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Effect of Nerve Blocks in Patients with Chronic Headaches, Neck, and Low Back Pain at Pain Care Clinics: A Prospective Study in Ontario Canada

Rifat Rehmani, MD, MSc[1]*, Hany Demian MD, MBBCH, CCFP[2] and Carol Peat, RN[3]

[1]Pain Care Clinics, Ontario, Canada

[2]Assistant Clinical Professor, McMaster University, Praesentia Healthcare LLC, Biospine lnstitute and Pain Care Clinics

[3]Praesentia Healthcare, Ontario, Canada

***Corresponding author**: Rifat Rehmani, Pain Care Clinics, 5225 Satellite Drive, Mississauga, ON, L4W 5P9, Tel: 1-647-200-6400; E-mail: rrehmani@paincareclinics.com

Abstract

Introduction: Anesthetic nerve blocks are commonly used in managing chronic pain, yet recent systematic reviews provide inconclusive evidence regarding their effectiveness. This study aims to evaluate the impact of nerve blocks on pain reduction and functional improvement in adults with chronic headaches, neck pain, or low back pain.

Methods: We conducted a prospective, one-group pretest-posttest study to assess the analgesic and functional effects of eight bupivacaine nerve blocks injections in patients with chronic pain. We hypothesized that nerve block treatments would lead to significant reductions in pain and improvements in function. A sample size of 598 participants was calculated. Primary outcomes were assessed using the Numeric

Pain Rating Scale (NPRS) and disease-specific functional status questionnaires. Secondary outcomes included functional assessment through the Brief Pain Inventory (BPI), Pain Disability Index (PDI), anxiety and depression via the Hospital Anxiety and Depression Scale (HADS), and quality of life measured by the Short Form-36 (SF-36).

Results: A total of 598 patients were enrolled, with 74% being female. The mean NPRS score decreased from 7.1 pre-treatment to 4.1 post-treatment. Disease-specific functional scores also showed notable improvement. Secondary outcomes demonstrated similar trends: BPI scores reduced from 45.0 to 25.7,

PDI scores dropped from 50.0 to 23.8, and HADS scores improved from 8.7/14.0 to 5.8/10.5. All changes were statistically significant ($p < 0.001$).

Conclusion: This prospective study indicates that nerve block therapy significantly improves pain, physical function, and reduces reliance on prescription medications, including opioids, with minimal adverse events.

Introduction

Chronic pain is a complex and debilitating condition that affects not only individuals but also imposes a significant burden on society. It is defined as "pain that occurs on at least half of the days for six months or more" [1]. According to large population-based surveys, approximately one in five Canadians experiences chronic pain [2]. Among them, two-thirds report their pain as moderate or severe, and half have lived with chronic pain for over ten years [2]. The economic impact of chronic pain in Canada is substantial. Health care expenditures and productivity losses related to chronic pain are estimated at $56 to $60 billion annually [3]. A recent study found that the weighted annual direct cost of managing chronic pain to the Canadian health care system alone is $7.2 billion [4]. The three most common sites of chronic pain are the low back, head (migraines), and neck. Chronic low back pain is defined as pain in the area between the bottom of the rib cage and the buttock creases persisting for more than six months. It is a leading cause of disability [5] and contributes significantly to health care use and socioeconomic strain. The estimated cost associated with chronic low back pain in the U.S. is approximately $50 billion annually [6]. Migraine, affecting approximately 14% of the global population, ranks eighth among diseases contributing to years lived with disability [7]. In Canada, about 8.3% of the population (2.7 million people) is diagnosed with migraine [8]. Similarly, neck pain ranks as the fourth leading cause of disability worldwide [7]. Studies indicate that up to 60% of patients continue to experience chronic neck pain five years after the initial episode [9]. Patients with chronic conditions often receive care in primary care settings, but many primary care physicians find the management of Chronic Non-Cancer Pain (CNCP) challenging [10]. Common reasons for referral to specialized pain clinics include the need for nerve blocks, diagnostic support, treatment guidance, and concerns around opioid prescribing [11]. A frequently used intervention in pain clinics is the anesthetic nerve block, which may reduce both acute and chronic pain [12]. These blocks are commonly administered for chronic pain in the back, neck, and face, as well as for headache-associated pain [13,14]. When performed by trained physicians, nerve blocks are generally safe. Although clinical experience supports their use, the evidence in the medical literature remains inconclusive. A recent systematic review found no definitive proof of either the effectiveness or ineffectiveness of nerve blocks [15]. We proposed a study to evaluate the impact of nerve blocks on chronic low back pain, headaches, and chronic neck pain-chosen based on their prevalence in population studies. Using a one-group pretest-post test design, we aimed to assess the analgesic and functional outcomes of eight bupivacaine nerve blocks injections. We hypothesized that participants would experience a significant reduction in pain and improvement in function following the intervention compared to baseline.

Materials and Methods

Study Objective

The study aimed to evaluate the effectiveness of standard care versus nerve blocks in improving pain and function among adults with chronic headaches, neck pain, and low back pain.

Study Design

This was a prospective, quasi-experimental study that used a one-group pre-test–post-test design. Participants were assessed on multiple outcome measures before and after receiving a series of nerve block treatments. Changes in pain, function, and quality of life were compared within the same individuals over time.

Setting and Participants

The study was conducted across multiple sites of Pain Care Clinics (PCC) in Ontario, Canada. Eligible participants included adults (>18 years) referred by family physicians for nerve block treatment for chronic headaches, neck pain, or low back pain lasting >6 months. All participants had to be able to read and understand English.

Inclusion Criteria

Consenting patients with chronic pain (≥ 6 months) in head, neck, or lower back, aged between 19 and 50 years, and had the cognitive ability to provide informed consent.

Exclusion Criteria

The exclusion criteria included pregnant or breastfeeding individuals, patients with active infections or inflammation, individuals with known allergies to local anesthetics, malignancy, major psychiatric disorders (e.g., schizophrenia, severe bipolar disorder, severe major depression) and conditions requiring acute medical or surgical intervention.

Patient Recruitment and Data Collection

All the participants received information about the purpose and examination involved in this study, and all the subjects signed written informed consent before enrolment in the study. All of the participants were thoroughly examined, and urine pregnancy test was done (for women).

Participants were categorized into one of three mutually exclusive groups: chronic headache, chronic neck pain, or chronic low back pain. They also completed different questionnaires to get the effects of pain on their functional activity, disability, and quality of life. It included the Numeric Pain Rating Scale **[16],** Patient Disability Score **[17],** The Brief Pain Inventory **[18]**, the Hospital Anxiety and Depression Scale **[19],** and the Short Form-36 Health Survey **[20].** In addition, specific questionnaires were also being completed for each disease category. Headache Disability Index in chronic headache category **[21],** Oswestry Disability Index **[22],** for low back pain category and Neck Disability Index **[23]** in chronic neck pain category.

During each weekly visit, the following were assessed: vital signs, nerve block procedure and completion of pain/function questionnaires (≈20 minutes). After the eighth treatment, participants were returned for a follow-up visit at two weeks, during which the same assessments were repeated.

Questionnaires

A variety of questionnaires were used to investigate the effects of intervention on pain, disability, and quality of life in chronic headaches, neck, and low back pain. Numerical Pain Rating Scale (NPRS) is a 11-point scale is a simple tool that tells us the patient's perceived intensity of pain in the past week. Patients were given a scale grid from 0 (no pain) to 10 (worst imaginable pain). 0: no pain, 1-3: Mild Pain, 4-6: Moderate Pain, and 7-10: Severe Pain. The

minimum clinically important difference (MCID) for NPRS was a 2-point change. Pain Disability Index (PDI) is a rating scale designed to measure the degree to which chronic pain is disrupting 7 categories of patient's life. Response to each category indicating the overall impact of pain in your life, not just when pain is at its worst. A score of 0 means no disability at all, and a score of 10 signifies that all of the activities in which you would normally be involved have been totally disrupted by the pain. Brief Pain Inventory [BPI]) is a patient-rated instrument that measures severity of pain on 0–10scale (0 = no pain and 10 = pain as bad as you can imagine) and assesses its interference with seven functional areas, using 0–10 interference scale (0 = does not interfere and 10 = completely interferes). Pain scores 4 are defined as clinically relevant **[18–20]**. An improvement from baseline was defined as a change in mean BPI score of >30%. Quality of life Short Form 36 (SF-36) is a widely used comprehensive 36-item consists of 36 items covering ten domains of physical and mental health: physical functioning (PF), role limitations caused by physical health problems (RF), bodily pain (BP), perception of general health (GH), vitality (VT), social functioning (SF), role limitations due to emotional health problems (RE), and mental health (MH). The eight domains were further grouped into two summary measures: the physical component summary (PCS) comprised of PF, RF, BP, and GH and the mental component summary (MCS) comprised of VT, SF, RE, and MH. Subjects were measured at baseline and then after the treatment with nerve blocks. On each scale, higher scores indicate better outcomes.

Anxiety and Depression (Hospital Anxiety and Depression Scale [HADS] is assessed by using the HADS questionnaire, which consists of two subscales, one measuring anxiety (HADS-A) and the other measuring depression (HADS-D). Higher scores indicate more symptoms of anxiety and depression. The HADS has shown good reliability and validity. Oswestry Disability Index (ODI) score is ranged from 0 to 50. Total score is converted into percent disability. ODI Scoring: 0% to 20% (minimal disability), 21%-40% (moderate disability), 41%-60% (severe disability), 61%-80% (crippled) and 81%-100% (may be bed bound or exaggerating their symptoms). Neck Disability Index (NDI) is 10-item questionnaire determines how participants see their daily activities. The maximum score is 50. Scores of < 4 indicate no disability; 5 to 14 indicate mild disability, 15 to 24 moderate disability, and 25-34 severe disability. Scores > 35 indicate complete perceived disability. Headache Disability Index (HDI) is a 25-item questionnaire that determines how participants see their daily activities. Using this system, a total score of 10-28 is considered to indicate mild disability; 30-48 is moderate disability; 50-68 is severe disability; 72 or more is complete disability.

Intervention

Participants received a series of eight weekly nerve block treatments administered by certified PCC physicians. The nerve blocks consisted of bupivacaine 0.25% and xylocaine 2% in a 9:1 ratio, administered using clean technique. Dosage was depended on the number and location of injection sites, with maximum doses as follows:

Bupivacaine 0.25%: up to 1 ml/kg (10–40 ml total)

Xylocaine 2%: up to 4 ml

Each nerve block targeted the relevant anatomical regions based on pain location:

Headache: accessory, supraorbital, auriculotemporal, occipital, mandibular, etc.

Neck: occipital, suprascapular, transverse scapular, brachial plexus, etc.

Low back: lumbar plexus, femoral, genitofemoral, medial branch, pudendal, etc.

Participants continued their usual care and medications, including opioids, during the study.

Outcome Measures

Multiple outcome measures were utilized. These included different questionnaires to measure pain severity, functional abilities, and opioid intake in terms of morphine equivalence.

Primary Outcomes

Primary outcomes are measures of function and pain. It included average self-reported back pain intensity. At baseline (week 1), and weeks 2, 3, 4, 5, 6, 7, 8, 9 and 11 participants reported the 'average pain intensity over the past week' on a Numerical Rating Scale (NPRS), where 0 was 'no pain' and 10 was the 'worst possible pain'. The NPRS is a widely used and validated measure. Pain intensity was chosen as the primary outcome as it is recommended as a core outcome measure for chronic musculoskeletal pain research and is a key priority for patients. The other primary outcome measure is disease-specific functional status questionnaires: Headache Disability Index in chronic headache category, Oswestry Disability Index for low back pain category and Neck Disability Index in chronic neck pain category.

Secondary Outcomes

Secondary outcome measures include the Brief Pain Inventory (BPI), Pain Disability Index (PDI), Anxiety and Depression by Hospital Anxiety and Depression Scale [HADS], and the quality of life, using the Short Form 36 (SF-36) physical and mental health component scores (0-100 scale; high score indicates greater quality of life). These are administered at all follow-up appointments with the exception that the HADS and SF-36 are only administered at weeks 1, 5, 9 and 10. Opioid use was converted to morphine equivalents and analyzed as an additional secondary measure [24].

Sample Size Calculation

Using PASS 2019 software and assuming a 20% dropout rate, a total of 747 participants were recruited to yield 597 data pairs. This sample provided 80% power to detect a small effect size (Cohen's d = 0.20) at a 0.05 significance level using a two-sided paired t-test.

Statistical Analysis

The results were tabulated and analyzed using SPSS version 24.0. Descriptive statistics, namely, mean ± standard deviation and frequency was applied to summarized demographic and clinical variables. Paired t-test was applied to assess any significant differences in mean scores between pretest and post-test. A p-value < 0.05 was considered statistically significant.

Ethics and Data Management

The study has been approved by the Advarra Institutional Review Board (Protocol Pro00041132). All procedures complied with the Declaration of Helsinki and Good Clinical Practice guidelines.

Data confidentiality was maintained by using de-identified, password-protected digital files and securely stored physical documents. Participant privacy was protected in all forms of data sharing.

Results

A total of 598 patients completed the study. General demographic data are presented in **Table 1.** The mean age of respondents was 61.5 (SD= 7.5). Notably, women outnumbered men in the study (female: male ratio 3:1), and approximately half were married. Fifty-six percent of patients had obtained higher

education (college, university or postgraduate studies). Forty-two percent of the population held some type of employment (full-time, part-time or self-employed), while 26% were retirees and 34% were unable to work or were disabled.

Table 1: General demographic study data.

Characteristics	n = 598 (%)
Female; n (%)	435 (74.0)
Age (years); mean ± SD	61.5 ± 7.5
BMI (kg/m2); mean ± SD	32.0 ± 4.0
Marital status; n (%)	
Single	121 (20.4)
Married	332 (55.4)
Divorced/Widowed	145 (24.2)
Occupation; n (%)	
Employed	240 (40.0)
Unable to work/Disability	203 (34.0)
Retired	155 (26.0)
Main area of pain; n (%)	
Back	456 (76.3%)
Neck	126 (21.0%)
Headache	16 (2.7%)

Prior to being referred to our clinic, almost all respondents had received plain films (95%), sixty percent had ultrasound examination and majority had received advanced imaging (e.g. MRI 90%, CT scan 72%). Visits to several allied health professionals occurred with the following frequency: physiotherapist (72%), massage therapist (58%), chiropractor (60%), acupuncture (50%) and naturopathic care (6%). Almost all (95%) had seen a family physician, and many had previously attended medical specialists and surgeons regarding their pain **(Table 2 and 3).** Almost all (99%) had been prescribed pharmacological treatments.

Table 2: Treatment sought prior to management at the current pain clinic.

Characteristics	n = 598 (%)
Alternative Therapies	
Naturopathy	36 (6%)
Physiotherapy	430 (72%)
Chiropractic	360 (60%)
Acupuncture	299 (50%)
Massage	347(58%)
Conventional Therapies	
Nerve blocks	150 (25%)
Epidurals	72 (12%)
Pain medication	592 (99%)

Table 3: Previous medical specialists seen prior to referral at the current pain clinic.

Medical specialists	n = 598 (%)
Family doctor	574 (96%)
Rheumatologist	197 (33%)
Physiatrist	209 (35%)
Neurologist	251 (42%)
Orthopedic surgeon	197 (33%)
Neurosurgeon	143 (24%)

We also found that sixty-three percent of patients has stopped or reduced non-prescription and prescription medications since starting nerve blocks, including a reduction in opioid use. Of 598 respondents, 194 (34%) had not stopped or reduced any medications since starting nerve blocks, and 377 (66%) had.

Table 4 presents patients' primary and secondary outcomes for the study before and after nerve blocks and revealed that there is significant reduction in pain as well improvement in function and the quality of life across all the parameters.

Table 4: Outcome Measures.

Outcome variables	Results		P value
	Pre-Test group	Post-Test group	
Primary outcome			
Numerical Pain Rating Scale (NPRS) (0–10 scale) ON ALL PATIENTS- Measured weekly	7.1	4.1	0.0001
Oswestry Disability Index (ODI) FOR BACK PAIN PATIENTS ONLY	58	26	
Neck Disability Index (NDI) FOR NECK PAIN PATIENTS ONLY	26	10	
Headache Disability Index (HDI) FOR HEADACHES PATIENTS ONLY	54	24	
Secondary outcome			
Brief Pain Inventory (BPI)	45	25.7	0.009
Pain Disability Index (PDI)	50	23.8	0.001
Hospital Anxiety and Depression Scale (HADS)			
Anxiety Score	8.7	5.8	0.01
Depression Score	14	10.5	0.02
Quality of Life: Short Form-36 (SF-36)			
Physical Domain	187 ± 10	233 ± 11	<.0001
Mental Domain	386 ± 19	482 ± 25	<.0001

Table 5 presents patients' quality of life before and after nerve blocks measured by SF-36. All values are mean ± SE. It showed an improvement in the overall score (386 ± 19 to 482 ± 25; P <.0001). The MCS score improved (199 ± 11 to 250 ± 11; P =.001), as did each of the four individual mental health domains (VT, SF, RE, MH). The PCS score also improved significantly (187 ± 10 to 233 ± 11; P <.0001), as did each of the four physical health domains (PF, RF, BP, GH). All results were statistically significant with P <.001 compared to pretest.

Table 5: RAND 36-Item Health Survey Total, Component, and Individual Domain Scores Pretest and posttest.

Time	Total	MCS	VT	SF	RE	MH	PCS	PF	RF	BP	GH
Pretest	386 ± 19	199 ± 11	32 ± 3	57 ± 3	51 ± 5	59 ± 2	187 ± 10	62 ± 3	40 ± 5	43 ± 2	45 ± 3
Posttest	482 ± 20	250 ± 11	45 ± 3	70 ± 3	68 ± 5	69 ± 2	233 ± 11	74 ± 3	59 ± 5	46 ± 2	54 ± 3

During the study period, there were only two reportable events, which were vasovagal events, which were managed by observation in the clinic. There were no deaths attributed to treatment.

Discussion

Our study found that there were significant pain relief and improved function and quality of life in posttest group. The reported pretest pain intensity was 7.1 by using NPRS before the intervention while it was 4.1 in the posttest group with p value <0.001. The results of the ODI-I Questionnaire illustrate a significant improvement in the grade of disability: from a score indicating a grade of severe disability to a level of moderate disability. We found similar results with NDI and HDI in patients with chronic neck and headaches. For the secondary outcomes of improved function and quality of life, we also found significant improvement as measured by the Brief Pain Inventory (BPI), Pain Disability Index (PDI), Anxiety and Depression: Hospital Anxiety and Depression Scale (HADS) and Quality of Life: Short Form-36 (SF-36) as shown in **Table 5**.

Literature Review

Our study found significant improvement with nerve blocks for chronic pain patients with back pain, neck pain and headaches with reduction in pain and improved function and quality of life with few adverse events. The result of our study is similar to a cross-Sectional survey of community-based pain clinics in Ontario, which is published recently **[25].** They found that the nerve blocks for Chronic Non-Cancer Pain (CNCP) in Ontario patients reported significant pain relief, with a median improvement of 2.5 points on an 11-point scale. Many patients also reduced medication use, highlighting the intervention's perceived benefits for function and quality of life. Another cross-sectional survey of Ontario community-based pain clinics found similar results to ours **[26].** However, it is yet to see whether this improvement in pain and function may result in employment, as many participants in our sample were receiving disability benefits. All outpatient interventional pain clinics in Ontario are obligated to report serious adverse events that occur within 10 days of receiving treatment to the College of Physicians and Surgeons of Ontario out of Hospital Premises Inspection Program (OHPIP). These include any patients being transferred to the ER after receiving a nerve block and all deaths from any cause within 10 days of treatment. During the study period, there were only two not reportable events, which were vasovagal events with spontaneous recovery after a short period of observation. There were no deaths attributed to treatment. Our participants reported reduced use of prescription medication, including opioids, after starting nerve block therapy. In contrast, a retrospective analysis of 47,723 patients in Ontario, Canada, who received nerve blocks for CNCP between 2013 and 2018 found no change in mean opioid dose between the year before and the year after starting nerve block therapy **[27].**

In 2020, the National Institute for Health and Care Excellence (NICE) recommended against spinal injections for managing chronic low back pain due to the lack of supporting evidence **[28].** Also in 2020, the American Society of Interventional Pain Physicians (ASIPP) released their updated guideline reaffirming recommendations in favour of radiofrequency ablation, nerve blocks and facet joint injections for chronic low back pain **[29].** One challenge with interpreting the evidence of therapies for chronic pain, including nerve blocks, is the role of non-specific effects.

Consider a 2013 survey of 260 patients with CNCP attending a tertiary multidisciplinary pain clinic in Ontario. The majority (88%) were receiving long-term opioid therapy, and no patients were receiving nerve blocks or other interventional procedures; 74%

reported >40% pain relief and 68% reported >40% functional improvement. Consistent with our findings, most of these patients (68%) were disabled from working and receiving wage replacement benefits [30].

Strengths and limitations

A key strength of our study is its prospective design, which helps minimize recall bias and allows for the observation of multiple outcomes over time. By comparing pre- and post-intervention data, we were able to directly assess the impact of nerve blocks on pain, function, and medication use. This design enhances internal validity and also supports external validity, increasing the potential to generalize our findings to other populations and clinical settings. However, several limitations must be acknowledged. Most notably, the absence of a control group limits our ability to attribute observed changes solely to the intervention, as improvements could also result from external factors or natural variation over time (secular trends). Another may be potentially unintentional bias in patient selection. Additionally, participants may have provided responses they believed were expected or socially acceptable—a potential source of social desirability bias. Another concern is the possibility of testing effects, where repeated exposure to the same assessment tools could lead to inflated estimates of treatment effectiveness.

Conclusions

Our prospective study found that nerve block therapy was associated with meaningful improvements in pain, physical function, and reduced reliance on prescription medications, including opioids, with very few adverse events. While these findings are encouraging, rigorously designed controlled trials are urgently needed to further determine the effectiveness of nerve blocks in managing chronic pain. Such studies should inform clinical guidelines that reflect both the best available evidence and the values and preferences of patients living with chronic pain.

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Data Sharing Statement

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethical Approval and Consent of Participants

The study protocol was approved by the Advarra Institutional Review Board (Protocol Pro00041132). All procedures complied with the Declaration of Helsinki and Good Clinical Practice guidelines. Informed consent was obtained from all subjects before participating in the study by signing the consent form before data collection.

Disclosure

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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