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ARAŞTIRMA / RESEARCH

Greater occipital nerve block in patients with primary headache and early term results

Primer baş ağrılı hastalarda büyük oksipital sinir blokajı ve erken dönem sonuçları

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Abstract

Purpose: Peripheral nerve blocks have long been used in headache treatment and greater occipital nerve (GON) blocks are the most frequently preferred peripheral nerve blocks in patients with headaches in the past years. In this study, the efficacy of GON blocks in patients with primary headache disorders was evaluated.

Materials and Methods: This retrospective cohort study was undertaken in April 2021 and April 2022. One hundred twenty-one patients with primary headache disorders were included. Changes in the duration and frequency of headache attacks, pain severity, and type of oral medication before and after the injection treatment during the first and third months of follow-up were evaluated.

Results: The number of headache attacks decreased from 13 to 5 and the visual analogue scale(VAS) score decreased from 9 to 5 at the end of the third month in the migraine group. Similarly, the number of headache attacks decreased from 17 to 7 and the VAS score decreased from 8 to 4 in tension-type headache (TTH) group. Improvements in all parameters were found to be statistically significant in both groups.

Conclusion: GON block is a low-cost, rapid and minimally invasive treatment, and our data support that this method can be an effective treatment option in patients with migraine and TTH who are resistant to oral medication by reducing the number, frequency and severity of headache attacks. In conclusion, GON blockade should be considered by clinicians as a primary treatment option in patients with migraine and TTH resistant to oral medication.

Keywords:. Primary headache, peripheral nerve blockade, greater occipital nerve block

Öz

Amaç: Büyük oksipital sinir [greater occipital nerve (GON)] blokajı son yıllarda baş ağrılı hastalarda en sık tercih edilen periferik sinir blokajlarındandır. Bu çalışmada primer baş ağrılı hastalarda GON blokajının etkinliği değerlendirilmiştir.

Gereç ve Yöntem: Bu retrospektif kohort çalışması Nisan 2021 ve Nisan 2022'de yapılmıştır. Birincil baş ağrısı bozukluğu olan yüz yirmi bir hasta dahil edilmiştir. İzlemin 1. ve 3. ayında enjeksiyon tedavisi öncesi ve sonrası baş ağrısı ataklarının süresi ve sıklığı, ağrı şiddeti ve oral ilaç tipindeki değişiklikler değerlendirildi..

Bulgular: 3. ayın sonunda migren grubunda aylık baş ağrısı atak sayısı 13'ten 5'e ve vizuel analog skala(VAS) skoru 9'dan 5'e düşmüştü. Benzer şekilde gerilim tipi baş ağrısı (GTB) grubunda aylık baş ağrısı atak sayısı 17'den 7'ye ve VAS skoru 8'den 4'e düşmüştü. Her iki grupta da tüm paremetrelerdeki iyileşmeler istatiksel olarak anlamlıydı.

Sonuç: GON bloğu, düşük maliyetli, hızlı ve minimal invaziv bir yöntemdir ve verilerimiz, bu yöntemin baş ağrısı ataklarının sayısını, sıklığını ve şiddetini azaltarak, ağızdan ilaç tedavisine dirençli migren ve GTB hastalarında etkili bir tedavi yöntemi olabileceğini göstermiştir. Sonuç olarak GON blokajı klinisyenlerce ağızdan ilaç tedavisine dirençli migren ve GTB hastalarında öncelikli bir tedavi seçeneği olarak düşünülmelidir.

Anahtar kelimeler: Primer baş ağrısı, periferik sinir blokajı, büyük oksipital sinir blokajı

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INTRODUCTION

Headache disorders are among the most common conditions of the central nervous system in the adult population. They represent the leading cause of disability worldwide in people younger than 50 years (particularly in women), and a major cause of tremendous losses to the global economy[1]. In addition, it carries a high healthcare cost, as it is one of the most common reasons for medical consultation in emergency departments[2]. According to The International Headache Society's 2018 headache classification, headaches are divided into 3 main categories: primary headaches, secondary headaches, and painful cranial neuropathies. In this classification, 90% of all headaches have consisted of primary headaches including migraine, tension-type headache (TTH), and trigeminal autonomic cephalgias[3].

The treatment options include acute, prophylactic, and non-pharmacological therapies for primary headaches[4]. Peripheral nerve blocks are at the forefront of non- pharmacological treatments. Today, peripheral nerve block treatment is accepted and reported to be effective in patients who are unable to tolerate oral medical treatment, patients with a variety of systemic diseases for which medical treatment is contraindicated, patients who are unable to achieve satisfactory results with other methods and pregnant women[5]. Greater occipital nerve (GON) blocks have been one of the most preferred peripheral nerve blocks in patients with headache disorders in recent years. It is known that the effect of GON blocks is on the trigeminovascular system. Studies have emphasized that there is a functional connection between the caudal trigeminal nucleus and the upper cervical segments[6,7]. When the GON block is performed, the injected anesthetic substance modulates the nerve innervated field by blocking afferent inputs and inhibiting sensitization in C2-3 dorsal horn convergence neurons[8].

There are limited numbers of studies in our country regarding the clinical follow-up of patients who underwent GON blockade due to primary headache. In this study, it is aimed to explore the changes in headache attack frequency, analgesic use, and pain intensity evaluated by Visual Analog Scale (VAS) scores in the 3-month follow-up of patients with primary headache disorders who showed poorer response to medical treatment and underwent GON blocks.

MATERIALS AND METHODS

Study design

In the current study, the medical records of patients who were diagnosed with a primary headache by their medical history, neurological examination, and brain imaging studies in Elbistan state hospital neurology policlinic between April 2021 and April 2022 were evaluated retrospectively. The patients who underwent GON blocks due to showed poor response to medical treatment and/or had a contraindication to it were included. Patients with allergy to local anaesthetics, patients with bleeding diathesis, those under anticoagulant treatment, patients who underwent cervical and cranial surgery, and patients with infection in the procedure area were excluded. The GON blocks had been performed on 196 patients; however, only 121 patients completed the therapy so the study was conducted on 121 patients while the remaining 75 dropped out of the study due to a loss of follow-up. The procedure was applied to all patients by a single physician.

The medical information was recorded anonymously by giving numbers to participants to protect their personal data. The diagnosis of migraine, TTH, cluster headache, trigeminal neuralgia, and medication overuse headache was based on The International Classification of Headache Disorders, 3rd edition[2]. The study was approved with Kahramanmaras Sutcu Imam University School of Medicine ethical committee decision dated and no: 25.05.2022/01. All patients were given detailed information about the nerve block procedure and their written consents were obtained. The study followed the Declaration of Helsinki.

Procedure

Sterilization and requirements for emergency health response were provided. The patients were seated or prone position with the neck slightly flexed. The GON was located approximately one-third of the distance from the occipital protuberance to the mastoid process where the location was approximately 2 cm inferior and 2 cm lateral from the protuberance and this area was cleansed using povidone-iodine or ethyl-alcohol. An inferior-lateral approach to inserting the needle toward the greater occipital nerve was used. The needle was withdrawn approximately 1 mm and aspirated to ensure the needle was not in contact with the occipital artery.

Then, 2 ml of 2% lidocaine was injected with a 26 Gauge 13 mm needle. The procedure was applied bilaterally. The patients were followed up under observation for half an hour. The blocking procedure was applied 4 times, once a week in the first month, and once a month in the 2nd and 3rd months, for a total of 6 sessions.

Data collection

The patients' records including the type of primary headache, whether they received prophylaxis treatment, medication in the prophylaxis treatment, VAS scores measuring the pain intensity of the patients for 1 month before the procedure and the first and third months after the procedure, frequency of attacks, duration of headache and the number of analgesic drugs were evaluated. VAS; It is the table used to convert some values that cannot be measured numerically[9]. The patients were taught how to use the scale, with a vas score of 0 'I have no pain' and a vas score of 10 'very severe pain' so that they could determine their own pain levels.

Statistical analysis

Continuous data were summarized with mean±standard deviation (SD) or median (IQR: 25 th - 75 th percentile). Categorical variables were presented with frequency (n) and percentage (%). The normality assumptions of the continuous variables were controlled by the Shapiro-Wilk test. The gender distribution of the study groups was compared with Fisher's Exact test. Independent t-test was used to compare age between groups. Friedman test with post-hoc Bonferroni test was applied for nonparametric comparison of changes in pre- and post-treatment headache frequency, severity, duration and the number of analgesics. At 80% power, the required minimum sample volume was calculated as 28. With the correction made for the Friedman test (nonparametric test), 28*1.15=32 is the minimum required sample volume. Statistical analysis was performed with IBM SPSS Statistics for Windows, Version 23.0 (IBM Corp., Armonk, NY). Two-sided p-value less than 0.05 was considered statistically significant.

RESULTS

A total of 121 patients, 106 (87.6%) female, and 15 (12.4%) male were included in the study. The age range was 18-75 and the mean age was 41.47±10.8. According to the headache classification, 86 had a migraine headache, 33 had TTH, 1 had cluster headache and 1 had trigeminal neuralgia. While the mean age of 86 migraine patients was 39.86±10.5, 94.2% were women. The male/female ratio and the mean age of the TTH group was significantly higher than migraine group ($p<0.05$). The demographic data of the patients are shown in Table 1.

Table 1. Demographic characteristics of the patients

Variables	TTH (n=33)	Migraine (n=86)	p
Age (years), mean±SD	46,12±10,51	39,86±10,5	0,004
Gender, n(%)			
Female	24(72,7)	81(94,2)	0,003
Male	9(27,3)	5(5,8)	

Independent t-test, Fisher's Exact test.
SD: Standard Deviation, TTH:Tension-type headache

Among migraine patients, 27 had chronic migraine and 59 had episodic migraine. Of the 33 patients with TTH, 24 patients had chronic and 9 had episodic TTH. Medication overuse was found in 70 (81.4%) of 86 migraine patients and 26 (78.8%) of 33 TTH patients. Thirty-three of 86 migraine patients were under tricyclic antidepressants (TCA), 15 of them were under beta blockers, 12 of them were under calcium channel blockers, 5 of them were under antiepileptic drugs and 5 of them were under serotonin-norepinephrine reuptake inhibitors (SNRIs). Sixteen of the migraine patients did not receive any prophylaxis treatment. Two of 16 patients who did not receive prophylaxis treatment were in pregnancy and 4 were in the lactation period. Among TTH patients, 17 patients were under TCA and 3 were under SNRI treatment, while 13 did not receive prophylaxis treatment. The cluster headache patient was under verapamil treatment as prophylaxis and the patient with trigeminal neuralgia was under carbamazepine treatment.

The pain characteristics of patients with migraine and tension-type headaches before GON block were compared. The highest pain scores (VAS) and duration of headache attacks were in the migraine group, while the highest number of attacks and the number of analgesic drugs used were in the tension-type headache group. Parameters such as number of attacks per month, number of analgesics used, duration of attacks, and VAS were compared before and after treatment in both migraine and TTH groups. Among migraine and TTH groups, a statistically significant decrease was observed in the number of attacks, the number of analgesics used, the duration of attacks, and the VAS score at 1 and 3 months compared to pre-treatment ($p<0.001$) (Table 2 and 3).

There was no significant change in the frequency of attacks in the migraine group when the same parameters were compared between the 1st and 3rd months. However, the 3rd month's clinical data were significantly better than the 1st month in terms of the number of analgesics used, the duration of headache attacks, and the VAS score (Table 2). Among the TTH group, there was a significant decrease only in the VAS score in the 3rd month compared to the 1st month, while no significant difference was observed between the 1st and 3rd-month data including the number of attacks, the number of analgesics used, and the duration of attacks (Table 3).

Table 2. Clinical findings during follow-up in the migraine group

					Post hoc comparison		
Variables	**Baseline Median(IQR)**	**1st month Median(IQR)**	**3rd month Median(IQR)**	**p**	**1st month vs. Baseline**	**3rd month vs. Baseline**	**3rd month vs. 1st month**
Number of attacks in a mounth	13(11-15)	6(4-7)	5(3-6)	<0.001	<0.001	<0.001	0.081
Number of analgesics used in a month	17(13-21)	7(6-8)	6(5-8)	<0.001	<0.001	<0.001	<0.001
Mounthly attack duration (hour)	20(18-27)	9(7-11)	8(6-10)	<0.001	<0.001	<0.001	0.001
VAS score	9(8-9)	5(4-6)	5(4-5)	<0.001	<0.001	<0.001	0.014

Friedman test with post hoc Bonferroni correction.
IQR: İnterquartile Range (25 th - 75 th percentile), VAS: Visual Analog Scale

Table 3. Clinical findings during follow-up in the Tension-type headache group

					Post hoc comparison		
Variables	**Baseline Median(IQR)**	**1st month Median(IQR)**	**3rd month Median(IQR)**	**p**	**1st month vs. Baseline**	**3rd month vs. Baseline**	**3rd month vs. 1st month**
Number of attacks in a mounth	17(14-19)	7(5-9)	7(5-8)	<0.001	<0.001	<0.001	0.999
Number of analgesics used in a month	18(15-24)	8(6-10)	6(5-9)	<0.001	<0.001	<0.001	0.058
Mounthly attack duration (hour)	18(15-27)	8(6-11)	6(4-8)	<0.001	<0.001	<0.001	0.147
VAS score	8(7-9)	5(4-5)	4(4-4)	<0.001	<0.001	<0.001	0.003

Friedman test with post hoc Bonferroni correction.
IQR: İnterquartile Range (25 th - 75 th percentile), VAS: Visual Analog Scale,

Only one patient, a 32-year-old female patient with a migraine, had developed hypotension and dizziness. Following the administration of the intravenous saline solution, she was soon observed to be normotensive. These complications did not repeat after the following sessions of hers. No significant complications were observed in other patients.

DISCUSSION

Although oral medication is the first-line treatment option for the treatment of primary headache, it may not be possible all the time to use due to comorbid diseases such as kidney or liver diseases, cardiovascular, cerebrovascular or peripheral vascular diseases, pregnancy, breastfeeding, or psychiatric conditions. Calcium channel blockers, beta-blockers, and antidepressants are used in prophylaxis treatment for their effects through different neurotransmitter systems, which might be responsible for serious side effects, and reduce patient compliance[10]. In such cases, peripheral nerve blocks and stimulation could be quite effective and safe procedures[5].

Peripheral nerve blocks for the treatment of pain are based on blocking sensory nerve fibers selectively by low-concentration of local anesthetics. Local anesthetics cause reversible blockade of sodium channels of nerve fibers and provide effective pain control by causing depolarization in demyelinating C fibers and myelinated A fibers that play a key role in pain signal transmission. The duration of the effectiveness of peripheral nerve blocks depends on the dosage and the pharmacokinetic properties of the local anesthetics used. They have a longer effect than predicted in clinical practice. It is thought that the prolonged analgesic effect following nerve blocking may be related to central pain modulation. Blocking the peripheral nerves of the head and neck may be beneficial for other painful syndromes which are not innervated by these nerves. This result is often explained by the concept of 'convergence' in the head and neck nociceptive system, especially between the trigeminal neurons and upper cervical sensory afferents[11].

Peripheral nerve blocks are most commonly performed on the GON and its branches. GON blocks in primary headaches were first started to be used in the 1980s by scientists such as James Lance and Peter Goadsby[12]. GON block, which is one of the most common blocks in daily practice, has recently become a frequently preferred method for primary headaches, especially for chronic migraine, and its effectiveness has been demonstrated in many studies[13,14]. In the current study, we aimed to evaluate the efficacy of GON block in our cohort and compared the results in patients with migraine, TTH, cluster headache, and trigeminal neuralgia.

Migraine occupies the sixth place among the leading causes of disability and it is responsible for a significant decrease in the quality of life of patients in their most productive periods[15]. The increase in the frequency of attacks and the number of painful days in migraine patients is a sign of chronification. According to the latest classification of the International Headache Society (IHS), chronic migraine is defined as a headache that occurs 15 days or more per month, of which at least 8 have migraine characteristics or respond to migraine-specific treatment[3]. While %31.4 of the migraine patients included in the study met the criteria for chronic migraine, of the %72.7 patients with TTH were chronic TTH patient.

The use of triptan, ergotamine, opioid, and combined analgesics for more than 10 times a month and simple analgesics for more than 15 days a month for 3 months due to primary headache is defined as medication overuse[3]. Medication overuse was found in 81.4% of our migraine patients. 78.8 % of patients with TTH had medication overuse. A meta-analysis evaluating seven randomized, controlled trials in migraine patients reported that GON block significantly reduced pain severity and analgesic use; however, it did not significantly change the duration of pain[16]. Similar to the results of this meta-analysis, clinical findings before and after the injection for our patient sample diagnosed with migraine showed that there was a significant decrease in pain intensity and analgesic use at the end of 1st and 3rd months. In contrast to the results of the meta-analysis, we found a significant decrease in pain duration compared to pre-treatment period. While there was no significant difference between the frequency of attacks in the 3rd month and the 1st month, the number of analgesics used, the duration of the attacks, and the VAS score were significantly lower in the 3rd month than in the 1st month.

The studies assessing the effectiveness of GON blocks in patients with TTH are limited and these studies have conflicting results. In a study by Leinisch-Dahlke et al., the authors performed GON blocks on 15 patients with TTH, and they found that only one patient described headache relief. The

authors reported no effect of greater occipital nerve block in patients with chronic TTH[17]. In a study conducted by Hasırcı et al., it was observed that the frequency and severity of headaches decreased in the short-term follow-up of the 12 patients with tension-type headache as a result of recurrent GON blocks[18]. In the current study, we detected a significant decrease in pain intensity, analgesic use, and pain duration at the end of the 1st and 3rd months compared to the pre-treatment period, just like in the migraine group. However, we did not find any significant difference between the 1st and 3rd months in the number of attacks and analgesic drugs, and the duration of headache attacks, but VAS scores significantly decreased after 3 months.

There are some research demonstrating the effectiveness of GON blocking in cluster headaches in the literature. In a study conducted on ten patients with cluster-type headache, clinical response to injections was obtained in 9 patients with varying durations. The mean duration of effectiveness of injection was reported as 10.3 weeks in 9 patients who benefited from the treatment[19]. We performed GON blocks on a patient with cluster headache. The 28-year-old male patient was examined for the first time for his headache complaints. The injection therapy was given together with verapamil prophylaxis. There was a 56.6 % reduction in the number of painful days and a 70% reduction in the duration of pain after 3 months of this therapy. Despite being few in number There are case series reporting successful results with GON blocks in patients with trigeminal neuralgia[20]. We performed a GON block together with carbamazepine prophylaxis on a 40-year-old female patient; however, no significant change was observed in the patient's symptoms and she was referred to the department of pain management.

As mentioned above, although many studies are reporting the effectiveness of GON blocks for the treatment of headache disorders, standardization has not yet been done in terms of the medication choice, dosage, method, and frequency of administration. Although there are no randomized controlled studies, the American Headache Society has reported application recommendations for GON blocks[21]. Dilli et al. compared the efficacy of lidocaine, bupivacaine, and methylprednisolone in patients with migraine and did not observe a significant difference between the groups in terms of migraine headache duration and the number of analgesic drugs[22]. Other studies comparing the effects of local anesthetics have also revealed that local anesthetics do not have any superiority over each other[23]. Lidocaine was used in this study because lidocaine is inexpensive and easy to access.

Studies on GON blocks with a mixture of steroids and local anesthetics have shown that steroids do not provide an additional contribution to the reduction in pain severity[22,23]. It is known that GON blocks can be performed both unilaterally and bilaterally in clinical practice. A study by Ünal et al. comparing the efficacy of unilateral and bilateral GON blocks revealed that there was no significant difference between the results of both application methods[24]. In our method, the blockade procedure was bilaterally performed. Another question related to the GON blocking method is whether the blockage should be done in a single session or in repetitive sessions. Numerous studies have shown that repetitive nerve blocks are more effective than single injections[22,24,25].

The findings of this study support that repetitive GON blocks with local anesthetics are effective in migraine and TTH patients, and they are consistent with the previous studies in the medical literature. While the cluster headache patient benefited from the GON blocks, our patient with trigeminal neuralgia did not respond to this treatment. Studies with larger numbers of patients are needed to demonstrate the effectiveness of GON block in cluster headache and trigeminal neuralgia patients. Except for one patient who had short-term hypotension and a presyncope attack, no serious local or systemic side effects were developed in any of the patients under GON block treatment. We believe that the minimal side-effect risks enable our patients to comply with GON blocks at a higher rate than medical treatment because of unwanted and undesirable effects that are possibly related to a drug. Our study had several limitations. The shortcomings of our study were that there was only one patient with trigeminal neuralgia and cluster headache and that we did not have follow-ups for the period after the 3-month treatment protocol. Despite these limitations, the current study could be a valuable data source for large analysis studies.

In conclusion, GON block is a low-cost, rapid and minimally invasive method to treat headache disorders. Our results show that this method can be an effective treatment method in patients with migraine and TTH who are resistant to oral medication by reducing the number, frequency and severity of headache attacks. In addition, GON

blocks improve the quality of life of chronic headache patients and reduce the number of medications, related side effects and treatment costs. In conclusion, clinicians could consider GON blocks as a primary treatment option in patients with migraine and TTH who do not respond to standard treatments.

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