European Review for Medical and Pharmacological Sciences 2024; 28: 4170-4178

Effectiveness of greater occipital nerve blockade in chronic cluster headache

M. KARACAN GOLEN[1], N. TEPE[2], Ş.M. IŞIK[3]

[1]Department of Neurology, Baskent Unıversity, Hospital Konya, Selçuklu, Turkey
[2]Department of Neurology, Faculty of Medicine, Balıkesir University, Balıkesir, Turkey
[3]Konya Numune State Hospital, Konya, Turkey

ABSTRACT. – OBJECTIVE: Greater occipital nerve (GON) blockade injections can be used to prevent episodic and chronic cluster headaches. In recent studies, prophylactic treatment has been used in addition to the GON blockade. In this study, we aimed to elucidate the effect of GON blockade on the attack frequency, pain intensity, and duration in patients diagnosed with chronic cluster headaches.

PATIENTS AND METHODS: The demographic characteristics of 30 patients who received GON blockade along with acute attack treatment, short- and long-term prophylactic treatment for cluster headache, and 24 patients who received only acute attack treatment, short- and long-term prophylactic treatment, before blockade treatment, in the 1st week and 1st month after blockade were investigated. Attack frequency, attack duration, and visual analog scale (VAS) variables were compared.

RESULTS: We evaluated the VAS score, daily attack frequency, and duration of pain attacks after repeated GON blockade and found a statistically significant difference in the VAS score, daily attack frequency, duration of pain attacks, average values of the treatment, and time interaction of pain intensity in the group in which GON blockade was applied in the 1st week and 1st month compared to the pre-treatment period ($p<0.01$), ($p<0.01$), ($p=0.044$).

CONCLUSIONS: Regarding the outcomes of this research, GON blockade provided significant improvement in pain frequency, attack duration, and VAS score in the period from attack treatment to the start of long-term prophylaxis treatment and one month after treatment, without the need to switch to different prophylaxis treatments. Therefore, GON blockade may be a preferable and reliable treatment option.

Key Words:
Headache, Cluster headache, Greater occipital nerve blockade, Cluster headache treatment.

Introduction

The diagnostic criteria for cluster headache (CH) are delineated in the 2018 edition of the International Classification of Headaches (ICHD-III) as a unilateral, intensely severe stabbing headache localized to the orbital, frontal, and temporal regions, often accompanied by cranial symptoms such as ipsilateral conjunctival hyperemia, lacrimation, rhinorrhea, and Horner syndrome[1]. Pain attacks can recur up to eight times a day, with each attack typically lasting approximately 15-180 min. Cluster headaches manifest in both episodic and chronic forms, contingent upon their periodicity. Episodic cluster headaches (ECH), constituting the majority of cases, are characterized by painful periods lasting from a week to a year, interspersed with remission periods lasting three months or longer. The cluster attack periods in ECH can endure several weeks to several months. Chronic cluster headache (CCH) is less common than ECH, with pain persisting for at least one year without remission or with remission lasting less than three months[1]. Its prevalence is estimated at 0.1-0.5% of the population, with a higher incidence among men (4:1) aged 30-50 years[2,3].

Appropriate medical management of cluster headaches depends on the frequency of individual attacks. Treatment options include the avoidance of triggering factors, acute attack treatment, short- and long-term prophylactic treatment, and surgical treatment[4]. The preferred treatments for acute attacks include subcutaneous sumatriptan, nasal triptans, and the administration of 100% oxygen at a rate of 7-12 L/min. In resistant cases where an adequate response to prophylaxis is not obtained, neuromodulation and surgical treat-

Corresponding Author: Meltem Karacan Golen, MD; e-mail: drmeltemkaracan@hotmail.com

ments, which apply ipsilateral posterior hypothalamic stimulation to the pain side, are planned. In addition to the aforementioned treatment modalities, short-term prophylaxis, also known as transitional-bridge treatment, aims to effectively manage potential new attacks while waiting for prophylactic treatment[4-6]. Oral corticosteroids, ergotamine, and 5HT1BD agonists are the preferred agents for transitional treatment. When corticosteroids are contraindicated or ineffective, an alternative is a greater occipital nerve (GON) blockade using local anesthetics or steroids[7].

In addition, results[8] evaluating the effectiveness of galcanezumab in the prophylaxis treatment of episodic cluster headaches show that it is more effective than verapamil in reducing ECH attacks in adults. However, new studies need to demonstrate the efficacy and benefit-risk profile of galcanezumab.

GON blockade is more commonly used in patients with migraines and has also been used as a treatment option in patients diagnosed with cluster headaches. The effectiveness of this method has been demonstrated in studies[9].

In this study, we aimed to assess the effect of GON blockade on the frequency of attacks, intensity of pain, and duration of pain in patients diagnosed with chronic cluster headaches.

Patients and Methods

A total of 54 patients aged 18-65 years were enrolled in this retrospective analysis, which was conducted at the neurology outpatient clinic of Konya Numune State Hospital between July 2018 and September 2023. These patients were diagnosed with chronic cluster headaches based on the diagnostic criteria outlined in the 2018 International Headache Classification (ICHD III)[1]. All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and the Helsinki Declaration of 1975, as revised in 2013. Ethics Committee approval was obtained from our institution under protocol number 2024/038, and an informed consent form was obtained from the patients before each blockade treatment.

Thirty patients who were followed up with a diagnosis of cluster headache and received acute attack treatment, short-term and long-term prophylactic treatment and GON blockade, and 24 patients who did not receive GON blockade and received only acute attack treatment, short-term and long-term prophylactic treatment were included. Demographic characteristics of the groups were examined. Attack frequency, attack duration, and Visual analog scale (VAS) variables were compared between the groups before blockade treatment and at one week and one month after blockade.

The following groups were excluded from the study: patients with headaches other than cluster headache; those with acute pathology or space-occupying lesions detected on cranial imaging; those who were pregnant or breastfeeding; patients with a history of malignancy or major psychiatric disorders; patients with bleeding diathesis; patients undergoing warfarin or derivative anticoagulant therapy; those with allergies to local anesthetics; individuals with a history of cervical and cranial surgery; those with neuromuscular dysfunction; and individuals with an infection in the procedure area.

Sterilization protocols and emergency response measures were implemented for all patients. Following the application of an antiseptic solution to clean the intervention site, the occipital artery was located approximately one-third medial to the imaginary line drawn between the protuberant occipitalis externa and mastoid process, whereupon an injection was administered. Upon bone contact with the needle, it was withdrawn and aspirated to confirm arterial entry, after which 1.5 ml of 2% lidocaine was applied bilaterally. A 26 Gauge 13 mm needle was used for this purpose. The patients were observed for approximately 30 minutes. The bilateral blocking procedure was conducted four times a week during the initial month, followed by once-monthly sessions in the second and third months, for a total of six sessions.

Statistical Analysis

Patient data collected within the scope of the study were analyzed using the IBM Statistical Package for the Social Sciences (SPSS) for Windows version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including frequency and percentage for categorical data and mean and standard deviation for continuous data were calculated. Compliance with a normal distribution was assessed using skewness and kurtosis coefficients. Variables demonstrating normal distribution according to treatment and time, such as the VAS score and attack frequency, were subjected to analysis using Generalized Linear Models, with

4171

multiple comparisons conducted using Bonferroni Correction. A Two-Way Robust ANOVA test was employed to analyze the number of attacks that did not comply with the normal distribution. Analysis results are presented as mean ± standard deviation and trimmed mean ± standard error. For comparisons between groups, the Independent Sample *t*-test was used for two groups, and Pearson's Chi-Square test was utilized to compare categorical variables. Statistical significance was determined when the *p*-value was lower than 0.05.

Results

Of the participants, 83.3% (n=45/54) were males and 16.7% (n=9/54) were females. The proportion of right-sided lateralization was 53.7% (n=29/54) and left-side lateralization was 46.3% (n=25/54). Tear occurrence was 83.3% (n=45/54), redness of the eyes was 72.2% (n=39/54), and edema of the eyelids was 44.4% (n=24/54). The rates of nasal congestion or runny nose, myosis, and ptosis were 50% (n=27/54), 37% (n=20/54), and 24.1% (n=13/54). The rate of redness and sweating on the forehead was 46.3% (n=25/54) and fullness in the ear was 38.9% (n=21/54). The proportion of participants who received GON blockade was 55.6% (n=30/54) (Table I).

There was no significant difference between the groups with and without GON blockade in terms of age, sex, presence of autonomic symptoms, episodic treatment, and short- and long-term prophylaxis (Table II).

The mean age of participants was 44.07 years. The average duration of the cluster periods was 117.87 days. The mean daily attack frequency was 5.98, with an average duration of 110.56 minutes. The mean VAS score before treatment was 8.89, which decreased to 5.69 in the 1st week after the GON blockade. During the first week, the average attack frequency per day was 2.87, and the average attack duration was 60 min/day. In the first month after GON blockade, the average VAS score decreased to 2.61. After one month, the attack frequency reduced to 1.3 per day, and the average attack duration decreased to 20.28 minutes (Table III).

The main effect of treatment was statistically significant on mean VAS values ($p<0.001$). In the group where GON blockade was not applied, the mean VAS value was 6.56±2.15, whereas in the GON blockade group, it was 5.07±3.21. Furthermore, the effect of time on mean VAS values was also statistically significant ($p<0.001$). The mean pre-treatment VAS value was 8.89±0.82, which decreased to 5.69±1.21 in the 1st week and further decreased to 2.61±1.73 after one month. Notably, the mean VAS scores measured at all the time points were significantly different. Additionally, there was a statistically significant interaction between treatment and time on the mean VAS score F (2.156)=32.68 ($p<0.001$) (Table IV; Figure 1).

The main effect of treatment on average attack frequency was found to be statistically significant ($p<0.001$). Specifically, the mean attack frequency in the group where the GON blockade was not applied was 3.94±1.93 days, while it was 2.93±2.45

Table I. Distribution of sociodemographic data and descriptive statistics.

	Frequency	%
Sex (male/female)	45/9	83.3/16.7
Lateralization (right/left)	29/25	53.7/46.3
Autonomic findings	54	100
Tears in the eye (no/yes)	9/45	16.7/83.3
Redness in the eye (no/yes)	15/39	27.8/72.2
Eyelid edema (no/yes)	30/24	55.6/44.4
Nasal congestion/runny nose (no/yes)	27/27	50/50
Myosis (no/yes)	34/20	63/37
Ptosis (no/yes)	41/13	75.9/24.1
Forehead, facial redness, sweating (no/yes)	29/25	53.7/46.3
Feeling of fullness in the ear (no/yes)	33/21	61.1/38.9
Episodic treatment (no/yes)	54	100
Prophylaxis treatment short-term (no/yes)	54	100
Prophylaxis treatment long-term (no/yes)	54	100
GON blockade		
No GON blockade applied	24	44.4
GON blockade applied	30	55.6

GON: greater occipital nerve.

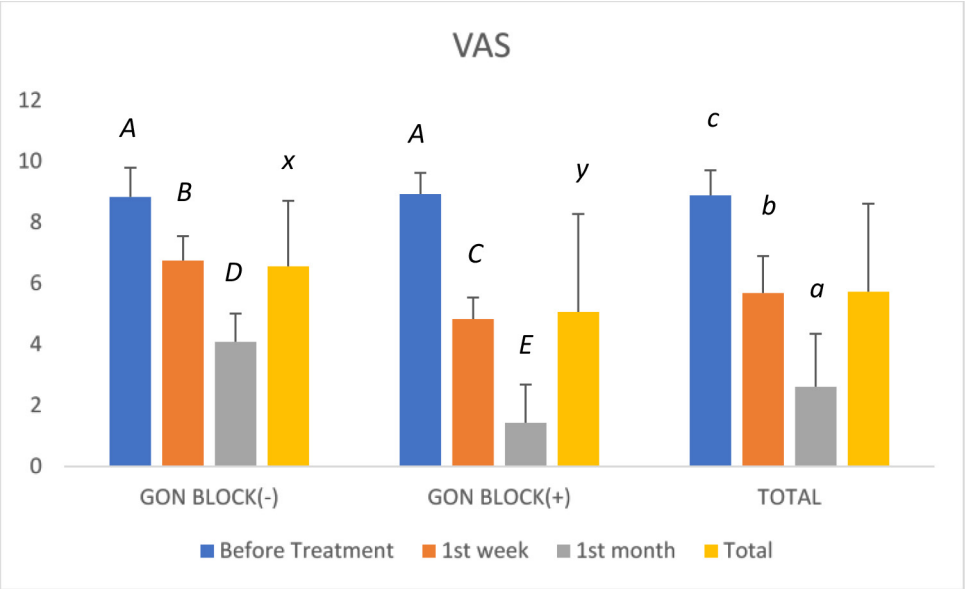

Figure 1. Comparison of VAS between groups according to treatment time (before treatment, first week, first month); (x-y: treatment status, a-c: treatment time, A-E: between treatment time and time interaction). All the columns named with the same letter indicate that there is no difference between groups.

days in the GON blockade group. Moreover, the effect of time on mean attack frequency was statistically significant (p<0.001). Prior to treatment, the mean attack frequency was 5.98±1.39 days, which decreased to 2.87±1.1 days in the 1st week and further decreased to 1.3±1.08 days after one month. Notably, the mean attack frequency measured at all time points demonstrated significant differences. Additionally, there was a statistically significant interaction between treatment and time on mean attack frequency F (2.156)=5.43 (p=0.005) (Table V; Figure 2).

The main effect of treatment was found to have a statistically significant effect on mean attack duration (p=0.001). Categorically, the mean attack duration in the group where the GON blockade was not applied was 69.8±5.44 days, whereas, in the GON blockade group, it was 49.9±5.59 days. Additionally, the effect of time on mean attack duration was statistically significant (p=0.001). Prior to treatment, the mean attack duration was 105±5.76 days, which decreased to 56.4±3.88 days in the 1st week and further decreased to 18.9±2.41 days after one month. The mean attack duration measured at all time points showed significant differences. Moreover, there was a statistically significant interaction between treatment and time on mean attack duration (p=0.044) (Table VI; Figure 3).

Table II. Comparison of demographic characteristics between groups.

	Treatment (GON blockade)		
	No GON blockade applied (24)	GON blockade applied (30)	*p*-value
Age	44.07±7.89	43.60±7.59	0.489
Sex (female/male)	7/17	7/23	
Autonomic findings	24	30	
Episodic treatment	24	30	
Prophylaxis treatment short-term	24	30	
Prophylaxis treatment long-term	24	30	

GON: greater occipital nerve.

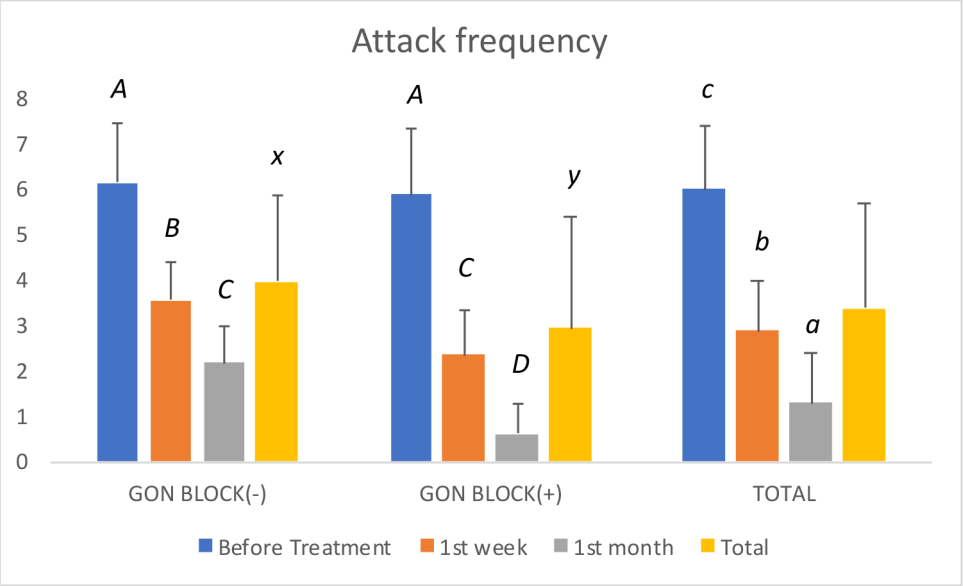

Figure 2. Comparison of the attack frequency between groups according to treatment time (before treatment, first week, first month) (x-y: treatment status, a-c: treatment time. A-D: between treatment time and time interaction). All of the columns named with the same letter indicate that there is no difference between groups.

Discussion

GON blockade is commonly employed in clinical practice as a therapeutic approach for patients with persistent headaches, notably chronic migraines. This intervention notably augments patients' daily functionality and quality of life, frequently leading to substantial satisfaction with the treatment outcomes. The utilization of this technique extends to various scenarios, including the management of cluster headache attacks, addressing pain in individuals unresponsive to both

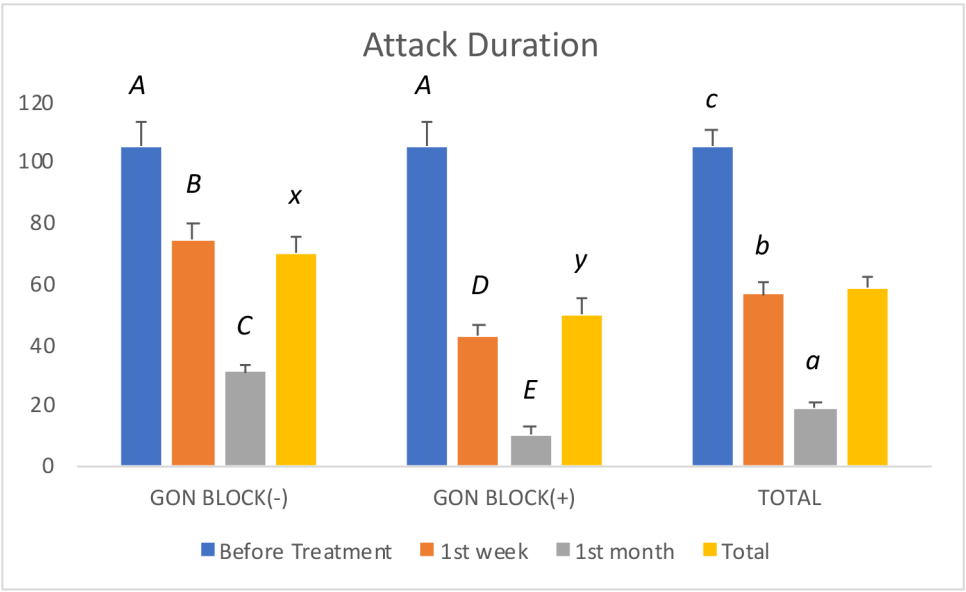

Figure 3. Comparison of attack duration between groups according to treatment time (before treatment, first week, first month) (x-y: treatment status, a-c: treatment time. A-E: between treatment time and time interaction). All of the columns named with the same letter indicate that there is no difference between groups.

Table III. VAS evaluation of attack duration and attack frequency in cluster headache patients before treatment, 1st week and 1st month.

	Frequency	%
Age	44.07±7.68	45 (26-62)
Cluster period duration days	117.87±52.87	90 (45-240)
Attack frequency before treatment (day)	5.98±1.39	6 (3-8)
Attack duration before treatment (minutes)	110.56±52.72	90 (60-360)
Pre-treatment VAS	8.89±0.82	9 (7-10)
1st week attack frequency (day)	2.87±1.1	3 (1-5)
1st week attack duration (minutes)	60±34.72	60 (30-240)
Week 1 VAS	5.69±1.21	5 (4-8)
Attack frequency after 1 month (days)	1.3±1.08	1 (0-4)
Attack duration after 1 month (minutes)	20.28±17.76	15 (0-90)
1st month VAS	2.61±1.73	3 (0-5)

VAS: visual analog scale.

Table IV. Comparison of VAS values according to treatment status and time.

Time	Treatment (GON blockade)		Total		F	*p*-value*	PES	DFn	DFd
	Not applied	Applied							
Before treatment	8.83±0.96^{A}	8.93±0.69^{A}	8.89±0.82^{c}						
1st week	6.75±0.79^{B}	4.83±0.7^{C}	5.69±1.21^{b}	Treatment	107.18	**<0.001**	0.407	1	156
1st month	4.08±0.93^{D}	1.43±1.25^{E}	2.61±1.73^{a}	Time	604.61	**<0.001**	0.886	2	156
Total	6.56±2.15	5.07±3.21	5.73±2.88	Treatment*-Time	32.68	**<0.001**	0.295	2	156

GON: greater occipital nerve; VAS: visual analog scale; PES: partial eta square; DFn: numerator degrees of freedom, DFd: denominator degrees of freedom. *Generalized Linear Models; Mean±Standard deviation. $^{a\text{-}c}$: There is no difference between the main effects with the same letter; $^{A\text{-}E}$: there is no difference between interaction groups with the same letter.

Table V. Comparison of attack frequency (days) according to treatment status and time.

Time	Treatment (GON blockade)		Total		F	*p*-value*	PES	DFn	DFd
	Not applied	Applied							
Before treatment	6.13±1.33^{A}	5.87±1.46^{A}	5.98±1.39^{c}						
1st week	3.54±0.83^{B}	2.33±0.99^{C}	2.87±1.1^{b}	Treatment	36.40	**<0.001**	0.189	1	156
1st month	2.17±0.82^{C}	0.6±0.67^{D}	1.3±1.08^{a}	Time	261.46	**<0.001**	0.770	2	156
Total	3.94±1.93	2.93±2.45	3.38±2.29	Treatment* Time	5.43	**0.005**	0.065	2	156

GON: greater occipital nerve; VAS: visual analog scale; PES: partial eta square; DFn: numerator degrees of freedom, DFd: denominator degrees of freedom. Mean±Standard deviation. $^{a\text{-}c}$: There is no difference between the main effects with the same letter; $^{A\text{-}D}$: there is no difference between interaction groups with the same letter.

short- and long-term prophylactic treatments, and instances where medical treatment options are constrained due to comorbid conditions, patient preferences, or the ineffectiveness of conventional medical interventions. This has prompted growing interest in exploring novel treatment modalities to address these clinical challenges[10,11].

In this study, attack frequency, VAS score and attack duration were evaluated in both groups of patients diagnosed with cluster headache and un-

Table VI. Comparison of attack durations (min) according to treatment status and time

Time	Treatment (GON blockade)		Total		Q	*p*-value*
	Not applied	Applied				
Before treatment	105±8.02^{A}	105±8.26^{A}	105±5.76^{c}			
1st week	74.5±5.09^{B}	42.7±3.66^{D}	56.4±3.88^{b}	Treatment	15.53	**0.001**
1st month	30.7±2.82^{C}	10.2±2.42^{E}	18.9±2.41^{a}	Time	279.38	**0.001**
Total	69.8±5.44	49.9±5.59	58.7±4.01	Treatment*Time	6.60	**0.044**

GON: greater occipital nerve. *Two-Way Robust ANOVA. Trimmed Mean±Standard error. $^{a-c}$: There is no difference between main effects with the same letter; $^{A-E}$: there is no difference between interaction groups with the same letter.

der medical treatment, those with GON blockade and those without GON blockade, compared to the pre-treatment period.

Although the mechanism of the effectiveness of GON blockade in cluster headache has not been fully elucidated, it is emphasized that the cervical block may affect the spinal trigeminal nucleus, reduce the sensory input that modulates the central processes, and therefore possibly interrupt the trigeminal autonomic reflex pathway by reducing trigeminal activity[12,13].

Cluster headache represents the predominant form of trigeminal-autonomic cephalalgia, occurring in approximately 0.1% of the general population[14,15]. It exhibits a higher prevalence among men than women, with a reported male-to-female ratio of 4.3, according to a meta-analysis[2] conducted in 2008. While cluster headaches can manifest at any age, their most common onset occurs between the ages of 30 and 40[16,17]. Consistent with these findings, we observed a similar pattern in our study. The average age of the patients diagnosed with cluster headaches whom we followed was 44.07±7.68 years, with males constituting 83.3% of the cases and females comprising 16.7%. Our data corroborate the predominance of cluster headaches in males, which is consistent with existing literature.

Each cluster headache attack is accompanied by severe or very severe unilateral pain localized to the orbital, supraorbital, and temporal regions and accompanying autonomic symptoms (eye redness, nasal congestion, periorbital edema, miosis, ptosis, unilateral facial and forehead sweating, restlessness, agitation)[1,18]. In our study, all participants were diagnosed with chronic cluster headaches, with 53.7% experiencing unilateral onset on the right side and 46.3% on the left side. Each attack is associated with multiple autonomic dysfunctions. Among the observed autonomic symptoms, lacrimation was the most prevalent, present in 83.3% of the cases, whereas ptosis was the least frequent, occurring in 24% of the cases.

All patients included in the study underwent attack and long-term prophylactic treatment. GON blockade was applied to 55.5% of the patients in the group of patients who did not benefit from medical treatment. We conducted a comparative analysis of the daily attack frequency, attack duration, and VAS scores before treatment, during the first week, and at the end of the first month, between the group that received GON blockade in addition to prophylactic treatment and the group that received only prophylactic treatment. When we evaluated the VAS data after repeated GON blockade, a statistically significant difference was found in the VAS average values of the treatment and time interaction of pain intensity in the group in which GON blockade was applied at the 1st week and 1st month compared to the pre-treatment period (p<0.001).

Upon evaluating the daily attack frequency following recurrent GON blockade, we noted a statistically significant difference in the frequency of attacks impacting patients' daily activities in the group that underwent GON blockade for the 1st week and 1st month, compared to the pre-treatment period (p<0.001). Additionally, we assessed the duration of pain attacks that occurred during the onset of cluster headaches following recurrent GON blockade. Our findings revealed a reduction in the duration of pain attacks with repeated applications in the group receiving GON blockade during the 1st week and 1st month, in contrast to the pre-treatment period (p=0.044). In a systematic review by Gordon et al[19], the safety and efficacy of GON blockade in cluster headaches were examined, concluding that GON blockade

is both safe and effective for cluster headache prevention. The study suggested that higher injectate volumes may enhance the likelihood of a favorable response, and the potential for serious adverse events could be mitigated through the use of methylprednisolone. Similarly, Lambru et al[7] reported the effectiveness of GON blockade in treating chronic cluster headaches, proposing that consecutive applications over a span of 3 months could be beneficial in managing this condition. Ambrosini et al[18] demonstrated in their study that even a single GON blockade could suppress and control attacks for approximately four weeks in over 80% of patients. Our study further corroborates these findings by illustrating that recurrent GON blockade serves as an effective transitional treatment for chronic cluster headaches, potentially eliminating the need for long-term use of oral corticosteroids and mitigating the associated side effects. Ailani and Young[20] evaluated the efficacy of nerve blockade and botulinum toxin injection in cluster headaches, highlighting the effectiveness of GON blockade as an alternative bridge treatment from conventional cluster headache therapy to steroid-based treatments[7,21].

In our study group, prophylactic treatments were tailored based on individual patient factors such as comorbidities, preferences, and treatment responsiveness. Although all patients received the same type and dose of prophylaxis, standardization between the groups was not feasible. Notwithstanding the valuable insights gained, our study is subject to limitations inherent to its design, including a small study group due to the low incidence of cluster headaches in the general population, as well as a small control group. Additionally, the study's limitations include its non-randomized nature and a relatively short follow-up period.

Conclusions

Regarding the outcomes of this study, it can be concluded that GON blockade led to significant improvements in pain frequency, attack duration, and VAS score during the period from attack treatment to the commencement of long-term prophylactic treatment, as well as in the month following treatment. These improvements were achieved without the need for transitioning to alternative prophylactic treatment. Therefore, a GON blockade is a preferable and reliable treatment option. Its implementation not only reduces treatment costs but also minimizes the loss of productivity for patients and facilitates a swift return to daily activities.

Looking ahead, as the occurrence of cluster headaches becomes more prevalent in clinical practice, prospective, randomized, placebo-controlled long-term studies involving larger case series are essential to provide further insights into the efficacy and safety of GON blockade. Such studies will contribute significantly to the advancement of scientific understanding in this area.

Conflict of Interest
The authors declare that they have no conflict of interest.

Funding
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Ethics Approval
Ethics approval was granted by the Ethics Committee of the Karatay University Local Ethics Committee under protocol number 2024/038 and dated 26.01.2024.

Informed Consent
Written informed consent was provided by the patients to receive therapy and for the publication of this study.

AI Disclosure
No artificial intelligence or assisted technologies were used in the study's production.

Data Availability
The datasets generated during and/or analyzed during the current study are available from the corresponding author upon reasonable request.

ORCID ID
Meltem Karacan Golen: 0000-0002-2422-9470
Nermin Tepe: 0000-0003-4148-25539
Şaziye Melike Işık: 0000-0001-7247-6970

Authors' Contributions
Concept: M.K.G, Ş.M.I, N.T; design: M.K.G, Ş.M.I; data: M.K.G, Ş.M.I, N.T, collection or processing: M.K.G, Ş.M.I; analysis or interpretation: M.K.G, Ş.M.I, N.T; literature search: M.K.G, Ş.M.I; writing: M.K.G.

References

1) Headache Classification Committee of the International Headache Society (IHS). The international classification of headache disorders, 3rd edition. Cephalalgia 2018; 38: 1-211.
2) Fischera M, Marziniak M, Gralow I, Evers S. The incidence and prevalence of cluster headache: a meta-analysis of population-based studies. Cephalalgia 2008; 28: 614-618.
3) Hoffmann J, May A. Diagnosis, pathophysiology, and management of cluster headache. Lancet Neurol 2018; 17: 75-83.
4) May A, Leone M, Afra J, Linde M, Sándor PS, Evers S, Goadsby PJ; EFNS Task Force. EFNS guidelines on the treatment of cluster headache and other trigeminal-autonomic cephalalgias. Eur J Neurol 2006;13: 1066-1077.
5) Robbins MS, Starling AJ, Pringsheim TM, Becker WJ, Schwedt TJ. Treatment of Cluster Headache: The American Headache Society Evidence-Based Guidelines. Headache 2016; 56: 1093-1106.
6) Leone M, Giustiniani A, Cecchini AP. Cluster headache: present and future therapy. Neurol Sci 2017; 38: 45-50.
7) Lambru G, Abu Bakar N, Stahlhut L, McCulloch S, Miller S, Shanahan P, Matharu MS. Greater occipital nerve blocks in chronic cluster headache: a prospective open-label study. Eur J Neurol 2014; 21: 338-343.
8) Pompilio G, Migliore A, Integlia D. Systematic literature review and Bayesian network meta-analysis of episodic cluster headache drugs. Eur Rev Med Pharmacol Sci 2021; 25: 1631-1640.
9) Peres MF, Stiles MA, Siow HC, Rozen TD, Young WB, Silberstein SD. Greater occipital nerve blockade for cluster headache. Cephalalgia 2002; 22: 520-522.
10) Karacan Gölen M, Yılmaz Okuyan D. The Efficacy of Greater Occipital Nerve Block in Patients With Chronic Migraine. J Contemp Med 2021; 11: 799-803.
11) Karacan Gölen M, Yılmaz Okuyan D. Comparison of the Effectiveness of Greater Occipital Nerve Block in Patients Receiving and not Receiving Medical Prophylactic Treatment in Chronic Migraine. Turk J Neurol 2022; 28: 19-23.
12) Goadsby PJ, Bahra A, May A. Mechanisms of cluster headache. Cephalalgia 1999; 19: 19-23.
13) Piovesan EJ, Kowacs PA, Tatsui CE, Lange MC, Ribas LC, Werneck LC. Referred pain after painful stimulation of the greater occipital nerve in humans: evidence of convergence of cervical afferences on trigeminal nuclei. Cephalalgia 2001; 21: 107-109.
14) Suri H, Ailani J. Cluster Headache: A Review and Update in Treatment. Curr Neurol Neurosci Rep 2021; 5: 21-31.
15) Kandel SA, Mandiga P. Cluster Headache In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024. Available at: https://www.ncbi.nlm.nih.gov/books/NBK544241/. Accessed on 29/7/2024.
16) Russell MB. Epidemiology and genetics of cluster headache. Lancet Neurol 2004; 3: 279-283.
17) Hoffmann J, May A. Diagnosis, pathophysiology, and management of cluster headache. Lancet Neurol 2018; 17: 75-83.
18) Ambrosini A, Vandenheede M, Rossi P, Aloj F, Sauli E, Pierelli F, Schoenen J. Suboccipital injection with a mixture of rapid- and long-acting steroids in cluster headache: a double-blind placebo-controlled study. Pain 2005; 118: 92-96.
19) Gordon A, Roe T, Villar-Martínez MD, Moreno-Ajona D, Goadsby PJ, Hoffmann J. Effectiveness and safety profile of greater occipital nerve blockade in cluster headache: a systematic review. J Neurol Neurosurg Psychiatry 2023;14: 73-85.
20) Ailani J, Young WB. The role of nerve blocks and botulinum toxin injections in the management of cluster headaches. Curr Pain Headache Rep 2009;13: 164-167.
21) Couch JR Jr, Ziegler DK. Prednisone therapy for cluster headache. Headache 1978; 18: 219-221.