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Cervical Vertigo—Cervical Pain: An Alternative and Efficient Treatment

THOMAS MICHELS, M.D.,[1] NILS LEHMANN, Ph.D.,[2] and SUSANNE MOEBUS, Ph.D., M.P.H.[2]

ABSTRACT

Objectives: Cervical vertigo (CV) is commonly attributed to a disturbed cervical proprioception and is associated with cervical pain (CP). It is assumed to respond to a treatment that improves CP. In a prospective observational study, we examined whether a treatment originally devised for patients with CP could improve CV also in cases without CP.

Design: During a period of 3 years, a total of 238 consecutive patients, 41 patients with CV only, 43 patients with CV and CP, 154 patients with CP only, received the same treatment, which consisted of local anaesthetics applied on average in 8 sessions to a fixed set of epidermal, epithelial, and periosteal locations. Outcome was relief of symptoms measured by a verbal-analogue scale at the end of therapy and on average a year later.

Results: At the end of therapy, 58% of patients with CV responded with complete remissions compared to 41% of patients with CP. At follow-up a year later, there were complete remissions in more than 50% in CV as well as in CP.

Conclusions: The applied therapy led to complete remissions of long duration in a high percentage of patients with CV even when symptoms of CP were missing. This therapy produced good effects for CP as well. Its neurophysiological basis is discussed and may offer a new approach not only to the treatment of CV and CP but in a general sense also to that of acute, chronic, and neuropathic pain. It needs to be emphasized, however, that this study was not a randomized controled trial and its encouraging results have to be proved by further research.

INTRODUCTION

Cervical vertigo (CV) is a controversial entity. Usually it is associated with cervical pain (CP) and is attributed to a disturbed cervical proprioception located in the muscle spindles of the neck.[1] A linear interaction of proprioceptive, vestibular, and visual input in the multisensory process of orientation in space has been proved.[2,3] Even the "vestibular" areas of the cortex are multisensory and respond not only to vestibular but also to proprioceptive and optokinetic stimuli.[4] The cervical proprioceptive contribution to the process of orientation seems to increase when other contributing systems become deficient. Thus, in vestibular neuritis the deficient vestibular input is compensated by an increased cervical proprioceptive input,[5] and the general increase of cervical proprioceptive input with advancing age is assumed to substitute for the declining vestibular function in the elderly.[6] For these reasons, CV may rarely exist as an independent entity but may represent a disturbed cervical proprioception that fails to compensate for other sensorial deficits of input to the process of orientation. This is of special importance when the accompanying symptom of pain is missing and therefore a necessary cervical treatment is not applied.

[1]Practice for Internal Medicine, Hematology, Radiology, Natural Cure, Cologne (Köln), Germany.
[2]Institute for Medical Informatics, Biometry and Epidemiology, University of Essen, Essen, Germany.

Our study aimed to examine whether a treatment originally developed for patients with CP and consisting of the application of local anesthetics (LAs) to a fixed set of locations could improve CV as well also in cases where CP was missing.

SUBJECTS AND METHODS

Two hundred and thirty-eight (238) consecutive outpatients (59 males, 179 females, age range 17–93, mean ± standard deviation = 56.3 ± 15.9 years) were treated and divided into 3 groups according to their complaints: 41 patients with CV only; 43 patients with CV and CP; 154 patients with CP only. The group with both symptoms, CV and CP, was evaluated twice: once for the prevailing symptom of CV = CV (+CP) and once for the prevailing symptom of CP = CP (+CV). The mean duration of complaints was in CV 11 months, in the group of CV and CP concerning CV = CV (+CP) 35 months, and concerning CP = CP (+CV) 62 months and in CP 42 months. Symptoms of CV consisted of intermittent attacks of slight or bothersome dizziness, disequilibrium, and unsteadiness of gait. Exclusion criteria were attacks of rotatory vertigo as the only symptom and allergies to LAs. Patients with suspected involvement of the central nervous system or the vestibular system were seen by a neurologist and/or ear, nose, and throat specialist before treatment to exclude central nervous or vestibular disorders. The following injections of a LA (Mepivacaine 0.5%) in a quantity of approximately 0.2 mL per site of injection were performed on each patient per session: *intraepidermal*, leading to wheals of 5–10 mm in diameter to eight locations covering the trapezius muscle (Fig. 1); *intraepithelial*, in the same way to the palatal velum, both sides (Fig. 2); *periosteal*, to the 6th or 7th cervical vertebra (prominent vertebra), both sides, penetrating the applied wheal in this region (Fig. 1) and reaching the side or base of the spinous process notifying the right depth of injection by bony resistance, and to the occipital bone, both sides, 25 mm above the intermastoid line and 25–50 mm from the midline (Fig. 1).

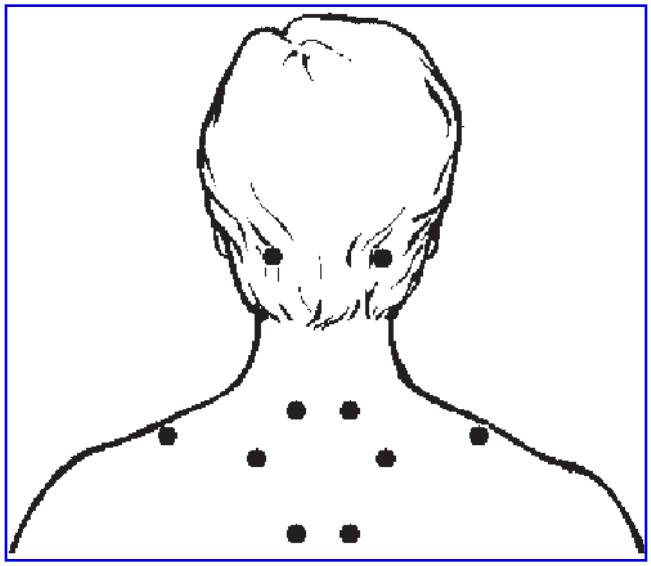

FIG. 1. Sites of intraepidermal and/or periosteal injection of a local anesthetic in the neck.

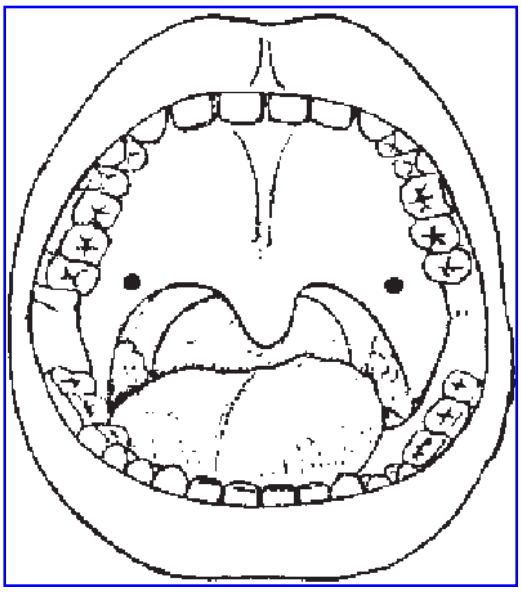

FIG. 2. Sites of intraepithelial injection of a local anesthetic to the palatal velum.

Because the therapy was devised originally to treat CP, each patient also received a short version of acupuncture as performed for CP by application of two dermal steel needles bilateral into the hairline over the forehead 20 mm lateral of the midline, removed after 30 minutes and one dermal needle to the cervical zone of the left ear (in right-handed persons, and vice versa). The first location corresponds to the area of Gallbladder 15 in traditional Chinese acupuncture, with an expected influence on headaches and the often underlying disorder of cervical syndromes. The second location is derived from Chinese ear acupuncture and is located on the lower end of the antihelical rim. It is used mainly in cervical syndromes. The duration of 30 minutes is the most common one for applied acupuncture in our country. Although it was a short version, it is most probable that the acupuncture exerted a beneficial effect not only in CP but also in CV. Its contributing role is assumed to be minor and its necessity should be proved by further studies.

During a period of 4–6 weeks, on average, eight sessions of therapy were applied in patients with CV or CV+CP and six sessions in patients with CP. Two to three sessions were given in the first week and one to two per week thereafter. The patients did not receive additional medication for vertigo or pain.

Verbal-analogue scales were used to evaluate improvements under therapy[7] with only three categories to reduce

individual/psychological changes of complaints: *complete remissions* (100% improvement), *partial remissions* (>30% and <100% improvement), and *failures* (<30% improvement). For the discussion *only complete remissions* were considered.

All presented data were recorded in a MS ACCESS (Microsoft Corporation) database. Statistical analysis was performed by Institute for Medical Informatics, Biometry, and Epidemiology at the University of Essen using SAS V8.2 (SAS Institute, Inc., Cary, NC).

RESULTS

Therapeutic results were reported as *early results* at the end of therapy and as *late results* on average 12 months after the end of therapy. Early result failures were counted as failures at the *late result* check again. The group of CV comprised 41 patients, that of CP 154 patients, and the group with both symptoms 43 patients. This last group was evaluated twice: once for the prevailing symptom of CV = CV (+CP) and once for the prevailing symptom of CP = CP (+CV).

<u>*Early results*</u> at the end of therapy showed:

1. complete remission (Fig. 3):
   in 58.5% = 24 patients of CV and in 65.1% = 28 patients of CV(+CP)
   in 41.6% = 64 patients of CP and in 51.2% = 22 patients of CP(+CV)
2. partial remission with a score of >30% improvement:
   in 24.4% = 10 patients of CV and in 25.6% = 11 patients of CV(+CP)
   in 46.1% = 71 patients of CP and in 39.5% = 17 patients of CP(+CV)
3. complete failures + partial remission with a score of <30% improvement:
   in 17.1% = 7 patients of CV and in 4.7% = 2 patients of CV(+CP)
   in 8.4% = 13 patients of CP and in 4.7% = 2 patients of CP(+CV).

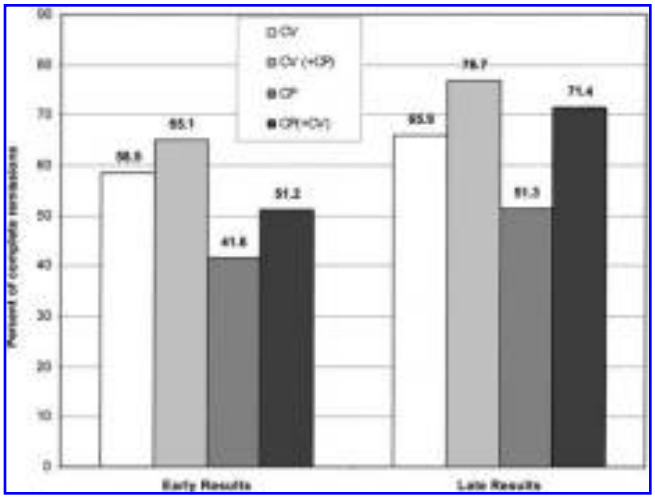

FIG. 3. Percent of complete remissions at the end of therapy = early results and 12 months later = late results. CV, cervical vertigo; CP, cervical pain; CV (+CP), cervical vertigo in patients with both symptoms; CP (+CV), cervical pain in patients with both symptoms.

In 0% of the CV group, 4.6% = 2 patients of the CV and CP group and 3.9% = 6 patients of the CP group, an early control was not realized. There is a marginally significant difference ($p = 0.052$) in resolution between complete remissions of patients with CV only and patients with CP only at the end of therapy.

<u>*Late results*</u> on average 12 months after the end of therapy showed:

1. complete remission (Fig. 3): in 65.9% = 27 patients of CV and in 76.7% = 33 patients of CV(+CP)
   in 51.3% = 79 patients of CP and in 71.4% = 31 patients of CP(+CV)
2. partial remission with a score of >30% improvement:
   in 12.1% = 5 patients of CV and in 14.0% = 6 patients of CV(+CP)
   in 20.8% = 32 patients of CP and in 16.7% = 7 patients of CP(+CV)
3. complete failures + partial remission with a score of <30% improvement:
   in 22.0% = 9 patients of CV and in 4.7% = 2 patients of CV(+CP)
   in 7.1% = 7 patients of CP and in 7.3% = 3 patients of CP(+CV)

In 0% of the CV group, 4.6% = 2 patients of the CV and CP group and 20.8% = 36 patients of the CP group a late control could not be realized. There is a marginally significant difference ($p = 0.097$) in resolution between complete remissions of patients with CV only and patients with CP only at late control.

DISCUSSION

Efficiency of the applied therapy

There is no common treatment for the symptoms of vertigo and dizziness. Both are believed to be the outcome of many different pathological and physiological processes with a prevailing good prognosis and spontaneous recovery.[8] On the other hand, these symptoms may be bothersome because of a long duration or even life-threatening in the elderly because of the danger of falling, bone fractures, and embolism. Comparing the results of this publication with those of other authors, it should be noted that different

scales for evaluation have been used. Of seven relevant publications, four apply visual analog scales with scores from 0 to 10 or 0 to 100.[9–12] The remaining three publications[13–15] use the same grades as applied in this study: complete remission; partial remission; and failure. Because partial remissions often show a certain variability, in this study only complete remissions have been compared.

Cervical vertigo. Complete remissions of 55.8% in CV and 57.1% in CV(+CP) at the end of therapy and of 52.8% in CV and 67.4% in CV(+CP) 12 months later in this study correspond to 11.7%,[14] 16%,[13] and 45.8%[9] in other publications.

Cervical pain. Complete remissions of 40% in CP and 44.9% in CP(+CV) at the end of therapy and of 49.4% in CP and 62.6% in CP(+CV) 12 months later in this study correspond to 10.1% demonstrated in one of four comparable publications.[15] The other three studies show no complete but only partial remissions of 25%–82.1%.[10–12]

Mode of the applied therapy

Therapeutic actions of LA. The therapy presented here is characterized by the application of LA:

1. distal to the structures affected
2. in subblocking concentration.

LA distal to the structures affected. Intraepidermal receptors of pain-mediating afferents are likely to become generators of spontaneous activity after nerve lesions proximal to them.[16,17] This increased spontaneous activity of cutaneous C-fiber nociceptors distal to the site of nerve lesion has been proved not only in the affected segment, but also in the neighboring ones.[18,19] It is accompanied by a significant increase of adrenergic sensitivity of those nociceptors.[17,20] The activated cutaneous nociceptors are highly susceptible to LAs. LAs inhibit pain without producing a conduction block and in spite of their application distal to the nerve lesion.[16,20]

LA in subblocking concentration. This inhibition by LA in subblocking concentration is attributed to "functional blockades" because of a reduction of nerve impulse afteroscillations. The reduction of these afteroscillations leads to lasting depressions of nerve fiber excitability.[21]

Moreover, membrane potential oscillations are most important for the development of pain. Only neurons with those oscillations—notably Ao-neurons, predominantly Aβ-afferents—are capable of sustained afferent burst discharge and firing necessary for the development of neuropathic pain states.[22,23] Burst discharge in sensory neurons is triggered by subthreshold membrane oscillations and maintained by depolarizing impulse afteroscillations or afterpotentials.[23–25] These subthreshold oscillations can be selectively abolished without interrupting spike propagation.[26] The oscillatory mechanism is highly sensitive to the following:

1. *Adrenaline* which evokes oscillations and repetitive firing.[24] This may explain the role of sympathetic postganglionic efferents for the peripheral sensitization of sensory afferent neurons.
2. *LAs,* by which oscillations are eliminated as well as ectopic firing even under lowest concentrations of LA insufficient to block axon conduction.[22,27]

Changes of afteroscillations are thought to govern the discharge patterns of peripheral and presynaptic arborizations of nerve fibers. These are areas of reduced conduction safety for afferent nerve impulses. The frequent branching points of those arborizations especially are highly sensitive to LA. At these branching points, there are step increases in diameter of thin peripheral to larger proximal fibers, which may already lead to blockades.[28]

Anatomical characteristics of the sites of application. Peripheral arborizations of nerve fibers are found in the *epidermis* and in the *palatal epithelium* in a very dense distribution. In both locations, they reach all three epidermal or epithelial layers as free nerve endings frequently branching in bush-like clumps.[17,29,30]

Epidermis of the neck. The epidermal nerve fibers show their highest density in the skin of the back (i.e., the neck, our site of injection) 25 times higher than at the fingertips.[29] In addition, alpha1-adrenoceptors are found in human epidermis in a much higher density than deeper in the dermis and are significantly increased in hyperalgesic skin.[31] This epidermal density of adrenoceptors and the abovementioned significant increase of adrenergic activity of sensitized cutaneous nociceptors distal from a nerve lesion[17,20] render a sensitive sympathetic access to the intraepidermal application of LAs.

Palatal epithelium. The epithelium of the palatal velum represents one of the most dense innervations of the oral mucosa.[30] The palatal epithelium served as a site of LA injection because of its immediate connection to the upper cervical ganglion and thereby to the sympathetic chain as proven by retrograde tracer methods.[32,33]

Periosteum. A further immediate access to the sympathetic chain is assumed by the LA injection to the *periosteum* of the vertebral column and the occipital bone. The periosteum, with its sensory and sympathetic nerve fibers, is the most dense innervated tissue of all bone structures.[34] The periosteal sympathetic fibers are derived from and stand in direct connection to the sympathetic chain.[35,36] The 6th or 7th cervical vertebra and the occipital bone were chosen as periosteal access because of their general importance in the treatment of CP.[37,38]

In this study, acupuncture originally was devised for the treatment of CP only and applied as a short version. Its contributing role to the presented results, especially in CV, will not be discussed here and its necessity will have to be clarified in further studies.

Dissociation of proprio- and nociception. The cutaneous sensory input to the proprioception is mediated by A β-fiber skin afferents.[39] Nociception is mediated by A δ- and C-fiber afferents. These fibers show a different sensitivity to LA. Because A β-fibers are more vulnerable to impulse blockades than A δ- and C-fibers, the proprioception is the first to show impairment under the onset of LA blockades followed by motor function and nociception.[40] This dissociation of proprio- and nociception under LA could explain the better response of the proprioceptive mediated CV rather than that of the nociceptive mediated CP in this study.

Therapeutic range in CV. Because CV is observed mainly in elderly patients, it seems likely that in CV it is not only the cervical proprioception that is affected, but also that there are additional deficits of other sensorial contributions to the multisensorial process of orientation (i.e., vestibular or optokinetic deficits that might not be substituted sufficiently by a disturbed proprioception). On this assumption, even vestibular and optokinetic deficits up to a certain degree could be compensated by the restitution of a disturbed cervical proprioception.

CONCLUSIONS

The therapeutic results of this study are attributed to repeated and *multisegmental* blockades of

1. The *somatosensory* cutaneous input of mainly
   A) β-fiber afferents in CV
   B) A δ- and C-fiber afferents in CP
2. The *sympathetic* epidermal, epithelial, and periosteal afferent input to the cervical sympathetic chain, thereby changing the sympathetic efferent influence on proprio- and nociception.

The importance of simultaneous therapy for the disturbed somatosensory input and of this disturbed input maintaining sympathetic influence becomes obvious by the description of the assumed underlying process in neuropathic pain: "It must be an abnormal afferent input acting on the spinal cord changing the response properties of dorsal horn neurons and preganglionic sympathetic motoneurones. This has the consequence of generating a vicious circle with the sympathetic efferent outflow modifying the afferent input that changes the sympathetic outflow."[41]

The strength of the presented data is that they were observed under the routine conditions of a normal outpatient office. A shortcoming is the lack of a control group. The results, however, are so encouraging that a clarification of remaining questions by further laboratory and clinical studies seems to be desirable and worthwhile.

OUTLOOK

The presented treatment is simple in its application, without major side effects, and followed by increasing periods of remission within a short time not only in CV but also in CP. It might be described as a *multisegmental somatosensory sympathetic therapy* and could be the basis of a new approach to the treatment of acute, chronic, and neuropathic pain and the clinical answer to the postulation of C.J.Woolf: "Treatment of established pain will be most effective when attempts at returning a disordered nervous system to normal are directed not only at trying to break the afferent limb that sets up the changes in the nervous system, but also at acting on the sympathetic disturbances that perpetuate the disorder. Strategies for treatment must recognize and aim to eliminate both those factors that are responsible for initiating the vicious circle of maladaptive plasticity and those which perpetuate it."[42]

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Address reprint requests to:
Thomas Michels, M.D.
Hauptstraße 309
51143 Köln
Germany

E-mail: dr.th.michels@web.de