Original Contribution

Prevalence of neuropathic pain in emergency patients: an observational study

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Abstract

Objective: Neuropathic pain (NP) in acute conditions has been poorly investigated. A diagnostic score, the DN4 scale (DN4), has been developed to help physicians to detect and treat NP appropriately. DN4 is a 10-item questionnaire. If you have 4 or more positive responses out of 10 items, the answer to the questionnaire is positive and you have a neuropathic pain. We aimed to determine the prevalence of NP in emergency department (ED) patients and to describe this population.

Methods: We used the DN4 in the patients with NP visiting the adult ED of a university hospital. Patients were asked about the characteristics of their pain using a face-to-face questionnaire.

Results: Among 533 patients with a DN4 score, 114 (21.4%) had NP. Neuropathic pain was independently negatively associated with age of 65 years of older (odds ratio [OR], 0.2; 95% confidence interval [CI], 0.05-0.8) and positively associated with intense pain (OR, 5.2; 95% CI, 1.5-18.2), located to the limbs (OR, 2.3; 95% CI, 1.2-4.0).

Conclusion: Neuropathic pain was common in ED patients and associated to a higher level of pain.

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1. Introduction

Pain basically results from activation of nociceptive nerves by actual or potent tissue-damaging stimuli. Pain can also arise after inadequate stimulation of peripheral sensory endings. The International Association for the Study of Pain has introduced the concept of neuropathic pain, defined as “a pain initiated or caused by a primary lesion or dysfunction in the nervous system” [1]. Recently, experts have defined neuropathic pain as a direct consequence of a lesion or disease regarding the somatosensory system [2]. However, neuropathic pain may occur spontaneously, after stimuli that should not be painful (allodynia) and that lead to inadequate response (hyperalgesia) [3]. Neuropathic pain is often associated with a lower quality of life and comorbid conditions such as neuropsychiatric disturbances [4].
Patients with neuropathic pain also have poorer health and higher health care costs [5]. Consequently, determining the presence of neuropathic pain is challenging for the global management of patients. Neuropathic pain is present in 7% to 8% of the general population [6,7], nearly a quarter of chronic pain patients [8] and 30% of patients with whiplash that occurred within 3 weeks [9]. Nevertheless, the incidence of neuropathic pain remains underestimated leading to inadequate treatment [10,11]. Consequently, scales have been developed to help physicians to recognize more easily neuropathic pain [12-17].

Pain is among the most frequent symptoms in patient visiting emergency department (ED). It has long been suggested that pain experienced by patients visiting EDs was caused by tissue injury and consequently relied on nociceptive mechanisms. Although nearly 80% of ED patients complain of pain, pain assessment remains scarce and emergency patients are usually undertreated [18,19] or mistreated. Lack of pain relief may be related to treatment inadequacy, especially if neuropathic pain is unrecognized. These evidences prompted us to assess patients with neuropathic pain visiting the ED of a university hospital for the presence of neuropathic pain, to estimate its prevalence, and to describe characteristics of this population.

2. Patients and methods

2.1. Study design

We designed a single-center observational survey using a structured questionnaire and validated scales 24 hours a day for a 2-week period. The study was carried out according to the principles of the Declaration of Helsinki and approved by the ethic committee that waived the necessity for written informed consent. The study was notified to the French personal data processing surveillance authorities (Commission Nationale Informatique et Libertés).

2.2. Setting

The survey set in the adults’ ED of a university hospital receiving roughly 48 000 medical and trauma patients a year.

![Participant flow](image)

**Fig. 1** Participant flow.
2.3. Study population

Consecutive adult patients with neuropathic pain visiting the ED during the study period were asked to participate to the survey. Patients were not included if they waived the invitation. They were excluded if they were younger than 18 years, were under legal constrain, or unable to answer the questionnaire (impaired consciousness, non–French speaker) and if they declared to have no pain at interview.

2.4. Data collection

Patients were asked to answer a face-to-face questionnaire conducted by a dedicated assistant investigator. Assistant investigators were trained on a pain comprehensive course and a data collection program. Data collected were demographics, underlying disorders, risk factors for neuropathic pain, pain characteristics including duration and site of pain, and pain measurement. Global pain was evaluated using Verbal Rating Scale (VRS) that allowed distribution of patients with neuropathic pain between 4 classes: mild, moderate, intense, and very intense. Verbal Rating Scale was assessed at baseline and at discharge of the ED. DN4 score was used as criterion standard to detect neuropathic pain (Appendix A). DN4 tests 10 neuropathic characteristics corresponding to 10 questions related to the description of pain, the association of paresthesia/dysesthesia in the painful area, the presence of sensory deficit, and evoked pain. The patient must answer each question in a dichotomous manner (“is the symptom present or not”). The score ranges from 0 (no symptom) to 10 (presence of the 10 neuropathic characteristics); a neuropathic pain was assessed by a score equal or above 4 (DN4+) [16]. At discharge, patients were interviewed for pain relief and for the use of analgesics.

2.5. Statistical analysis

First, we performed a descriptive study of neuropathic pain in the ED patients, using proportions and their 95% confidence intervals (95% CIs). Then, we compared the characteristics of pain between patients with neuropathic pain and those with nonneuropathic pain, using χ² or Fischer exact tests as appropriate. The internal validity of the DN4 scale was assessed by calculating the κ agreement coefficient between the « touching » item and all the other items of the scale.

Comparisons were also expressed as odds ratios (ORs) and their 95% CIs, considering patients with no neuropathic pain as the reference category. We further constructed a logistic regression model to predict neuropathic pain. All variables with \( P < .05 \) were included in the model, ran with a conditional backward stepwise procedure. The diagnosis of the regression model and its robustness were checked.

All tests were 2-tailed, and statistical significance was set at \( P < .05 \). The software SPSS for Windows, version 12.0 (Copyright SPSS Inc, Chicago, Ill, 2003) was used for data analysis.

3. Results

The inclusion period extended from the 3rd to the 17th of March 2007. Among 1490 patients visiting the ED during the study period, 131 had exclusion criteria. Interviews could not be proposed to 614 patients because assistant investigators were on duty with other participants (Fig. 1). A total of 745 patients were eligible; 72 waived the invitation to participate (response rate: 87%). Among the 673 that answered the questionnaire, 137 declared no pain and were excluded and 3 were excluded for not having answered the DN4 scale.

The study population consisted of 533 participants. Table 1 summarizes the characteristics of the population. Pain lasted for less than 1 month in most patients (88%; 95% CI, 76%-83%); 61% of patients (95% CI, 56%-66%) experienced pain after a trauma. Limbs (46%; 95% CI, 42%-50%), head (17%; 95% CI, 14%-20%), and abdomen (15%; 95% CI, 12%-18%) were the most frequent sites of pain. Analgesics intake before visiting the ED was declared by 220 patients (42%; 95% CI, 37%-46%).

Among the study population, 96 patients (18%; 95% CI, 15%-22%) reported none of the neuropathic features listed in the DN4 scale. The most common features detected were pain increase by brushing, feeling numbness, burning, electric shocks, pins and needles, and tinglings (Table 2). The internal validity of the DN4 scale is shown in Table 3. The most concordant item with the hypoesthesia to touching was the hypoesthesia to prick (\( \kappa = 0.63 \)). The other items had a poor concordance with the hypoesthesia to touching (ie, \( \kappa < 0.23 \)).

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Main characteristics of the study population</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
</tr>
<tr>
<td>Age (y), mean (SD)</td>
<td>44 (20)</td>
</tr>
<tr>
<td>Male sex, n (%)</td>
<td>258 (49)</td>
</tr>
<tr>
<td>Married, n (%)</td>
<td>235 (45)</td>
</tr>
<tr>
<td><strong>Characteristics of the pain</strong></td>
<td></td>
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<tr>
<td>Painkiller taking before ED, n (%)</td>
<td>220 (41)</td>
</tr>
<tr>
<td>Acute pain (&lt;1 mo), n (%)</td>
<td>470 (94)</td>
</tr>
<tr>
<td><strong>Causal lesion</strong></td>
<td></td>
</tr>
<tr>
<td>Trauma n (%)</td>
<td>237 (61)</td>
</tr>
<tr>
<td>Nontrauma n (%)</td>
<td>152 (39)</td>
</tr>
<tr>
<td><strong>Has previously experienced similar pain</strong></td>
<td></td>
</tr>
<tr>
<td>Head, n (%)</td>
<td>90 (17)</td>
</tr>
<tr>
<td>Neck/shoulder, n (%)</td>
<td>47 (9)</td>
</tr>
<tr>
<td>Limb, n (%)</td>
<td>243 (46)</td>
</tr>
<tr>
<td>Back, n (%)</td>
<td>73 (14)</td>
</tr>
<tr>
<td>Thorax, n (%)</td>
<td>48 (9)</td>
</tr>
<tr>
<td>Abdomen, n (%)</td>
<td>81 (15)</td>
</tr>
<tr>
<td>Miscellaneous, n (%)</td>
<td>96 (18)</td>
</tr>
</tbody>
</table>
Finally, 114 patients (21%; 95% CI, 18%-25%) were positive for neuropathic pain according to DN4. Among these, 12 had known risk factors for neuropathic pain: diabetes mellitus (n = 3), developing cancer (n = 6), chemotherapy (n = 1), and chronic alcohol addiction (n = 2). Only 11 patients (10%; 95% CI, 5%-17%) positive for DN4 had previous chronic pain. Most patients (n = 98, 90%; 95% CI, 83%-95%) complained of acute pain (ie, lasting for 1 month or less). The main conditions that lead to pain were opened wounds (22%), mechanical low back pain (13%), tendinitis (7%), and infections, mostly arthritis (7%). The DN4 score mostly ranged from 4 to 5 (Fig. 2). The proportion of male was not different in DN4-positive patients than in others, whereas the proportion of patients older than 65 years was lower (OR, 0.3; 95% CI, 0.1-0.7; Table 4). Limbs were significantly more often involved (OR, 2.3; 95% CI, 1.5-3.4), and level of pain at arrival was higher (OR, 2.5; 95% CI, 1.3-4.9). DN4-positive patients had a trend to experience more care-related pain (OR, 1.7; 95% CI, 1.0-3.0). Pain was evaluated at discharge in 399 participants. In this subpopulation, baseline and discharge VRS were more often intense or very intense in DN4-positive patients than in DN4-negative patients (P = .02), whereas the use of analgesics before the arrival to the ED did not significantly differ between the 2 groups. After adjusting for confounding variables, neuropathic pain was negatively associated with age more than 65 years (OR, 0.2; 95% CI, 0.05-0.8) and positively associated with pain, intense or very intense, at baseline (OR, 5.2; 95% CI, 1.5-18.2) and pain located at the limbs (OR, 2.3; 95% CI, 1.2-4.0).

### Table 2

<table>
<thead>
<tr>
<th>Items of the DN4 questionnaire</th>
<th>Total, n (%)</th>
<th>Neuropathic pain (n = 114), n/N (%)</th>
<th>Nonneuropathic pain (n = 419) n/N (%)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burning</td>
<td>151 (29)</td>
<td>64/107 (59)</td>
<td>87/390 (21)</td>
<td>.001</td>
</tr>
<tr>
<td>Painful cold</td>
<td>44 (9)</td>
<td>25/105 (24)</td>
<td>19/376 (5)</td>
<td>.001</td>
</tr>
<tr>
<td>Electric shocks</td>
<td>142 (28)</td>
<td>67/113 (59)</td>
<td>75/383 (20)</td>
<td>.001</td>
</tr>
<tr>
<td>Tinglings</td>
<td>113 (22)</td>
<td>65/110 (59)</td>
<td>48/402 (12)</td>
<td>.001</td>
</tr>
<tr>
<td>Pins and needles</td>
<td>147 (28)</td>
<td>80/112 (71)</td>
<td>67/405 (17)</td>
<td>.001</td>
</tr>
<tr>
<td>Numbness</td>
<td>171 (33)</td>
<td>72/110 (66)</td>
<td>99/402 (25)</td>
<td>.001</td>
</tr>
<tr>
<td>Itching</td>
<td>47 (9)</td>
<td>30/111 (27)</td>
<td>17/399 (4)</td>
<td>.001</td>
</tr>
<tr>
<td>Pain increased by brushing</td>
<td>179 (35)</td>
<td>69/112 (62)</td>
<td>110/397 (28)</td>
<td>.001</td>
</tr>
<tr>
<td>Hypoesthesia to touch</td>
<td>79 (20)</td>
<td>46/93 (50)</td>
<td>33/305 (11)</td>
<td>.001</td>
</tr>
<tr>
<td>Hypoesthesia to prick</td>
<td>47 (12)</td>
<td>31/85 (37)</td>
<td>16/293 (6)</td>
<td>.001</td>
</tr>
</tbody>
</table>

4. Discussion

In the present study, we reported that (i) 21% of patients with neuropathic pain visiting the ED experienced neuropathic pain according to the DN4 questionnaire; (ii)

![Fig. 2](image-url) Distribution of the DN4 scores in the study population, according to previous experience of a similar pain.
neuropathic pain occurred in the setting of conditions commonly encountered in emergency patients; (iii) patients with neuropathic pain were more likely to have insufficient pain relief at discharge; and (iii) patients with neuropathic pain were independently more often younger than 65 years and had more often intense pain using the VRS score or pain located to the limbs. To our knowledge, we report here the first study to systematically use DN4 scale to evaluate neuropathic characteristics in medical and trauma patients visiting the ED with pain.

According to French guidelines [20], pain in the ED should be treated with acetaminophen, morphine, and nonsteroidal anti-inflammatory drugs (ie, medications targeting nociceptive pain). To our knowledge, no guideline of the management of neuropathic pain in this setting has been published. DN4 is a 10-item scale that constitutes a new and easy-to-use diagnostic tool to detect neuropathic pain characteristics at bedside [16]. A score of 4 points or above (DN4+ patients) allows the clinician to suspect a neuropathic pain with a 82.9% sensitivity and a 89.9% specificity.

The prevalence of DN4+ patients was similar to that found in studies of patients with chronic pain (21% and 25%) [6,7]. However, the use of another tool, the Leeds Assessment of Neuropathic Symptoms and Signs questionnaire detected 34% patients with neuropathic pain in acute whiplash [9]. This difference may result from the difference between populations. In the study of Sterling and Pedler [9], the population targeted had presumed neurologic involve-
ment; in ours, the population included was every patient with neuropathic pain visiting the ED.

Although neuropathic pain has mostly been studied in chronic patients, its definition involves both acute and chronic pain [1,2]. In chronic patients, neuropathic pain had been related to nervous lesions (55%) such as traumatic nerve injury, postherpetic neuralgia, or poststroke pain but also to nonneurologic lesions (45%) such as osteoarthritis, inflammatory arthropathy, or mechanical low back pain [16]. In our study, 90% of patients had acute pain and no central neurologic lesions for most of them; a single patient had headache related to acute stroke.

Neuropathic pain screening tools have raised interest for clinicians and researchers because nonspecialists can use them easily. Furthermore, they have a substantial sensitivity and specificity, lending obvious value to epidemiologic studies [21]. Screening tools for neuropathic pain underscore the need for further assessment. A clear distinction must be made between identifying features of neuropathic pain (which is the goal of screening tools) and diagnosing neuropathic pain (for which screening tools are not designed) [21]. These tools have only been described once for patients with acute whiplash (<3 weeks) and helped to identify patients with higher level of pain and disability [9]. This is the first study to use a neuropathic pain questionnaire assessment in a nonselected emergency population. Although this questionnaire is easier to use than those previously developed to assess neuropathic pain, it still remains time consuming, especially in the setting of emergency medicine. In addition, 3 items of the questionnaire require physical examination, and consequently, DN4 is not easy to use at triage. However, the detection of neuropathic pain has direct implications for treatment that should be directed toward specific pain mechanisms [22]. We found that patients with hypoesthesia to touching were more often inclined to have hypoesthesia to tinglings, pins and needles, itching, and hypoesthesia to prick.

In our study, the presence of a DN4+ scale was associated with a higher pain level at entrance and discharge that could be due to the inadequacy of the first treatment in the setting of emergency medicine [19,23]. This can lead to recalcitrance to chronic pain [22] and to physical rehabilitation [24]. Pain assessment and treatment are challenging but are a fundamental issue in emergency medicine. Staff education, development of protocols, and continuous evaluation of bundles [18,25-26] have been proposed to improve management of pain. The use of DN4 could be proposed to allow physicians to identify features of neuropathic pain in more patients with neuropathic pain for whom usual treatment has failed. However, because using DN4 in routine could be difficult, it might be restricted to patients whose pain relief is unsatisfactory at discharge or to clusters of patients that need to be determined. In this study, we found that young age, intensity of pain, and location at the limbs were factors associated with neuropathic pain.

Our study has some limitations. First, it is a single-center observational study whose conclusions should be supported by other reports. Despite study design and a dedicated staff 24 hours a day, 614 patients of 1490 were not approached for participation. Even if no patient selection was done, this should soften the interpretation of our results. However, evidences suggest that the features of neuropathic pain are probably underestimated in emergency patients because chronic neuropathic pain is often related to nonneurologic reason.

In our observational study, some patients had no pain reassessment before discharge. Our conclusion about pain relief at discharge should be smoothed by this bias. Another weakness is that patients were evaluated during their emergency visit. Unfortunately, patients had no follow-up after discharge, and therefore, we cannot answer whether pain resolved in a similar rate and delay in patients with and without neuropathic pain, whereas pain relief at discharge was scarce in patients experiencing neuropathic pain. In addition, we did not investigate whether these patients were more likely to develop chronic pain.

This study is only descriptive and does not help to answer whether a positive DN4 scale means that another analgesic is needed such as antiepileptic or antidepressant. Indeed, nociceptive analgesics have little or no efficacy against neuropathic pain. The use of a 10-item scale such as DN4 is time consuming. One further investigation could be either to select a few items of the DN4 that are very specific for ED or to find a cluster of ED patients that will be asked to answer the DN4.

Finally, because our study was not aimed at determining factors predicting neuropathic pain, some of them may not have been included in our scale. Therefore, the independence of the factors associated with neuropathic pain should be considered with caution.

5. Conclusion

Neuropathic pain frequently occurs in patients who present with pain to the ED and is associated with lower pain relief at discharge. The use of a 10-item scale such as DN4 is time consuming. Therefore, answering to the DN4 scale can hardly be proposed to each patient with neuropathic pain visiting the ED. DN4 scale could be used just for patients according to their demographic or medical characteristics (young patients, limbs pain, intense pain, etc) or to unsatisfactory pain relief to improve treatment efficiency with specific medications.

Appendix A

Question 1. Does the pain have one or more of the following characteristics?

1. Burning
2. Painful cold
3. Electric shocks
Question 2. Is the pain associated with one or more of the following symptoms in the same area?

4. Tinglings
5. Pins and needle
6. Numbness
7. Itching

Question 3. Is the pain located in an area where the physical examination reveals one or more of the following characteristics?

8. Hypoesthesia to touch
9. Hypoesthesia to prick

Question 4. In the painful area, can the pain be caused or increased by

10. Brushing

References