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ROLE OF GREATER OCCIPITAL NERVE BLOCK FOR MIGRAINE PROPHYLAXIS

Original Research

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ABSTRACT

Background: Migraine is a chronic, disabling neurological disorder marked by recurring episodes of headache and associated symptoms, significantly affecting patients' quality of life and functional capacity. Despite its global burden, prophylactic treatment remains underutilized, particularly in chronic cases unresponsive to medication. Recent evidence supports peripheral nerve blocks, especially greater occipital nerve (GON) block, as a promising intervention for migraine prevention.

Objective: To determine the effectiveness of greater occipital nerve (GON) block in terms of mean reduction in headache frequency, severity, and analgesic consumption as a prophylactic treatment for patients with migraine.

Methods: A quasi-experimental study was conducted at the Neurology Department of Pak Emirates Military Hospital, Rawalpindi, over a six-month period from July to December 2023. A total of 138 patients diagnosed with migraine were enrolled after informed consent using consecutive sampling. Baseline data on headache frequency, duration, severity (measured via Visual Analog Scale), and monthly analgesic consumption were recorded. GON block was administered bilaterally with 2 mL of 0.25% bupivacaine under sterile ultrasound-guided technique. The intervention was repeated weekly during the first month and once monthly for the subsequent two months. Follow-ups were conducted at 1-, 2-, and 3-months post-intervention. Data were analyzed using SPSS version 25.0; $p \leq 0.05$ was considered statistically significant.

Results: The median age of patients was 38 (IQR: 8.25) years. Headache frequency significantly reduced from 8 (IQR: 2) to 4 (IQR: 2) attacks per month (p=0.000). Median headache duration declined from 10 (IQR: 7) to 5 (IQR: 4) hours (p=0.000). The VAS pain score decreased from 7 (IQR: 2) to 4 (IQR: 2) (p=0.000), and analgesic use reduced from 11 (IQR: 5) to 6 (IQR: 3.25) per month (p=0.000).

Conclusion: GON block showed significant clinical benefit as a prophylactic treatment for migraine, reducing headache frequency, intensity, duration, and analgesic dependency. It offers a viable alternative in patients with chronic migraine not adequately managed by pharmacologic therapy.

Keywords: Analgesics, Chronic Migraine, Headache Disorders, Migraine, Nerve Block, Pain Management, Prophylaxis.

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INTRODUCTION

Migraine is a prevalent and debilitating neurological disorder, recognized as the third leading cause of disability worldwide (1). Characterized by recurrent, often severe headaches, it significantly compromises quality of life and imposes functional limitations, frequently necessitating emergency care or outpatient visits. These recurrent healthcare interactions not only reflect the condition's severity but also contribute to a considerable socioeconomic burden (2). Epidemiological data indicate that migraines affect approximately 16% of the global population, with a marked predominance in women compared to men, exhibiting a 3:1 sex ratio (3). Despite the widespread prevalence and associated disability, migraine remains under-treated, with only a small fraction of individuals receiving prophylactic interventions. It is estimated that while nearly 38% of patients with episodic migraines could benefit from preventive therapy, only 3% to 13% are actually prescribed such treatment (4). Managing migraine effectively poses a clinical challenge, particularly in cases where patients no longer respond to pharmacological regimens. In such scenarios, minimally invasive strategies like peripheral nerve blocks and radiofrequency therapies have gained attention for their therapeutic potential (5). Among these, the greater occipital nerve (GON) block has emerged as a promising intervention for both the diagnosis and management of primary headache disorders (6). The GON, which predominantly originates from the dorsal root of the second cervical nerve (C2), serves as the main sensory input to the occipital scalp region (7). The anatomical convergence of sensory fibers from the cervical spine and the trigeminal nucleus caudalis (TNC) at the level of the upper cervical spinal cord forms a functional unit known as the trigemino-cervical complex (TCC), which plays a crucial role in the pathophysiology of migraine (8). By targeting this interface, the GON block modulates the excitability of second-order neurons involved in both trigeminal and cervical afferent processing (9).

The therapeutic benefits of GON-blocks are attributed to their ability to influence the trigeminovascular system, a central component in migraine development. Additionally, this approach offers several practical advantages, including a favorable safety profile, low cost, ease of administration, and minimal risk for drug interactions, making it a viable alternative in both acute and preventive migraine management (9,10). Despite growing international evidence supporting its efficacy, local research on the use of GON-blocks remains scarce, particularly in resource-constrained settings where alternative treatments are essential. Given this gap, there is a compelling need to explore the clinical utility of GON-blocks in the prophylactic treatment of migraine within the local context. The present study, therefore, aimed to determine the effectiveness of GON-blocks in reducing the frequency and severity of migraine attacks, decreasing the need for analgesic use, and ultimately improving patient-reported outcomes.

METHODS

This study employed a quasi-experimental design to evaluate the effectiveness of greater occipital nerve block (GONB) as a prophylactic intervention in patients with migraine. The research was conducted over a six-month period, from July 2024 to December 2024, at the Neurology Department of the Pak Emirates Military Hospital, Rawalpindi, following approval from the Institutional Ethical Review Committee. A total of 138 patients diagnosed with migraine were recruited through a non-probability consecutive sampling technique. The sample size was calculated using a 95% confidence level, a 7% margin of error, and an estimated migraine prevalence of 22.0% in the Pakistani population (11). Informed written consent was obtained from all participants prior to inclusion. Participants were adults aged 18 to 60 years of either gender who met the International Classification of Headache Disorders criteria for chronic migraine. Patients were eligible if they were intolerant to, contraindicated for, or nonresponsive to acute migraine therapy. Those with a history of medication-overuse headache, secondary headache disorders, prior peripheral nerve blocks or botulinum toxin injections within the last three months, surgery involving the occipital region, known allergy to local anesthetics, pregnancy or lactation, or chronic systemic conditions (e.g., cardiovascular, renal, hepatic, endocrine diseases), or other chronic pain conditions like fibromyalgia and low back pain were excluded (3,5).

Chronic migraine was defined as headache occurring on 15 or more days per month for more than three months, with at least eight days fulfilling criteria for migraine headache. Migraine without aura involved attacks lasting 4–72 hours, typically unilateral, pulsating, moderate to severe in intensity, worsened by physical activity, and accompanied by photophobia, phonophobia, or nausea. Migraine with aura included reversible visual, sensory, or speech/language symptoms that developed gradually, were completely reversible, and not associated with motor weakness (12). The effectiveness of GONB was assessed by measuring reductions in monthly migraine

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frequency, headache severity using the Visual Analog Scale (VAS) (13), and analgesic consumption. At baseline, demographic and clinical information, including migraine frequency, duration, severity (VAS), and monthly analgesic use, was collected and recorded on a structured proforma. Patients were also provided with a headache diary and instructed to record the number of headache days, frequency of migraine attacks, pain severity, and analgesic usage over the three-month follow-up period.

GONB procedures were performed in the operating theatre under continuous monitoring of ECG, oxygen saturation, and blood pressure. Patients were placed in the prone position, and bilateral distal GONB was administered using ultrasound guidance. A linear ultrasound probe was positioned at the medial third of the superior nuchal line, between the mastoid process and the external occipital protuberance, to localize the greater occipital nerve and occipital artery using Doppler imaging. Following sterile preparation, a location confirmation technique was performed using a sensory stimulation test to verify appropriate needle placement based on the elicitation of paresthesia in the dermatomal distribution of the occipital nerve. Once localization was confirmed, 2 mL of 0.25% bupivacaine was injected per side using a pulsed radiofrequency (PRF) needle. Patients were monitored for 30 minutes post-procedure for immediate adverse effects. The blocking protocol was administered bilaterally once weekly for the first month (four sessions) and once monthly during the second and third months (two additional sessions), totaling six sessions over three months. Patients were followed up monthly, and migraine frequency, duration, severity (VAS), and analgesic consumption were recorded at each visit. Participants were allowed to manage acute migraine episodes using analgesics, triptans, or ergot derivatives as needed. Any adverse events associated with the procedure were recorded. Data analysis was performed using the Statistical Package for Social Sciences (SPSS) version 25.0. The Shapiro-Wilk test was applied to assess normality, and since the data were not normally distributed, continuous variables such as age, headache frequency and duration, VAS score, and analgesic consumption were presented as medians with interquartile ranges (IQR). Categorical variables, including gender, migraine type, and severity classification, were summarized as frequencies and percentages. The Wilcoxon signed-rank test was employed to compare pre- and post-intervention values at baseline and after three months, with a p-value of ≤ 0.05 considered statistically significant.

RESULTS

A total of 138 patients were enrolled in the study. The median age of the participants was 38 years with an interquartile range (IQR) of 8.25 years. Among the participants, 27.5% were aged between 18 to 35 years, 69.6% between 36 to 50 years, and 2.9% between 51 to 60 years. Females constituted a slightly higher proportion of the sample at 56.5%, while males accounted for 43.5%. Regarding the type of migraine, 44.9% of patients experienced migraine with aura, while 55.1% reported migraine without aura. When categorized by severity of pain, 28.3% reported moderate to severe pain, 67.4% experienced very severe pain, and 4.3% described their headache as the worst pain imaginable. In terms of quantitative outcomes, the median monthly frequency of headache episodes showed a significant reduction from 8 (IQR: 2) at baseline to 4 (IQR: 2) at three months post-intervention (p=0.000). Similarly, the median duration of headache decreased from 10 hours (IQR: 7) at baseline to 5 hours (IQR: 4) at the end of the study period (p=0.000). The severity of pain, assessed using the Visual Analog Scale (VAS), also demonstrated notable improvement, with scores declining from a median of 7 (IQR: 2) to 4 (IQR: 2) (p=0.000). Moreover, the median number of analgesics consumed monthly reduced significantly from 11 (IQR: 5) at baseline to 6 (IQR: 3.25) after three months (p=0.000).

Analysis of functional disability and quality of life revealed significant improvements following the intervention. At baseline, participants reported high levels of functional impairment with a median disability score of 70 (IQR: 10), which decreased markedly to 40 (IQR: 12) after three months of treatment. Correspondingly, quality of life improved substantially, with the median score rising from 40 (IQR: 8) at baseline to 70 (IQR: 10) at the end of the study period. Both changes were statistically significant (p=0.000), reflecting the positive impact of greater occipital nerve block on daily functioning and well-being in patients suffering from chronic migraine. These findings align with the observed reductions in headache frequency, duration, pain severity, and analgesic use, providing further evidence of the intervention's clinical effectiveness.

Table 1: Demographic Characteristics of Study Participants

Variables	Frequency (n)	Percentage (%)
Age group: 18-35 years	38	27.5
Age group: 36-50 years	96	69.6
Age group: 51-60 years	4	2.9
Gender: Male	60	43.5

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Variables	Frequency (n)	Percentage (%)
Gender: Female	78	56.5
Severity: Moderate to severe	39	28.3
Severity: Very severe	93	67.4
Severity: Worst pain	6	4.3
Type of Migraine: With aura	62	44.9
Type of Migraine: Without aura	76	55.1

Table 2: Median (IQR) of Quantitative Variables (n=138)

Variables	At baseline	At 3 months	Z value	Significance
Age (in years)	38 (8.25)	-	-	-
Frequency of headache (monthly)	8 (2)	4 (2)	-10.216	0.000
Duration of headache (in hours)	10 (7)	5 (4)	-10.219	0.000
VAS score	7 (2)	4 (2)	-10.321	0.000
Number of analgesics consumed monthly	**11 (5)**	**6 (3.25)**	**-10.262**	**0.000**

Table 3: Functional Disability and Quality of Life Analysis

Variable	Baseline Median (IQR)	3-Month Median (IQR)	Z value	P value
Functional Disability Score	70 (10)	40 (12)	-9.874	0
Quality of Life Score	40 (8)	70 (10)	-9.901	0

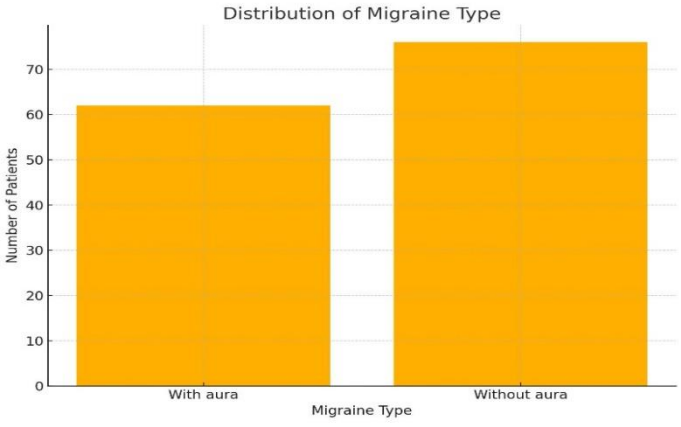

Figure 1 Distribution of Migraine Type

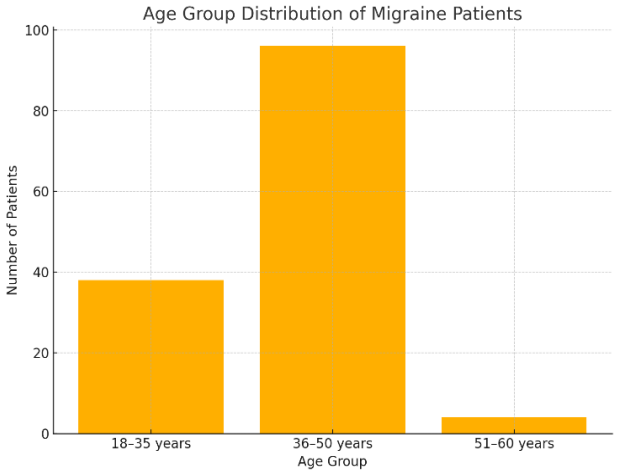

Figure 2 Age Group Distribution of Migraine Patients

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DISCUSSION

The present study demonstrated that the administration of greater occipital nerve (GON) block significantly reduced the frequency, duration, and severity of migraine headaches, along with a marked decrease in the monthly consumption of analgesics. These findings reinforce the therapeutic value of GON block in migraine prophylaxis, particularly in patients with chronic migraine who remain refractory to conventional pharmacological regimens. The observed improvements were statistically significant and clinically meaningful, offering encouraging evidence in favor of integrating this minimally invasive intervention into broader migraine management protocols. Migraine, as a chronic neurological disorder, contributes significantly to global disability and impairs quality of life. The chronic phase of migraine is particularly debilitating, often accompanied by an increased number of headache days and intensified symptom burden, which ultimately leads to decreased productivity and higher healthcare utilization (14,15). The poor responsiveness of chronic migraine to standard medications further underscores the need for alternative therapeutic strategies. Peripheral nerve blocks, especially GON block, have emerged as promising options in this context due to their ability to modulate pain pathways and reduce central sensitization (16). The present findings are consistent with previous studies that reported significant reductions in headache frequency, attack duration, and pain severity following GON block, affirming its role as a viable prophylactic approach in chronic migraine (17).

The reduction in pain severity as indicated by VAS scores, coupled with the decline in the number of painful days and analgesic use, aligns well with the pathophysiological rationale of targeting the trigeminocervical complex through occipital nerve blockade. Such an intervention offers not only symptom relief but also potential for improving patient functionality and social participation. The findings of this study were comparable to prior research wherein a marked improvement in headache indices was reported three months post-intervention (18). This uniformity of outcomes across different populations further strengthens the general efficacy of GON block in migraine management. Importantly, the study also demonstrated a substantial improvement in quality of life and functional disability scores, suggesting broader psychosocial benefits beyond mere symptom control. By reducing the burden of pain, GON block appears to indirectly enhance social interaction, occupational engagement, and physical health. These improvements contribute to a holistic benefit that is often lacking in purely pharmacologic treatments, particularly those associated with long-term side effects or poor adherence (19).

Despite its promising results, the study had certain limitations that should be acknowledged. It was conducted at a single center with a modest sample size, which may limit the generalizability of the findings to wider populations. Moreover, the follow-up period was restricted to three months, precluding any conclusions about the long-term efficacy and sustainability of GON block. The study also did not evaluate the effect of the intervention on associated migraine symptoms such as photophobia, phonophobia, and nausea, which are critical in determining overall treatment response. Furthermore, only bupivacaine was used as the local anesthetic agent; thus, the potential efficacy of other anesthetics remains unexplored. Another limitation lies in the absence of a comparative analysis against other established prophylactic treatments, which restricts the ability to determine relative efficacy or cost-effectiveness. Nevertheless, the study's strengths include the use of standardized criteria for chronic migraine diagnosis, consistent procedural protocols, and the incorporation of validated outcome measures such as VAS and headache diaries. The inclusion of functional and quality of life metrics added value by providing a more comprehensive assessment of patient-centered outcomes.

Future research should aim to conduct multicenter, randomized controlled trials with larger sample sizes and longer follow-up periods to assess the durability of clinical benefits and safety profile over time. Comparative studies exploring GON block versus pharmacological prophylaxis, as well as its combined use, could also offer deeper insights into optimal management pathways. Additionally, evaluation of its impact on associated symptoms and exploration of different local anesthetic formulations would provide a more nuanced understanding of its therapeutic scope (20). In summary, this study contributes valuable evidence supporting the effectiveness of GON block in reducing the burden of migraine in terms of frequency, severity, duration, analgesic dependence, and quality of life impairment. While further high-quality studies are warranted, GON block stands out as a promising, safe, and patient-friendly option in the preventive armamentarium against chronic migraine.

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CONCLUSION

In conclusion, the findings of this study suggest that greater occipital nerve block is an effective prophylactic intervention for migraine, offering substantial relief in terms of reducing headache frequency, intensity, and duration, while also decreasing the reliance on analgesic medication. The positive impact observed on patient functionality and quality of life underscores its potential as a practical and well-tolerated treatment option for individuals with chronic migraine. These results highlight the clinical relevance of GON block in routine migraine management and support its broader integration into therapeutic strategies. Further research involving larger and more diverse populations is warranted to reinforce and generalize these outcomes.

Author Contribution

Author	Contribution
Aida Younis	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Khurram Haq Nawaz	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Imran Ahmad	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Umer Farooq	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Muhammad Jamil	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Munawar Khan	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published
Inayat Ullah*	Contributed to study concept and Data collection Has given Final Approval of the version to be published

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