



Effectiveness of a Nurse-Led Bundle of Interventions in Reducing Neuropathic Pain Among Orthopaedic Patients

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ABSTRACT

Background: Patients recovering from fractures and orthopedic trauma routinely endure significant discomfort, and this suffering is usually attributed entirely to the injury itself and its surgical repair. What often goes unnoticed within that discomfort is a distinct, nerve-related component burning, tingling, numbness that can develop alongside the mechanical injury but is easily overlooked when nursing attention stays focused on the fracture alone. Left unaddressed, this hidden neuropathic pain can slow rehabilitation and prolong patients' dependence on caregivers. **Objectives:** To assess the level of existing neuropathic pain among orthopedic patients, to evaluate the impact of a bundle of interventions in reducing this pain, and to determine its association with selected socio-demographic variables. **Methods:** A pre-experimental one-group pre-test post-test design was used among 60 orthopedic patients aged 40–60 years with neuropathic pain, admitted at GIMS Teaching Hospital, Gadag, enrolled through non-probability purposive sampling. Neuropathic pain was assessed using the standardized DN-4 questionnaire (score ≥ 4 indicating neuropathic pain) before and on the 7th day after implementation of a bundle of interventions patient education, non-pharmacological measures, and patient empowerment delivered three times daily for seven days. Data were analysed using descriptive statistics and the paired t-test and Chi-square test. **Results:** Every participant began with clinically significant pain (mean DN-4 score 5.83, SD 0.96). By day seven, two-thirds of patients (66.7%) had dropped into the reduced-pain range, and the average score fell to 3.42 (SD 1.12) a highly significant change (paired $t = 19.43$, table value = 2.00, $p < 0.05$). Post-test pain levels were significantly associated with patients' occupation ($\chi^2 = 12.69$, $p < 0.05$) and family income ($\chi^2 = 10.63$, $p < 0.05$), but not with age, gender, education, or the other background factors studied. **Conclusion:** A simple, nurse-led bundle combining education, non-drug techniques, and patient involvement meaningfully eased neuropathic pain in this group, suggesting it is a practical addition to routine orthopedic bedside care.

Keywords: neuropathic pain; bundles of intervention; DN 4 questionnaire; orthopedic patients; pain care

INTRODUCTION

Pain remains one of the most common reasons people seek health care, and a sizeable share of those who experience it go on to live with pain long-term, making it a leading contributor to disability and reduced quality of life worldwide [1]. In India, the picture is no different pain-related complaints are among the most frequent reasons patients consult a physician, and nationally representative surveys suggest a large proportion of middle-aged and older adults live with some form of persistent pain [2].

The International Association for the Study of Pain defines pain as an unpleasant sensory and emotional experience linked to actual or potential tissue damage, a definition revised in 2020 specifically to capture how subjective and individual the experience can be [3]. Within this broad category, neuropathic pain arising from injury or dysfunction of the nervous system itself, rather than from ongoing tissue damage behaves differently from ordinary injury pain and rarely responds well to standard analgesics [4]. Its hallmark symptoms (burning, shooting sensations, tingling, numbness, heightened sensitivity to touch) overlap with other pain types and are not reliably

picked up by routine clinical assessment, which is a major reason it so often goes unrecognized in everyday practice [5].

Orthopedic trauma is a particularly common trigger for this kind of nerve involvement. Beyond the direct damage to bone and soft tissue, fractures, dislocations and their surgical fixation can compress or injure nearby peripheral nerves through swelling, traction, bone displacement, or the surgery itself [6]. Several studies illustrate how often this happens: over half of patients with chronic spinal pain in one large cohort showed a neuropathic component [7], nearly three in ten patients developed neuropathic pain a year after fixation of wrist, hip or ankle fractures [8], and postsurgical orthopedic rehabilitation patients have shown probable neuropathic pain in close to half of cases screened [9,10]. Despite this, orthopedic care tends to stay focused on fracture healing and mobility, leaving this coexisting pain component under-addressed.

Because neuropathic pain rarely responds to any single treatment, most reviews of the evidence point toward combining pharmacological and non-pharmacological approaches into a coordinated bundle rather than relying on isolated measures [11]. Nurses, who spend the most sustained time at the bedside,

are well placed to catch these symptoms early and deliver such a bundle as part of routine care which is the premise this study set out to test.

Neuropathic pain after orthopedic trauma tends to fly under the radar compared with ordinary injury pain, largely because catching it takes more deliberate screening than a routine vital-signs check allows for. This gap is even wider in India, where published research on pain and quality of life is already sparse [2], and almost none of it looks specifically at neuropathic pain following mechanical orthopedic injury. One of the few Indian studies to screen for it carried out among patients with traumatic spinal cord injury at a tertiary hospital found neuropathic features in close to three-quarters of those assessed [12], which suggests the true scale of the problem in Indian orthopedic wards could be considerably larger than current records show.

On the wards, nursing assessment still leans almost entirely on standard 0–10 pain-intensity scales instruments built to gauge how severe pain feels, not to pick out the burning, tingling, or numbness that mark a neuropathic component. In practice, patients showing these signs are often managed no differently from anyone else, since no standardized bedside protocol exists to flag and respond to nerve-related symptoms specifically. Left unaddressed, this hidden pain component can gradually wear down a patient's psychological wellbeing and physical function, adding to the disability already caused by the orthopedic injury and prolonging how long patients stay dependent on family caregivers.

Structured, multi-component care bundles have already shown clear value in comparable orthopedic settings one such bundle developed for fragility hip-fracture patients brought about a meaningful drop in in-hospital mortality [13]. Whether a similar, nurse-led bundle could ease neuropathic pain specifically among mechanically injured orthopedic patients had not yet been explored, and answering that question while building India-specific evidence to inform future bedside pain-care protocols is what this study set out to do.

Novelty: Indian nursing literature offers little structured, protocol-driven guidance for identifying and managing neuropathic pain arising specifically from mechanical orthopedic trauma. This study addresses that gap by developing and testing a nurse-administered bundle of interventions in this population.

Objectives: This study aimed to determine how much neuropathic pain orthopedic patients were already experiencing, examine whether a bundle of interventions could reduce it, and explore whether any improvement was linked to socio-demographic characteristics.

MATERIALS AND METHODS

A pre-experimental, one-group pre-test post-test design was used in the orthopedic wards of GIMS Teaching Hospital, Gadag, Karnataka. Sixty patients with neuropathic pain, aged 40–60 years and able to communicate verbally, were enrolled through non-probability purposive sampling; critically ill and ventilator-supported patients were excluded. Sample size was calculated using the standard formula for detecting a mean difference between paired observations ($\alpha = 0.05$, power = 80%), yielding a minimum requirement of 58 participants after adjusting for attrition; 60 were ultimately enrolled.

Data were collected using a researcher-developed proforma covering socio-demographic and clinical variables, together with the standardized DN-4 questionnaire 7 interview-based items and 3 clinical examination items, each scored 0 or 1, with a total score ≥ 4 out of 10 indicating neuropathic pain. Content validity of the socio-demographic tool and the intervention bundle was established through expert review in medical-surgical nursing.

Following pre-test assessment, participants received a bundle of interventions delivered three times daily for seven days: patient education (orientation to neuropathic pain, symptom recognition, lifestyle guidance), non-pharmacological measures (relaxation techniques, nutritional and sleep advice), and patient empowerment (encouraging active participation and self-care). The bundle drew conceptually on Jean Watson's Theory of Human Caring. A post-test using the same DN-4 tool was conducted on day 7. Data were analyzed using descriptive statistics, the paired t-test, and the Chi-square test at the 0.05 level of significance.

Ethical clearance was obtained from the institutional research committee, along with written administrative approval from the hospital. Informed written consent was obtained from all participants, who were assured of anonymity, confidentiality, and the right to withdraw at any time.

RESULTS

Data were analyzed from 60 orthopedic patients aged 40–60 years. Table 1 summarizes the sample's socio-demographic and clinical profile: 35% (21) were aged 40–45 years, 55% (33) were male, half (50%, 30) had non-metric education, and 27% each were farmers or unemployed. Nearly half (48%, 29) had a monthly family income of ₹10,001–20,000, 88% (53) had been hospitalized 1–15 days, and 83% (50) were diagnosed with a lower limb fracture. Sleep was disturbed in 47% (28), and 65% (39) reported no personal habits such as smoking, alcohol, or tobacco use.

Table 1: Distribution of demographic and clinical variables (N = 60)

Variable	Category	n	%
Age (years)	40–45	21	35.0
	46–50	8	13.0
	51–55	13	22.0
	56–60	18	30.0
Gender	Male	33	55.0
	Female	27	45.0

	No formal education	18	30.0
Education	Non-metric	30	50.0
	Post-metric	10	17.0
	Graduate & above	2	3.0
Occupation	Unemployed	16	27.0
	Daily wage worker	6	10.0
	Farmer	16	27.0
	Private employer	6	10.0
	Government employer	2	3.0
Religion	Self-employed	14	23.0
	Hindu	48	80.0
	Muslim	12	20.0
Monthly family income (₹)	≤10,000	18	30.0
	10,001–20,000	29	48.0
	20,001–30,000	10	17.0
	>30,000	3	5.0
Duration of hospitalization	1–15 days	53	88.0
	16–30 days	6	10.0
	>30 days	1	2.0
Diagnosis	Lower limb fracture	50	83.0
	Upper limb fracture	9	15.0
	Chest fracture	1	2.0
	Adequate	11	18.0
Sleeping pattern	Inadequate	21	35.0
	Disturbed	28	47.0
Dietary pattern	Vegetarian	21	35.0
	Mixed	39	65.0
Personal habits	Smoking	5	8.0
	Alcohol	1	2.0
	Tobacco	15	25.0
	None	39	65.0

At pre-test, all 60 participants (100%) scored ≥ 4 on the DN-4 — the entire sample had active neuropathic pain. By post-test, 40 (66.7%) had dropped into the reduced-pain range (score 0–3), while 20 (33.3%) still showed persistent pain

Table 2: Comparison of pre-test and post-test neuropathic pain levels (N = 60)

Pain Level	Pre-test n (%)	Post-test n (%)
Reduced pain (0–3)	0 (0%)	40 (66.7%)
Persistent pain (≥ 4)	60 (100%)	20 (33.3%)
Total	60 (100%)	60 (100%)

Mean DN-4 scores fell from 5.83 (SD 0.96) at pre-test to 3.42 (SD 1.12) at post-test, a reduction of 2.41 points that was statistically significant (paired $t = 19.43$ against a table value of 2.00, $p < 0.05$), confirming the bundle's effectiveness (Table 3).

Table 3: Effectiveness of the bundle of interventions in reducing neuropathic pain (N = 60)

Test	Mean	SD	Mean difference	Paired t-value	Table value
Pre-test	5.83	0.96	2.41	19.43*	2.00
Post-test	3.42	1.12			

* $p < 0.05$

Of the eleven socio-demographic and clinical variables tested against post-test pain scores, only current occupation ($\chi^2 = 12.69$, $df = 5$, $p < 0.05$) and monthly family income ($\chi^2 = 10.63$, $df = 3$, $p < 0.05$) showed a significant association (Table 4).

Table 4: Association between post-test neuropathic pain score and selected socio-demographic variables

Variable	df	χ^2 value	Table value	Association (p = 0.05)
Age	3	6.894	7.815	Not significant
Gender	1	1.212	3.841	Not significant
Education	3	7.600	7.815	Not significant
Current occupation	5	12.690	11.070	Significant*
Religion	3	0.468	7.815	Not significant
Monthly family income	3	10.630	7.815	Significant*
Duration of hospitalization	3	0.000	7.815	Not significant
Type of diagnosis	2	2.510	5.991	Not significant
Sleeping pattern	2	1.349	5.991	Not significant
Dietary pattern	1	0.329	3.841	Not significant
Personal habits	3	2.815	7.815	Not significant

*significant at $p < 0.05$

DISCUSSION

Before the intervention, every patient in this sample was living with active neuropathic pain a striking figure that echoes earlier findings on how common and how easily missed this component is in orthopedic populations, where clinical attention typically stays fixed on the primary fracture. After seven days of the bundle, two-thirds had moved into the reduced-pain range, and the average DN-4 score dropped significantly ($t = 19.43$, $p < 0.05$).

This mirrors evidence from elsewhere: a six-component bundle for pain care in medical-surgical patients produced significantly better pain-care quality scores after implementation [14], and a systematic review of rehabilitation interventions for chronic neuropathic pain spanning education, cognitive-behavioural approaches and exercise similarly reported improved pain and functional outcomes.¹⁵ Structured bundles have shown comparable benefit in other orthopedic contexts too, including a meaningful drop in in-hospital mortality among fragility hip-fracture patients receiving bundled care [15]. Together, these findings reinforce the broader pattern that coordinated, multi-component care tends to outperform routine, single-modality management for pain of this kind.

Of the socio-demographic variables tested, only occupation and family income were significantly associated with post-test pain scores. This is plausible both factors shape how much rest, nutrition and follow-up support a patient can realistically access

during recovery, which could in turn affect how well they respond to a structured pain-care bundle. The absence of association with age, gender, education, or the remaining variables suggests the bundle worked reasonably consistently across the sample.

CONCLUSION

A structured, nurse-administered bundle combining patient education, non-pharmacological measures and patient empowerment produced a statistically significant reduction in neuropathic pain among orthopedic patients over seven days. Its benefit held broadly across the sample, varying mainly with patients' occupation and family income, supporting its use as a practical, low-cost addition to routine orthopedic bedside care. Larger studies with a control group and longer follow-up are recommended to confirm and extend these findings.

DECLARATIONS

Funding: No funding was received for this study.

Conflicts of interest: The authors declare no conflicts of interest.

Ethical approval: Ethical approval was obtained from the Institutional Ethics Committee prior to the study. Written informed consent was obtained from all participants, and confidentiality and the right to withdraw from the study were ensured.

Data availability: Data are available upon reasonable request to the corresponding author.

REFERENCES

- Zimmer Z, Fraser K, Grol-Prokopczyk H. A global study of pain prevalence across 52 countries: examining the role of country-level contextual factors. *Pain*. 2021;163(9):1740-1750.
- Goyal AK, Mohanty SK. Association of pain and quality of life among middle-aged and older adults of India. *BMC Geriatr*. 2022;22(1):939.
- Raja SN, Carr DB, Cohen M, Finnerup NB, Flor H, Gibson S, et al. The revised International Association for the Study of Pain definition of pain: concepts, challenges, and compromises. *Pain*. 2020;161(9):1976-1982.
- Orza F, Boswell MV, Rosenberg SK. Neuropathic pain: review of mechanisms and pharmacologic management. *NeuroRehabilitation*. 2000;14(1):3-10.
- Haanpää ML, Backonja MM, Bennett MI, Bouhassira D, Cruccu G, Hansson PT, et al. Assessment of neuropathic pain in primary care. *Am J Med*. 2009;122(10 Suppl):S13-S21.
- Mohler LR, Hanel DP. Closed fractures complicated by peripheral nerve injury. *J Am Acad Orthop Surg*. 2006;14(1):32-37.

7. Yamashita T, Takahashi K, Yonenobu K, Kikuchi S. Prevalence of neuropathic pain in cases with chronic pain related to spinal disorders. *J Orthop Sci.* 2014;19(1):15-21.
8. Waldolato G, Polese JC, Pires RE, Camargos F, Portilho R, Waldolato R, et al. The hidden impact of neuropathic pain after surgical fixation of wrist, hip, and ankle fractures: a cross-sectional retrospective study evaluating its prevalence and risk factors. *Injury.* 2023;54 Suppl 6:110708.
9. Sidon E, Rogero R, McDonald E, Daecher A, Shakked R, Pedowitz DI, et al. Prevalence of neuropathic pain symptoms in foot and ankle patients. *Foot Ankle Int.* 2019;40(6):629-633.
10. Padua L, Aprile I, Cecchi F, Molino Lova R, Arezzo MF, Pazzaglia C; Don Carlo Gnocchi Pain-Rehab Group. Pain in postsurgical orthopedic rehabilitation: a multicenter study. *Pain Med.* 2012;13(6):769-776.
11. Colloca L, Ludman T, Bouhassira D, Baron R, Dickenson AH, Yarnitsky D, et al. Neuropathic pain. *Nat Rev Dis Primers.* 2017;3:17002.
12. Yadav A, Joshi M. Occurrence of neuropathic pain and its characteristics in patients with traumatic spinal cord injury. *J Spinal Cord Med.* 2024;47(6):952-959.
13. Bandara S, Lynch G, Cooke C, Varghese P, Ward N. Using care bundles to improve surgical outcomes and reduce variation in care for fragility hip fracture patients. *Geriatr Orthop Surg Rehabil.* 2017;8(2):104-108.
14. Rice KL, Castex J, Redmond M, Burton J, Guo JW, Beck SL. Bundling interventions to enhance pain care quality (BITE Pain) in medical surgical patients. *Ochsner J.* 2019;19(2):77-95.
15. Bäckryd E, Ghafouri N, Gerdle B, Dragioti E. Rehabilitation interventions for neuropathic pain: a systematic review and meta-analysis of randomized controlled trials. *J Rehabil Med.* 2024;56:jrm40188.



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