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Effectiveness of greater occipital nerve blocks in chronic migraine

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Ethics Committee Approval
This study was approved by Bülent Ecevit University Clinical Research Ethics Committee (No 2021/05, 10.03.2021).
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Abstract

Background/Aim: Chronic migraine (CM) is defined as headache occurring on 15 or more days per month for more than three months, which, on at least 8 days per month, has the features of a migraine headache. Greater occipital nerve (GON) blocks with local anesthetics and steroids are used in CM. GON block is widely used effectively in CM treatment. The aim of this study was to assess the effectiveness of GON blocks in CM.

Methods: This retrospective cohort study was conducted in Bulent Ecevit University Faculty of Medicine, Department of Neurology. Data of 43 CM patients who had GON block were collected. CM was diagnosed using International Classification of Headache Disorders (ICHD-3). GON blocks were repeated every week in the first month and monthly thereafter for the following 6 months. The injections were performed radially at 2 cm lateral and 2 cm inferior to the protuberantia occipitalis externa with a needle and 2 mL of 0.25% bupivacaine bilaterally. Headache attack frequency (days), headache duration (hours) and severity of pain (Visual Analog Scale (VAS)) were compared between before and after GON block in the first month.

Results: Headache attack frequency decreased from 12.8 (8.4) (pretreatment) to 3.8 (3.5), and headache severity (VAS), from 8.5 (1.2) to 4.5 (1.8) (P<0.001 for both) within one month. No serious adverse effects were observed.

Conclusion: This study showed significant decreases in headache parameters in CM. GON block is widely used effectively in CM treatment, and there is a need to standardize the application technique, dose, and frequency.

Keywords: Chronic migraine, Greater occipital nerve block, Headache attack frequency, Headache severity

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Introduction

Chronic migraine (CM) is defined as headache occurring on at least 15 days per month for more than three months, which, on at least 8 days per month, has the features of a migraine headache [1]. CM is characterized by recurrent moderate to severe headaches, with a severe impact on socioeconomic functioning and quality of life [2, 3]. Chronic migraine affects 1–2% of the general population, and in about 8% of patients with migraine, it usually develops from episodic migraine [3, 4]. The risk factors for chronic migraine include overuse of acute migraine medication, ineffective acute treatment, obesity, depression, and stressful life events. Age, female sex, and low educational status increase the risk of chronic migraine [3, 5].

Antidepressants are the most used prophylactic drugs. Beta blockers, antiepileptic drugs such as topiramate and valproate, and calcium channel blockers are used for treatment [2, 3]. Cognitive behavioral therapy and botulinum toxin are effective [6, 7]. Current treatments still have insufficient efficacy in migraine patients, and treatment of chronic migraines presents a challenge for the physicians.

Greater occipital nerve (GON) block with local anesthetics is another method of treatment developed because of the scarcity of prophylactic drugs. Some studies assessed the efficacy of GON block in the treatment of other headache syndromes, including cluster headache, chronic daily headache, and cervicogenic headache, trigeminal neuralgia and postdural puncture headache [8-18], but there are a few studies on CM treatment [2, 5, 19, 20]. The block method, administration frequency, the type and quantity of anesthetics used vary.

The aim of this study was to determine the effectiveness of GON block with the local anesthetic bupivacaine for CM prophylaxis in patients who do not use prophylactic agents.

Materials and methods

This retrospective cohort study was conducted in Bulent Ecevit University Faculty of Medicine, Department of Neurology between 2019-2020 on 43 CM patients who had GON block. CM was diagnosed using International Classification of Headache Disorders (ICHD-3) [1]. GON blocks were repeated every week in the first month and monthly thereafter for the following 6 months.

Exclusion criteria for this study were as follows: Having undergone occipital nerve block or occipital nerve stimulation, using prophylactic agents for migraine, having an active infection/skull defect/hemangioma in the injection area, a history of allergic reaction to the local anesthetic, a history of occipital region surgery, being pregnant or breastfeeding, having uncontrolled hypertension, uncontrolled diabetes mellitus, liver disease, congestive heart failure, history of a psychiatric disease, renal failure and using anticoagulants.

The injections were performed radially 2 cm lateral and 2 cm inferior to the protuberantia occipitalis externa with a needle and 2 mL of 0.25% bupivacaine bilaterally. The patients were kept under observation for 30 minutes to note the possible side effects.

Headache attack frequency (days), headache duration (hours) and severity of pain (Visual Analog Scale (VAS)) were compared before and after GON block in first month. Headache severity was recorded using a VAS. All patients were informed about the scale numbered from 0 (no pain) to 10 (worst pain ever experienced).

Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS Inc.; Chicago, IL, USA) 18.0 program. The suitability of the data to normal distribution was assessed by the Kolmogorov–Smirnov test. To summarize data obtained in the study, descriptive statistics were presented as mean (standard deviation) or median with minimum-maximum (min-max) values, depending on the distribution of the continuous variables, while categorical variables were presented as numbers and percentages. The Wilcoxon test was used to evaluate the effectiveness of GON blockade. *P*-value <0.05 was considered statistically significant.

Results

A total of 43 patients, including 39 females and 4 males, were included in the study. The median age of the patients was 40.2 (11.6) years. Table 1 shows the comparison of frequency, duration, and severity of the patients' headaches before and after bilateral GON blocks. Headache attack frequency decreased from 12.8 (8.4) (pretreatment) to 3.8 (3.5) (first month). Headache duration and severity (VAS) decreased from 17.1 (16.8) hours to 4.6 (5.3) hours, and from 8.5 (1.2) to 4.5 (1.8) (first month), respectively (P<0.001 for all). No serious adverse effects were observed.

Table 1: Pre- and post-treatment of results

n=43	Pretreatment	First month - Post-treatment	*P*-value*
Headache attack frequency (days) (per month)	12.8 (8.4)	3.8 (3.5)	<0.001
Headache duration (hours)	17.1 (16.8)	4.6 (5.3)	<0.001
VAS	8.5 (1.2)	4.5 (1.8)	<0.001

VAS: Visual Analog Scale

Discussion

Our findings showed that repeated GON block with bupivacaine bilaterally significantly decreased the number of headache days, headache duration, and VAS pain scores in patients with CM.

The effectiveness of GON block in CM has been shown in several studies [2, 5, 19-21]. The block method, administration frequency, the type and quantity of anesthetics used vary. GON block procedures are yet to be standardized.

Inan et al. [19] reported the first randomized, placebo-controlled study on GON blockade for the treatment of chronic migraine, and showed that after 3 months, repetitive GON block with bupivacaine decreased the number of headaches, headache duration, and VAS scores of CM patients. They stated that GON blockade was effective on CM treatment. Our 1- month follow-up results were similar and effective.

Dilli et al. [23] reported that GON blockade did not reduce the frequency of migraine in CM when compared with placebo. They did not use repetitive blocks.

Inan et al. [19] showed that weekly and monthly treatments were similarly effective and reported that patients

responded well to once- monthly treatment, which is more feasible than once- weekly treatment.

Unal-Artık et al. [5] reported that GON block was an effective treatment method for chronic migraine and that unilateral GON block was as effective as bilateral GON block. They showed that repeated administration was needed to achieve effective GON blockade in patients with chronic migraine. In our study, we repeated GON blocks with bupivacaine bilaterally.

In their meta-analysis, Zhang et al. [17] reported that compared to controls, GON block significantly decreases pain intensity and analgesic medication consumption but has no significant impact on headache duration. In our study, GON block decreased headache duration.

The pathophysiology of CM is not well understood, and recent advances have indicated that cortical hyperexcitability, brainstem dysfunction, and central sensitization are important in the development of CM [24].

It is related to a group of signs that originate in the autonomic nervous system. Migraine is thought to be of neurovascular origin. It is triggered by an excitation of the cerebral cortex with abnormal control of the pain-related neurons in the trigeminal nucleus which are located in the brain stem [25].

GON block treats symptoms of migraine related to modulation of afferent signals to the trigeminal nucleus caudalis, which bridges the gap between sensory regions of the ophthalmic branch of the trigeminal nerve and the greater occipital nerve. Injecting this region with a local anesthetic decreases sensory input to the trigeminal nucleus caudalis [8].

It is well known that the trigeminocervical complex is connected to the nucleus salivatorius with raphe nucleus, locus coeruleus, and hypothalamus. Painful stimulus of cranial structures is transmitted through the trigeminal nerve and the superior cervical nerve to the trigeminocervical complex and then upper centers [2, 3, 17]. There is important functional connection between the sensory occipital segments and the trigeminal nociceptive system in humans. Thus, GON block is an effective treatment option in migraine patients, and protects the patients from serious complications [2, 3, 17, 19, 21].

The response to GON block was not only dependent on the direct local anesthetic effect of the injection. The mechanism of action might have been via changes in brain nociceptive pathways. Another explanation that GON injections initiate diffuse noxious inhibitory controls, independent of anesthetic effect. Neurophysiological and clinical data suggest there is a functional connection between the sensory occipital segments and the trigeminal nociceptive system in humans. GON block for unresponsive CM should therefore be considered an effective management tool [9].

Another point still under discussion is the choice of medication to be used in the procedure. The current approach is to use local anesthetics and local anesthetic-steroid mixtures.

The literature does not include any study focused on the dose of local anesthetic that results in effective GON block. However, studies suggest the use of 1-2% lidocaine (10-20 mg / mL) and / or 0.25-0.5% bupivacaine (2.5-5 mg / mL) for effective GON block [26].

There are studies in which the GON block is combined with corticosteroids [23, 27, 28]. These studies revealed that corticosteroid supplementation did not reduce pain intensity but extended the duration of pain relief. More studies are needed to investigate this problem.

There are few adverse events following GON block, such as injection site pain, local infection, local hematoma and abdominal distension, paresthesia, and benign intracranial hypertension [17]. No adverse effects were observed in our study.

Limitations

This study was limited by the retrospective design, and the lack of a control group. Further placebo-controlled research involving large populations are needed.

Conclusion

Recurrent GON block is an effective treatment method of CM and protects patients from serious complications related to the side effects of drugs. This method is simple, safe, and cost-effective. Systemic side effects of other prophylactic drugs, which have limited use in liver and kidney diseases, and in case of pregnancy and breastfeeding, are avoided, as well as the high cost of chronic drug use. Botulinum toxin injections can be more painful for patients and the injection cost is higher than local anesthetics. More studies are needed to better define the safety and cost-effectiveness of the GON block for CM treatment.

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