Original Article

Efficacy of Adding a Distal Level Block to a C2 Level Greater Occipital Nerve Block under Ultrasound Guidance in Chronic Migraine

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Abstract

Objective: To investigate the benefit of adding a distal level greater occipital nerve (GON) block to the proximal level GON block under ultrasound guidance in patients with chronic migraine (CM) with cutaneous allodynia (CA). **Methods:** Seventy-eight patients with CM were included. A single US-guided GON block was performed at proximal and distal levels in patients with CM with CA and only at the proximal level in patients with CM without CA. Thirty (38.5%) patients with bilateral pain received bilateral GON blocks, and 48 (61.5%) with unilateral pain received unilateral GON blocks. The patients were evaluated using Numeric Rating Scale (NRS) scores before treatment and 1 and 4 weeks after treatment and through Headache Impact Test-6 (HIT-6) scores before treatment and 4 weeks after treatment. **Results:** The NRS scores significantly decreased at first and fourth weeks, and the HIT-6 scores significantly decreased at fourth week ($p < 0.001$) compared with preintervention scores in all groups. No significant difference was found between the groups regarding the postinterventional first and fourth week when the decreases of NRS and HIT-6 scores were compared ($p = 0.599$). There were no significant differences in the effectiveness of unilateral and bilateral GON blocks ($p > 0.001$). **Conclusion:** A single US-guided GON block is an effective and safe treatment option in patients with CM, providing a positive effect on pain and quality of life for 4 weeks. The addition of a distal level GON block to the proximal level GON block provides no extra benefit to patients with CM with CA.

Keywords: Allodynia, Chronic migraine, Greater occipital nerve block, Headache, Ultrasound

Introduction

Chronic migraine (CM) is a neurologic disease associated with significant disability, loss of productivity, increased economic burden, psychological distress, and poor quality of life.[1] According to the International Classification of Headache Disorders (ICHD) third edition, CM is defined as a headache that occurs 15 days or more per month, of which at least eight have migrainous character.[2] Increased headache day frequency, medication overuse, obesity, sleep and psychiatric disorders, female sex, earlier age of onset, lower socioeconomic status, stressful situation, comorbid pain disorders (such as asthma, noncephalic pain, head and neck injury, insomnia, snoring), caffeine intake, and cutaneous allodynia can be listed as risk factors for transformation to CM.[3]

In several primary headache syndromes that are refractory to medical treatment, peripheral nerve blocks are frequently used as minimally invasive techniques.[4] Nerve blocks can help reduce the systemic adverse effects of pharmacologic treatment and the frequency and severity of attacks. Greater occipital nerve (GON) block is the most commonly used nerve block technique in migraine headaches.[5-7] GON block can be administered from the landmark level (medial one-third of the superior nuchal line between the occipital protuberance and the mastoid process) with the blind technique. Under ultrasound (US) guidance, it can be performed both from the proximal (C2 vertebra) level and from the landmark (distal) level.[8,9] In the literature, there are many studies evaluating the effectiveness of GON blocks, most of which were performed using the blind landmark (classic distal occipital approach) technique.

US guidance provides visualization of the GON, creating a more precise block. Therefore, US-guided GON block is a relatively safe and more effective procedure than the landmark technique. Compared with distal US-guided block, the advantages of the US-guided GON block performed from the C2 level can be listed as the deeper location of the nerve between the muscle layers, the low risk of damage to the occipital artery, and easier skin disinfection (away from the hairline).[10-12] Cutaneous allodynia (CA) is a marker for central

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sensitization of nociceptive neurons in the trigeminal nucleus caudalis and is a common symptom during migraine attacks. The frequency and severity of CA are directly proportional to the duration of migraine headaches; thus, it is more common in CM.[13,14] Considering that allodynia is an indicator of central sensitization, we hypothesized that blocks at two levels might be more effective on pain (NRS) and HIT-6 scores in patients with CM with CA. The aim of the current study was to investigate whether an accompanying distal level GON block to a proximal level (C2) GON block provided additional benefit for these patients. To the best of our knowledge, there is no study in the literature evaluating the effectiveness of GON blocks at two levels in the same procedure. Therefore, we think that our study will contribute to the literature.

Material and Methods

In this retrospective observational study, between August 2021 and May 2022, 78 of 90 patients who presented to the pain and neurology outpatient clinic with a diagnosis of CM according to ICHD-3 criteria, who were resistant to conservative treatment and who had only proximal (C2) level and proximal + distal level GON block under US guidance were included in the study. The ethical approval of the study was obtained from the local ethical committee of Izmir University of Health Sciences Tepecik Training and Research Hospital Izmir, Turkey (Number: 2022/04-19). Demographic data, migraine headache durations (years), the side and localization of migraine headaches, the prophylactic oral medical treatments currently used, and the presence of CA were noted for all patients. Each patient in the study received and signed an informed consent form. Despite all patients receiving migraine preventive treatment, their pain continued. The presence of CA was determined using Allodynia Symptom Checklist (ASC) scores.[15]

GON block interventions have been performed from the proximal level under US guidance in our daily clinical practice. According to the hypothesis that double level block at the same procedure might be more effective in CM patients with CA, distal level GON block was added to the proximal level block as a routine clinical protocol in these patients since January 2022. Thus, the study population was divided into two groups; GON block performed at proximal and distal levels (group 1, after January 2022) and the proximal level only (group 2, before January 2022). All the patients who underwent two-level GON blocks in group 1 had CA. All 78 patients are summarized in Figure 1 with a flowchart diagram. In the next stage, the patients were divided into two groups based on the application of unilateral and bilateral GON blocks, and the outcomes were evaluated accordingly.

Patients with comorbidities that prevented interventional treatment, patients with other primary headaches other than migraine, those aged under 18 and over 65 years, and patients who did not accept GON block therapy were excluded from the study. To assess the outcomes of the

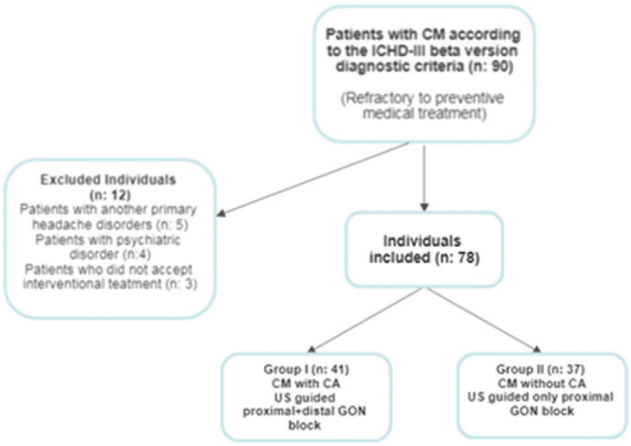

Figure 1: Flowchart of the distribution of patients who underwent US-guided GON block therapy in the study, *CM* chronic migraine, *ICHD* International Classification of Headache Disorders, *US* ultrasound, and *GON* greater occipital nerve

intervention, preintervention, postinterventional first week, and postinterventional fourth-week Numeric Rating Scale (NRS) scores and Headache Impact Test-6 (HIT-6) scores of preintervention and the postinterventional fourth week were used.

Allodynia Symptom Checklist (ASC)

ASC contains 12 items and assesses the subtypes and severity of CA. The items on the list are answered as follows: "Not applicable to me," "Never," "Rarely," "Less than half," and "Half or more than half." The total score ranges from 0 to 24. CA severity is graded as follows: no CA (scores of 0–2), mild CA (scores of 3–5), moderate CA (scores of 6–8), and severe CA (scores of ≥9).[15]

Numeric Rating Scale (NRS)

Pain severity was rated by patients before and after treatment using the NRS, where numbers from 0 to 10 were present on a 10-cm-long line, "0" indicates "no pain" and "10" indicates "unbearable pain." NRS is often used to measure severity or frequency in epidemiologic and clinical research for various symptoms including pain.[16]

The Headache Impact Test (HIT-6)

HIT-6 is a questionnaire that assesses the impact of headaches on quality of life including social, role, and cognitive functioning, as well as areas such as vitality, pain, and psychological distress. Three of the six items deal specifically with the previous 4 weeks; for the remaining three questions, no time interval is specified. Items are answered on a five-point Likert scale (6 = never, 8 = rarely, 10 = sometimes, 11 = very often, 13 = always). The total score ranges from 36 to 78, with high scores indicating greater effect.[17]

Intervention

GON block treatment was performed at the C2 level and the distal level under the guidance of a high-frequency probe (8–12–Mhz Toshiba Apollo 300 color Doppler US scanner)

under sterile conditions in the local operating room, with the patient in the prone position and with a slightly flexed head. For proximal GON blocks, imaging is started from the occipital prominence, scanning downward to detect the first bifid spinous process of C2. After finding the C2 level, the probe is moved laterally toward the block side and slightly oblique to the lateral edge of the probe. The GON is localized between the obliquus capitis inferior and the semispinalis capitis muscle layers. After identifying the GON, a 22-gauge 5-cm needle is inserted using an in-plane technique from lateral to medial, and 1.5 mL of 0.5% bupivacaine diluted in 1.5 mL of saline is injected under real-time scanning [Figure 2]. For distal GON blocks, the US probe is initially placed in a transverse plane over the landmark block site, with the center of the probe in the medial one-third of the superior nuchal line between the occipital protuberance and the mastoid process. Then, under real-time scanning, a 22-gauge 5-cm needle is inserted with an in-plane technique toward the GON, which is located medial to the occipital artery pulse detected in Doppler mode, and 1.5 mL of 0.5% bupivacaine diluted in 1.5 mL of saline is injected [Figure 3].[18]

Statistical analysis

The statistical analyses were performed using the Number Cruncher Statistical System (Kaysville, Utah, USA) version 2007. The quantitative variables were evaluated in terms of normal distribution using histograms, Q-Q plots, and the Shapiro–Wilk test. All continuous variables revealed non-normal distribution, except for "age," thus throughout the text, these were presented as median (minimum–maximum) values, and the Mann–Whitney U test was used to make comparisons between the two groups. The difference of the median values in related samples within the same groups was evaluated using Wilcoxon's signed-rank test. Qualitative variables are presented as frequency and percentages. Differences regarding distribution in the two groups were evaluated using Pearson's Chi-square test or Fischer's exact test. A Spearman correlation coefficient was applied for quantitative variables. A *P* value of less than or equal to 0.05 was considered statistically significant.

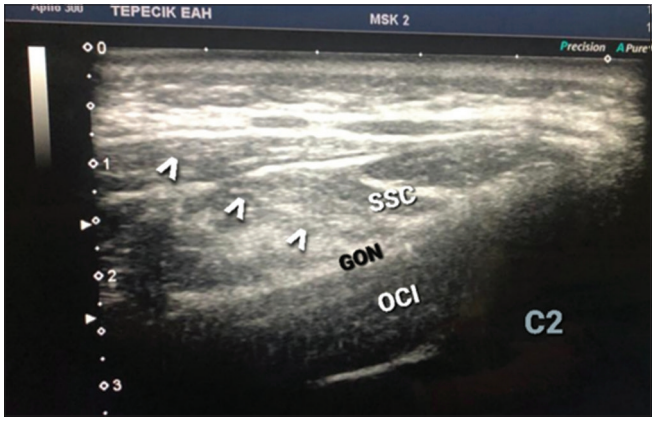

Figure 2: Ultrasound-guided greater occipital nerve (GON) block at C2 (proximal) level with in-plane technique from lateral to medial. *SSC* semispinalis capitis muscle, *OCI* obliquus capitis inferior muscle. *GON* greater occipital nerve, *C2* cervical 2 vertebra corpus, arrowheads: block needle

Results

The demographic and clinical characteristics of the study population are presented in Table 1. The median age of all 78 patients was 40 (range, 32–48) years. The difference between the groups in regard to age was not significant (z = -0.055, *P* = 0.580). Overall, there were 29 (37.2%) males and 49 (62.8%) females. The difference between the groups regarding sex distribution was not significant (χ^2 = 0.679, *P* = 0.410). The distribution of the medications prescribed before intervention is summarized in Table 1, and the distribution of the medications already in use revealed no significant difference between the groups (χ^2 = 0.366, *P* = 0.947).

Overall, the median duration of pain was 13.5 (range, 10–20) years. The main duration of pain was 14 (range, 10–20) years in group 1 and 13 (range, 10–20) years in group 2, and the difference was not significant (z = -0.139, *P* = 0.890). All patients in group 1 had CA (100% vs. 0%, χ^2 = 78.0, *P* < 0.001). There was a significant difference between the groups in regard to ASC scores [8 (6–10) for group 1 and 1 (0–2) for group 2, z = -7.720, *P* < 0.001)]. The pain was localized in the frontal region in 18 (23.1%) patients, the fronto-temporal region in 23 (29.5%), and the occipital region in 37 (47.4%) patients. There was a significant difference between the groups regarding pain localization (χ^2 = 23.231, *P* < 0.001). Thirty (38.5%) patients had bilateral pain, 25 (32.1%) had right-sided pain, and 23 (29.5%) patients had left-sided pain. The difference between the groups in terms of the sidedness of the pain was significant (χ^2 = 0.129, *P* = 0.630). Among all patients, 18 (23.1%) patients developed an adverse effect, temporary dizziness immediately after the intervention. The rate of adverse effects between the groups revealed no significant difference (χ^2 = 0.062, *P* = 0.804).

Moreover, the median NRS at preintervention and the postinterventional first and fourth weeks were 8 (range, 8–9),

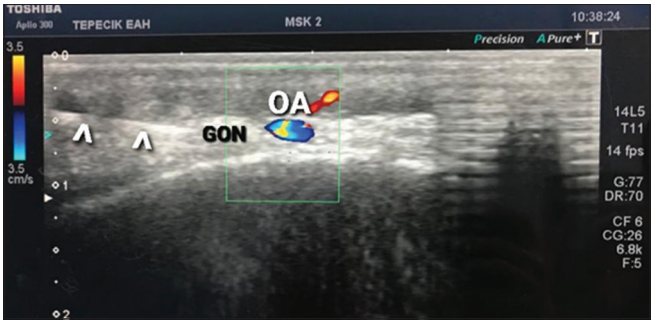

Figure 3: Ultrasound-guided greater occipital nerve (GON) block at distal level with in-plane technique from medial to lateral. GON is localized medial of the occipital artery. *GON*: greater occipital nerve *OA:* occipital artery, arrowheads: block needle

4 (range, 3–6), and 4 (range, 3–5), respectively [Table 2]. There was no significant difference between the groups in regard to the median NRS values at preintervention (z = -0.180, P = 0.857) and the postinterventional fourth-week follow-up (z = -1.231, P = 0.218), but it was considerably higher in group 2 at the postinterventional first week (z = -2.410, P = 0.016). Additionally, in regard to the difference between the postinterventional first week vs. preintervention and the postinterventional fourth week vs. preintervention, the overall drop (z = -7.798, P < 0.001 and z = -7.904, P < 0.001, respectively), in group 1 (z = -5.707, P < 0.001 and z = -5.773, P < 0.001, respectively) and in group 2 (z = -5.381, P < 0.001 and z = -5.434, P < 0.001, respectively), was significant.

As revealed in Table 2, the median HIT-6 scores before intervention and after intervention at the fourth week were 68 (range, 64–78) and 60 (range, 56–66), respectively. This drop in all patients was significant (z = -7.705, P < 0.001). There was no significant difference between the groups in regard to the median HIT-6 scores at preintervention (z = -0.0265, P = 0.979) and the postinterventional fourth week (z = -0.526, P = 0.599). However, the median HIT-6 scores at the postinterventional fourth week were significantly lower than those of the preintervention scores in group 1 (z = -5.599, P < 0.001) and group 2 (z = -5.331, P < 0.001).

Although the duration of pain was directly proportional to preintervention NRS scores (r = 0.304, P = 0.07), preintervention HIT-6 (r = 0.342, P = 0.002), and postinterventional fourth week HIT-6 scores (r = 0.326, P = 0.004), preintervention NRS scores revealed a positive correlation with their counterpart HIT-6 scores (r = 0.635, P < 0.001). Additionally, postinterventional

Table 1: Demographic and clinical characteristics of the study population

Variables		Total (n=78)	Group 1 (n=41)	Group 2 (n=37)	P
Age, years		40 (32–48)	40 (32–48)	39 (34–48)	0.580[a]
Sex	Male	29 (37.2)	17 (41.5)	12 (32.4)	0.410[b]
	Female	49 (62.8)	24 (58.5)	25 (67.67)	
Medications	Antidepressant	37 (47.4)	20 (48.8)	17 (45.9)	0.947[b]
	Antiepileptic	16 (20.5)	9 (22)	7 (18.9)	
	Beta-blocker	13 (16.2)	6 (14.6)	7 (18.9)	
	Ca^{++}channel blocker	12 (15.4)	6 (14.6)	6 (16.2)	
Duration of pain, years		13.5 (10–20)	14 (10–20)	13 (10–20)	0.890[a]
(CA)		41 (52.6)	41 (100)	0 (0)	<0.001[a]
ASC score		8 (6–10)	8 (6–10)	1 (0–2)	<0.001[a]
Pain localization	Frontal	18 (23.1)	4 (9.8)	14 (37.8)	<0.001[c]
	Fronto-temporal	23 (29.5)	7 (17.1)	16 (43.2)	
	Occipital	37 (47.4)	30 (73.2)	7 (18.9)	
Side of pain	Bilateral	30 (38.5)	15 (36.6)	15 (40.5)	0.630[b]
	Right	25 (32.1)	12 (29.3)	13 (35.1)	
	Left	23 (29.5)	14 (34.1)	9 (24.3)	
Adverse effect		18 (23.1)	9 (22)	9 (24.3)	0.804[b]

[a]Mann–Whitney U test, [b]Pearson's Chi-square test, [c]Fisher's exact test. ASC: Allodynia Symptom Checklist CA: Cutaneus allodynia

Table 2: Summary and comparative analysis results of Numerical Rating Scale and Headache Impact Test-6 scores between the groups

Variables	Total	Group 1	Group 2	Group 1 vs. 2 P[a]
Numerical Rating Scale				
Preintervention	8 (8–9)	8 (8–9)	8 (8–9)	0.857
Postinterventional first week	4 (3–6)	4 (3–6)	5 (3–6)	0.016
Postinterventional fourth week	4 (3 – 5)	4 (3 – 5)	5 (3 – 5)	0.218
Preinter. vs Postinter. first week P[b]	<0.001	<0.001	<0.001	
Preinter. vs Postinter. fourth week P[b]	<0.001	<0.001	<0.001	
Headache Impact Test-6				
Preintervention	68 (64–78)	68 (64–78)	68 (65–78)	0.979
Postinterventional fourth week	60 (56–66)	60 (56–62)	60 (56–66)	0.599
Preinter. vs Postinter. fourth week P[b]	<0.001	<0.001	<0.001	

[a]Mann–Whitney U test, [b]Wilcoxon's signed-rank test.

fourth-week NRS scores also revealed a positive correlation with their counterpart HIT-6 scores (r = 0.266, $P = 0.019$).

From the point of view of laterality, 30 (38.5%) patients received bilateral and 48 (61.5%) patients received unilateral GON blocks. There was no difference between the patients who received bilateral and unilateral GON blocks regarding age (z = -0.939, $P = 0.348$) and duration of pain (z = -0.965, $P = 0.335$). The distribution of sex ($\chi^2 = 0.166$, $P = 0.684$) and previous medications ($\chi^2 = 4.883$, $P = 0.181$) revealed no significant differences. Pain localization showed no significant difference between the patients ($\chi^2 = 5.348$, $P = 0.069$). In subgroup analysis, the patients who received unilateral interventions had a higher rate of pain in the frontal region (29.2% vs. 13.3%), but this difference was not significant ($\chi^2 = 2.607$, $P = 0.167$). The rate of pain in the fronto-temporal region was higher in patients who received bilateral interventions (43.3% vs. 20.8%, $\chi^2 = 4.495$, $P = 0.034$). The rate of pain in the occipital region revealed no differences between patients who received unilateral and bilateral interventions (50% vs. 43.3%, $\chi^2 = 0.329$, $P = 0.566$). The rate of adverse effects was considerably higher in patients who received bilateral GON blocks ($\chi^2 = 30.985$, $P < 0.001$). In the subgroup analysis, in patients who received bilateral interventions, the rates of temporary dizziness between group 1 (n = 9, 60%) and 2 (n = 8, 53.3%) revealed no significant difference ($\chi^2 = 0.136$, $P = 0.713$).

The comparative analysis results of NRS and HIT-6 scores between patients who received bilateral and unilateral GON blocks are presented in Table 3. Although the median preintervention NRS (z = -2.575, $P = 0.010$) and postinterventional first-week NRS scores (z = -2.303, $P = 0.021$) were significantly higher in patients who received bilateral GON blocks, there was no difference in terms of postinterventional fourth-week median NRS scores (z = -1.337, $P = 0.181$). The drops in postinterventional first-week and fourth-week NRS scores were significantly lower than those of preintervention NRS in both the patients who received unilateral and bilateral GON blocks (all $P < 0.001$). From the HIT-6 point of view, there was no significant difference between patients who received unilateral and bilateral GON blocks in preintervention HIT-6 (z = -1.931, $P = 0.054$) and postinterventional fourth-week HIT-6 scores (z = -0.917, $P = 0.055$), but the decrease in postinterventional fourth-week median HIT-6 values was significant both in patients who received bilateral (z = -4.796, $P < 0.001$) and unilateral (z = -6.063, $P < 0.001$) GON blocks.

Table 3: Summary and comparative analysis results of Numerical Rating Scale and Headache Impact Test-6 scores between the bilateral and unilateral GON blocks

Variables	Bilateral ($n=30$)	Unilateral ($n=48$)	P[a]
Numerical Rating Scale			
Preinterventional	9 (8–9)	8 (8–9)	0.010
Postinterventional first week	5 (3–6)	5 (3–6)	0.021
Postinterventional fourth week	4 (3–5)	5 (3–5)	0.181
Preinter. Vs Postinter. first week P[b]	<0.001	<0.001	
Preinter. Vs Postinter. fourth week P[b]	<0.001	<0.001	
Headache Impact Test-6			
Preinterventional	68 (65–78)	68 (66–76)	0.054
Postinterventional fourth week	60 (56–64)	60 (56–66)	0.055
Preinter. Vs Postinter. fourth week P[b]	<0.001	<0.001	

[a]Mann–Whitney U test, [b]Wilcoxon's signed-rank test.

Discussion

In the present study, US-guided GON block reduced NRS and HIT-6 scores in all patients with CM at the fourth-week follow-up. According to our study data, a significant improvement in headache-related quality of life and pain scores was observed after 4 weeks with a single GON block treatment. In addition, there were no adverse effects, except for short-term temporary dizziness, in patients who underwent bilateral GON blocks. The addition of distal level GON blocks to proximal level GON blocks did not provide extra benefit to patients with CM with CA. The patients who underwent unilateral and bilateral GON blocks benefited similarly from the procedure.

GON block is a useful method because of its early effect in reducing the severity of pain, permanent effect after a single injection, easy technique, minimal invasiveness, minimal adverse effects, minimal drug interactions, and lower cost. Many studies in the literature suggest that US-guided GON blocks are more effective.[8,9,19] In the current study, all GON blocks were performed under US guidance by the same experienced pain physician at both proximal and distal levels. Palamar *et al*.[20] compared the effectiveness of US-guided distal level single session GON blocks using bupivacaine 0.5% and placebo in migraine pain. They evaluated the change in visual analog scale (VAS) scores and headache severity at the first-month post-intervention and concluded that US-guided GON block with 1.5 mL of 0.5% bupivacaine was a safe, easy, and effective technique, and US-guided GON block increased the effectiveness of the injection. Similarly, in our study, we performed all GON blocks using the same local anesthetic under US guidance, we performed a single block and observed a significant decrease in NRS scores, but we did not have a placebo group.

Karaoğlan *et al*.[21] compared unilateral and bilateral C2 level GON blocks (once per week, four times a month) for the treatment of CM and found that the C2 level GON block was effective, but bilateral blocks were not superior to unilateral blocks at the 3-month follow-up. The proximal GON block technique is similar to that performed in our study, but the local anesthetic doses (4 mL of 0.5% bupivacaine) differed from ours. In our study, bilateral GON blocks were performed on patients with bilateral headaches, and unilateral GON blocks

were used in patients with unilateral headaches. The drop in post-interventional NRS and HIT-6 scores was significantly lower than that of pre-intervention in both the patients who received unilateral and bilateral GON blocks, and there was no significant difference between the groups.

As it is known, CM affects the quality of life negatively. In a study investigating the effect of GON block on life quality, disability, and comorbid psychiatric and sleep disorders in patients with CM, a prominent improvement was observed in all conditions. Unlike our study, the authors followed up the patients through the pretreatment and posttreatment first and third months Migraine Quality of Life Questionnaire (MQoLQ), VAS, Headache Impact Test (HIT), Migraine Disability Assessment Scale (MIDAS), Beck Depression Inventory, Beck Anxiety Inventory, and Pittsburgh Sleep Quality Index Scales, and GON block (1.5 mL of bupivacaine 0.5% and 1 mL of saline) was performed using the landmark blind technique, which was repeated weekly for three weeks, then monthly for 2 months.[22] In our study, we used HIT-6 scoring to evaluate the effect of headaches on quality of life using GON block therapy. The decrease in HIT-6 scores of all GON blocks performed during the fourth-week follow-up supports the positive effect of GON block treatment on quality of life. There is no definite opinion about the local anesthetic dose and the frequency of GON blocks in the literature; physicians mostly perform GON blocks according to their clinical experience. In studies of cervicogenic headache, occipital neuralgia, and various craniofacial pain syndromes, 4–5 mL solutions were used for proximal level GON blocks and were considered safe.[23,24] In a retrospective study that compared the efficacy and complications of US-guided GON block at the level of C2 and distal level with the landmark technique in patients with migraine, two units of 4 mL 0.5% bupivacaine were administered for the proximal GON block, and a complication with reversible cerebellar findings (dysdiadochokinesia, dysmetria, and ataxia) was observed in two patients.[25] In our study, no adverse effects were observed in any patients. This may be due to the lower local anesthetic dose and concentration we used.

A previous meta-analysis reported that local anesthetics could reduce headache frequency and intensity compared with placebo, but the addition of corticosteroids showed no additional benefits with limited evidence.[26] All GON blocks in our study were performed with 1.5 cc bupivacaine diluted in half with saline, which we routinely use in daily practice, and did not add corticosteroids. In a randomized, multicenter, double-blind, and placebo-controlled study with 84 patients with CM by Inan *et al*.,[27] GON block with a mixture of 1.5 mL of 0.5% bupivacaine and 1 mL of saline was superior to placebo and effective, safe, and cost-effective for the treatment of CM. The primary endpoints were headache days, headache duration, and difference in pain scores. All GON blocks were performed using the landmark blind technique weekly for 4 weeks randomly using bupivacaine and saline, then blinding was removed, and it was repeated monthly for the following 2 months using only bupivacaine. The authors found weekly and monthly GON blocks with bupivacaine were similarly effective but mentioned that once-monthly treatment was more feasible and better tolerated by patients than once-weekly treatment.

We performed all GON blocks under Us guidance without a placebo group. However, the local anesthetic doses used were similar. We performed a single GON block on our patients, not repeat blocks, and then held follow-up examinations after 4 weeks. We investigated the effectiveness of the single blocks; the HIT-6 scale we used was suitable for the evaluation of the patient's quality of life in the last 4 weeks.

Patients with CM often have CA associated with the sensitization of central pain neurons. The presence of allodynia during a migraine attack greatly increases the patient's disability. Peripheral nerve blocks can decrease pain and allodynia quickly, and their effects can last for several weeks or months.[28]

Ashkenazi and Young[29] evaluated the effect of GON blocks, with or without trigger point injections on brush allodynia and headache in migraine in their study. GON blocks were performed with a mixture of 2 cc 2% lidocaine and 5 mg triamcinolone at the landmark level. For trigger point injections, 0.5 cc of 2% lidocaine was used. Unlike their study, in our study, GON blocks were performed under US guidance, no steroids were added, and no trigger point injections were performed. They concluded that GON blocks, with or without trigger point injections, reduced both headaches and brush allodynia in patients with migraine, both ipsilaterally and contralaterally to the block with similar efficacy. This suggests that the GON block effect propagates along the midline via a putative multi-synaptic anatomic pathway. The fact that the effects of unilateral and bilateral GON blocks were similar in our study supports this theory. Although several factors such as study design, the dose of local anesthetic, block methods, and the number of blocks led to differences in studies in the literature, the results of our study also support the positive effect of US-guided GON block therapy on pain and HIT-6 scores in patients with CM.

Some strengths of our study can be listed as follows: All GON blocks at both proximal and distal levels were performed under US guidance by an experienced pain specialist, and there is no other study in the literature evaluating the effectiveness of the nerve by blocking it at two levels in the same procedure. In our study, we did not evaluate the effect of GON block therapy on CA. We aimed to evaluate the additional effect of GON blocks performed at two levels in the same procedure on patients with CM with CA, on pain, and HIT-6 scores. As a result, the addition of a distal level GON block to a proximal level GON block provided no extra benefit to patients with CM with CA. However, a significant improvement in headache-related quality of life and pain scores was observed after 4 weeks with a single GON block in all patients. Moreover, there are no significant differences in the effectiveness of unilateral and

bilateral GON blocks. We think that no definite conclusion can be made about laterality because the applied GON block was determined according to the pain side, and there was no control group. The lack of follow-up on the effect of GON block treatment on allodynia scores, the short follow-up period, and the absence of a control group can be listed as the limitations of our study.

In conclusion, US-guided GON block is an effective and safe treatment option in patients with CM. A single GON block provides a positive effect on pain and quality of life for 4 weeks. The addition of a distal level GON block to a proximal level GON block did not provide extra benefit to patients with CM with CA. Randomized and placebo-controlled studies can be conducted to evaluate the effect of repeat GON blocks and/or GON radiofrequency therapy on patients with CM with CA in the long-term period.

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Conflicts of interest
There are no conflicts of interest.

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