Scientific Research Publishing

Open Journal of Anesthesiology, 2026, 16(1), 15-29
https://www.scirp.org/journal/ojanes
ISSN Online: 2164-5558
ISSN Print: 2164-5531

Prevalence and Associated Factors of Postoperative Neuropathic Pain

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How to cite this paper: Ndom Ntock, F., Kona, S., Gams Massi, D., Kolawa Djopkang, S., Biloguy, W., Bengono, R.S., Beyiha, G. and Metogo Mbengono, J. (2026) Prevalence and Associated Factors of Postoperative Neuropathic Pain. *Open Journal of Anesthesiology*, **16**, 15-29.
https://doi.org/10.4236/ojanes.2026.161003

Received: December 16, 2025
Accepted: January 20, 2026
Published: January 23, 2026

Abstract

Background: Postoperative neuropathic pain (PNP) is associated with a significant decline in quality of life, characterized by sleep disturbances, persistent functional limitations, and psychological distress, including anxiety and depression. The objective of this study was to determine the prevalence and associated factors of PNP. **Methods:** We conducted an analytical cross-sectional study in the general surgery and gynecology departments of first-category hospitals in the city of Douala. Sociodemographic, clinical, surgical, and therapeutic data, as well as the DN4 score, were collected from 211 operated and hospitalized postoperative patients. Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 26. Multivariate logistic regression was used to identify factors associated with the occurrence of PNP by estimating odds ratios (ORs) and their 95% confidence intervals (95% CIs). **Results:** The mean age of patients was 45.41 ± 14.75 years. The most represented age group was 41 to 55 years, with 96 patients (45.5%). The majority of patients were male (n = 122, 57.8%), unemployed (n = 86, 40.8%), and originated from the West region of Cameroon (n = 99; 46.9%). The prevalence of PNP was 28%. Neuropathic pain was mainly of moderate intensity (62.7%; n = 37), described as burning (54.2%; n = 32), associated with tingling sensations (55.9%; n = 33), and triggered by brushing (89.8%; n = 53). Gynecological surgery (aOR = 1.53; 95% CI: 1.19 - 2.80; p = 0.002), anxiety disorders (aOR = 1.72; 95% CI: 1.48 - 3.18; p = 0.001), amputation (aOR = 1.96; 95% CI: 1.13 - 3.40; p = 0.025), mastectomy (aOR = 1.71; 95% CI: 1.09 - 2.90; p = 0.012), and thoracotomy (aOR = 1.36; 95% CI: 1.26 - 4.61; p = 0.009) were significantly associated with postoperative neuropathic pain. **Conclusion:** The prevalence of PNP is high among postoperative patients and is most commonly characterized by burning sensa-

tions, tingling, and brush-induced allodynia. Its occurrence is independently associated with preoperative anxiety, amputations, mastectomies, as well as gynecological and thoracic surgeries.

Keywords

Postoperative Neuropathic Pain, Prevalence, Associated Factors

1. Introduction

Postoperative neuropathic pain (PNP) falls within the broader category of neuropathic pain, defined by the International Association for the Study of Pain as pain "caused by a lesion or disease of the somatosensory nervous system". This definition, proposed by Treede *et al.* (2008) [1] and further refined by the NeuPSIG group [2], is accompanied by a grading system (possible/probable/definite) that is useful for both research and clinical practice. In the surgical setting, PNP refers to pain that appears or worsens after an operation and is typically described as burning sensations, electric shocks, brush-evoked allodynia, and paresthesia, with focal sensory abnormalities on examination; screening is facilitated by validated tools such as the DN4 (Neuropathic pain in 4 questions) [1]-[3].

From an epidemiological standpoint, chronic postsurgical pain (CPSP) affects approximately 10% - 50% of operated patients, depending on the type of surgery, with 2% - 10% experiencing severe forms; a neuropathic component is common. Syntheses indicate that among patients with CPSP, the proportion of neuropathic pain is about 66% after thoracotomy and 68% after breast surgery, compared with about 31% after inguinal hernia repair and about 6% after hip/knee arthroplasty [4], while phantom limb pain affects nearly 60% of amputees [5]. More recent updates emphasize incorporating functional interference and quality of life into the definition of CPSP [4]-[7].

Risk factors for PNP are multifactorial and occur before, during, and after surgery. The most robust predictors are preoperative pain and the severity of acute postoperative pain [8] [9]. Additional factors include psychological variables (anxiety, depression, catastrophizing) [10], female sex and younger age in several series, and the type of procedure (thoracotomy, mastectomy, amputation, gynecologic or abdominal wall surgery), which carries an increased risk of iatrogenic nerve injury [4] [7]. Moreover, early identification of a neuropathic profile in the acute phase (positive DN4) increases the likelihood of persistence in the medium term [11].

The consequences of PNP are substantial: impaired quality of life, functional limitations, and sleep disturbances, with a psychological burden (anxiety, depression) greater than that observed in other chronic pain conditions [12] [13]. PNP is also associated with increased healthcare use and analgesic consumption, including a risk of persistent opioid use after surgery [14], supporting multimodal

approaches and targeted prevention for high-risk procedures [7] [9]. Finally, despite progress, treatment efficacy for neuropathic pain remains partial, reinforcing the value of mechanistic stratification and complementary non-pharmacological options [15].

Local relevance. In Sub-Saharan Africa, postoperative pain is very common and often undertreated due to organizational and resource constraints; however, specific documentation of PNP remains scarce, and routine use of standardized tools (DN4, painDETECT, NPSI) is heterogeneous [16]. In Cameroon, the DN4 has demonstrated clinical utility in other contexts (e.g., diabetic neuropathy), but PNP has been little studied, preventing estimation of its burden and limiting the development of locally adapted prevention strategies [17]. Data from South Africa further highlight a high prevalence of chronic pain in the general population and a marked impact on quality of life, arguing for stronger pain surveillance and management systems [18] [19]. The objective of our study was to determine the prevalence of PNP and its associated factors.

2. Materials and Methods

2.1. Study Design, Setting, and Period

To meet the study objectives, we conducted an analytical cross-sectional study in the surgical and gynecological inpatient departments of two first-category hospitals in the city of Douala: the Douala General Hospital (DGH) and the Douala Gyneco-Obstetric and Pediatric Hospital (DGOPH). The study period extended from March 1 to May 31, 2023.

2.2. Study Population

We targeted patients who had undergone surgery and were hospitalized in the surgical and gynecology departments of the aforementioned hospitals.

2.3. Inclusion Criteria

Patients aged over 18 years, in the immediate or early postoperative period, who provided written informed consent to participate in the study.

2.4. Exclusion Criteria

Patients (or their representatives) who refused to participate in the study.

2.5. Sampling Method

Sampling was exhaustive and consecutive throughout the study period.

2.6. Sample Size

The minimum required sample size was estimated at 202 participants, using Cochran's formula for estimating a proportion [20], based on a 15.6% prevalence of postoperative neuropathic pain reported in the Gyneco-Obstetrics Department of the CHU Gabriel Touré [21].

2.7. Data Collection Procedure

We developed and validated a study protocol with the research team, obtained ethical clearance from the ethics committee of the University of Douala, as well as the necessary hospital authorizations before data collection. For scheduled surgeries, we checked the weekly operating room schedules and logs to confirm that the procedures had been performed. Hospitalized patients were then informed of the study objectives and given written consent to participate. At inclusion, we collected sociodemographic data, medical history, and preoperative anxiety levels using the APAIS score. Each patient was then re-evaluated between 12 hours and postoperative day 5 (H + 12 to D5), during which we recorded the type of surgery, incision type, anesthesia technique, DN4 score, pain characteristics, and the analgesic treatment administered.

2.8. Definition of Technical Terms

- Postoperative neuropathic pain (PNP) is defined as a DN4 score ≥ 4/10 [22].
- Preoperative anxiety was defined by an APAIS anxiety subscore > 10 [23].
- Allodynia: Pain caused by a stimulus that does not normally provoke pain.
- Chronic musculoskeletal pain intensity: ≤5 = mild, 6 - 7 = moderate, ≥8 = severe [24].
- Emergency surgery: A procedure performed outside the planned surgical circuit, indicated due to an immediate or short-term vital risk.
- Long surgery: A procedure with a duration of ≥2 hours.
- DN4 assessment: A 10-item questionnaire used to detect neuropathic pain, positive if the score is ≥4/10, with a sensitivity of 82.9% and specificity of 89.9% [3].

2.9. Ethical Considerations

Ethical clearance (No. 3947 CEI-Udo/08/2023/T) and research authorizations from the respective hospitals were obtained prior to any data collection. Anonymity, confidentiality, no additional costs, and the freedom to withdraw at any time without consequences to the quality of care were fully guaranteed for all participants.

2.10. Data Analysis

Data were entered and analyzed using IBM SPSS Statistics version 26. Categorical variables were described as counts and percentages, and continuous variables as means and standard deviations. Comparisons were performed using the chi-square test or Fisher's exact test for categorical variables, and Student's t-test for comparisons of means. Factors associated with postoperative neuropathic pain (PNP) were assessed using logistic regression, with odds ratios (ORs) and 95% confidence intervals (95% CIs) estimated. Variables that showed an association in bivariate analysis (OR > 1 and $p < 0.05$) were then selected for multivariable analysis to identify factors independently associated with PNP. All statistical tests were conducted with

a 95% confidence level and a 5% margin of error. A p-value < 0.05 was considered statistically significant.

3. Results

3.1. General Characteristics of the Study Population

The mean age of the patients was 45.41 ± 14.75 years. The most represented age group was 41 to 55 years, with 96 patients (45.5%). The majority of patients were male (n = 122, 57.8%), unemployed (n = 86, 40.8%), and originated from the West region of Cameroon (n = 99, 46.9%) (Table 1).

Table 1. General characteristics of the study population.

Variables	Total (N = 211)	Percentage (%)
Mean age ± SD (years)	45.41 ± 14.75	
Age groups		
[18 - 25]	34	16.1
[26 - 40]	34	16.1
[41 - 55]	96	45.5
[56 - 70]	39	18.5
>70	8	3.8
Gender		
Male	122	57.8
Female	89	42.2
Occupation sector		
public sector	57	27
private sector	68	32.2
Unemployed	86	40.8
Region of origin		
West	99	46.9
Littoral	86	40.8
Adamawa	15	7.1
East	11	5.2

3.2. Prevalence of Postoperative Neuropathic Pain

The prevalence of postoperative neuropathic pain (PNP) was 28% (n = 59) (Figure 1).

3.3. Characteristics of Postoperative Neuropathic Pain

The most frequently reported type of pain was burning, observed in 32 patients (54.2%). Among the associated symptoms, tingling sensations were the most common, noted in 33 patients (55.9%). The main triggering factor identified was brush-

ing, reported by 53 patients (89.8%). Regarding pain intensity, the majority of participants described it as moderate, with 37 patients (62.7%) (Table 2).

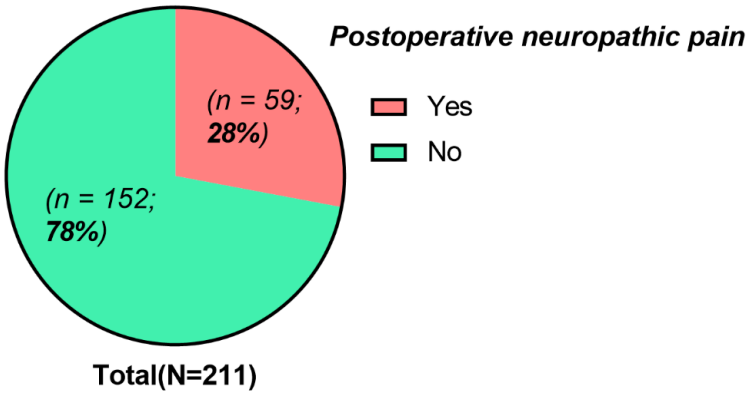

Figure 1. Prevalence of postoperative neuropathic pain.

Table 2. Characteristics of postoperative neuropathic pain.

Variables	Total (N = 59)	Percentage (%)
Type of pain		
Burning	32	54.2
Electric shock	27	45.8
Painful cold sensation	0	0
Associated signs		
Itching	8	13.6
Tingling	14	23.7
Numbness	4	6.8
Pins and needles	33	55.9
Triggering factor		
Brushing	53	89.8
None	6	10.2
Intensity		
Mild	8	13.6
Moderate	37	62.7
Severe	14	23.7

3.4. Factors Associated with Postoperative Neuropathic Pain

3.4.1. Sociodemographic Factors

Patients aged 26 to 40 years were significantly more likely to develop postoperative neuropathic pain, with a crude odds ratio (cOR) of 1.91 (95% CI: 1.04 - 3.87, p = 0.034). Similarly, female gender was associated with an increased likelihood of PNP, with a cOR of 2.521 (95% CI: 1.21 - 5.26, p = 0.014) (Table 3).

Table 3. Bivariate logistic regression analyzing sociodemographic factors associated with postoperative neuropathic pain.

	PONP			
Sociodemographic factors	**Yes, n (%)**	**No, n (%)**	**cOR (95% CI)**	**p-value**
Age groups (years)				
[18 - 25]	2 (3.4%)	32 (21.1%)	0.35 (0.14 - 1.81)	0.062
[26 - 40]	21 (35.6%)	13 (8.6%)	**1.91 (1.04 - 3.87)**	**0.034**
[41 - 55]	24 (40.7%)	72 (47.4%)	1.393 (0.29 - 6.73)	0.68
[56 - 70]	8 (13.6%)	31 (20.4%)	0.74 (0.3 - 1.21)	0.057
>70	4 (6.8%)	4 (2.6%)	0.150 (0.28 - 1.80)	0.12
Gender				
Male	23 (39%)	99 (64.8%)	0.30 (0.25 - 1.52)	0.76
Female	36 (61%)	53 (35.2%)	**2.521 (1.21 - 5.26)**	**0.014**
Region of origin				
West	13 (22%)	58 (38.2%)	0.7 (0.35 - 2.21)	0.11
Littoral	30 (50.8%)	32 (21.1%)	1.30 (0.87 - 2.36)	0.08
Adamawa	7 (11.9%)	4 (2.6%)	2.08 (0.94 - 7.61)	0.19
East	4 (6.8%)	4 (2.6%)	0.12 (0.05 - 1.2)	0.78

PONP: Postoperative neuropathic pain; cOR: Crude odds ratio; CI: Confidence interval.

3.4.2. History and Comorbidities Associated with Postoperative Neuropathic Pain

Anxiety disorders were significantly associated with a higher risk of PNP, with a crude odds ratio (cOR) of 4.38 (95% CI: 2.13 - 9.02, p = 0.001). Similarly, depressive disorders were significantly associated with PNP, with a cOR of 5.93 (95% CI: 2.1 - 16.72, p = 0.001) (Table 4).

Table 4. Bivariate logistic regression analyzing medical history and comorbidities associated with postoperative neuropathic pain.

	PONP			
Factors	**Yes, n (%)**	**No, n (%)**	**cOR (95% CI)**	**p-value**
Medical history				
Diabetes	28 (47.5)	4 (2.6)	2.66 (0.7 - 6.44)	0.99
Hypertension	8 (13.6)	21 (123.8)	NA	NA
Neuropathy	4 (6.8)	0 (0.0)	NA	NA
HIV	8 (13.6)	3 (2.1)	3.46 (0.39 - 5.78)	0.095
Corticosteroid therapy	1 (1.7)	4 (2.6)	2.41 (0.22 - 26.32)	0.47
Alcohol	40 (67.8)	90 (59.2)	4.018 (0.827 - 12.72)	0.088
Chronic kidney disease	8 (13.6)	4 (2.6)	1.21 (0.45 - 3.7)	1
Psychological context				
Anxiety disorders	22 (37.3)	23 (15.2)	**4.38 (2.13 - 9.02)**	**0.001**
Depressive disorders	9 (15.3)	2 (1.3)	**5.93 (2.1 - 16.72)**	**0.001**

Continued

Sleep disorders	2 (3.4)	3 (2.0)	2.23 (0.86 - 4.63)	0.234
None	26 (44.1)	119 (78.8)	0.69 (0.38 - 1.6)	0.11
Surgical history				
Never operated	39 (66.1)	124 (81.6)	0.62 (0.12 - 1.23)	0.85
Operated once	20 (33.9)	28 (18.4)	1.26 (0.78 - 2.80)	0.13
Same site	11 (91.7)	8 (66.7)	**2.25 (0.93 - 4.66)**	**0.06**
Different site	1 (8.3)	3 (28.2)	0.81 (0.16 - 1.10)	0.6

PONP: Postoperative neuropathic pain; NA: Not applicable; cOR: Crude odds ratio; CI: Confidence interval.

3.4.3. Interventional Factors

Among the types of procedures, amputation (cOR = 1.68; 95% CI: 1.16 - 3.70; p = 0.032), mastectomy with lymph node dissection (cOR = 2.12; 95% CI: 1.88 - 5.24; p = 0.021), orchidectomy (cOR = 1.45; 95% CI: 1.05 - 1.93; p = 0.041), and thoracotomy (cOR = 1.86; 95% CI: 1.07 - 3.30; p = 0.039) were significantly associated with an increased risk of postoperative neuropathic pain. In terms of surgical specialties, gynecological surgery (cOR = 1.23; 95% CI: 1.01 - 1.90; p = 0.038) and thoracic surgery (cOR = 1.47; 95% CI: 1.08 - 2.81; p = 0.041) were also significantly associated with PNP (Table 5).

Table 5. Bivariate logistic regression analyzing interventional factors associated with postoperative neuropathic pain.

	PONP			
Factors	**Yes, n (%)**	**No, n (%)**	**cOR (95% CI)**	**p-value**
Recruitment mode				
Emergency	18 (30.5)	57 (38.3)	1.69 (0.28 - 3.87)	0.125
Scheduled	41 (69.5)	88 (59.1)	2.22 (0.56 - 8.21)	0.18
Type of anesthesia				
General anesthesia (GA)	6 (10.2)	77 (50.7)	1.12 (0.26 - 5.54)	0.825
Regional anesthesia (RA)	45 (76.3)	66 (43.4)	2.58 (0.97 - 11.6)	0.074
Local anesthesia (LA)	8 (13.6)	9 (5.9)	1.55 (0.69 - 4.89)	0.12
Type of procedure				
Amputation	16 (27.1)	4 (2.6)	**1.68 (1.16 - 3.7)**	**0.032**
Cesarean section	8 (13.6)	20 (13.2)	0.91 (0.38 - 3.64)	0.65
Mastectomy with lymph node dissection	13 (22.0)	3 (1.95)	2.12 (1.88 - 5.24)	0.021
Osteosynthesis	4 (6.8)	22 (14.5)	0	0.73
AVF	1 (1.7)	4 (2.6)	0.38 (0.14 - 2.22)	0.068
Orchidectomy	2 (3.4)	3 (1.95)	**1.45 (1.05 - 1.93)**	**0.041**
Thoracotomy	5 (8.5)	1 (0.65)	**1.86 (1.07 - 3.30)**	**0.039**
Varicocelectomy	8 (13.6)	3 (1.95)	0	0.12

Continued

Type of surgery				
Gynecology	21 (35.6)	36 (23.7)	**1.23 (1.01 - 1.9)**	**0.038**
Traumatology	20 (33.9)	39 (25.7)	2.08 (0.84 - 7.57)	0.071
Urology	12 (20.3)	16 (10.5)	2.17 (0.95 - 5.05)	0.056
Thoracic surgery	2 (3.4)	1 (1.52)	**1.47 (1.08 - 2.81)**	**0.041**
Vascular surgery	4 (6.8)	5 (3.25)	1.18 (0.88 - 7.74)	0.46
Type of incision				
Longitudinal	30 (50.8)	80 (52.6)	1.11 (0.25 - 2.04)	0.089
Transverse	29 (49.2)	72 (47.4)	0.13 (0.01 - 1.09)	0.96
Duration of procedure				
<1 h	4 (6.8)	16 (10.5)	NA	NA
Between 1 - 2 h	49 (83.1)	75 (49.1)	2.32 (0.45 - 3.36)	0.078
>2 h	6 (10.2)	60 (39.5)	1.81 (0.62 - 2.1)	0.073
ASA score				
ASA I	37 (86.0)	78 (76.5)	2.18 (0.64 - 5.13)	1.06
ASA II	6 (14.0)	24 (23.5)	0.33 (0.11 - 2.09)	0.62

PONP: Postoperative neuropathic pain; NA: Not applicable; cOR: Crude odds ratio; CI: Confidence interval.

3.4.4. Surgical and Psychological Predictors of Postoperative Neuropathic Pain

Gynecological surgery (aOR = 1.53; 95% CI: 1.19 - 2.80; p = 0.002), thoracic surgery (aOR = 1.62; 95% CI: 1.11 - 3.60; p = 0.016), anxiety disorders (aOR = 1.72; 95% CI: 1.48 - 3.18; p = 0.001), amputation (aOR = 1.96; 95% CI: 1.13 - 3.40; p = 0.025), mastectomy (aOR = 1.71; 95% CI: 1.09 - 2.90; p = 0.012), and thoracotomy (aOR = 1.36; 95% CI: 1.26 - 4.61; p = 0.009) were significantly associated with postoperative neuropathic pain (Table 6).

Table 6. Multivariate logistic regression of factors showing association in bivariate analysis.

Factors	aOR (95% CI)	p-value
Age groups [26 - 40] years	0.13 (0.03 - 1.37)	0.224
Depressive disorders	1.30 (0.76 - 1.98)	0.096
Gynecological surgery	**1.53 (1.19 - 2.8)**	**0.002**
Female gender	1.82 (0.81 - 2.02)	0.097
Anxiety disorders	**1.72 (1.48 - 3.18)**	**0.001**
Amputation	**1.96 (1.13 - 3.4)**	**0.025**
Mastectomy	**1.71 (1.09 - 2.9)**	**0.012**
Orchidectomy	0.15 (0.02 - 0.67)	0.81
Thoracotomy	**1.36 (1.26 - 4.61)**	**0.009**

aOR: Adjusted odds ratio; CI: Confidence interval.

4. Discussion

The prevalence of postoperative neuropathic pain (PNP) observed in our study (28%) falls within the range of prevalences reported in the early phase following certain high-risk surgeries, notably thoracic surgeries, where approximately one-third of patients exhibit a neuropathic component in the first days and weeks post-operatively [25]-[27]. This "early" prevalence is of prognostic interest, as a positive DN4 score early after surgery is associated with an increased risk of long-term neuropathic persistence [28]. The most common sensory profiles (burning, tingling, brushing) closely matched the descriptors and signs included in the DN4, which combines symptoms and clinical examination and is considered positive for a score ≥ 4/10 [3] [29].

The independent associations identified with specific procedures are largely consistent with the literature. After thoracic surgery/thoracotomy, injury to intercostal nerves and central sensitization explain the high proportion of neuropathic components in persistent pain; retrospective series and critical reviews report that approximately 25% to 60% of patients develop chronic post-thoracotomy pain, with about one-third presenting neuropathic features [26] [27]. Mastectomy is classically associated with injury to the intercostobrachial nerve, and reviews/meta-analyses report high rates of persistent pain with a substantial neuropathic component after breast cancer treatment [30]. Amputation is frequently accompanied by phantom limb pain and stump pain with a neuropathic phenotype; the meta-analysis by Limakatso *et al.* estimated a prevalence of approximately 6 out of 10 patients reporting phantom limb pain [31]. Finally, gynecological surgery is associated with a non-negligible risk of chronic pain, with studies showing rates around 30% one year after hysterectomy and a subset with a neuropathic phenotype [32]-[34].

The psychological factors that showed an effect in our model, particularly anxiety disorders, were consistent with quantitative syntheses: the systematic review and meta-analysis by Theunissen *et al.* demonstrated that preoperative anxiety and catastrophizing increased the risk of chronic postoperative pain, and a more recent meta-analysis confirms the association (albeit moderate) between anxiety, depression, catastrophizing, and chronic postoperative pain [35] [36]. These data support the hypothesis that psychological vulnerability potentiates the transition from acute to persistent pain; this continuum has been extensively discussed in reference reviews [25] [37].

In terms of mechanisms, our findings can be explained by a combination of peripheral nerve injury (intercostal/intercostobrachial, trunk nerves) and central sensitization, phenomena well documented in surgical cohorts and mechanistic reviews [4] [37]. Furthermore, multicentric studies such as GENDOLCAT have highlighted the combined influence of surgery type and clinical/psychological factors on the risk of medium-term chronic pain [34].

In our study, female sex was associated with PNP in bivariate analysis, but this association disappeared after multivariable adjustment. This pattern is compatible

with the literature: meta-analyses suggest that female sex is often linked to a higher risk of chronic postsurgical pain, but with modest effect sizes, and the association may attenuate when adjusting for more proximal factors (preoperative pain, type of surgery, psychological factors) [38]. A plausible explanation is confounding by procedure type: some surgeries, more frequent in women (e.g., breast/mastectomy and gynecological surgery), are more likely to involve neuropathic mechanisms and persistent pain, which may create a crude association with sex that is subsequently absorbed by surgical variables in the model [4] [34]. Finally, recent syntheses emphasize that risk factors for persistent postsurgical pain are multifactorial and strongly procedure-dependent, which helps explain why sex does not always remain an independent predictor after adjustment [7].

Although depressive disorders were strongly associated with PNP in bivariate analysis ($p = 0.001$), they were no longer significant after adjustment in the multivariable model. A plausible explanation is the frequent co-occurrence and strong correlation between anxiety and depressive symptoms in the perioperative setting: when anxiety is included in the model, it may capture part of the shared variance (negative effect), making the association with depression non-independent. This interpretation is consistent with evidence showing that preoperative anxiety and/or state anxiety are robust predictors of persistent postoperative pain, sometimes more consistent than depression after adjustment for clinical and surgical factors [36] [36]. Moreover, the effect of psychological factors may vary by surgical model; in some procedures, anxiety emerges as the main determinant, whereas depression loses its independent effect once covariates are considered [39]. Finally, syntheses on persistent postsurgical pain note that anxiety and depression both belong to "negative affective constructs", and their independent contributions depend on the covariates selected (type of surgery, intensity of acute pain, complications) and on the structure of the statistical model [25] [38].

Our study presented several limitations: First, the cross-sectional nature of our study did not allow us to infer the chronicity of specific categories of pain, such as chronic postoperative pain, which is defined as pain persisting beyond three months after surgery. Second, the DN4 is a validated screening tool (cutoff $\geq 4/10$) with good sensitivity and specificity, but it is distinct from a formal neurophysiological diagnosis. Third, the precision of some estimates may have been limited by the size of subgroups and unmeasured confounding factors (surgical techniques, analgesic protocols, complications). Finally, the absence of longitudinal follow-up did not allow a direct link to be established between early PNP and persistent pain, although the literature suggests an increased risk when early neuropathic symptoms are present.

5. Conclusion

In conclusion, our results showed that slightly more than one quarter of postoperative patients experienced PNP, with a phenotype consistent with DN4 descriptors and associated factors dominated by high-risk surgeries (thoracic surgery/thora-

cotomy, mastectomy, amputation, gynecological surgery) and anxiety. These findings, in line with the literature, support systematic DN4 screening during hospitalization and risk stratification integrating psychological factors and surgical type. Practically, a positive screen (DN4 ≥ 4) or identification of a high-risk patient should prompt: 1) a structured pain assessment (pain mapping, intensity, functional impact, brief neurological examination, and assessment of allodynia/hyperalgesia) and, where available, early input from a pain/anesthesia team; 2) initiation or optimization of multimodal analgesia with adjuvants targeting neuropathic mechanisms according to local protocols and contraindications; 3) implementation, when feasible, of nerve-sparing techniques and/or targeted regional analgesia (peripheral nerve blocks, epidural/paravertebral/interfascial plane techniques depending on the surgical site) for patients undergoing high-risk procedures; and 4) management of psychological factors, particularly anxiety (education, reassurance, non-pharmacological strategies, referral when needed). Finally, a scheduled follow-up at 3 - 12 months is warranted to document persistence, adapt treatment, and classify persistent pain according to the 11th revision of the International Classification of Diseases published by the World Health Organization.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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