Greater occipital nerve block is ineffective in chronic tension type headache

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Patients with primary headache syndromes often describe a pain distribution, that does not respect the trigeminal innervation of the head. In addition to pain in frontal areas, innervated by the first (ophthalmic) division of the trigeminal nerve, the pain often occurs in occipital parts of the head, innervated by the greater occipital nerve, a branch of the C_2 spinal nerve root. Anatomical and neurophysiological studies in animals suggest a convergence of cervical and trigeminal input in the trigeminal nucleus caudalis. Modulation of this pathway has been discussed to be of potential benefit in headache disorders. We investigated in an open pilot study the effect of bilateral block of the greater occipital nerve with 50 mg prilocaine and 4 mg dexamethasone in patients with chronic tension type headache. From 15 patients, only one patient described a headache relief after initial exacerbation of headache for 2 days. Headache intensity was unchanged in 11 patients. In further three patients, the headache worsened in the first hours or days after injection. No serious adverse events were observed. One patient showed a bradycardia (36/min) after the first injection during palpation of the muscles of the neck. Three patients suffered pain on the injection site for a few days. Our results indicate that block of the greater occipital nerve is not effective in the treatment of chronic tension type headache. If at all, rather a 'pro-nociceptive' effect was observed. □*Chronic tension type headache, greater occipital nerve, nerve block, trigeminal nerve, pathophysiology*

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Introduction

From a clinical point of view, numerous patients suffering from primary headache syndromes, such as migraine or tension type headache, report nuchal symptoms, such as tenderness, stiffness or pain of the neck, which may accompany the headache (1, 2). In animal models stimulation of the greater occipital nerve increases the metabolic activity in the trigeminal nucleus caudalis and in the cervical dorsal horn (3).

Primary nociceptive afferents from the meninges terminate in the caudal trigeminal nucleus (4, 5), but also to some extent in the C2 spinal segment (6). In this segment most of the afferents of the greater occipital nerve terminate as well (7). The convergent input from both trigeminal and occipital territories at the level of second order neurons in the brainstem is a possible mechanism for the referral of pain originating from the front to the back of the head and vice versa (8–10). The physiology of trigeminocervical input involves a population of nociceptive neurons that receives convergent input from the supratentorial dura and the greater occipital nerve (GON). Stimulation of the GON increases central

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excitability of dural afferent input (9) whereas stimulation of nociceptive afferent C-fibres of the dura mater leads to an increasing response in trigeminocervical nociceptive neurons to cervical input (11). Understanding this interaction is likely to be pivotal in characterizing a possibly effective treatment with cervical manipulation, such as chiropratic maneuvers or GON injection. It has been discussed, that primary headache syndromes like migraine and cluster headache may benefit from GON block (12, 13). For example the rationale to use botulinum toxine in primary headaches was based on the concept, that a constant (cervical) muscular input may influence and possibly facilitate trigeminal nociception (14, 15). To date, several, mostly negative studies using botulinum toxin in migraine, cluster headache and tension type headache have been published (16, 17). On the other hand, stimulation of the greater occipital nerve using a suboccipital stimulator has been found usefull in chronic migraine (18), and GON-blockade has been reported to influence cluster headache, although local steroid injection has been used as well (19). The question arises, whether specific blockade of the greater occipital nerve may influence headaches, which are thought to involve muscle tension (20) which in turn may provoke or facilitate central sensitization (21, 22). The purpose of this open pilot study was to evaluate the therapeutic effect of a single bilateral block of the GON with 5 ml prilocaine 1% and 4 mg dexamethasone in patients with chronic tension type headache not sufficiently treatable by pharmacological therapy.

Patients and methods

Fifteen patients (9 males, 6 females; age range 20–64 years) with chronic tension type headache (CTTH) according to the International Headache Society classification (23) participated. Patients were recruited from the headache outpatient clinic of the University of Regensburg. All patients suffered from CTTH for several years and either failed on preventative therapy or experienced intolerable side-effects (for demographic details see Table 1). None of the patients had a medication overuse headache. In fact, despite suffering from constant pain, most of the patients never took NSAID or painkillers at all, because they found them ineffective. Informed consent was obtained from all patients and the study was approved by the Ethics Committee of the University of Regensburg.

In this pilot study, using an open trial design, all patients received a greater occipital nerve block bilaterally with 50 mg prilocaine 1% (5 ml) and 4 mg dexamethasone (1 ml). The block was carried out by an anaesthetist who has routine experience conducting nerve blocks and during the procedure pulse, blood pressure and blood oxygenation was monitored. All patients described the appearance of hypo- or anaesthesia in the occipital area immediately (i.e.

Table 1 demographic data: Age, gender, headache duration in years, headache days per month, headache pain intensity before and up to 5 days after the greater occipital nerve blockade and headache relief after GON blockade

	Age	Gender	Headache duration (years)	Headache days/month	Intensity before	Intensity after	Headache relief
1	29	F	8	Daily	4	4	None
2	62	M	11	20	3–10	3–10	None
3	45	M	26	Daily	2–3	8 (after inj)/3	None
4	27	F	16	Daily	3–4	3–4	None
5	23	M	5	Daily	8	8	None
6	45	M	28	20	3–8	3–8	None
7	50	M	5	Daily	6	8	None
8	33	M	19	20	5	7	None
9	48	M	7	Daily	4	4	None
10	64	F	34	Daily	3–4	3–4	None
11	21	F	6	Daily	3	3	None
12	51	M	23	Daily	3–5	3–5	None
13	52	M	3	Daily	5	5	None
14	20	F	4	Daily	5	8 (after inj)/2	Yes
15	27	F	20	Daily	2–3	2–3	None

Pain intensity was measured with the 0–10 scale (0 = no pain; 10 = most severe pain).

in minutes) following the procedure. Mean headache intensity (NRS: scale 0–10; where 0 = no pain and 10 = most severe pain) and side-effects were assessed before and up to 3 weeks after the procedure. Patients were contacted by telephone several times after the blockade: The first contact took place in the first five days after blockade (patient 10 was reached on day 10). Three further contacts followed in the 6–8 weeks after blockade (patient 10 was reached only two-times). A positive treatment response was defined as a reduction of headache days of >50% or reduction of headache intensity >50% compared to before the GON-block. Treatment response was expected after subsiding of the anaesthesia immediately or in the first five days after blockade. All patients suffered from chronic tension type headache for several years and were well known in our headache outpatient clinic. In the past they had kept a daily diary during treatment periods and were familiar with the headache intensity. For this reason assessment of pain intensity were relaying on regular telephone follow up.

Results

Table 2 summarizes the results and side-effects; 11 (73%) of 15 patients experienced no change in headache intensity or frequency, either in the first days or in the following two weeks after greater occipital nerve block. In four patients headache exacerbated: Patient 3 experienced worsening of headache in the first hours after block with relief to prior intensity on the following day; patient 7 experienced worsening of headache in the following weeks after the blockade (after 4 weeks the pain intensity relieved to the level prior to blocking); in patient 8 the headache changed from more unilateral to mostly bilateral headache of stronger intensity in the first two weeks after injection; patient 14 suffered from a stronger headache in the first two days after the block, then she described a continuos relief in the following weeks.

Table 2 Pain intensity and side-effects in the first 5 days after GON blockade. Side-effects after GON blockade. Patient 14 reported a pain relief after initial worsening and is shown in pain relief as well as pain worsening because the initial pain worsening was assessed as a side-effect

	Patients *n* (%)	Patient number.
Pain relief	1 (7%)	
Pain worsening	4 (27%)	
Pain free	0 (0%)	
Additional side-effects	6 (40%)	
Side-effects		
Bradycardia	1 (7%)	13
Local pain on the injection site	3 (20%)	4, 5, 6
Neck pain	1 (7%)	14
Face redness	1 (7%)	2
Pain worsening	4 (27%)	3, 7, 8, 14

Side-effects other than headache worsening were seen in 6 patients (Table 2). Because of bradycardia (36/min) after the first injection, patient 13 was blocked only on one side. Bradycardia occurred spontaneously during palpation of the neck and relieved spontaneously after 1 minute. No other side-effects were seen in this patient and no change in headache intensity was observed. Patients 4–6 suffered from mild local pain on the injection site for the first days after injection. Patient 14 described neck pain on the first two days after GON block. All side-effects relieved completely and spontaneous.

Discussion

Pharmakotherapy of chronic tension type headache includes simple analgesics, nonsteroidal anti-inflammatory drugs, antidepressants and anticonvulsive drugs (24, 25). New treatment modalities with nitric oxide synthase inhibitors are discussed (21).

The rationale for manipulation of cervical structures, e.g. blockade of the GON, is the clinical phenomenon of referred pain which does not respect the peripheral cutaneous distribution of either the trigeminal or occipital nerves. Patients with migraine (12), cluster headache (13, 19) and cervicogenic headache (26, 27) may benefit from GON block.

In our study the block of the GON failed in 14/15 Patients. Moreover 4 patients experienced a significant worsening of the pain following the procedure. Other side-effects were mild and temporary. The bradycardia in one patient occurred during palpation of the neck before the second injection and is most likely due to a vagal reaction, instead of an adverse event of the first block. Only one patient described a headache relief on the third day after the injection following an initial headache progress for two days. However, a spontaneous relief or a placebo effect cannot be ruled out. It is noteworthy, that we treated a group of patients, who were previously unresponsive to any kind of acute or preventative therapy. A negative selection effect regarding drug resistance or expectation of the patients, which would influence therapeutical and placebo effects, is likely. An alternative reason for treatment failure is the possibility that a single GON block is not

sufficient for interrupting the mechanism of referred pain or sensitization discussed above. Patients suffering from chronic migraine, who experienced a marked beneficial response to implanted bilateral suboccipital stimulators, described that headache recurred after switching off the stimulator (18). In chronic tension type headache an increased tenderness of pericranial myofascial tissues is a common finding (28) and painful input from these tissues may be referred to the head and perceived as headache. A central sensitization at the level of the spinal dorsal horn/trigeminal nucleus following a prolonged nociceptive input from these structures is discussed to play a crucial role in the pathophysiology of chronic pain (21, 29).

Our data suggest additional mechanisms in the pathophysiology of chronic tension type headache, rather the simple 'referral of pain' from occipital sensory input to trigeminal structures at brainstem level (10). However, as four out of 15 patients even showed an increase in headache intensity, an involvement of this system at some level is most likely. We have no explanation for this 'pro-nociceptive' effect of blocking the afferent input of the greater occipital nerve, and find it intriguing that stimulation of the occipital nerve in chronic migraine patients leads to pain relief (18). One could speculate, that accordingly stimulation of the greater occipital nerve in patients with CTTH may lead to a pain relief. This however, would contradict the expectations regarding data from experimental animal, in that GON stimulation will have a faciliatory effect on dural stimulation (11). To answer this question further clinical studies are required.

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