Review

Comprehensive Assessment of Neuropathic Pain: A Scoping Review of Diagnostic Tools.

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Abstract

Background

Neuropathic pain is a complex and often chronic condition caused by damage to the Somatosensory system. Over the years, several tools have been developed to assist in identifying and quantifying NP.

Aim

This Scoping review aims to evaluate and compare the most widely used Neuropathic pain assessment tools to understand their strengths, limitations, and clinical utility.

Methods

Review was conducted with a systematic search of databases including PubMed, Scopus and Embase. The tools examined included DN4, LANSS, PainDETECT, and the NPQ.

Results

A total of 8 studies were included in the review. The DN4 demonstrated the highest sensitivity (82.9%) and specificity (89.9%), making it a reliable tool for rapid screening. LANSS and the Pain DETECT also showed high sensitivity and specificity, particularly in differentiating NP from nociceptive pain. The NPQ, although showing slightly lower sensitivity (66.9%) and specificity (74.4%) was unique in its comprehensive assessment of both sensory and emotional components of NP.

Conclusion

The DN4, LANSS and Pain DETECT are effective tools for rapid neuropathic pain screening, especially in primary care settings. However, the NPQ offers a more detailed assessment of Neuropathic pain symptoms, including emotional and psychological aspects, making it a valuable tool in more complex cases.

JK-Practitioner2024;29(4):1-5.

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Introduction

Neuropathic pain is a debilitating condition that arises from direct injury or disease affecting the somatosensory system.[1] It can result from various conditions such as diabetes, postherpetic neuralgia, spinal cord injury, stroke, multiple sclerosis, and chemotherapy-induced neuropathy[1,2]. Globally, the prevalence of neuropathic pain is estimated to affect 7-10% of the general population, but its impact is often underestimated due to its complex presentation and difficult diagnosis [3]. Neuropathic pain manifests in a variety of symptoms, including burning, tingling, electric-shock-like sensations, hyperalgesia, and allodynia, which can differ significantly between individuals. These symptoms are often accompanied by emotional and psychological distress, further complicating treatment and management [4]. Accurate diagnosis and assessment are critical for effective management of neuropathic pain [1-5]. However, NP is notoriously difficult to diagnose due to its heterogeneous presentation, making the use of standardised assessment tools essential in both clinical and research settings [6].

The purpose of the scoping review is to examine the existing assessment tools for NP. By evaluating the strengths, limitations, and clinical utility of these tools. This review aims to provide a comprehensive overview that may guide healthcare professionals in the diagnosis and management of NP.

Methods

Study Design

A scoping review framework was adopted to map of existing literature on neuropathic pain assessment tools. The approach follows the guidelines provided by Arksey and O'Malley [7]. This review was registered in Open Science Framework registries (OSF) with a registration 10.17605/OSF.IO/8GHSP.

Search Strategy

A thorough search approach was created to find pertinent research. Databases searched included: PubMed, Scopus and Cochrane Library.

Search terms combined keywords and medical subject heading (MeSH) such as "neuropathic pain," "assessment tools," "pain questionnaire," "validity," "DN4," "PainDETECT," "specificity," "Sensitivity," "Neuropathic pain questionnaire," and "LANSS."

Boolean operators[8](AND, OR) were used to combine search terms where appropriate. Additionally, filters for human studies, English language publications, and peer-reviewed articles were applied. The search included articles published between January 1999 and August 2024. This timeframe was selected to capture all relevant studies on the NPQ and other assessment tools for NP developed or validated during this period.

Table 1.

Database	Search fields	Terms
PubMed	Title, abstracts and full texts	"Neuropathic pain" AND "PainDETECT" OR "LANSS" OR "DN4" OR "NPQ"
Scopus		"Neuropathic pain" OR "Nerve Pain"
Cochrane Library		"Neuropathic Pain" AND "Assessment Tools"

Table 1. Search Strategy

Inclusion and Exclusion Criteria

Inclusion Criteria

- Articles published from January 1999 to August 2024.
- Studies focused on the development, validation, or clinical use of NP assessment tools.
- Studies involving adult patients (18 years and older) with confirmed neuropathic pain.
- Articles published in English language.

Exclusion Criteria

- Studies focused on paediatrics populations.
- Non-English language articles.
- Studies unrelated to NP assessment (e.g., unrelated pain conditions)
- Review articles and case reports without primary data.

Study Selection Process

Two independent reviewers screened the titles, abstracts, and full texts of the articles for eligibility. Using the SM, articles from various databases were examined. The authors chose a single database because of repeatedly writing articles. Other studies were excluded to avoid reproducibility. All articles were imported into the Mendeley reference management software, and duplicates were excluded. The preferred reporting items for systematic reviews and meta-analysis flowchart was used to direct the selection and evaluation process. By choosing to include all possibly relevant research, a more thorough approach was taken at this point rather than excluding ambiguous papers. The second review step was undertaken by the same two impartial evaluators who thoroughly examined the complete text of the chosen articles. More focus was placed on selecting only those items that met all qualifying requirements. In instances of uncertainty, a third reviewer was consulted to determine the eligibility for inclusion in Table 2.

Process of Data Charting

Two reviewers independently extracted data from various categories, including authorship, year of publication, journal, and the country of the study, study population like type of neuropathic pain and demographic data (age, gender, geographical location), assessment tool includes (name and description of the tool (e.g., DN4, LANSS, NPQ, PainDETECT), tool characteristics, psychometric properties and clinical utility and study outcomes.

Critical Appraisal Tool

One evaluator used the OCEBM LoE framework developed by the Oxford Center for Evidence-Based Medicine to appraise each article.(9) The OCEBM LoE framework serves as a concise and efficacious instrument for assessing the robustness of findings in research studies and determining the methodological soundness of each article9. In accordance with this system, the articles were categorized based on their

Characteristics	Inclusion
Participants	Adults with neuropathic pain (e.g., diabetic neuropathy etc)
Intervention	Use of neuropathic pain assessment tools
Comparator	Comparison between different neuropathic assessment tools
Outcome measures	Neuropathic pain reduction, pain intensity, quality of life, functional improvement.
Study design	Clinical trials

Table 2. Eligibility Criteria

LoE, ranging from level I (indicating a higher LoE) to level V (indicating a lower LoE). Greater methodological quality and a lower chance of bias are indicated by a greater LoE.

Results

Evidence Selection

The literature search yielded 1,258 articles. After removing duplicates, 1,053 articles were screened based on their titles and abstracts. After full-text screening, 239 articles were excluded. A total of 8 studies met the eligibility criteria and were included in the final review. Information on the included articles is summarised in the PRISM-ScR flow diagram. The general characteristics of the included studies will be made available on request.

Result Synthesis

Level of evidence and study design

Based on the methodological design of the eight included articles, all were randomised controlled trials (RCTs). These RCTs specifically evaluated the efficacy and psychometric properties of neuropathic pain assessment tools. 3 RCTs(10–12) assessed the DN4 tool's performance in randomised trials, evaluating its effectiveness in distinguishing neuropathic pain from other pain types. 2 RCTs(13,14) focused on the LANSS tool, examining its validity and reliability. 2 RCTs(15,16) investigated PainDETECT in randomised trials, analysing its ability to effectively screen for neuropathic pain across different patient populations. 1 RCT (17)evaluated the NPQ in a randomised setting, providing data on its comprehensive assessment of neuropathic pain.

Sample Characteristics

3 RCTs evaluating DN4 included sample size ranging from 100-500 participants. 2 RCTs on LANSS had sample sizes between 120 and 300 participants. 2 RCTs assessing PainDETECT involved sample sizes of 150-400 participants and 1 RCT evaluating NPQ included a sample size of 150 participants.

Protocol Characteristics

Most studies compared the validity of one assessment tool to other assessment tools effectiveness and comparing its performance with others. 1 study's objective was to validate the NPQ's comprehensive assessment of neuropathic pain, including sensory and emotional components.

Outcomes used to find treatment efficacy

All articles included Visual Analog Scale (VAS) or Numeric Pain Rating Scale (NPRS) for pain intensity. Some studies also included Quality of Life (QOL) assessment tool like (SF-36), for impact of neuropathic pain and its management on overall quality of life[10–17].

Discussion

This scoping review included 8 articles. Main purpose of this review is to assess the efficacy and psychometric properties of various neuropathic pain assessment tools, specifically the DN4, LANSS, PainDETECT and NPQ. Each tool offers a unique approach to diagnosing neuropathic pain, reflecting a range of methodologies and theoretical foundations. This review underscores the importance of selecting the appropriate assessment tool based on the clinical context and specific patient needs. By providing a comparative analysis of these tools, the review offers valuable insights into their relative strengths and limitations, guiding clinicians in choosing the most effective tool for their practice. The synthesis of findings from RCTs ensures that the results drawn are based on robust evidence, enhancing the reliability of the recommendations for clinical practice and future research directions. This comprehensive overview aims to support clinicians in making informed decisions and to stimulate further research to refine and expand the utility of these assessment tools.

DN4 developed to identify neuropathic pain through a combination of patient-reported symptoms and clinical examination findings, DN4 has emerged as a widely accepted tool due to its strong psychometric properties. Its ability to effectively differentiate neuropathic pain from other pain types makes it an asset in both research and clinical settings.

LANSS focuses on identifying neuropathic pain based on patient-reported symptoms and has been validated in various populations. Its straightforward approach and ease of use have contributed to its widespread adoption,

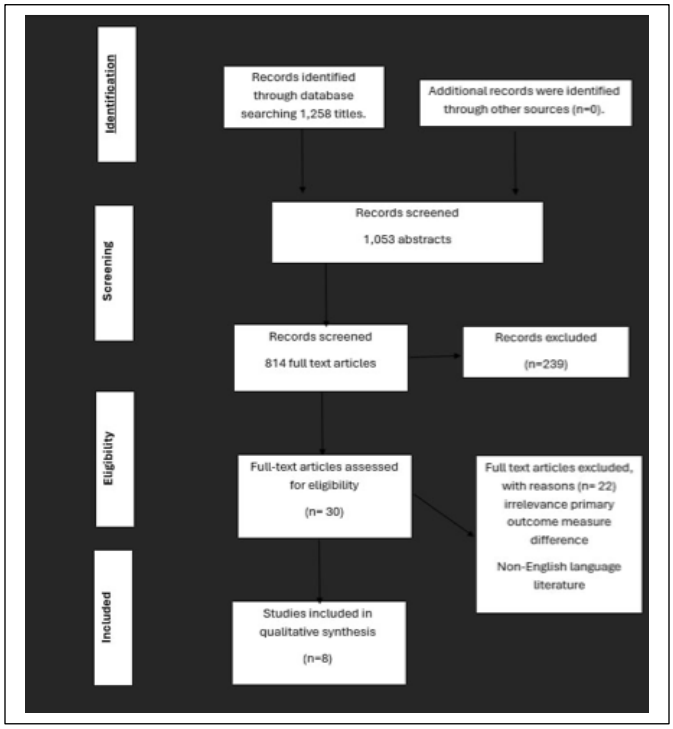

Figure 1. PRISMA ScR flow diagram.

though it may offer less comprehensive diagnostic information compared to DN4.

PainDETECT provides a detailed assessment of pain characteristics to distinguish neuropathic pain from other pain types. Its high sensitivity makes it particularly useful for screening purposes, although variability in specificity suggests it may be prone to false positives.

NPQ offers a holistic assessment by addressing both sensory and emotional aspects of neuropathic pain. With fewer RCTs available, its full potential and practical applicability in clinical settings remain less established compared to the other tools.

1.Diagnostic Accuracy and Psychometric Properties:

- DN4- tool has been consistently shown to have high sensitivity and specificity in diagnosing neuropathic pain. Its reliability and validity have been well-established.
- LANSS- LANSS also showed strong diagnostic performance, with good sensitivity and specificity. It has been validated in various clinical settings and is considered effective for differentiating neuropathic pain from other pain types.
- PainDETECT- It proved to be a valuable tool for screening neuropathic pain, with high sensitivity. Its applicability in both specialised pain clinics and general practice settings underscores its versatility.
- NPQ- NPQ was less frequently studied. It effectively captured both sensory and emotional aspects of pain.

2.Clinical Utility:

- Impact on Treatment Decision- The tools reviewed have demonstrated varying impacts on clinical decision-making. DN4, LANSS and PainDETECT have been shown to guide treatment decisions effectively, leading to appropriate management of neuropathic pain. NPQ's comprehensive assessment may contribute to more nuanced treatment plans.
- Integration into clinical practice- DN4, LANSS, and PainDETECT have been successfully integrated into clinical workflows, demonstrating their ease of use and acceptance by clinicians. NPQ's integration is promising but less documented in the literature.

3.Patient Outcomes:

- Pain Intensity and Relief- All tools, including DN4, LANSS, PainDETECT and NPQ, have been associated with improvements in pain management and relief. Their ability to accurately identify neuropathic pain contributes to more targeted and effective treatments.
- Quality of life: The assessment tools have had a positive impact on patients' quality of life by improving the accuracy of pain diagnosis and management. However, the extent of this impact varies and warrants further exploration.

Limitations

The studies varied in sample sizes, clinical settings, and patient demographics, which can affect the generalizability of the findings. The NPQ had fewer RCTs available, which limits the strength of evidence for this tool compared to others. More research is needed to fully evaluate its effectiveness and clinical utility. Differences in how outcomes are measured and reported across studies may influence the interpretation of findings.

Future Implications

Conducting more RCTs, especially for NPQ, to strengthen the evidence for its efficacy and clinical utility. Evaluating the long-term impact of these tools on patient outcomes and treatment effectiveness. Developing standardized outcome measures and improve comparability and reliability across studies.

Conclusion

This scoping review provides a comprehensive assessment of the psychometric properties and clinical utility for four widely used neuropathic pain assessment tools: DN4, LANSS, PainDETECT, and NPQ. The review underscores that DN4, LANSS and PainDETECT are reliable and valid tools with well established sensitivity and specificity for diagnosing neuropathic pain, making them highly suitable for routine clinical use. NPQ presents a more holistic approach by assessing both sensory and emotional aspects of neuropathic pain.

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