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Midterm clinical outcomes of ultrasound-guided bilateral C2 level greater occipital nerve block in patients with chronic migraine

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Abstract

Background & Objective: The overall estimated prevalence of chronic migraine is 0.7%–5.1%, leading to a social, emotional, and economic burden. Published data have shown the short-term efficacy of greater occipital nerve block in chronic migraine. This study aimed to assess the midterm clinical outcomes of four sessions of ultrasound-guided bilateral greater occipital nerve (GON) block at the C2 level. In addition, it evaluated the factors that may be associated with clinical success. *Methods:* This was a single-center retrospective analysis. Demographic data, pre-procedural Beck Anxiety and Depression Inventory (BAI/BDI) scores, headache frequency in a month, headache days in a month, mean headache attack duration (hours), mean pain intensity (Visual Analog Scale 0–100 mm), Migraine Disability Assessment (MIDAS) grades, and Headache Impact Test—6 (HIT-6) levels at baseline and at 1-, 3-, and 6-month visits were evaluated. A reduction of 30% in headache days in a month was considered to represent clinical success. *Results:* Headache frequency, headache days, mean headache attack duration, mean pain intensity, MIDAS grades, HIT-6 levels, and medication overuse improved at 1-, 3-, and 6-month visits compared to the baseline ($p < .001$). There was no statistically significant correlation between clinical success at 6 months and age, disease duration, baseline attack duration, pain severity, MIDAS grades, HIT levels, BDI scores, and BAI scores (p = .279, .193, .160, .826, .068, .207, .389, and .076, respectively).
Conclusion: Clinical improvement, reduction in disability and impact of headache, and even transformation to episodic migraine occurred up 6 months after four sessions of GON block at the C2 level in patients with chronic migraine. Also, clinical responsiveness at the 6-month visit was not related to age, migraine characteristics, baseline depression and anxiety, or headache disability scores.

Keywords: Chronic migraine, greater occipital nerve block, impact of headache, disability, depression, anxiety.

INTRODUCTION

Chronic migraine has been defined by the *International Classification of Headache Disorders* (Third Edition) as a headache occurring on 15 or more days in a month for longer than 3 months, with at least eight attacks in a month and having the features of migraine.[1] The overall estimated prevalence of chronic migraine is 0.7%–5.1%. It negatively affects emotional and family relationships, education, economic status, and general health.[2,3]

The management of chronic migraine involves acute and preventive treatment, with the aim of reducing headache frequency, relieving pain, restoring function, and preventing progression. Triptans, dihydroergotamine and ergotamine, nonsteroidal anti-inflammatory agents, and neuroleptics help in relieving migraine attacks. Beta-blockers, angiotensin receptor blockers, angiotensin-converting enzyme inhibitors, antidepressants, and valproate have been suggested as prophylactic treatment for chronic migraine.[4] However, the efficacy of these treatments has been determined in high frequency episodic migraine, and the evidence-based efficacy of these treatments in chronic migraine is unclear. Despite appropriate prophylactic treatment, chronic migraine may become refractory to treatment.[5]

In 1997, Caputi *et al*. showed that the frequency of total and severe headache attacks decreased after repeated blockage of the supraorbital nerve and greater occipital nerve (GON) in 27 patients

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with migraine refractory to pharmacological treatment.[6] The GON derives from the dorsal root at the C2 level. It is one of the trigeminocervical complex afferents located between the nucleus caudalis and the C3 spinal level. Segmental and central sensitization develops because of chronic headache. It is known that the transfer of afferent pain pathways to the trigeminocervical complex can be inhibited by GON block.[7] Recently, Gul *et al*. reported that four sessions of blind-technique distal GON block improved the number of headache days and pain intensity for 3 months in patients suffering from chronic migraine.[8]

Ultrasound-guided proximal GON block at the C2 level was first described by Greher *et al*. in a cadaver study.[9] The safety and 1-month analgesic efficacy of this treatment have been shown in occipital neuralgia and cervicogenic headache.[10] Flamer *et al*. compared ultrasound-guided proximal with distal GON block in patients with chronic migraine. They showed that short-term efficacy on improving the intensity of pain, number of headache days in a week, quality of life, and levels of anxiety and depression was similar between the groups. They reported that proximal administration was advantageous in terms of reducing drug consumption and argued that distal administration might be disadvantageous because GON gave its small branches before reaching the distal target area.[11]

The literature has shown successful short-term clinical outcomes with GON block in chronic migraine. The present study aimed to evaluate the results of 6-month clinical follow-up with four sessions of ultrasound-guided bilateral GON block at the C2 level. Also, the factors that may be associated with the clinical outcome were evaluated.

METHODS

This was a cross-sectional study conducted between March 2019 and June 2020 at Health Sciences University, Konya Training and Research Hospital, after obtaining approval from the Ethics Committee of Konya Necmettin Erbakan University Meram Medical Faculty (no.: 2020/2971; date: December 18, 2020).

Patients with chronic migraine diagnosed according to the *International Classification of Headache Disorders*, third edition (beta version), who were referred to the algology clinic for interventional pain therapies, and who were unresponsive, had contraindications, or were intolerant to prophylactic treatment were evaluated. Those who underwent ultrasound-guided bilateral GON block at the C2 level between March 2019 and June 2020 were included in the study. Those aged younger than 18 years or older than 65 years; who had a history of surgery, trauma, or a medical condition resulting in abnormal local anatomy of the head/neck near the target site, any interventional pain treatment to the head/neck area in the previous 12 months, change in pharmacological treatment within 6 weeks before 6 months after GON block; and patients who had any lack of follow-up parameters were excluded.

Headache diaries and clinical follow-up files were used to collect data. Demographic data, pre-procedural Beck Anxiety and Depression Inventory (BAI/BDI) scores, headache frequency in a month, headache days in a month, mean headache attack duration (hours), mean pain intensity (Visual Analog Score [VAS] 0–100 mm), Migraine Disability Assessment (MIDAS) grades, and Headache Impact Test—6 (HIT-6) levels at baseline and at 1-, 3-, and 6-month visits were recorded.

The primary outcome was to evaluate the change in the number of headache days in a month, number of headache attacks in a month, mean pain severity of the attacks (VAS 0–100 mm), mean duration of the attacks (hours), values of HIT-6 and MIDAS questionnaire scores, and usage of medication at the 1-, 3-, and 6-month visits as compared with the baseline. In addition, we recorded the incidence of side effects/complications and any transformation of chronic to episodic migraine. A reduction of 30% or more in the number of headache days in a month was accepted as clinical success.[12] The secondary outcome was to evaluate the relationship between success at 6 months and independent variables such as headache characteristics, symptom duration, BAI, and BDI.

The MIDAS questionnaire has been developed to assess headache-related disability in patients with migraine. The questionnaire includes five questions, capturing information on missed workdays, household chores, non-work activity, and days with substantially reduced productivity over a period of 3 months. The total score is calculated by adding the five headache-related disability items together. Higher scores indicate increased disability due to headache. The total MIDAS score can be further used to define four grades of headache-related disability, including grade I for "minimal/infrequent disability" (0–5), grade II for "mild/infrequent disability" (6–10),

grade III for "moderate disability" (11–20), and grade IV for "severe disability" (21+).[13]

The HIT-6 questionnaire is a simple, easy-to-administer assessment that can be used as a clinical evaluation of the impact of headache on a patient's quality of life. The questionnaire measures the negative impact of headache on social functioning, role functioning, vitality, cognitive functioning, and psychological distress. It also measures the severity of pain caused by headache. The four impact severity categories of headache are as follows: little/no impact (49 or less), some impact (50–55), substantial impact (56–59), and severe impact (60–78).[14]

The BDI is a 21-item, self-report rating inventory that measures characteristic attitudes and symptoms of depression. Its cutoff scores used with patients having affective disorders include the following: no/minimal depression (0–9), mild to moderate depression (10–18), moderate to severe depression (19–29), and severe depression (30–63).[15]

The BAI consists of 21 self-reported items (four-point scale) and is used to assess the intensity of physical and cognitive symptoms of anxiety during the past week. Scores may range from 0 to 63: minimal anxiety (0–7), mild anxiety (8–15), moderate anxiety (16–25), and severe anxiety (26–63).[16]

Intervention

A pillow was placed over the upper chest of the patient so that the neck was slightly flexed. The skin area was cleaned with povidone–iodine. A 12 MHz linear transducer of (ACUSON S2000; Siemens, Munich, Germany) with a sterile disposable cover was used.

The ultrasound probe was placed in the midline occipital region in transverse orientation. The probe was moved caudally to identify the second cervical vertebral level (C2). Once the C2 spinous process was visualized, the probe was moved laterally and obliquely, with its medial edge over the spinous process of the C2 level and its lateral edge over the transverse process of the C1 level. In this position, the inferior obliquus capitis muscle (IOCM) was visualized, and the semispinalis capitis muscle (SSCM) was immediately superficial to it. At this level, GON was identified as a honeycombed structure lying in the interfascial plane between the IOCM and the SSCM. After analyzing with color Doppler followed by negative aspiration, 1.5 ml of 0.5% bupivacaine was injected into each GON with a 21-gauge 1.5-inch needle. Four weekly injections were administered.

Statistical analysis

Statistical analyses were performed using SPSS (v.20.0; IBM Corp., Armonk, NY, USA). There was no missing data for the variables in the study. The Shapiro–Wilk test was used to evaluate the normality of distribution of the data gathered. Data with normal distributions was summarized as means and standard deviations, whereas that with non-normal distributions was summarized as medians and interquartile ranges. Categorical data was summarized as numbers and percentages. Variables with non-normal distribution and ordered categorical variables were analyzed with the Friedman analysis. The Wilcoxon rank-sum test was performed to compare repetitive measurements. The Bonferroni correction was used to avoid possible type 1 errors. The McNemar test was adopted to compare the changes in paired nominal data. A binary logistic regression analysis was performed to examine the cause–effect relationship between the dependent and independent variables. Chi-square or Fisher's exact test was used to assess relation between categorical variables. A p-value of less than .05 was considered statistically significant.

RESULTS

This retrospective analysis was conducted on 25 patients (Figure 1). The age of the patients was 42.56 ± 10.51 years, and the duration of migraine was 12.75 ± 10.03 years. Out of the total, 92% of the patients were female (n = 23) and 88% (n = 22) were married.

Baseline anxiety and depression levels of the patients were evaluated. Twelve percent (n = 3) had minimal anxiety, 36% (n = 9) had mild anxiety, 32% (n = 8) had moderate anxiety, and 20% (n = 5) had severe anxiety. 24% (n = 6) had minimal depression, 32% (n = 8) had mild depression, 32% (n = 8) had moderate depression, and 8% (n = 2) had severe depression.

The frequency of headaches in a month, number of headache days in a month, average duration of headache attacks (hours), and average values of pain intensity at the baseline and at 1, 3, and 6 months after the procedure are presented in Table 1. 44.4% of the patients (n = 11) had unilateral migraine. There was no statistically difference between patients with unilateral migraine and bilateral migraine in the frequency of headaches in a month, number of headache days in a month, average duration of headache attacks (hours), and average values of pain intensity at the baseline (p = 0.979, 0.687, 0.149, 0.893). MIDAS grades

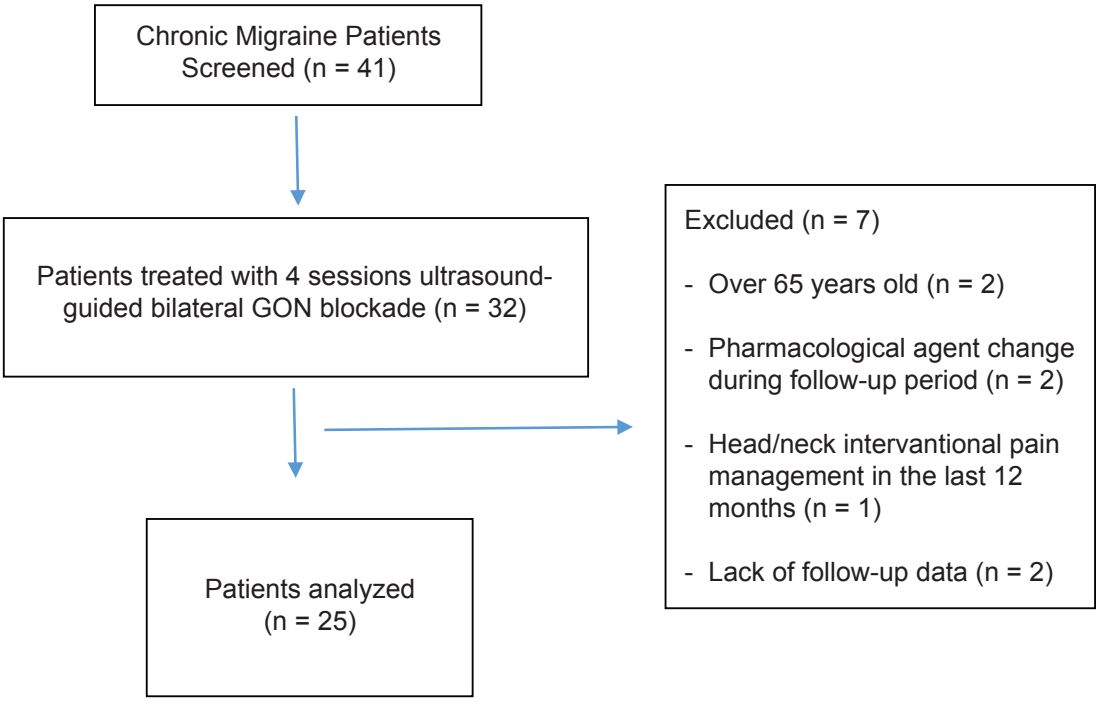

Figure 1. Flow diagram of the study

Table 1: Migraine headache characteristics at baseline and postintervention

Variables	IQR (25%-75%)	Median	95%C.I.	p
Number of headache days in a month				
baseline	16.00-30.0	28.00	20.92-26.35	
1. mo	2.00-12.50	3.00	3.82-11.14	<0.001
3. mo	0.00-15.00	4.00	4.16-12.55	
6. mo	1.00-15.50	4.00	4.36-12.84	
Mean pain severity (0-100 mm)				
baseline	80.00-95.00	90.00	84.58-91.82	
1. mo	20.00-70.00	50.00	35.29-59.51	<0.001
3. mo	5.00-75.00	40.00	26.98-55.82	
6. mo	15.00-75.00	30.00	28.48-57.52	
Headache frequency in a month				
baseline	8.00-30.00	16.00	14.51-22.61	
1. mo	2.00-6.50	3.00	2.92-9.00	<0.001
3. mo	0.50-9.50	3.00	3.06-10.62	
6. mo	1.50-6.50	4.00	3.00-10.36	
Mean headache attack duration (hour)				
baseline	8.00-51.00	24.00	19.96-40.36	
1. mo	20.00-70.00	5.00	5.54-19.82	<0.001
3. mo	5.00-75.00	5.00	5.34-20.90	
6. mo	15.00-75.00	8.00	6.71-23.69	

Table 2: Numbers and percentages of HIT-6 levels at baseline and post-intervention

Level	HIT-6			
	baseline	1. month	3. month	6. month
1 (Little or no impact)	0	60.0 (n = 15)	68.0 (n = 17)	60.0 (n = 25)
2 (Some impact)	8.0 (n = 2)	8.0 (n = 2)	4.0 (n = 1)	0
3 (Substantial impact)	4.0 (n = 1)	4.0 (n = 1)	0	0
4 (Severe impact)	88.0 (n = 22)	28.0 (n = 7)	28.0 (n = 7)	40.0 (n = 10)
Total	100.0 (n = 25)	100.0(n = 25)	100.0 (n = 25)	100.0 (n = 25

and HIT-6 levels at the baseline and follow-up visits are provided in Tables 2 and 3, respectively.

According to the Friedman analysis, a statistically significant difference in the frequency of headache attacks, number of headache days, duration of headache attacks, and values of pain intensity was found between the baseline and control visits ($p < 0.001$). The pairwise comparison was evaluated with the Wilcoxon signed-rank test (Table 4). Further, a statistically significant difference was found between the baseline and control visits in MIDAS grades and HIT-6 levels ($p < 0.001$; Table 4).

The baseline evaluation of chronic migraine with medication overuse was 84% (n = 21); it regressed in 24% (n = 6) at the 6-month visit. According to the baseline, a statistically significant difference was found on comparing the presence of medication overuse at the 6-month visit ($p < 0.001$). The percentage reduction in the number of headache days in a month compared to the baseline at the 1-, 3-, and 6-month visits are given in Table 5.

At the 6-month visit, 68% (n = 17) of the patients were transformed to have low-frequency episodic migraine and 4% (n = 1) to have high-frequency episodic migraine.

As regards the evaluation of side effects and complications, dizziness developed in the first session in four patients. In repeated sessions, dizziness recurred in only one of these patients in the second session. Severe migraine attacks were detected in eight of the patients a few hours after the first session, and side effects did not recur in repeated sessions.

Clinical success meant a reduction of 30% in headache days in a month, and at 1, 3, and 6 months, the reduction was 84% (n = 21), 72% (n = 18), and 68% (n = 17), respectively. There was no statistically significant correlation between clinical success at the 6-month visit and age, disease duration, baseline attack duration, pain severity, MIDAS grades, HIT-6 levels, BDI scores, and BAI scores (p = 0.279, 0.193, 0.160, 0.826, 0.068, 0.207, 0.389, and 0.076, respectively). There was no statistically difference between bilateral migraine and unilateral migraine in terms of clinical success at the 6-month visit (p = 0.389, χ^2 = 1.634).

DISCUSSION

In this study, the number of headache days, the frequency, severity, and duration of migraine attacks, and the impact of disability and headache on daily life improved over 6 months with four sessions of ultrasound-guided GON block at the C2 level. Our results are in accord with those of Gul *et al*., who showed that repeated distal GON blockage with bupivacaine significantly decreased headache days, headache duration, and VAS pain scores for 3 months in patients with

Table 3: Numbers and percentages of MIDAS grades at baseline and post-intervention

Grade	MIDAS		
	baseline	3. month	6. month
1 (no disability)	4.0 (n=1)	48.0 (n=12)	48.0 (n=12)
2 (mild disability)	4.0 (n=1)	12.0 (n=3)	8.0 (n=2)
3 (moderate disability)	0.0 (n=0)	8.0 (n=2)	8.0 (n=2)
4 (severe disability)	92.0 (n=23)	32.0 (n=8)	36.0 (n=9)
Total	100.0 (n=25)	100.0 (n=25)	100.0 (n=25)

Table 4: Comparison of headache characteristics, HIT-6, and MIDAS at post-procedure with baseline

Variables	p*		
	baseline – 1. mo	baseline – 3. mo	baseline – 6. mo
Number of headache days/month	<0.001	<0.001	<0.001
Headache frequency/month	<0.001	0.001	0.001
Mean headache attack duration (hour)	<0.001	<0.001	<0.001
Mean attack pain severity (0-100 mm)	<0.001	<0.001	<0.001
HIT-6	<0.001	<0.001	<0.001
MIDAS	NA	<0.001	<0.001

*Bonferroni correction was used to avoid possible type 1 error
NA: not available

chronic migraine.[8] Çatav *et al*. also showed that three sessions of distal GON block improved the frequency, duration, and severity of migraine attacks as well as quality of life for a 3-month follow-up period.[17] Ulusoy *et al*. followed 84 patients for 3 months after repeated distal GON blockage and evaluated the outcomes with the 24-hour migraine quality of life questionnaire, HIT-6, and MIDAS. They observed improvements in quality of life and disability.[18] The present study's contribution to the literature is that improvement for up to 6 months following a course of GON blocks is documented.

In this study, the frequency of medication overuse was 84% at the baseline, and it decreased to 24% at the 6-month visit. Ashkenazi *et al*. reported that medication overuse decreased from 54% to 50% at the end of 1 month, and mean analgesic consumption decreased by 19.3 doses in patients with distal GON block.[19] Çatav *et al*. showed that no patients in the treatment group needed medications at the 3-month control visit.[17] Ulusoy *et al*. performed five sessions of unguided distal GON block in 83 patients. They reported that baseline medication overuse was 50%, to 0% at the 1- and 3-month follow-ups.[18] The present study showed that four sessions of ultrasound-guided proximal GON block improved medication overuse, which is in line with the literature.

Chronic migraine causes more disability because of headache than episodic migraine.[20] In this study, 72% of the patients transformed to episodic migraine at the 6-month visit. Fernandes et al. reported that 20% of the responders with chronic migraine had been transformed to have low-frequency episodic migraine after peripheral trigeminal nerve and GON block at 3 months of follow-up.[21] A neurophysiological study reported that the increased serotonergic effect of GON block helps patients with chronic migraine to have a reduced frequency of headache and transforms their chronic migraines into episodic migraine.[22]

This study showed that clinical success at the 6-month visit was not related to depression and anxiety levels before the procedure. In contrast, Cola *et al*. demonstrated that symptoms of concomitant depression are a negative predictor of clinical success in onabotulinum toxin injection in patients with chronic migraine.[22] Ulusoy *et al*. showed that the increase in the quality of life after GON block in patients with chronic migraine was negatively correlated with anxiety and depression.[18] The inconsistency of the findings may be related to difficulty in evaluation of depression and anxiety levels reliably. The questionnaires used in the present study and the literature were self-administered. More reliable results can be obtained in studies evaluating anxiety and depression with clinical structural questionnaires prepared by psychiatrists.

In this study, severe postoperative migraine attacks occurred 3–4 hours after the procedure in

Table 5: Percent decrease of the number of headache days compared to baseline

Follow-up times	IQR(25%-75%)	Median	95% C.I
1. month	50.00-88.75	85.71	58.25-82.90
3. month	10.00-100.00	85.71	47.15-80.86
6. month	10.00-96.42	82.14	46.17-80.05

IQR: Interquartile range
C.I.: Confidence interval

approximately one-third of the patients. Weibel *et al*. noted that cutaneous atrophy, transient dizziness, and localized pain at the site of injection might develop after blind-technique GON block.[23] Gul *et al*. reported that patients complained of localized pain at the site of injection, vertigo, and nausea after GON block.[8] Also, Lambru *et al*. showed that triamcinolone-induced alopecia and skin atrophy might develop after the injection.[24] In the present study, the GON block applied with pure local anesthetic provided an advantage in terms of not developing side effects such as steroid-induced alopecia, skin atrophy and cutaneous atrophy. In the literature, hypothalamic-pituitary-adrenal axis suppression and Cushing syndrome have been reported after neuro-axial blocks with steroids[25], and after repetitive GON block.[26] Future randomized comparative studies can be designed to compare the safety and efficacy of GON block with pure local anesthetic alone or in combination with steroids.

The present study has a few limitations. First, this study was not a controlled study. Obtaining more reliable results on the midterm clinical results of C2 level GON block will be possible with placebo-controlled randomized studies. Second, its retrospective design. The exclusion of patients with a lack of follow-up parameters/data and those with changes in pharmacological treatment were the factors that reduced this bias in our study. The relatively small size of the study was the third limitation that may reduce the reliability of our conclusions. Fourth is the likelihood of spontaneous remission as a confounding factor for positive clinical results. Twenty six percent of patients with chronic migraine remitted in episodic migraine during the 2-year follow-up period in an observational study.[27] Future studies in which patients refractory to pharmacological treatments and refusing interventional therapies were taken as a control group can be planned for more reliable assess clinical outcomes of interventional procedures.

A detailed evaluation of clinical results and complications/adverse effects during long-term follow-up were the strengths of the study.

In conclusion, clinical improvement, reduction in disability and headache-related impact, and even transformation to episodic migraine is possible up to 6 months after four sessions of GON block at the C2 level in patients with chronic migraine. In addition, clinical success at 6 months was not related to baseline depression, anxiety, and disability scores.

DISCLOSURE

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Conflict of interest: None.

REFERENCES

1. Arnold M. Headache classification committee of the international headache society (ihs) the international classification of headache disorders. *Cephalalgia* 2018; 38: 1-211.
2. Natoli J, Manack A, Dean B, *et al.* Global prevalence of chronic migraine: a systematic review. *Cephalalgia* 2009: 30(5):509-609.
3. Buse DC, Fanning KM, Reed ML, *et al*. Life with migraine: effects on relationships, career, and finances from the chronic migraine epidemiology and outcomes (CaMEO) study. *Headache* 2019; 59: 1286-99.
4. Lionetto L, Negro A, Palmisani S, *et al*. Emerging treatment for chronic migraine and refractory chronic migraine. *Expert Opin Emerg Drugs* 2012; 17: 393-406.
5. Agostoni EC, Barbanti P, Calabresi P, *et al*. Current and emerging evidence-based treatment options in chronic migraine: a narrative review. *J Headache Pain* 2019; 20: 92.
6. Caputi CA, Firetto V. Therapeutic blockade of greater occipital and supraorbital nerves in migraine patients. *Headache* 1997; 37: 174-9.
7. Bartsch T. Migraine and the neck: new insights from basic data. *Curr Pain Headache Rep* 2005; 9: 191-6.
8. Gul H, Ozon A, Karadas O, Koc G, Inan L. The efficacy of greater occipital nerve blockade in chronic migraine: A placebo-controlled study. *Acta Neurol Scand* 2017; 136: 138-44.
9. Greher M, Moriggl B, Curatolo M, Kirchmair L, Eichenberger U. Sonographic visualization and ultrasound-guided blockade of the greater occipital nerve: a comparison of two selective techniques confirmed by anatomical dissection. *Br J Anaesth* 2010; 104: 637-42.
10. Pingree MJ, Sole JS, O'Brien TG, Eldrige JS, Moeschler SM. Clinical efficacy of an ultrasound-guided greater occipital nerve block at the level of C2. *Reg Anesth Pain* Med 2017; 42: 99-104.
11. Flamer D, Alakkad H, Soneji N, et al. Comparison of two ultrasound-guided techniques for greater occipital nerve injections in chronic migraine: a double-blind, randomized, controlled trial. *Reg Anesth Pain Med* 2019; 44: 595-603.
12. Recommendation N. Botulinum toxin type A for the prevention of headaches in adults with chronic migraine, NICE TA 260, June 2012. Recommended NICE Recommundation.
13. Stewart WF, Lipton RB, Dowson AJ, Sawyer J. Development and testing of the Migraine Disability Assessment (MIDAS) Questionnaire to assess headache-related disability. *Neurology* 2001; 56: S20-S8.
14. Kosinski M, Bayliss M, Bjorner J, *et al*. A six-item short-form survey for measuring headache impact: The HIT-6™ . *Qual Life Res* 2003; 12: 963-74.

15. Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. *Arch Gen Psychiatry* 1961; 4: 561-71.
16. Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: psychometric properties. *J Consult Clin Psychol* 1988; 56: 893.
17. Çatav S, SOLMAZ FA, Kirdemir RP. Migren başağrısında büyük oksipital sinir bloğu uygulama sonuçlarımız. *Agri* 2017; 29: 33-7.
18. Ulusoy EK, Bolattürk ÖF. The effect of greater occipital nerve blockade on the quality of life, disability and comorbid depression, anxiety, and sleep disturbance in patients with chronic migraine. *Neurol Sci* 2020: 1-7.
19. Ashkenazi A, Matro R, Shaw JW, Abbas MA, Silberstein SD. Greater occipital nerve block using local anaesthetics alone or with triamcinolone for transformed migraine: a randomised comparative study. *J Neurol Neurosurg Psychiatry* 2008; 79: 415-7.
20. Buse DC, Manack AN, Fanning KM, *et al*. Chronic migraine prevalence, disability, and sociodemographic factors: results from the American Migraine Prevalence and Prevention Study. *Headache* 2012; 52: 1456-70.
21. Fernandes L, Khan N, Dobson J, Randall M, Idrovo L. Multiple Cranial Nerve Blocks as an Alternative Preventative Therapy for Chronic Migraine. *Headache* 2020; 60: 981-7.
22. Viganò A, Torrieri MC, Toscano M, *et al*. Neurophysiological correlates of clinical improvement after greater occipital nerve (GON) block in chronic migraine: relevance for chronic migraine pathophysiology. *J Headache Pain* 2018; 19: 73.
23. Weibelt S, Andress-Rothrock D, King W, Rothrock J. Suboccipital nerve blocks for suppression of chronic migraine: safety, efficacy, and predictors of outcome. *Headache* 2010; 50: 1041-4.
24. Lambru G, Lagrata S, Matharu MS. Cutaneous atrophy and alopecia after greater occipital nerve injection using triamcinolone. *Headache* 2012; 52: 1596-9.
25. Lee MS, Moon HS. Safety of epidural steroids: a review. *Anesth Pain Med (Seoul)*. 2021; 16: 16-27.
26. Lavin PJ, Workman R. Cushing syndrome induced by serial occipital nerve blocks containing corticosteroids. *Headache* 2001; 41: 902-4.
27. Manack A, Buse DC, Serrano D, Turkel CC, Lipton RB. Rates, predictors, and consequences of remission from chronic migraine to episodic migraine. *Neurology* 2011; *76*(8), 711-8.