BMC Neurology

RESEARCH Open Access

Comparison of two methods of greater occipital nerve block in patients with chronic migraine: ultrasound-guided and landmark-based techniques

Gizem Gürsoy[1*] and Hale Arkan Tuna[2]

Abstract

Background Migraine is a primary headache defined as moderate-to-severe pain lasting 4 to 72 h, ranking 2nd among the disabling conditions for both genders regardless of the age and the greater occipital nerve (GON) block has been reported as an efficient treatment method for migraine. The present study aims to evaluate and compare the efficiency of the two methods of GON block, i.e., the ultrasound (US)-guided technique and the landmark-based technique.

Method Having a prospective and randomized design, the study assigned the patients with chronic migraine into two groups after which a neurologist performed landmark-based GON block in the first group while an algologist performed US-guided GON block in the second group. During the 3-month follow-up period, the number of days with pain, the duration of pain, the number of analgesic drugs taken in a month, and Visual Analogue Scale (VAS) scores were compared with the values before treatment and at the 1st week, 1st month, and 3rd month after treatment.

Results US-guided GON block group included 34 patients while there were 32 patients in the landmark-based GON block group. US-guided GON block group showed significantly reduced VAS scores and frequency of attacks compared to the landmark-based GON block group at Month 1 after the procedure. After a 3-month follow-up period of the two groups, the frequency of attacks, analgesic intake and the duration of attacks were lower in both groups compared to the baseline. At 3-month follow-up, the mean of VAS scores decreased from 9,47 ± 2,69 to 4,67 ± 1,9 in US-guided GON block group and from 9,46 ± 0,98 to 7 ± 2,5 in the landmark-based GON block group.

Conclusion It was determined that both US-guided and landmark-based GON block were efficient techniques in patients with chronic migraine. US-guided GON block technique resulted in lower VAS scores, shorter durations of pain, lower frequencies of attack, and lower intake of analgesics compared to the landmark-based GON block technique.

Keywords Headache, Chronic migraine, Ultrasound-guided GON block, Landmark-based GON block

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Background

Migraine is a primary headache defined as moderate-to-severe pain lasting 4 to 72 h, ranking 2nd among the disabling conditions for both genders regardless of the age according to the Global Burden of Disease Study 2019, and a typical attack of which is unilateral, throbbing, and worsening with routine physical activity. The most common accompanying symptoms are photophobia, phonophobia, nausea, and vomiting [1, 2]. Chronic migraine is defined as having a headache for more than 15 days a month over the course of 3 months, which is of migrainous character for at least 8 days out of these 15 days. It has been found that more than 2% of the general population and more than 10% of the migraine patients are affected by it [3, 4].

It has been reported in the literature that the greater occipital nerve (GON) block is an efficient treatment method for migraine, tension headache, and cervicogenic headache, and different types and doses of local anesthetics has been used for blocking resulting in the failure to standardize the treatment method [5, 6]. Both animal studies and human subject research have shown the effect of the GON block in the trigeminovascular system which plays a vital role in the pathophysiology of migraine. It has been shown that the excitability of the meningeal afferent input increases with the stimulation of the GON and cutaneous C-fibers while GON block hinders the sensitization of the C2 dorsal horn convergent neurons by reducing their input [5].

Landmarks where 1/3 medial of the imaginary line between the occipital external protuberance and the mastoid process is taken as the reference point are used for the landmark-based GON block. US-based GON block, on the other hand, can be performed both proximally (C2 vertebra), and distally benefiting from the adjacent occipital artery [7, 8].

The study's primary aim was to evaluate and compare the efficiency of the two methods of greater occipital nerve (GON) block, i.e., the US-guided technique and the landmark-based technique for 3 months in the chronic migraine patients. It was aimed to evaluate whether a significant decrease in parameters would be observed 3 months after GON block compared to before treatment. In order to determine this clinical efficacy; analgesic drugs use, attack frequency, the duration of pain and VAS score were evaluated in this study.

The study's secondary aim was to the potential adverse effects of GON block.

Methods

Patients aged between 18 and 65 years who applied to the neurology outpatient clinic with headaches more than 15 days per month in a 3-month period and migraine-type headaches on at least 8 of these 15 days and who consented to the study were included in this prospective study. Patients with additional neurological conditions such as cerebrovascular disease, multiple sclerosis, epilepsy; pregnant women, patients with cancer, and patients diagnosed with another primary headache, patients who did not consent to the study or dropped out were excluded from the study. Patients were randomized into two groups with the help of a web-based software. G*power 3.1.9.4 software package was used to calculate the sample size. For VAS, the effect size was determined to be 0.632 based on the allocation ratio = 1 calculated from previous studies. With power set to be 0.80, it was planned to include a minimum of 64 patients in the study, i.e., 32 patients per group.

A neurologist performed landmark-based GON block in the first group. For the landmark-based GON block, patients were put in the prone position with their heads and necks flexed, and the occipital external protuberance was located by palpation in each patient. GON is located approximately at one third of the distance from the occipital external protuberance to the mastoid process. This location should correspond to a point 2 cm inferior and 2 cm lateral to the occipital external protuberance. Following the identification of this landmark, the neurologist pushed the needle until its tip touched the periosteum, then they pulled the needle back by 1 mm and aspirated it to make sure it was not in contact with the occipital artery, and performed bilateral block with a total of 2 ml bupivacaine 0.5%, 1 ml each side, using a 5 ml syringe and a 0.45×13 mm 26 Gx ½ needle.

The algologist (pain medicine specialist) performed US-guided (Mindray DC-3) GON block in the second group. While patients were put in the prone position, the 5–10 MHz probe of the US device was transversally placed in the midline on the occipital external protuberance and then moved caudally to produce an axial image of the atlas, the first bony structure beneath the occiput. Next, the probe was placed caudally at the level of C2 vertebra (the axis). The C2 vertebra has a bifid process which is characteristically prominent with right and left tubercles. After the spinous process of the axis was located, the probe was moved laterally to view the obliquus capitis inferior muscle (OCIM), a separate muscle posterior to the laminae of the axis and anterior to the semispinalis capitis muscle (SsCM). Once the GON, an oval-shaped hypoechoic structure between the SsCM and OCIM, was viewed, the needle was inserted using the in-plane technique and it was ensured through negative aspiration that there was no vascular puncture, followed by the performance of bilateral block to the greater occipital nerve with a total of 2 ml bupivacaine 0.5%, 1 ml each side (Figs. 1 and 2).

The block techniques performed with same equipment for both groups were planned to use bupivacaine once a

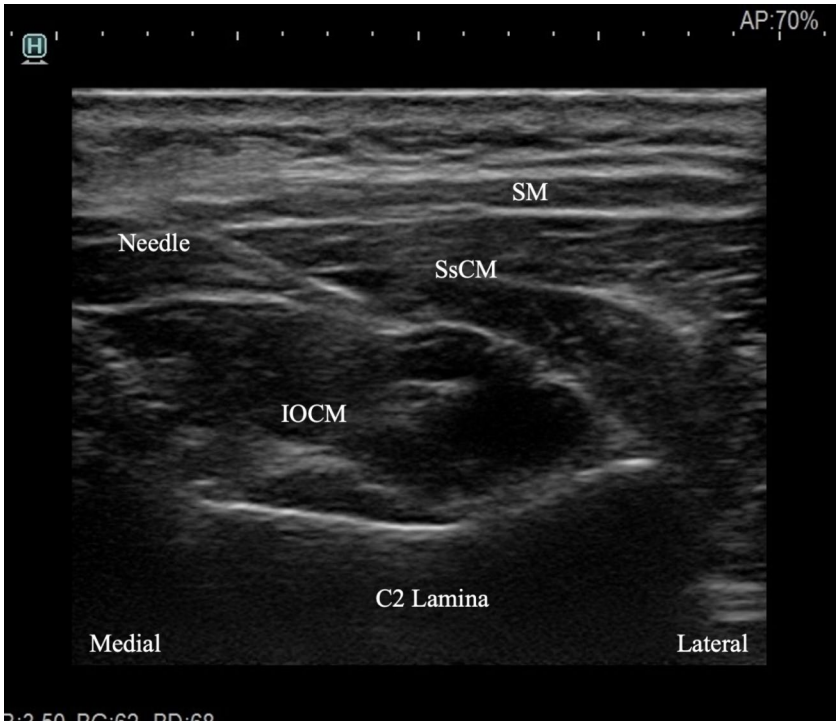

Fig. 1 Ultrasound guided greater occipital nerve (GON) block

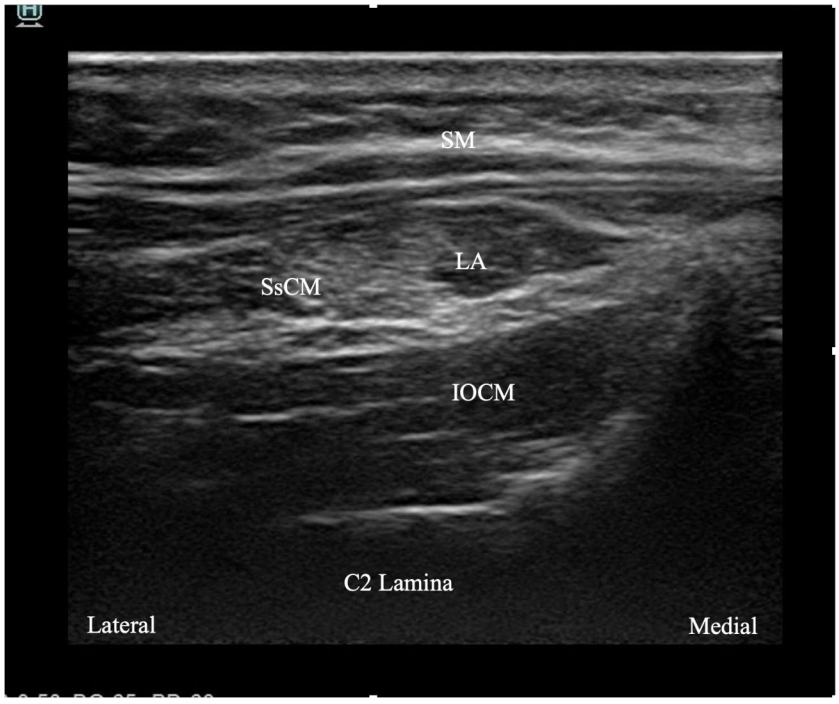

Fig. 2 The expansion of the band after injection of LA in US guided technique

week over the course of 4 weeks, and to avoid affecting the efficiency of the techniques, no prophylactic treatment was started after the block, or in the case of an ongoing prophylaxis, the treatment plan was not changed and no drugs were added.

Apart from the demographics such as age and gender data, the MIDAS scores, and the number of painful days, duration of pain, analgesic intake within a month and the VAS scores prior to GON block were recorded for both groups. And after the GON block, those 4 parameters

were re-investigated at Week 1 and Months 1 and 3. The study, which started in June 2022, ended in September 2023 due to the completion of the 3-month follow-up of the last patient. At the end of the first month, the patients which did not see benefits (showing no more than 50% decrease in the number of painful days) were excluded (Fig. 3).

Data were analyzed using the SPSS 25 software package. Descriptive statistics used for data analysis were mean, standard deviation, and median values. The Shapiro-Wilk test was used to determine whether the data showed normal distribution. When the it was observed that the data did not show normal distribution, the Mann-Whitney U Test was employed for comparisons between the two groups. The Greenhouse-Geisser test was used with Bonferroni corrections.

Results

A total of 82 patients who consented to the study, were included in the study while 2 patients in the US-guided GON block group and 4 patients in the landmark-based GON block group were later excluded due to irregular visits by them. Following the further exclusion of five patients from each group at the end of the first month because they did not benefit from the treatment, the study proceeded with a total of 66 patients, i.e., 34 in the US-guided GON block group and 32 in the landmark-based GON block group. Since female is the prevalent gender among the patients, no male patients were included in the study to eliminate the gender factor.

The mean age of patients in US-guided GON block group was 43.25±9.71 years while it was 37.73±9.37 years in the landmark-based GON block group. In US-guided GON block group; two patients were describing the left side, 9 patients were describing the right side, and 23 patients were describing pain spreading to the entire head without choosing a side. In the landmark-based GON block group; pain localization was 4, 6 and 22, respectively.

All patients used paracetamol, non-steroidal analgesic drugs and triptans for headache, the sum of these 3 drug groups was determined as the number of analgesic drugs taken. There was no one using more than 6 triptans per month.

52 patients were receiving prophylactic treatment. 22 patients were using serotonin and norepinephrine reuptake inhibitors (SNRIs), 13 patients were using tricyclic antidepressants, 9 patients were using topiramate, 6 patients were using propranolol, and 2 patients were using flunarizine. 14 patients had received prophylactic treatment in the past and they did not want to receive prophylactic treatment at the time of presentation because they did not see any benefit from them.

At the baseline; the mean of frequency of attacks was 15,76±3,11 days per month in US- guided GON block group and 19,71±7,73 in the landmark-based GON block group. The mean of duration of attacks was 33,05±22,33 h in US- guided GON block group and 28,09±24,57 in the landmark-based GON block group. VAS scores' mean was calculated as 9,47±2,69 in US- guided GON block group and 9,46±0,98 in the

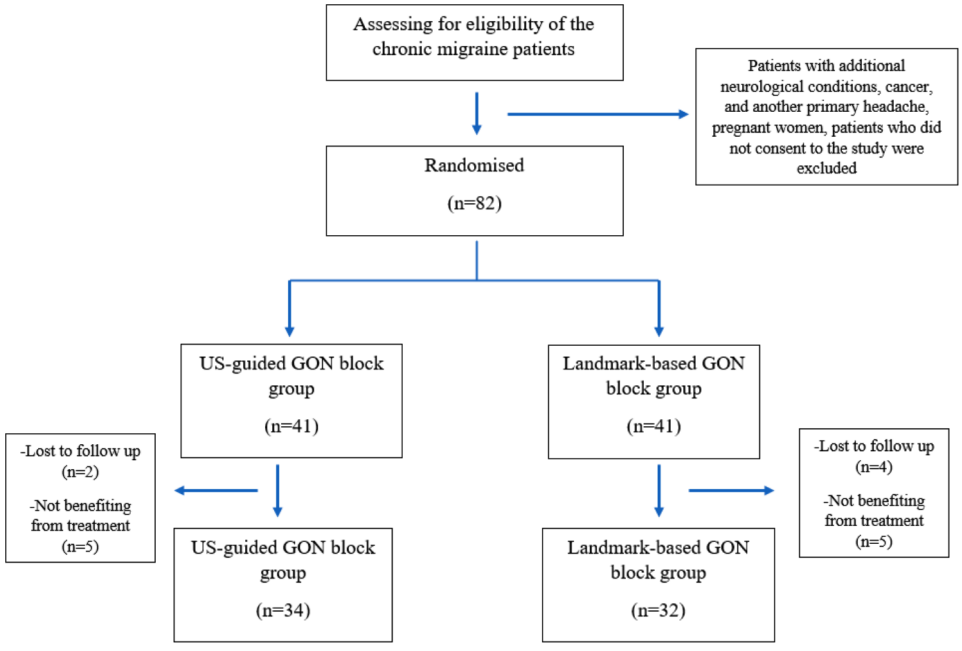

Fig. 3 Flow chart of the patient selection and analysis

Table 1 Baseline frequency and duration of attacks numbers, VAS scores and analgesic intake of the patients

		Group	*N*	Mean	Std. Deviation	Median	Mann Whitney-U	*p*
Baseline	Frequency of attacks	USG	34	15,7647	3,11457	15,5000	417,000	,101
		Landmark	32	19,7188	7,73027	19,5000		
	Analgesic intake	USG	34	44,7941	18,16720	40,0000	139,500	,000
		Landmark	32	20,5938	12,11200	18,5000		
	Duration of attacks	USG	34	33,0588	22,33755	24,0000	436,500	,159
		Landmark	32	28,0938	24,57163	24,0000		
	VAS score	USG	34	9,4706	2,69944	9,0000	379,500	,022
		Landmark	32	9,4688	,98,323	10,0000		

Table 2 Frequency and duration of attacks numbers, VAS scores and analgesic intake of the patients at the end of third month

		Group	*N*	Mean	Std. Deviation	Median	Mann Whitney-U	*p*
3rd month	Frequency of attacks	USG	34	1,7353	,79,043	2,0000	190,500	,000
		Landmark	32	4,5625	2,85044	4,5000		
	Analgesic intake	USG	34	3,5294	2,21886	4,0000	426,000	,124
		Landmark	32	5,3750	4,36075	4,0000		
	Duration of attacks	USG	34	7,0000	4,47214	6,0000	325,500	,005
		Landmark	32	15,3438	13,26312	12,0000		
	VAS score	USG	34	4,6765	1,90248	4,0000	235,500	,000
		Landmark	32	7,0000	2,51447	7,5000		

landmark-based GON block group. The average number of analgesic drugs taken in a month was 44,79±18,16 in US- guided GON block group and 20,59±12,11 in the landmark-based GON block group.

While there was no difference in baseline frequency and duration of attacks between the two groups, the baseline VAS scores and analgesic intake of the patients prescribed US-guided GON block were significantly high (Table 1).

When the difference in efficiency between the two groups was evaluated at Week 1 after the procedure, there was, again, no difference in the frequency of attacks and the duration of attacks, whereas the mean of VAS scores in US-guided GON block group was significantly lowered, it was decreased to 5,47±2,27 while the landmark-based GON block group's mean was 7,12±3,21 (p=0,001).

US-guided GON block group showed significantly reduced VAS scores and frequency of attacks compared to the landmark-based GON block group at Month 1 after the procedure. At the end of the first month; in US-guided GON block group; attacks' number was reduced to 2,58±0.95 (p=0.004) and VAS scores' mean was reduced to 5,08±1,54 (p=0,000). They were 5,40±3,83 and 7,12±2,67 in the landmark-based GON block group, respectively. Moreover, at the end of the 3rd month, the decrease in VAS score and attack frequency was significantly in favor of the US-guided GON block group, as at the end of the 1st month, and this was accompanied by a decrease in attack duration. In landmark-based GON block group; number of attack was reduced to 4,56±2,85, number of analgesic intake was reduced to 5,37±4,36, duration of attacks' mean was decreased to 15,34±13,26 and VAS scores' mean was decreased to 7±2,51. These values were 1,73±0,79 for number of attacks; 3,52±2,21 for analgesic intake; 7±4,47 for duration of attacks and 4,67±1,90 for VAS scores' mean in US-guided GON block group (Table 2).

Considering the ratios, both groups showed the same level of decrease in the number of attacks at Week 1 after the procedure. However, patients in US-guided GON block group showed a decrease by 82.94% at Month 1 and 88.44% at Month 3 in the number of attacks while these ratios were 72.24% and 74.71%, respectively, in the other group, indicating a significant difference between the groups. A similar pattern of difference was seen in the duration of attacks and the analgesic intake: while there were no significant differences in the results at Week 1, the results for US-guided GON block group were significantly lowered at Months 1 and 3 compared to the other group.

The change in VAS scores, on the other hand, was significantly lower in US-guided GON block group from the first week of the procedure (Table 3).

According to the analysis performed with Greenhouse-Geisser, there were differences between the groups that underwent US-guided and landmark-based GON block in terms of frequency of attacks, analgesic intakes, duration of attack values and VAS scores recorded at the baseline, 1st week, 1st month, and 3rd month (Table 4).

When the attack frequency, analgesic intakes, attack duration and VAS scores of both US-guided and landmark-based GON block group were compared at the follow-up points, a difference was observed between

Table 3 Change of the frequency of attacks, analgesic intake, duration of attacks and VAS scores' ratio between the groups

		Group	*N*	Mean of percentage change	Std. Deviation	Median of percentage change	Mann Whitney-U	*p*
Frequency of attacks	Change in 1st week	USG	34	,8652	,07142	,8667	499,000	,562
		Landmark	32	,8659	,10,043	,8667		
	Change in 1st month	USG	34	,8294	,07608	,8417	330,000	,006
		Landmark	32	,7224	,16,622	,6833		
	Change in 3rd month	USG	34	,8844	,06206	,9000	260,500	,000
		Landmark	32	,7471	,15,098	,7333		
Analgesic intake	Change in 1st week	USG	34	,8904	,09098	,9000	466,500	,318
		Landmark	32	,8644	,11,350	,8583		
	Change in 1st month	USG	34	,8678	,07917	,8819	302,000	,002
		Landmark	32	,6558	,30,552	,7550		
	Change in 3rd month	USG	34	,9072	,06770	,9292	203,500	,000
		Landmark	32	,6735	,27,816	,7571		
Duration of attacks	Change in 1st week	USG	34	,5193	,31,656	,5774	442,500	,189
		Landmark	32	,3747	,41,745	,2917		
	Change in 1st month	USG	34	,6000	,31,244	,6667	292,000	,001
		Landmark	32	,2734	,54,987	,3333		
	Change in 3rd month	USG	34	,6821	,33,270	,8167	249,000	,000
		Landmark	32	,2499	,68,021	,3333		
VAS score	Change in 1st week	USG	34	,4019	,25,336	,3333	308,000	,002
		Landmark	32	,2514	,33,219	,1556		
	Change in 1st month	USG	34	,4461	,17,101	,4722	255,000	,000
		Landmark	32	,2481	,26,024	,2000		
	Change in 3rd month	USG	34	,4879	,21,604	,5278	240,000	,000
		Landmark	32	,2593	,24,911	,2000		

Table 4 Differences of the groups in terms of frequency of attacks, analgesic intakes, duration of attack values and VAS scores recorded at the baseline, 1st week, 1st month, and 3rd month

			F	*p*
US-guided GON block	Frequency of attacks	Greenhouse-Geisser	563,675	,000
	Analgesic intake	Greenhouse-Geisser	169,941	,000
	Duration of attacks	Greenhouse-Geisser	36,988	,000
	VAS	Greenhouse-Geisser	40,032	,000
Landmark-based GON block	Frequency of attacks	Greenhouse-Geisser	134,203	,000
	Analgesic intake	Greenhouse-Geisser	59,208	,000
	Duration of attacks	Greenhouse-Geisser	8,119	,002
	VAS	Greenhouse-Geisser	10,060	,000

the baseline values and the 1st week, 1st month, and 3rd month mean values. The 1st month attack frequency, analgesic intakes and duration of attack values of the US-guided GON block group differed from the baseline and 3rd month values, but did not differ from the 1st week value. The VAS scores at 1st month differed from the baseline values, but there was no significant difference with the 1st week and 3rd month values. The 1st month frequency of attack and analgesic intakes values of landmark-based GON block group differed from the baseline and 1st week values. The first month duration of attack values and VAS scores were only different from the baseline values in landmark-based GON block group (Tables 5 and 6).

At the end of the study, a significant decrease was observed in the number of frequency and duration of attacks, number of analgesic intake and VAS score compared to the baseline in both groups (Tables 7 and 8).

Discussion

Since it acts early in reducing pain severity, is easy to use and minimally invasive, and has minimum side effects, minimum drug interactions, and a low cost, GON block is a beneficial and useful method. Many studies in the literature argue that US-guided GON bock is more effective [9]. In the present randomized controlled study with chronic migraine patients, the same pain medicine specialist performed the GON block proximally in one group, and the same neurologist performed the landmark-based GON block distally in the other group. Our study supports that US-guided GON block might be more effective than the landmark-based GON block.

The greater occipital nerve ends its course as the medial branch of the dorsal ramus of the C2 spinal nerve and may also receive contributions from the dorsal ramus of C3. During its course, it ascends between the obliquus capitis superior and semispinalis capitis and innervates

Table 5 Comparison of the attack frequency, analgesic intake, attack duration and VAS scores of US-guided GON block group at follow-up points

Pairwise Comparisons			*p*
Frequency of attacks	Baseline	1st week	,000
		1st month	,000
		3rd month	,000
	1st week	Baseline	,000
		1st month	,089
		3rd month	,738
	1st month	Baseline	,000
		1st week	,089
		3rd month	,000
	3rd month	Baseline	,000
		1st week	,738
		1st month	,000
Analgesic intake	Baseline	1st week	,000
		1st month	,000
		3rd month	,000
	1st week	Baseline	,000
		1st month	1,000
		3rd month	,575
	1st month	Baseline	,000
		1st week	1,000
		3rd month	,010
	3rd month	Baseline	,000
		1st week	,575
		1st month	,010
Duration of attacks	Baseline	1st week	,000
		1st month	,000
		3rd month	,000
	1st week	Baseline	,000
		1st month	,111
		3rd month	,005
	1st month	Baseline	,000
		1st week	,111
		3rd month	,029
	3rd month	Baseline	,000
		1st week	,005
		1st month	,029
VAS	Baseline	1st week	,000
		1st month	,000
		3rd month	,000
	1st week	Baseline	,000
		1st month	1,000
		3rd month	,302
	1st month	Baseline	,000
		1st week	1,000
		3rd month	1,000
	3rd month	Baseline	,000
		1st week	,302
		1st month	1,000

Table 6 Comparison of the attack frequency, analgesic intake, attack duration and VAS scores of the landmark-based GON block group at follow-up points

Pairwise Comparisons			*p*
Frequency of attacks	Baseline	1st week	,000
		1st month	,000
		3rd month	,000
	1st week	Baseline	,000
		1st month	,000
		3rd month	,001
	1st month	Baseline	,000
		1st week	,000
		3rd month	,602
	3rd month	Baseline	,000
		1st week	,001
		1st month	,602
Analgesic intake	Baseline	1st week	,000
		1st month	,000
		3rd month	,000
	1st week	Baseline	,000
		1st month	,000
		3rd month	,001
	1st month	Baseline	,000
		1st week	,000
		3rd month	,940
	3rd month	Baseline	,000
		1st week	,001
		1st month	,940
Duration of attacks	Baseline	1st week	,003
		1st month	,038
		3rd month	,046
	1st week	Baseline	,003
		1st month	1,000
		3rd month	1,000
	1st month	Baseline	,038
		1st week	1,000
		3rd month	1,000
	3rd month	Baseline	,046
		1st week	1,000
		1st month	1,000
VAS	Baseline	1st week	,001
		1st month	,000
		3rd month	,000
	1st week	Baseline	,001
		1st month	1,000
		3rd month	1,000
	1st month	Baseline	,000
		1st week	1,000
		3rd month	1,000
	3rd month	Baseline	,000
		1st week	1,000
		1st month	1,000

Table 7 Comparison of the baseline values and 3rd month's values of US-guided GON block group

		Mean	N	Std. Deviation	Percentage change	Wilcoxon Signed Test	p
Frequency of attacks	Baseline	15,7647	34	3,11457	0,889925	-5,093	,000
	3rd month	1,7353	34	,79,043			
Analgesic intake	Baseline	44,7941	34	18,16720	0,921208	-5,089	,000
	3rd month	3,5294	34	2,21886			
Duration of attacks	Baseline	33,0588	34	22,33755	0,788256	-4,979	,000
	3rd month	7,0000	34	4,47214			
VAS	Baseline	9,4706	34	2,69944	0,506209	-5,100	,000
	3rd month	4,6765	34	1,90248			

Table 8 Comparison of the baseline values and 3rd month's values of the landmark-based GON block group

		Mean	N	Std. Deviation	Percentage change	Wilcoxon Signed Test	P
Frequency of attacks	Baseline	19,7188	32	7,73027	0,768622	-4,940	,000
	3rd month	4,5625	32	2,85044			
Analgesic intake	Baseline	20,5938	32	12,11200	0,738999	-4,784	,000
	3rd month	5,3750	32	4,36075			
Duration of attacks	Baseline	28,0938	32	24,57163	0,453837	-3,429	,001
	3rd month	15,3438	32	13,26312			
VAS	Baseline	9,4688	32	,98,323	0,26073	-4,303	,000
	3rd month	7,0000	32	2,51447			

the scalp up to the vertex by running along the occipital artery after piercing the aponeurosis of the trapezius [10].

External landmarks are used in the blind technique for nerve block: while the point medially corresponding to 1/3 of the imaginary line running between the occipital external protuberance and the mastoid process or 1 to 2 cm inferior to the midpoint of this line may be chosen as the suitable landmark for the block, the point corresponding to 3 cm inferior and 1.5 cm lateral to the protuberance may also be preferred [8, 9, 11]. A cadaver study conducted taking into account that there might be anatomical variations showed that the nerve was located one thumb's breadth (2 cm) lateral to the occipital external protuberance and on the line corresponding to the base of the thumbnail (2 cm inferior to the occipital external protuberance) [10]. US-guided GON block can be performed from either distal or proximal levels for the latter of which the C2 spinous process is located and the probe is moved laterally to identify the GON at the level of the obliquus capitis inferior muscle [12, 13]. For the distal level, the location of the occipital artery is utilized as this artery runs laterally to the nerve [14].

The proximal approach to GON block was first identified in 2010. GON's proximal location between the tissue layers at the level of C2 vertebra imparts different sonographic properties to it. This allows for the injection of less local anesthetics, mitigates the risk of the drug to spread to related structures such as the lesser occipital nerve and the third occipital nerve, facilitates the ultrasound imaging, and helps target the nerve potentially more correctly [15].

A study designed to compare two US-guided techniques, i.e., the proximal and the distal approaches, showed that both the distal and the proximal approaches could provide a short-term improvement in the headache severity, a reduction in the number of days with headache, and an improvement in sleep quality in patients with chronic migraine. The relevant study further reported that when compared to the distal technique, the proximal approach to GON block could provide analgesic benefits to patients with chronic migraine for a longer period of time [13]. For our study, the advantages of the proximal GON block from the C2 vertebra level can be listed as the deeper location of the nerve between the muscle layers, a lower risk of damaging the occipital artery, and easier skin disinfection thanks to the further location of the injection site from the hairline.

Palamar et al. compared the efficiency of the single-session US-guided GON blocks from the distal level using bupivacaine 0.5% and placebo. They evaluated the change in the VAS scores and the severity of headache within one month of the procedure and concluded that US-guided GON block with 1.5 ml of bupivacaine 0.5% was a safe, easy and effective technique and it enhanced the efficiency of the injection [7]. With no placebo group, our study used the same anesthetic at the same dose (1 ml of bupivacaine 0.5%) for all the GON blocks performed once a week over the course of one month, i.e., four times in total, and found a significant decrease in VAS scores.

Karaoğlan et al. retrospectively documented the results of the unilateral and bilateral C2-level GON blocks (once a week, four times a month) in chronic migraine treatment and found that at Month 3 the C2-level GON block

was effective, whereas the bilateral blocks were not superior to the unilateral blocks [16]. Although the proximal GON block technique was similar to that of our study, the dose of local anesthetics used (4 ml of bupivacaine 0.5%) was different. Furthermore, since our study compares two methods, it used bilateral GON block in all patients.

A meta-analysis reported that local anesthetics might reduce the frequency and severity of headaches when compared to placebo while adding corticosteroids had no additional benefits with limited evidence [17]. Taking into account the possible side effects of the steroids, our study aimed to determine the efficiency of only the injection of local anesthetics in GON block. All the GON blocks in our study used 1 ml of bupivacaine 0.5%, which is the daily routine dose, and involved no added corticosteroids.

US-guided or landmark-based for GON block has been reported to be an effective method in the treatment of headache [18, 19]. A paper compiling the results of GON block in headaches reported that GON block was effective in migraine, cluster headache, cervicogenic headache, postdural puncture headache, and occipital neuralgia, and that the evidence for acute short-term care was stronger than that for the long-term protection [20]. A study where 44 patients with chronic migraine were given placebo and bupivacaine found at the end of 3 months a marked reduction in the frequency of pain and VAS scores for the bupivacaine group compared to the placebo group [21]. A randomized, double-blind, placebo-controlled study with patients with chronic migraine found that over the 12-week follow-up period, the group where the block was performed using lidocaine for 4 weeks experienced fewer painful days compared to the placebo group [22]. Another multicenter, randomized, double-blind, placebo-controlled study reported that the bupivacaine group showed a marked decrease in the frequency, duration, and severity of pain at the end of Month 1 compared to the baseline, and this group had a fewer number of painful days and lower pain scores compared to the saline-injected group. Following the unblinding at Months 2 and 3, the saline group was changed to bupivacaine injection and results obtained were similar to those of the bupivacaine group [23].

Another study with the same design investigating episodic migraine similarly found a lower number of painful days compared to the placebo group; however, it reported no superiority to the placebo group in the severity and duration of pain [24]. A meta-analysis investigating the results of 417 patients diagnosed with chronic migraine concluded that the frequency of migrainous headache and the pain scores showing the pain severity were remarkably lowered after the block, as also shown by our study [25].

Review of literature on the comparison of methods reveals that a study with 45 patients with occipital headache concluded after a 4-week follow-up that US-guided GON block was more effective than the landmark-based technique [26]. Our study, however, required a longer follow-up to conclude that US-guided GON block was more effective.

Strengths: A longer follow-up period compared to most block studies, and the same specialist performing all the blocks in the one group.

Limitations: A small sample, presence of auras due to patients' interpretation of the prodromes as auras, and no mention of the duration of condition since the patients reported a large window.

Conclusion

The present study concludes that both US-guided and landmark-based GON blocks are efficient techniques in patients with chronic migraine. When the results from US-guided GON blocks were compared to those of the landmark-based GON blocks, VAS scores were lower, the duration of pain was shorter, the number of attacks were lower, and the analgesic intake was reduced in US-guided GON block group. These results suggest that if and when a clinician is to perform a GON block, it would improve the treatment success to prefer US-guided GON block first. Since the present study is the first study to the best of our knowledge that compares two methods of GON block in patients with chronic migraine, further studies are needed which would have a bigger sample size and compare the efficiency of the methods in other primary headaches as well.

Abbreviations

GON	Greater occipital nerve
LA	Local anesthetic
OCIM	Obliquus capitis inferior muscle
US	Ultrasound
SM	Splenius muscle
SsCM	Semispinalis capitis muscle
VAS	Visual analog scale

Acknowledgements

We thank Abdullah Karaakın from Beykent University for translating this study from Turkish into English. This study was presented as an oral presentation at the 59. National Neurology Congress in December 2023.

Author contributions

All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by Gizem Gürsoy and Hale Arkan Tuna. The first draft of the manuscript was written by Gizem Gürsoy and all authors commented on previous versions of the manuscript.

Funding

No funding was received for conducting this study.

Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
The Ethics Committee of the Ümraniye Teaching Hospital approved the present study with its letter of approval no. 161 of 21.04.2022.

Consent for publication
The subjects included in the study gave their written informed consent.

Competing interests
The authors declare no competing interests.

Received: 19 June 2024 / Accepted: 21 August 2024
Published online: 04 September 2024

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