Surgical procedures

The last therapeutic option for patients with CeH seems to be surgery. The most studied surgical intervention is percutaneous radiofrequency neurotomy [10]. The major problem in evaluating this technique is the existence of several different approaches: radiofrequency neurotomy of C2 medial rami [46], radiofrequency neurotomy of C3–C6 medial rami [47] and radiofrequency neurotomy of sinuvertebral nerves of C3/C4 [48]. The results are conflicting since some studies have reported positive outcomes [49,50], whereas others have not [51]. In fact, Haspeslagh *et al*. did not find evidence that radiofrequency treatment of cervical facet joints and upper dorsal root ganglions was more effective than GON blockade in patients with CeH [52].

Some authors propose the use of pulsed radiofrequency as a potential treatment for patients with CeH related to the C2 nerve [53–56]. The main difference with continuous radiofrequency is that pulsed radiofrequency delivers high-intensity currents in pulses, making heat dissipate so that temperatures are not as neurodestructive. It seems that radiofrequency should be particularly applicable for the treatment of headache stemming from the C2–C3 zygapophyseal joints, in which case the target nerve is the third occipital nerve.

Other surgical option is decompression and microsurgical neurolysis of the C2 spinal nerve, with excision of scars as well as ligamentous and vascular elements that produce nerve compression [57]. Again, evidence of its effectiveness is scarce.

Occipital nerve stimulation is emerging as a promising therapy for some patients with refractory and intractable headaches. This form of neuromodulation involves surgical positioning of leads containing electrodes under the skin of the occipital region. The leads are energized with electrical signals coming from an internal pulse generator. Rodrigo-Royo *et al.* reported that occipital nerve stimulation was effective in four patients with chronic CeH [58]. However, the effectiveness of occipital neuromodulation for CeH has not been tested in controlled studies.

Physical assessment & cervicogenic headache

Physiotherapy is the therapeutic option most frequently requested and used by individuals with CeH (around 75%) [59]. In fact, although the evidence in favor of physical therapy is somewhat limited, it is nevertheless greater than that supporting most medications, anesthetic injections and surgical procedures for CeH [60]. Clinical reasoning for the management of patients with CeH with physical therapy is clearly justified by the presence of several musculoskeletal impairments of the cervical spine in these patients. This association should be expected, given that the source of the pain is located at the cervical structures. Here, we briefly summarize the most updated data on this topic.

Restriction in cervical range of motion

A reduced cervical range of motion is advocated as one of the main features of CeH. Indeed, restricted cervical range of motion is considered a diagnostic criterion for CeH [1–4]. A restriction of cervical movement is a variable finding in other headaches, but CeH characteristically shows a clear limitation in neck motion [61,62] that is not related to age [63]. Furthermore, headache frequency and associated disability are correlated with such reduction of neck movement in patients with CeH [64].

Although any cervical spine motion can be limited, it seems clear that rotation is the most affected movement. It has been suggested that patients with CeH exhibit side-to-side differences of at least 10° in cervical rotation [65]. This assumption was based on the use of the cervical flexion–rotation test (Figure 1) as a clinical tool for the diagnosis of upper cervical spine restriction. This test is carried out by placing the cervical spine of the patient in flexion while the therapist passively rotates the head. The basis of the test is that cervical motion is limited to the C1–C2 level when the head is held in full flexion [66]. It has been found that subjects with CeH have an average of 28° of atlantoaxial rotation to the side of the headache as compared with an average rotation of 44° toward the asymptomatic side and in healthy people. The cervical flexion–rotation test has showed an overall diagnostic accuracy of 85–91% for CeH [67], with a positive cutoff value of 32° [68].

Upper cervical spine dysfunction

Physical therapists contend that they can diagnose cervical sources of headache by manual examination of the upper cervical

Figure 1. The cervical flexion–rotation test. The cervical spine of the patient is placed in flexion while the therapist passively rotates the head to each side.

joints with palpation and mobility tests [69,70]. For manual diagnosis of cervical spine dysfunctions, passive accessory intervertebral movements are proposed (Figure 2). The diagnosis of cervical spine dysfunction is made when a joint exhibits early end-feel, increased quality of resistance and reproduction of the patient's complaint [71,72]. A study published in 1988 compared manual diagnosis made by a physical therapist with that made with diagnostic blocks of cervical facets joints reporting an accuracy of 100% [73]. However, the sample size was small and the blocks were not controlled. Other studies have reported a good inter-rater reliability (κ: 0.4–0.8) for this kind of assessment in patients with CeH [74]. However, the validity of this assessment is not universally accepted [75,76].

There are several studies suggesting that upper cervical spine joint dysfunctions, particularly at C0/C1 and C1/C2 segments are highly prevalent in patients with CeH and that they can help to discriminate between CeH and other headaches such as tension- type headache or migraine [62,77–80]. A systematic review found very limited evidence for cervical dysfunction in patients with migraine other than in animal models [81].

Figure 2. Posterior–anterior upper cervical spine joint mobilization (passive accessory intervertebral movements). The thumbs of the therapist make contact over the C1/C2 zygapophyseal joint. A posterior–anterior glide is applied to the joint.

Cervical muscle impairments

Patients with CeH also exhibit deficits in the strength of cervical flexor and extensor muscles as compared with patients suffering from migraine or tension-type headache [62,77,78,82]. There is preliminary evidence suggesting that cervical extensor muscle strength is particularly affected in CeH originating from trauma following a motor vehicle accident [83].

Some studies have revealed an altered motor strategy during the clinical execution of the craniocervical flexion test in patients with CeH. The craniocervical flexion test represents a clinical indicator of impaired activation of the deep cervical flexor muscles, the longus capitis and colli [84]. The features assessed are the activation and isometric endurance of the deep cervical flexor muscles as well as their interaction with the superficial cervical flexor muscles during the performance of five progressive stages of increasing craniocervical flexion range of motion [85]. Patients with CeH show greater activation of the sternocleidomastoid muscle and reduced activity of the longus colli and longus capitis muscles [62,77,78,86].

Jull *et al.* demonstrated reduced cross-sectional area of the semispinalis capitis, but not longissimus capitis or trapezius muscles, measured at the level of C2 vertebrae on the symptomatic side in patients with CeH [77]. Such selective atrophy might be attributed to localized involvement of the upper cervical segments.

Musculoskeletal impairments can help differential diagnosis in CeH

It seems that no one of the clinical signs and symptoms are sufficient to discriminate CeH from other types of headache. If the source of the pain is the cervical spine, musculoskeletal dysfunctions should be mainly present in CeH and not in other headaches. Two studies investigated whether a cluster of musculoskeletal impairments can help to differentiate between patients with CeH and with other headaches. Those studies reported that the presence of palpable painful upper cervical joint dysfunction, restricted cervical spine extension and impaired performance on the craniocervical flexion test exhibited 100% sensitivity and 94% specificity to differentiate CeH from tension-type headache and migraine [77,78]. Although further research is clearly required to validate the capacity of this pattern of musculoskeletal impairments to differentially diagnose CeH, incorporating measures of cervical function to the physical examination appears promising as a clinical diagnostic aid. Additionally, the presence of these musculoskeletal impairments can orientate the proper management of these patients with physical therapy.

Physical therapy for cervicogenic headache

Numerous physical therapy interventions are proposed for the management of CeH: spinal manipulation (Figure 3), massage, stretching, connective tissue, dry needling (Figure 4), spinal

mobilization or neuromuscular approaches [87]. What is certain regarding CeH is that a cooperative effort should be considered in the treatment of these patients between physical therapists, neurologists and surgeons. A multidisciplinary effort leads to a better management of CeH [88]. The next section discusses the best evidence available for the different physical therapy options applied for CeH.

Spinal manipulation or mobilization

A survey conducted in Australia reported that spinal joint mobilization and/or manipulation were the manual therapies most used by physical therapists for the treatment of patients with CeH [89]. This preference is based on the clinical rationale that CeH represents referred pain elicited by nociceptive stimulation of upper cervical spine joints and that clinical trials involving patients with proven painful disorders of upper cervical zygapophyseal joints have shown significant relief of the headaches with treatment directed at cervical pain generators [90]. In addition, several studies have showed that noxious stimulation of the atlanto-occipital (C0/C1), lateral atlantoaxial (C1/C2) and C2–C3 zygapophyseal joints provoke pain in the occipital region [91–93]. Therefore, it seems logical that for effective management of CeH manual therapy, interventions should target the upper cervical spine joints, particularly the C1/C2 segment.

Several systematic reviews investigated the effectiveness of spinal manipulation in the management of headaches, particularly tension-type, migraine and CeH [94–98]. These reviews yielded inconsistent results, most probably because spinal manipulation is not equally effective for different headaches [99]. In fact, it seems that spinal joint manipulation might be effective for CeH. A recent systematic review found six randomized controlled trials suggesting that spinal joint manipulation was more effective than physical therapy, gentle massage, drug therapy or no intervention at all, whereas three trials showed no differences compared with placebo, manipulation, physical therapy, massage or waiting lists [100]. The highest quality randomized controlled trial was performed by Jull *et al.* [101]. These authors found that spinal joint manipulation and specific exercise targeted to deep neck flexor muscles reduced headache frequency and intensity in patients with CeH at short and long-term follow-up [101]. Haas *et al.* aimed to make preliminary estimates of the relationship between headache outcomes and the number of spinal manipulations received [102]. This study showed that a positive effect might be obtained in the range of 8–16 sessions for headache relief in CeH although a dose effect cannot be ruled out at this stage [102]. The application of spinal joint manipulations targeted to the upper cervical spine is recommended for CeH, but not for tension-type headache, in some evidence-based guidelines [103].

Nevertheless, the use of cervical spinal joint manipulations remain controversial because of the reported adverse reactions and subsequent concerns about safety. These adverse reactions range from minor conditions such as stiffness, increased pain and limitation in motion [104], to more serious injuries, including permanent neurological deficits, dissection of carotid or vertebral arteries and also death [105,106]. If all contraindications and red flags are ruled out (i.e., osteoporosis, vertebral artery impairments or fracture), there is potential for a clinician to prevent 44.8% of adverse events associated with cervical manipulation. Yet, 10.4% of the events are unpreventable so that cervical spine manipulation carries an inherent risk even after a thorough exam and proper clinical reasoning [107]. In such a scenario, spinal joint mobilization techniques are considered to be safer than cervical spine manipulation. Certain studies have specifically investigated the effectiveness of joint mobilization of the upper cervical spine in patients with CeH. Youssef and Shanb found that upper cervical spine mobilization was more effective than massage therapy for reducing headache pain parameters and cervical range of motion in patients with CeH [108]. On the other hand, Hall *et al.* demonstrated that the application of sustained natural apophyseal glides in rotation targeted to the C1/C2 joint (Figure 5) led to an immediate reduction of pain in patients with CeH [109].

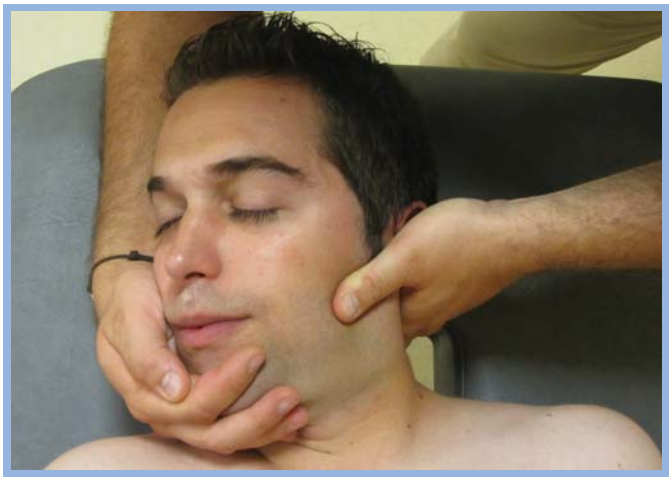

Figure 3. Upper cervical spine joint manipulation. The therapist uses the manipulative hand to localize the targeted segment (C1/C2) in rotation motion and uses the hand to perform a high-velocity, low-amplitude thrust into rotation, which is directed up toward the patient's contralateral eye.

Figure 4. Dry needling applied over trigger points in the upper trapezius muscle.

Figure 5. Sustained natural apophyseal glides in left rotation targeted to the C1/C2 joint. The therapist places the thumbs over the C1/C2 joint on the left side by applying a posterior–anterior and inferior–superior slide to the joint. The patient actively turns the head to the left in a pain-free range of motion.

Since there are close anatomical, functional and pathophysiological relationships between the cervical spine and the temporomandibular joint (TMJ) [110,111], some authors have suggested that the TMJ could also contribute to headache [112]. Two studies have determined that the inclusion of manual therapies targeted to the TMJ in combination with manual therapy targeted to the cervical spine was more effective for decreasing headache intensity and increasing neck function in patients with CeH [113,114]. These authors indicate that clinicians should look for features of TMJ disorders when examining patients with CeH, particularly if previous treatment fails when directed to the cervical spine [113,114].

Figure 6. Manual therapy addressing trigger points in the sternocleidomastoid muscle. The fingers of the therapist grasp the taut band from both sides with a pincer palpation and stroke centrifugally away from the trigger point.

Soft tissue interventions

CeH pain has been mostly related to joint, disk and ligament disease of the upper cervical spine. However, the upper cervical nerves also receive afferent inputs from the muscle tissues. Accordingly, some authors claim that analyzing and managing of muscle imbalances may increase the effectiveness of physical therapy interventions for CeH [115–117]. There is one case report showing that treatment of sternocleidomastoid muscle trigger points (hypersensitive spots eliciting referred pain with stimulation) was effective for the management of CeH [118]. Otherwise, a pilot randomized controlled study revealed that manual therapy targeted to sternocleidomastoid muscle trigger points (Figure 6) was effective for improving headache intensity, pressure sensitivity, cervical range of motion and motor performance of the deep cervical flexors in individuals with CeH [119]. A recent systematic review has concluded that manual therapies targeted to either muscle or joints of the upper cervical spine might be an effective treatment for CeH, although this conclusion should be considered with caution at this stage since the studies mostly included participants with infrequent CeH [120].

Other physiotherapeutic interventions

Other therapy modalities, such as transcutaneous electrical nerve stimulation, have been investigated in patients with CeH with some positive results [121,122]. However, most of these studies were not controlled [123]. Some authors have suggested that transcutaneous electrical nerve stimulation should be applied to specific, not to all, patients with CeH [124].

Prognosis variables for physical therapy

The inconsistent results concerning physiotherapy management of CeH can be related to the fact that maybe not all therapeutic interventions are appropriate for all patients with CeH, or maybe not all patients with CeH will benefit from a particular intervention [125]. In line with this hypothesis, some studies have tried to identify potential prognostic variables to guide some physical therapy interventions in patients with CeH.

Niere found that a higher frequency of attacks predicted a positive response of patients with CeH to spinal manipulative therapy [126]. Fleming *et al.* reported that age and provocation or relief of headache with movement were factors associated with better outcomes in patients with CeH undergoing physical therapy [127]. Alternatively, Jull *et al.* could not find a concrete pattern of variables that might predict responsiveness to physiotherapy in patients with CeH [128].

It seems plausible that different therapeutic techniques might be effective for specific subgroups of patients. Therefore, subclassification could help to identify those patients who are most likely to benefit of certain therapeutic approaches. As a consequence, the treatment choice for CeH should be made on an individual basis [129].

Complementary & alternative therapies

Complementary and alternative therapies are used by some patients with CeH, albeit they are not supported by scientific evidence. For instance, few studies have investigated the effects of acupuncture for management of CeH pain, and the results are controversial [130–132]. Future studies should analyze the effectiveness of several alternative interventions that are currently being used by patients with CeH.

Conclusions

CeH can be attributed to a disorder of the upper cervical spine or the adjacent soft tissues. The anatomical substratum of CeH is the convergence of trigeminal and upper cervical nociceptive inputs on the trigeminocervical nucleus caudalis. There are a variety of therapeutic approaches for the management of CeH, but scientific evidence of their effectiveness is scarce. So far, no medication drug has proven to be effective. GON blockades seem to be effective although the evidence is still limited. Cervical nerve blockades, facet joint injections and certain surgical procedures can be effective, but their use remains controversial. The presence of musculoskeletal impairments in the cervical spine can support the diagnosis and may be a helpful therapeutic aid. Several physical therapy techniques are proposed for this headache, with spinal manipulation and soft tissues interventions being the most commonly used by clinicians. However, the lack of solid evidence of positive effects and risks of serious complications for spinal manipulation should be considered in favor of other physical therapy options associated with less risk. The inconsistent results in the literature can be related to the fact that maybe not all therapeutic interventions are appropriate for all patients with CeH, or maybe not all individuals with CeH can benefit from a particular intervention. Future studies are clearly needed on this topic.

Expert commentary

In the current manuscript, we have summarized most updated evidence related to the management of CeH. Current evidence suggests that physical therapy is probably the most proper therapeutic tool for the management of CeH. However, there are few randomized controlled trials investigating the effectiveness of physical therapy interventions in CeH. Additionally, the studies have investigated the effects of just one or two manual therapies in isolation, for example, spinal joint manipulation and/or massage, but they have not analyzed the effects of multimodal management. It seems plausible that not all patients with CeH will benefit from a particular intervention, and that treatment choices should be made on individual basis. Future studies should: investigate the effectiveness of multimodal interventions in the management of patients with CeH; and to identify subgroups of patients with CeH who will benefit from each particular intervention. In the authors' experience, individuals with CeH where the symptoms are reproduced during the physical examination are those most likely to benefit from physical therapy interventions.

Five-year view

There is preliminary evidence showing that physical therapy approaches should be applied for the management of patients with CeH. In the authors' opinion, future research should focus on implementing multimodal interventions on clinical practice. In addition, it is necessary to validate current clinical studies on prognostic factors (clinical prediction rules) to determine if a subgroup of patients with CeH can potentially benefit from any particular intervention. Although several advances have been made in the last few years, more research is needed for a better management of patients with CeH.

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Key issues

- Many treatments have been proposed for cervicogenic headache (CeH), but only few of them have been tested in randomized controlled trials and even fewer have proven effective.
- No drugs are effective for CeH.
- Local injections of anesthetics or nerve blocks have been used as diagnosis and treatment tools in patients with CeH, but the evidence for their effectiveness is limited.
- Surgical interventions for CeH are not sufficiently validated.
- The presence of several musculoskeletal impairments of the cervical spine in patients with CeH justifies the application of physical therapy interventions.
- There are several physical therapy interventions proposed for CeH (manipulation, massage, stretching, connective tissue, dry needling or spinal joint mobilization), but no solid evidence supports their effectiveness at this moment.
- The lack of solid evidence of positive effects and risks of serious complications for spinal manipulation should be considered in favor of other physical therapy options.
- It seems that certain subgroups of individuals with CeH could respond positively to specific interventions.

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