



AN OBSERVATIONAL STUDY OF ULTRASOUND-GUIDED GREATER OCCIPITAL NERVE BLOCK VERSUS PULSED RADIOFREQUENCY ABLATION FOR OCCIPITAL NEURALGIA IN REFRACTORY MIGRAINE

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ABSTRACT

Migraine, a paroxysmal disorder can lead to chronic migraine which becomes less responsive to medications. This observational study compares the outcomes of two commonly used techniques to alleviate occipital neuralgia in patients of chronic migraine. After ethical committee approval, 60 adult patients suffering from refractory migraine coming to the Neurology OPD from January 2023 to December 2025, to this referral centre were included. 24 patients received greater occipital nerve (GON) block while 36 patients received Pulsed Radiofrequency Ablation of greater occipital nerve. Pain was assessed by numerical rating scale (NRS) and total pain index (TPI) on monthly OPD follow ups of these 60 patients. Our study showed that the PRFA and GON block, both were effective in controlling occipital neuralgia with migraine. However, PRFA showed longer pain relief than Ultrasound-guided GON block.

KEYWORDS : Chronic Migraine, Occipital Neuralgia, Pulsed Radiofrequency Ablation, Greater Occipital Nerve Block.

INTRODUCTION

Migraine is highly prevalent and is the seventh leading cause of ictal headache worldwide,¹ yet it has received relatively little attention as a major public health issue. Attacks of migraine occur with a broad spectrum of frequency and severity; for some persons it is an occasional problem that can be effectively managed, but for many it is frequent, incapacitating, and refractory to current therapy.

Migraine one of the most common neurovascular disorders, is classified as chronic migraine (CM) and episodic migraine (EM). CM is defined as more than 15 headache days per month over a period of 3-months and EM is defined as less than 15 headache days per month. Migraine is a paroxysmal disorder with a natural fluctuation between a low and a high frequency pattern in part influenced by modifiable and non-modifiable risk factors.² Increased attack frequency can lead to the so-called 'CM', which then becomes less responsive to acute as well as prophylactic migraine medications.³ The term refractory migraine has been used in literature for a long time. Patients with refractory migraine are those who have failed adequate trials of preventive medicines, alone or in combinations from at least 2 out of 4 drug classes (-blockers, anticonvulsants, tricyclic antidepressants and calcium channel blockers).⁴

Recent clinical and anatomical investigations have found that migraine is caused by irritation or compression of sensory nerves of head and neck. One of the region focused is occiput, where irritation or compression of greater, lesser and third occipital nerve has been described and investigated. It has been found that there are multiple sites of compression of occipital nerves along its path, which often leads to occipital neuralgia.

Occipital neuralgia, also known as Arnold's neuralgia, is defined by the International Headache Society (IHS) as a unilateral or bilateral paroxysmal, shooting or stabbing pain in the posterior part of the scalp, in the distribution of the greater occipital nerve (GON), lesser occipital nerve (LON), or third occipital nerve (TON), sometimes accompanied by diminished sensation or dysesthesia in the affected area and commonly associated with tenderness over the involved nerves.⁵

Several pharmacological treatments have been proven to be effective in the treatment of CM including aspirin, acetaminophen, aspirin plus caffeine, nonsteroidal anti-inflammatory drugs (NSAIDs), triptans, dihydroergotamine,

antiemetics, opioid combinations and butorphanol nasal spray etc.⁶

Recently, both invasive and non-invasive neurostimulation therapies have been used for the treatment of CM⁷; mainly for those with symptoms refractory to conventional treatment. Nerve blocks are being increasingly performed for treatment of Occipital Neuralgia. Various nerve blocks like greater occipital nerve block, sub occipital nerve block and supraorbital nerve block have shown beneficial results in decreasing pain associated with migraine.⁸ The beneficial effect of these blocks varies from one week to six months and may be associated with drawbacks like requiring repeated number of blocks, vascular puncture and partial effect of the block. The studies evaluating effect of GON block with local anesthetics alone or with steroid for the acute and prophylactic treatment of migraine, cervicogenic headache and cluster headache have generally reported transient (<1 month) benefit, with there being no significant difference was noted between the local anesthetics alone and the combination of local anesthetic and corticosteroid.⁹

Pulse radiofrequency ablation (PRFA) treatment is known to reduce pain, primarily by the induction of a low-intensity electrical field around sensory nerves that results in depressed conduction and inhibition of long-term activation in the lightly myelinated A-delta fibers and the small unmyelinated C fibers.¹⁰ In experimental studies, PRF-mediated pain relief is suggested to be due to modulation of the descending noradrenergic and serotonergic pathways.

MATERIAL & METHODS

This comparative observational study comparing PRFA with greater occipital nerve block (GONB) was carried out from January 2023 to December 2025 in Department of Anaesthesiology & Critical Care of this referral hospital. Following ethical clearance and consent from patients the study was carried out. Patients suffering from Chronic Migraine with occipital neuralgia coming to the neurology department not responding to medical management for headache are referred to the department for second line of treatment.

The procedure was done on the day care basis. On the day of procedure, Numerical Rating Scale (NRS) and Total Pain Index (TPI) were recorded. The patients underwent the procedure in random. Written informed consent was taken from the participants before the procedure.

Intervention was performed in the operation theatre (OT) set

up under all aseptic precautions. Patients coming with CM are pre-procedure evaluated to assess fitness for the proposed procedure. Detailed history is taken from all the participants regarding site, duration and severity of pain. Pain score is evaluated by using Numerical Rating Scale (NRS) from 0 to 10 and graded as Mild Pain = 0-3, Moderate Pain = 3-6 and Severe Pain = 7-10.

The procedure side was determined by the patient's clinical symptoms and according to the painful side reported in their headache diaries. Intravenous access was obtained. Patients were asked to place themselves in prone position on the operation table and vital parameters- electrocardiography (ECG), heart rate (HR), noninvasive blood pressure (NIBP), oxygen saturation (SPO2) were recorded at base line (before procedure) and then at 5 minute intervals till the end of procedure. Mild sedation was given with intravenous midazolam 1 mg if required in anxious or uncooperative patients. The procedure was performed using ultrasound-guidance with a high-frequency (7-13 MHz) transducer.

For GON block, greater occipital nerve was identified medial to the occipital artery in the medial one-third of the superior nuchal line between the occipital tubercle and mastoid process. After administration of 2% lignocaine at the site to reduce discomfort during the procedure, a 22-gauge 1.5 inch needle was advanced beneath the lateral border of the probe using an in-plane technique and 2.5 ml bupivacaine was injected around the nerve.

PRFA of GON was also done on day care basis under all aseptic precautions and ultrasound guidance. The greater occipital nerve was located medial to the occipital artery in the medial one-third of the superior nuchal line between the occipital tubercle and mastoid process. After administration of 1-2 ml 2% lignocaine at the site, a 50-mm long 22-G blunt RFA needle was advanced towards the nerve. After the proper placement of the needle microelectrode was inserted through the needle. A mild electrical stimulation was used to observe the motor and sensory stimulation for ensuring proper positioning of the microelectrode by eliciting tingling sensation in the distribution of GON and rule out involvement of any large muscles and to prevent nerve damage. Three cycles of pulsed radiofrequency of 2 min duration were performed at 40-42 degrees centigrade temperature.

The disability due to migraine was assessed using migraine disability assessment questionnaire (MIDAS). This scale grades the disability of patients from grade 1 to 4.

We also used the 5-point Likert scale format to measure satisfaction level among the patients.

Observation and Follow up

Following the procedure, all patients were shifted to post-anesthesia care unit (PACU), where they were observed and monitored for vital signs and any neurological complications. If there was any complication occurring during or post procedure that was noted in details and managed accordingly. All patients were evaluated for pain intensity and overall neurological function before discharge and advised to maintain their pain diary. Patients with a NRS > 3 were advised to take Ibuprofen: 200-800 mg or Diclofenac: 50-100 mg twice a day. Patients with a NRS 4-6 were given either Beta-blockers or calcium channel blockers and antiepileptics.

Patients having severe headache NRS >6 were advised to take tramadol 50 mg 2-3 times a day. Patients were re-evaluated every month for total of 3 month at pain clinic. They were assessed for reduction in frequency and severity of pain according to numerical rating scale (NRS) and total pain index (TPI). The responders were defined as at least a 50% reduction in the frequency of moderate or severe migraine

headache days. The analgesic requirement of the patient was calculated every month by using medical quantification scale (MQS). Any improvement in their migraine disability assessment questionnaire score (MIDAS) and 5-point Likert scale format to measure satisfaction level among the patients were assessed on the 3rd month after the procedure.

RESULTS

The sample size calculation was based on 80% power ($\alpha=0.05$), if the percentage of responders in the target population is taken as 75% with active treatment and 35-40% with GON block group. In the given two years, 60 cases coming for management of refractory migraine were taken up for the study. 36 cases of Occipital Neuralgia were given PRFA and 24 cases were given GON block. (Table 1) Data were presented as mean $\pm$ SD or Median (interquartile range) where appropriate. Continuous variables were examined for normality. Demographic data were analyzed using Students t-test and Chi square test. Continuous variables (intra procedural and post procedural vitals) were analyzed using Mann Whitney U test between the 2 groups. Continuous variables within the group were compared using Wilcoxon sign-rank test. Categorical variables (including sex, presence of headache, MIDAS etc.) were compared using Chi square test. Data were analyzed using computer Statistical software SPSS version 21 (SPSS Inc. Chicago. IC.USA). P value of < 0.05 was considered significant.

The present study was aimed to compare the effectiveness of ultrasound guided PRFA of greater occipital nerve and ultrasound guided greater occipital nerve block in refractory migraine with occipital neuralgia. Findings of the study have been discussed below:

General Characteristics

Migraine is more common between the age of 10 to 14 years of age and continues to increase until 35 to 39 years of age with higher incidence in females than in males, in our study 97% of the patients were females, the mean age of the patient in GON block group and PRFA group was comparable with SD of (35.60[12.52] vs. 37.80[12.20]; $P=0.630$). In our study there was no difference in side of pain about 20%-40% patients had pain in both the sides.

Table 1: General Characteristics (N=60)

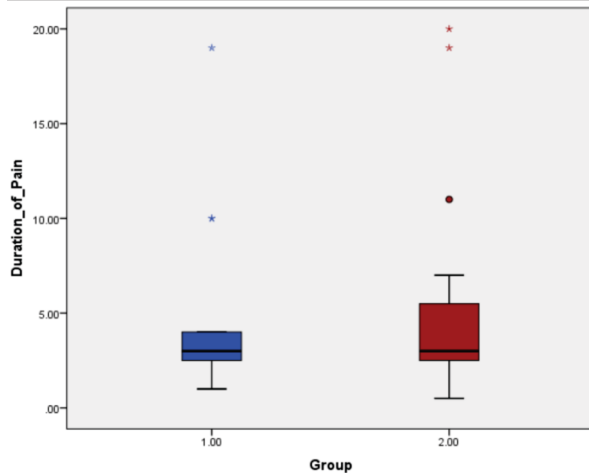
	GON Block (n=24)	PRFA (n=36)	P Value
Age (years)	35.60 [12.52]	37.80 [12.20]	0.630#
Gender (Male/Female) (n)	2/22	0/36	0.309##
Height (cm)	158.90 [10.00]	166.53 [9.30]	0.494#
Weight (kg)	62.47 [3.50]	60.13 [4.98]	0.149#

Pain

In our study pain was not only localized to occipital region, apart from occipital region most of the patients presented with pain in frontal region, temporal region, parietal region and vertex in both the groups. We observed that preoperative occipital pain was comparable in both GON block group and PRFA group of patients ($P=0.624$). Post-procedure occipital pain was significantly lower in GON block group in comparison to PRFA group ($P=0.004$). Occipital pain was significantly lower at 2 months ($P=0.003$) and 3 months ($P=0.001$) in PRFA group in comparison to GON block group. Total pain was similarly significantly lower at 2 month ($P=0.021$) and 3 month ($P=0.001$) in PRFA group in comparison to GON block group. In our study, we observed that percent decrease in the occipital pain was highest at 3 months in PRFA group and at one month in GON block group. Similarly, percent decrease in total pain was highest at 3 months in PRFA group and at 2 months in GON block group. Percent decrease in the occipital pain and total pain at 3 month was significantly higher in PRFA group in comparison to GON block showing better role of PRFA in the treatment of pain. However, we did not measure effectiveness of the therapy for longer duration.

Table 2: Duration of Pain

	GON Block (n=24)	PRFA (n=36)	P Value#
Duration of pain (Years)	3.0 [2.0, 4.0]	3.0 [2.0, 7.0]	0.775

**Figure 1: Box-Plot Showing Comparison of Duration of Pain Between Groups; X-Axis: Groups (Group 1: Gon Block; Group 2: Prfa Group); Y-Axis Shows Duration of Pain in Years****Total Pain Index (TPI)**

We observed that patients in PRFA group had significantly lower TPI at 2 months ($P=0.004$) and 3 months ($P=0.001$) in comparison to GON block group. (Table 2) Percent decrease in TPI was also higher in PRFA group in comparison to GON block group both at 2 months and 3 months. The TPI is an incorporated pain scale of the weighted intensity and duration of headache attacks. Our findings are in concordance with Choi et al¹¹ who observed significant decrease in TPI post-PRFA. (Table 3)

Table 3: Percent Change in Occipital Pain

Occipital NRS	GON Block (n=24)		PRFA (n=36)		P Value#
	Mean	SD	Mean	SD	
Postoperative	-55.46%	7.07	-45.20%	6.76	<0.0001
1 Month	-72.04%	6.55	-68.35%	6.86	0.143
2 Month	-68.24%	5.67	-75.78%	4.31	<0.0001
3 Month	-66.67%	7.89	-76.52%	3.51	<0.0001

MIDAS

On migraine disability assessment, we observed that migraine disability assessment score was significantly higher in GON block group in comparison to PRFA group ($P<0.0001$) while pre-procedure, disability was comparable in both the groups. Though MIDAS assessment has been used in other interventions however there are no previous studies in literature where MIDAS has been used to assess quality of life following PRFA of greater occipital nerve. Okmen et al.¹² evaluated six months of results from repeated greater occipital nerve blocks (GON). After treatment, the initial MIDAS mean was found to be 2.82 per month; this declined to 1.47 in 3rd, and was 1.50 in the 6th month. This difference was noted to be statistically significant. The authors concluded that GON blockage with 2mL of 0.5% Bupivacaine can be a supportive management for migraine treatment, with no serious adverse effects reported.

Table 4: Midas

MIDAS		GON Block (n=24)	PRFA (n=36)	P Value#
Pre-procedure	Grade 1	0	0	0.068
	Grade 2	0	0	
	Grade 3	2 (8.3%)	12 (33.3%)	
	Grade 4	22 (91.7%)	24 (66.7%)	

3 Months	Grade 1	0	0	<0.0001
	Grade 2	5 (20.8%)	32 (88.9%)	
	Grade 3	19 (79.2%)	4 (11.1%)	
	Grade 4	0	0	

MQS

We observed that MQS score was significantly higher in GON block in comparison to PRFA group at 2 months ($P=0.010$) and 3 months ($P=0.003$). Venelderen et al.¹³ reported a decrease in the median medication score from 11.2 before treatment to 4.4, 3.4, and 2.2 at the one, 2, and 6 month assessment intervals with PRFA treatment.

Likert

We observed that from total of 36 patients, 33 patients were satisfied and 3 patients were neither satisfied, nor dissatisfied in PRFA group where as in GONB group 8 patients were satisfied and 16 patients were neither satisfied nor dissatisfied from the procedure, no patients were very satisfied or very dissatisfied in both the groups.

DISCUSSION

Migraine is one of most common causes of headaches, and its cumulative incidence is 18% in men and 43% in women.¹⁴ The two common techniques, Pulsed radiofrequency ablation and Greater Occipital Nerve blocks, for reduction in Occipital Neuralgia of chronic Migraine were compared for their efficacy. Pulsed radiofrequency ablation (PRFA) is known to be safe and effective in alleviating pain. The technique works by delivering an electrical field and heat bursts to targeted nerves or tissues without damaging these structures.¹⁵ Accordingly, PRF does not produce sufficient heat that results in structural damage. The proposed mechanism of PRF is that the electrical field produced by PRF can alter pain signals.

In this study we found that pain relief and satisfaction levels were better with Pulsed Radiofrequency Ablation of the greater occipital nerve. Initial Occipital Neuralgia pain relief was better provided by GON Nerve blocks but in a longer run PRFA was found to be more effective in reducing Occipital Neuralgia headache. Complications of both procedures was negligible and it was observed that PRFA was a better alternative for management of Occipital Neuralgia in Chronic Migraine cases.

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