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Assessing neuropathic pain in patients with low back-related leg pain: Comparing the painDETECT Questionnaire with the 2016 NeuPSIG grading system

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Abstract

Background: Low back-related leg pain with nerve root involvement is conceptually regarded as a neuropathic condition. However, it is uncertain to what extent patients with this condition can be formally classified with neuropathic pain.
Method: First, we used the 2016 revision of the IASP Special Interest Group on Neuropathic Pain (NeuPSIG) grading system for neuropathic pain to grade patients suffering from low back-related leg pain and a corresponding disc herniation with either *unlikely, possible, probable* or *definite* neuropathic pain. Examination included bedside quantitative sensory testing. Next, we used the clinical classification based on the 2016 NeuPSIG grading system as a reference standard to assess the ability of the painDETECT Questionnaire to identify patients with neuropathic pain.
Results: Of the 50 included patients, six (12%) fulfilled the clinical classification criteria for *probable* and 44 (88%) for *definite* neuropathic pain, while none were graded *unlikely* or *possible*. According to painDETECT, 23 patients (46%) were classified with *unlikely* neuropathic pain, 18 patients (36%) had an *uncertain* condition and in nine patients (18%) neuropathic pain was *likely*. Among the 44 patients graded as having *definite* neuropathic pain by the clinical classification, eight were classified as *likely* neuropathic pain by painDETECT, resulting in an agreement of 18%. Of these 44 patients graded with *definite* neuropathic pain, painDETECT classified 21 patients (48%) as *unlikely* and 15 (34%) as *uncertain*.
Conclusion: Our results do not support the use of painDETECT as a screening tool to classify or grade neuropathic components in patients with low back-related leg pain.
Significance: The painDETECT Questionnaire performed poorly at detecting neuropathic pain among patients with low back-related leg pain, compared to clinical examination based on the 2016 NeuPSIG grading system as a reference standard. Our results do not support the use of painDETECT as a screening tool to classify or grade neuropathic components in this population.

1. Introduction

A major cause of low back-related leg pain is lumbar intervertebral disc herniation with nerve root involvement (Porchet et al., 2002). In addition to the possible mechanical effects on the nerve root or dorsal root ganglion, molecular factors related to the herniated nucleus pulposus and local immune reaction are associated with root dysfunction and symptoms (Takahashi et al., 2003; Dilley et al., 2005; Mulleman et al., 2006). A causal association between symptoms and disc herniation confirmed by imaging is generally assumed when pain radiates to the leg in a neuroanatomically plausible distribution.

The International Association for the Study of Pain (IASP) defines neuropathic pain (NP) as 'pain initiated or caused by a primary lesion or dysfunction in the nervous system' (Jensen et al., 2011; IASP, 2012). The IASP Special Interest Group on NP (NeuPSIG) has developed a grading system to guide decisions with four levels of certainty with which NP can be determined: *unlikely*, *possible*, *probable* and *definite* NP (Treede et al., 2008). The grading system was revised in 2016 (Finnerup et al., 2016). The level of *possible* NP presupposes a history of a relevant neurological lesion and a pain distribution that is neuroanatomically plausible. The level of *probable* NP requires additional clinical findings, optimally the presence of negative sensory signs, confirmed by clinical examination or quantitative sensory testing. Lastly, the level of *definite* NP requires all of the above plus an objective diagnostic test, such as magnetic resonance imaging (MRI), confirming a neural lesion or disease.

Painful radiculopathy, defined as objective loss of sensory and/or motor function as a result of conduction block in axons of a spinal nerve or its roots (IASP, 2012), is acknowledged as an NP condition (Finnerup et al., 2016). It is unknown to what extent this population can be graded with *definite* NP using clinical classification based on the 2016 NeuPSIG grading system.

The painDETECT Questionnaire was developed specifically for back pain as a patient-reported outcome measure to detect NP without clinical examination and has been used extensively in both secondary and tertiary care (Freynhagen et al., 2006, 2016). The questionnaire includes one item about the presence of radiating pain, one item about pain course pattern and seven items on sensory symptoms. Total score ranges from −1 to 38 points. The authors have suggested that scores of ≤12 indicate *unlikely*, 13–18 *uncertain* and ≥19 *likely* presence of NP. A *likely* neuropathic component was reported in 16–68% of patients with low back-related leg pain (Morsø et al., 2011; Uher and Bob, 2013; Baron et al., 2017; Mathieson et al., 2017), and in 12–38% of patients with low back pain only (Freynhagen et al., 2006, 2016; Schmidt et al., 2009; Förster et al., 2013; O'Sullivan et al., 2014; Hiyama et al., 2015; Reimer et al., 2017).

However, it remains an unresolved issue, if questionnaires without an additional examination or objective measures, can classify NP accurately (Hansson and Haanpää, 2007; Cruccu and Truini, 2009). Thus, in this study, we compared the painDETECT Questionnaire with the 2016 NeuPSIG grading system as a reference standard, in patients with low back-related leg pain and a corresponding disc herniation.

2. Methods

2.1 Setting

Data from the present study were part of a prospective, one-year observational study on prognostic factors in patients with low back-related leg pain referred to a secondary health-care back clinic at the Østfold Hospital Trust, Norway. Inclusion criteria were patients aged 18–65 years, low back-related leg pain with a corresponding lumbar disc herniation at the relevant side and level confirmed by MRI. Imaging was interpreted and described by an external radiologist as part of the standard procedure prior to the consultation. The radiologist's written report and the images were evaluated by the treating physician and physiotherapist as part of the clinical evaluation and diagnostic procedure. Exclusion criteria were cauda equina syndrome, ongoing infection, suspected malignancy, pregnancy, breastfeeding, other illness interfering with the study purpose, such as diabetes-neuropathy, inflammatory disease or spinal stenosis, prior herniation surgery at the same disc level or any lumbar fusion, or poor Norwegian language skills.

2.2 Patients

This study cohort consisted of the first 50 consecutively recruited patients who agreed to undergo a comprehensive clinical examination. The sample size of 50 was chosen pragmatically and specified prior to data collection. All patients received written information and signed an informed consent form. The study was approved by the Norwegian Regional Committee for Medical Research Ethics.

2.3 Patient-reported outcome measures

The painDETECT Questionnaire (Freynhagen et al., 2006) was administered using the Norwegian version, which has been translated through Mapi Research Trust (Mapi Research Trust) with support from Pfizer AS. No validation or reliability study of the Norwegian version has been published.

Pain intensity was assessed using separate numeric rating scales (0–10) for low back pain and leg pain during the last week, with anchors *no pain* (0) to *worst thinkable pain* (10). Pain medication use was measured by self-reported frequency and is presented here as daily, weekly or monthly/no use. From the questionnaire data, we combined the categories monthly and no use, and daily and several times daily.

Anxiety and depression were assessed using the Hopkins Symptom Checklist-25 (HSCL-25; Hesbacher et al., 1980), a shortened version of the HSCL questionnaire (Derogatis et al., 1974), which includes 10 items to assess anxiety (HSCL-25 Anxiety) and 15 items to assess depression (HSCL-25 Depression). Each item has four response categories ranging from *not at all* (1) to *extremely* (4), referring to symptoms during the previous week. The score is calculated as the mean of the completed items. An average item score of ≥1.75 was found to be a good predictor of current help-seeking behaviour in a Norwegian epidemiological study and is commonly used to define cases with emotional distress (Nettelbladt et al., 1993). In Norwegian population studies, 14–20% of women and 8–9% of men report values ≥1.75 (Sandanger et al., 1999; Rognerud et al., 2002).

Functional status was assessed using the Oswestry disability index (ODI), a self-report measure for back pain (Baker et al., 1989; Grotle et al., 2003). ODI assess 10 areas of pain and daily activities (pain intensity, personal hygiene, lifting, walking, sitting, standing, sleeping, sexual activity, social activity and travelling) with a total score range of 0–100. A higher score indicates greater disability.

All questionnaires were completed after the clinical examination in a separate room or hallway. The patients were instructed to complete the forms on paper, without any involvement from the clinicians, but were given the opportunity to ask for help if needed.

2.4 Clinical assessment

All patients were initially examined with a routine clinical assessment, including a general back-pain orientated neurological assessment, including muscular function, deep tendon reflexes and presence and outline of sensory abnormalities (to light touch with cotton, pinprick, warm and cold temperature), and neurodynamic tests such as the straight leg raise test and slump test. All findings were recorded in a study form and sensory abnormalities in the lower back and lower extremities were noted and drawn on a standardized body chart.

Patients were further assessed with a bedside-derived quantitative sensory examination in the most painful area (Walk et al., 2009; Finnerup et al., 2016), including response to static and dynamic light tactile pressure and touch, pinprick, vibration, warm and cold, and sensory threshold to punctate tactile stimulation. The examination started with a demonstration of the test procedure on the patients' arm followed by testing the most painful area compared to a homologous contralateral reference site, with two repetitions.

Dynamic light tactile touch was assessed with three strokes over 2–3 cm using a SENSELab Brush-05 (Somedic SenseLab AB, Sösdala, Sweden). Static pressure was assessed using the blunt side of the brush with just enough pressure to indent the skin. Pinprick was assessed using a spring-loaded needle device with approximately 40 g of pressure (Neuropen NT0100; Owen Mumford, Woodstock, Oxfordshire,UK) applied four times. Response to warm and cold temperatures was assessed using a thermal sensory testing device that preheated steel rollers to temperatures at 25 °C and 40 °C, which were rolled slowly with minimal pressure (Rolltemp, Somedic SenseLab AB, Sweden). Grading of these tests was performed subjectively by the patient in relation to the corresponding contralateral side and scored as no sensation, decreased, normal or increased sensation. If pain was elicited by the tests, a verbal pain rating scale (0–10) was scored. Pain to pinprick was noted only if the patient subjectively felt pain distinctly more pronounced in the pain area. In case of inconsistency between the two repetitions of each test (one normal and one abnormal response), the results were coded as a normal response.

The Sensory detection threshold was tested with Semmes-Weinstein type monofilaments (SENSELab Aesthesiometer, Somedic SenseLab AB, Sösdala, Sweden) with varying nominal force and thickness ranging from 2.55 mN (0.026 g/0.14 mm) to 1078 mN (110 g/1.01 mm). The threshold was established with three series of ascending and descending stimulus intensities, followed by

confirmation test with the nearest softer filament. The result was coded with the mean value.

Vibration detection threshold was assessed using a Rydel-Seiffer 64 Hz graduated (8/8 scale) tuning fork (Medicon, Tuttlingen, Germany). The threshold was established by the patients' immediate report when the perceived vibration sensation disappeared. Testing was performed both in the painful area and on a bony prominence if they did not overlap. The choice of bony prominence was based on the suspected nerve root involvement and distribution of self-reported pain and sensory changes (e.g. the medial bony prominence of the big toe in cases with suspected L5 radiculopathies). The result was coded with the mean value of two repetitions.

All patients were examined by the same physiotherapist (first author, EH). The physiotherapist did not have access to the patient-reported outcome measure during the consultation.

2.5 Classification according to the 2016 NeuPSIG grading system

Patient interviews and clinical examination charts were used to classify patients with *unlikely*, *possible*, *probable* or *definite* NP according to the 2016 NeuPSIG grading system (Finnerup et al., 2016). The grading procedure is summarized in a flow chart (Fig. 1). Patients were classified with a negative sensory sign if the assessment indicated partial or complete sensory loss. Loss to static or dynamic light tactile pressure and touch, pinprick, warm or cold were scored by a subjective report of either no or decreased sensation. For sensory detection threshold, the value

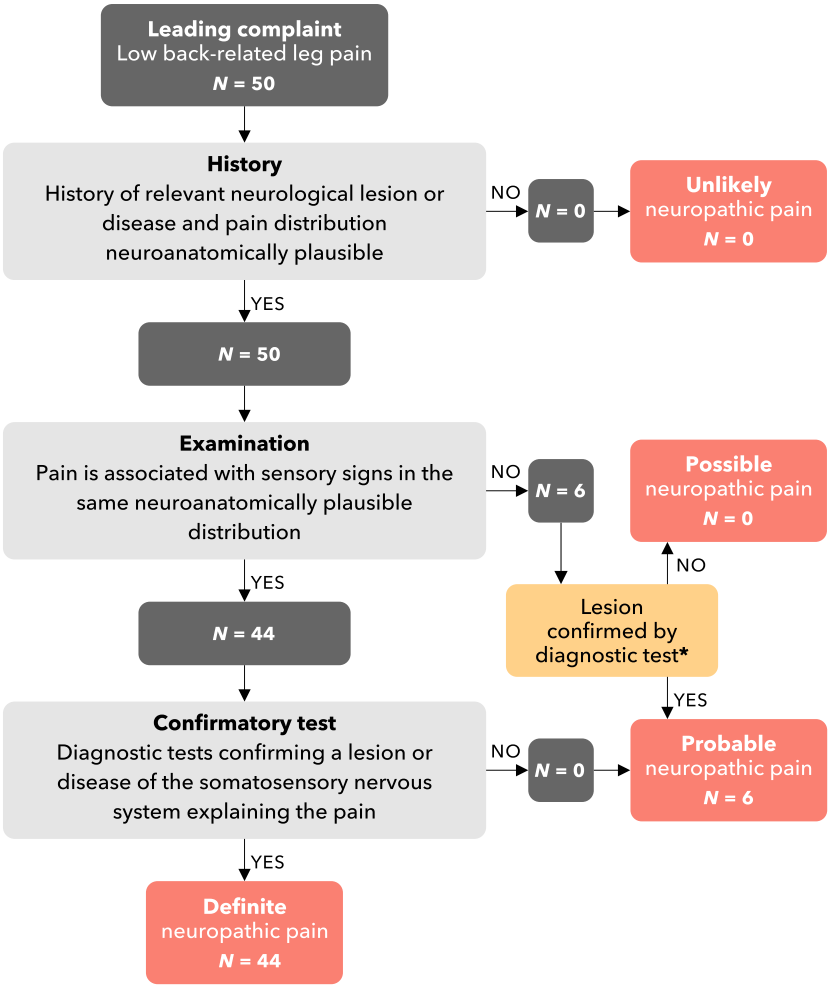

Figure 1 Flow chart summarizing the procedure for grading neuropathic pain in the present study, based on the 2016 NeuPSIG grading system. *No sensory signs could be demonstrated in these six patients, but all had pain in a distribution consistent with the innervation territory of a nerve root, supported by an MRI confirmed disc herniation at the appropriate level. These patients where therefore graded with *probable* NP.

corresponding to the recorded monofilament force was used, and as recommended by Rolke et al. (2006), the sensory threshold to punctate tactile stimulation values was log-transformed (base 10). For vibration detection threshold, the value corresponding to the tuning fork 8/8 scale was used. For both sensory and vibration threshold, values below 2 standard deviations (SD) of the individual's own reference control area test were classified as a negative sensory sign (Backonja et al., 2013). The calculations were performed by the first author (EH).

For those not graded with *probable* NP by the above approach, the patient data and clinician drawn body charts were reviewed manually by two of the authors (EH and LG) for sensory abnormalities, both negative or positive (hyperalgesia, allodynia), outside the main pain area. Since positive sensory signs carry less weight towards NP probability (Finnerup et al., 2016), we required distinct signs from more than one modality and supporting evidence for radiculopathies, such as corresponding reflex or myotomal muscle weakness, to grade *probable* NP based on positive sensory signs. Only signs or symptoms from strictly neuroanatomically plausible distributions were used. The results were based on the two authors' consensus.

The grading of *definite* NP was based on MRI, demonstrating a lumbar disc herniation corresponding to clinical signs and symptoms, which was present in all patients.

As stated by Finnerup et al. (2016, Fig. 2 legend), in cases where sensory signs may be difficult to demonstrate although the nature of the lesion is confirmed by a diagnostic test, the level of *probable* continues to be appropriate. Patients graded with *possible* NP after completing the above procedures were therefore graded with *probable* NP based on their MRI confirmed lesion.

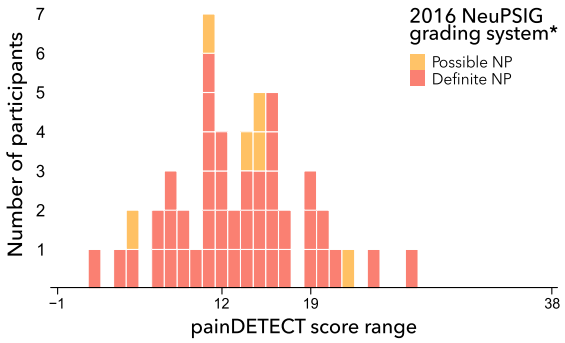

Figure 2 The frequency of patients' painDETECT scores coloured according to the 2016 NeuPSIG grading system. *No patients were graded with *unlikely* or *possible* neuropathic pain by the clinician.

2.6 Analyses

The ability of painDETECT to identify patients with NP using the 2016 NeuPSIG grading system as a reference standard was assessed by calculating the proportions of agreement between the two tools. The painDETECT categories *unlikely*, *uncertain* and *likely* NP were compared against the 2016 NeuPSIG grading system categories *unlikely*, *possible*, *probable* and *definite* NP. Further, we calculated the proportion of disagreement between the painDETECT category *unlikely* and the 2016 NeuPSIG grading system *definite*. The proportions of agreement/disagreement were calculated as a percentage with 95% confidence intervals (Newcombe, 1998).

All analyses were performed in RStudio v1.0.136 (RStudio Team, 2016)/R version 3.3.2 (R Core Team, 2017), with the package 'tidyverse' v1.1.1 (Wickham, 2017a) and 'forcats' v0.2.0 (Wickham, 2017b).

3. Results

3.1 Patients

Fifty patients, 17 females and 33 males, with a mean age of 42.8 (SD 8.9) years, were included in the study. Except for one male, aged 53, none reported prior lower back surgery. The mean HSCL-25 and ODI scores were 1.42 (SD 0.3) and 41.1 (SD 15.7), respectively. Four females (24%) and four males (12%) had HSCL-25 scores ≥1.75. Patient characteristics are presented in Table 1.

3.2 Grading of neuropathic pain

The grading procedure according to the 2016 NeuPSIG grading system is summarized in Fig. 1. All 50 patients fulfilled the criteria for *possible* NP, based on the distribution and description of pain and sensory disturbances. Forty-four patients (88%) fulfilled criteria for *probable* NP, based on negative sensory signs found by the bedside-derived quantitative sensory examination (n = 36, 72%) or distinct negative or positive sensory signs in the pain area of their leg corresponding to a single root radiculopathy as assessed by manual review of the body charts (n = 8, 16%). These patients were further graded with *definite* NP, based on MRI confirmed lumbar intervertebral disc herniation with nerve root involvement corresponding to signs and symptoms. The remaining six patients (12%), in whom sensory signs could not

Table 1 Patient characteristics.

	Grading of neuropathic pain according to the 2016 NeuPSIG grading system		
	Probable NP (n = 6)	Definite NP (n = 44)	Total (N = 50)
Age (years; mean, SD)	45.5 (10.4)	42.4 (8.7)	42.8 (8.9)
Females, n (%)	1 (16.7%)	16 (36.4%)	17 (34%)
Duration (weeks; median, IQR)			
Low back pain[a]	25 (12–40) (n = 6)	11 (2–33) (n = 41)	12 (2–34) (n = 47)
Leg pain	19 (12–26)	11 (7–22)	12 (7–22)
Pain intensity (0–10; mean, SD)			
Low back pain	5.2 (2.6)	4.9 (2.9)	4.9 (2.9)
Leg pain	8.0 (0.6)	6.6 (1.9)	6.8 (1.8)
Main pain area, n (%)			
Leg	6 (100%)	38 (86.4%)	44 (88%)
Back	0 (0%)	3 (6.8%)	3 (6%)
Back and leg	0 (0%)	3 (6.8%)	3 (6%)
Most distal pain radiation, n (%)			
Knee	0 (0%)	3 (6.8%)	3 (6%)
Upper calf	2 (33.3%)	2 (4.6%)	4 (8%)
Lower calf/ankle	2 (33.3%)	20 (45.5%)	22 (44%)
Foot	2 (33.3%)	19 (43.2%)	21 (42%)
Pain medication, n (%)			
Daily	4 (66.7%)	34 (77.3%)	38 (76%)
Weekly	1 (16.7%)	4 (9.1%)	5 (10%)
Monthly or no use	1 (16.7%)	6 (13.6%)	7 (14%)
Anxiety and depression (HSCL-25)[b] (0–4; mean, SD)	1.28 (0.2)	1.44 (0.4)	1.42 (0.3)
HSCL-25 scores ≥1.75, n (%)	0 (0%)	8 (18.2%)	8 (16%)
Oswestry disability index (0–100; mean, SD)	33 (5.3)	42.2 (16.3)	41.1 (15.7)
painDETECT Questionnaire (−1 to 38; mean, SD)	13.7 (5.6)	13.4 (5.2)	13.4 (5.2)
Muscle weakness, n (%)[c]	4 (66.7%)	28 (63.6%)	32 (64%)
Reflex loss or absence, n (%)[c]	1 (16.7%)	24 (54.6%)	25 (50%)
Presence of negative sensory signs within the main pain area, n (%)[d]	0 (0%)	36 (81.8%)	36 (72%)
Static tactile pressure		23 (52.3%)	23 (46%)
Dynamic tactile touch		15 (34.1%)	15 (30%)
Pinprick		21 (47.7%)	21 (42%)
Warm (40 °C)		17 (38.6%)	17 (34%)
Cold (25 °C)		18 (40.9%)	18 (36%)
Sensory threshold detection		4 (9.1%)	4 (8%)
Vibration		15 (34.1%)	15 (30%)
Any presence of sensory abnormalities, n (%)[e]	0 (0%)	8 (18.2%)	8 (16%)
Level of disc herniation			
L3/L4	1 (16.7%)	2 (4.6%)	3 (6%)
L4/L5	3 (50%)	13 (29.6%)	16 (32%)
L5/sacrum	2 (33.3%)	28 (63.6%)	30 (60%)
Uncertain (two levels possible)	0 (0%)	1 (2.3%)	1 (2%)

[a]Eleven patients without present low back pain were not included in calculations regarding low back pain.
[b]Hopkins symptom checklist-25.
[c]Numbers represent only clinical findings consistent with the suspected nerve root lesion.
[d]Based on data from the bedside-derived quantitative sensory examination.
[e]Based on data from the general back-pain oriented neurological examination not restricted to the main pain area, comprising both negative and positive sensory findings within a neuroanatomically plausible distribution.

be demonstrated, were graded with *probable* NP based on an MRI confirmed lesion.

Twenty-three patients (46%) had painDETECT scores indicating *unlikely* NP component, 18 patients (36%) were classified as *uncertain,* and nine patients (18%) as *likely*. The painDETECT scores according to the 2016 NeuPSIG grading system is shown in Fig. 2, indicating normally distributed responses. The mean (SD) painDETECT score for those graded with *probable* and *definite* by the 2016 NeuPSIG grading system

was 13.7 (5.6) and 13.4 (5.2), respectively. The frequency of painDETECT descriptors used by the patients is presented in Table 2. There were less than 2% missing entries in the painDETECT Questionnaire data.

3.3 Agreement between painDETECT and the 2016 NeuPSIG grading system

Among the 44 patients graded as *definite* NP by the 2016 NeuPSIG grading system, eight were classified as *likely* NP by painDETECT, resulting in an agreement of 18.2% (CI 8.7–33.2%), see Table 3. Of the 44 patients who according to the 2016 NeuPSIG grading system were graded with *definite* NP, 21 patients (47.7% [CI 32.7–63.1%]) were classified as *unlikely* by painDETECT and 15 patients (34.1% [CI 20.9–50%]) as *uncertain*. Six patients were graded by the 2016 NeuPSIG grading system as *probable*, and of these painDETECT classified one as *likely*, three as *uncertain* and two as *unlikely*. No patients were graded by the 2016 NeuPSIG grading system with *unlikely* or *possible* NP.

4. Discussion

In this study, 12% of the patients were graded with *probable* NP according to the 2016 NeuPSIG grading system, and 88% were graded with *definite* NP. The strict selection criteria entailed a high likelihood of NP, and the fact that all patients fulfilled the criteria for *probable* was as expected. In contrast, painDETECT classified 46% as unlikely, 36% as *uncertain* and only 18% as *likely*. Using the clinical classification based on the 2016 NeuPSIG grading system as a reference standard, painDETECT generally failed to detect patients with NP in this sample. Further, of those 23 patients classified by painDETECT with an *unlikely* neuropathic pain component, all but two were graded with *definite* NP based on clinical classification. Thus, our results do not support the use of painDETECT as a screening tool to classify or grade neuropathic components in patients with low back-related leg pain.

Epping et al. (2017), using the previous 2008 NeuPSIG grading system (Treede et al., 2008) as reference standard, reported a mean (SD) painDETECT score of 13.3 (6.7) in the *definite* NP group as compared to 11.6 (5.6) in a *non*-NP group. Their study included 46 patients with clinically suspected lumbar radiculopathy, and the patients were split into two groups, a *definite* NP group (41.3%) and a *non*-NP group (58.7%) consisting of those who were graded *unlikely*, *possible* and *probable*. Our results substantiate this finding, as the mean painDETECT score in the 2016 NeuPSIG grading system *definite* group in the present study did not differ from the score in the *probable* group, even though our inclusion criteria might increase the likelihood of selecting patients with NP. However, the number of patients in the *probable* group did only include six subjects.

In a study including several pain conditions, seven of 34 patients with a clinical diagnosis of radiculopathy were classified with *likely* NP by painDETECT (De Andrés et al., 2012). In another cohort of 66 in-patients with a diagnosis of sciatica and MRI confirmed disc herniation, 44% were classified by painDETECT with *likely* NP (Uher and Bob, 2013). In a trial performed in primary health care, Mathieson et al. (2017) reported that 28% of 209 patients with a clinical diagnosis of sciatica were classified with

Table 2 painDETECT responses: Pain course pattern and symptom descriptors.

Number of patients with selected painDETECT pain course pattern, *n* (%)[a]	
Persistent pain with slight fluctuations	20 (40%)
Persistent pain with pain attacks	17 (34%)
Pain attacks without pain between	6 (12%)
Pain attacks with pain between	6 (12%)

Number of patients with painDETECT scores ≥3 and ≥4 on single symptom descriptors, *n* (%)[b]	Score ≥3	Score ≥4
Burning sensation	13 (26%)	4 (8%)
Tingling or prickling sensation	25 (50%)	16 (32%)
Pain to light touch	7 (14%)	3 (6%)
Sudden pain attacks	27 (54%)	18 (36%)
Cold or heat occasionally painful	4 (8%)	3 (6%)
Numbness sensation	28 (56%)	17 (34%)
Pain triggered by slight pressure	15 (30%)	7 (14%)

[a]One patient did not complete this question.
[b]Scores represent 3 = moderately, 4 = strongly and 5 = very strongly.

Table 3 Agreement between painDETECT classification and clinical classification based on the 2016 NeuPSIG grading system.

	2016 NeuPSIG grading system				
	Definite NP	Probable NP	Possible NP	Unlikely NP	Total
painDETECT					
Likely NP	8	1	0	0	9
Uncertain	15	3	0	0	18
Unlikely NP	21	2	0	0	23
Total	44	6	0	0	50

Cell counts represents number of patients. NP, neuropathic pain.

likely NP by painDETECT. Imaging was not a requisite for inclusion in that study, but there was a requirement for at least 4 on a scale from 1 to 6 for *leg pain intensity* or 3 on a scale from 1 to 5 for *leg pain interference in daily activities*. This may in part explain the difference compared to our results, as higher pain intensity scores have been associated with higher painDETECT scores in several studies (Freynhagen et al., 2006; Beith et al., 2011; Morsø et al., 2011; Spahr et al., 2017). Further, Gierthmühlen et al. (2017) reported that six of 19 low back pain patients with a clinical diagnosis of radiculopathy and compatible MRI findings were classified with *likely* NP by painDETECT. However, none of these studies did a formal comparison of painDETECT using a reference standard, as in the present study.

The large discrepancy in the results between the two tools in the present study may have several explanations. The most prominent difference may be their means of discerning sensory loss phenomenon. Sensory changes are generally regarded as the hallmark for NP, and the new NeuPSIG grading system emphasizes the importance of uncovering sensory loss (Finnerup et al., 2016). However, painDETECT has only one item to assess this dimension ('Do you suffer from a sensation of numbness in the areas that you marked?'). Furthermore, the numbness has to be experienced as problematic, which the wording 'suffer' might imply. In a previous study, Vollert et al. (2016) did not find the overall painDETECT score related to the presence or absence of sensory loss as determined by quantitative sensory testing in a mixed cohort of participants with NP.

In the present study, we used a bedside sensory assessment to investigate sensory loss. To fully evaluate sensory abnormalities, including subclinical sensory deficits, detailed quantitative sensory testing is recommended (Freynhagen et al., 2008; Haanpää et al., 2011). Our finding that 28% had no detectable sensory loss in the main pain area is in line with Vollert et al. (2016) who by quantitative sensory testing found that 30% of patients with radiculopathy had no loss to mechanical or thermal stimuli. The use of bedside sensory procedures to improve quality of clinical assessment has been recommended (Walk et al., 2009; Backonja et al., 2013; Birklein and Sommer, 2013; Cruz-Almeida and Fillingim, 2014; Finnerup et al., 2016) and our results suggest that bedside testing is sufficient to establish the level of *probable* NP according to the 2016 NeuPSIG grading system in this population. With the addition of an objective diagnostic test, such as MRI, the clinical inclusion criteria used in the current study seems to be sufficient to establish a sample consisting of patients with NP components.

It has been questioned if symptom descriptors used in self-report measures are sensitive and specific enough to be discriminatory for NP (Rasmussen et al., 2004; Hansson and Haanpää, 2007). Similar pain descriptors as used in painDETECT have been frequently found in cases generally considered as non-neuropathic. For instance, Bouhassira et al. (2005) found that 30% of patients diagnosed with osteoarthritis, inflammatory arthropathies or mechanical low back pain reported *burning* and *numbness,* more than 15% reported *electric shocks*, *tingling* or *pins and needles*, and 10% reported *painful cold*. In another study including patients diagnosed with neuropathic or non-NP, sensory descriptors from an early version of the Neuropathic Pain Questionnaire (Krause and Backonja, 2003) and the Neuropathic Pain Scale (Galer and Jensen, 1997) also overlapped between the two groups (Behrman et al., 2007). The authors concluded that the ability of these descriptors to classify NP were particularly inadequate for the radiculopathies.

It is possible that some of the abnormal sensory findings in the present study may have been caused by other mechanisms than conduction block in axons of a spinal nerve or its roots, such as nociceptive and inflammatory processes. Rasmussen et al. (2004) reported sensory abnormalities in 57.7% classified with *unlikely* NP by three neurologists based on history and bedside clinical examination. The corresponding proportions in those with *definite* and *possible* NP were 97.8% and 85.9%, respectively. Further, changes to mechanical and thermal sensation threshold have been associated with pain in rheumatoid arthritis and osteoarthritis (Hendiani et al., 2003; Wylde et al., 2012). Moreover, Freynhagen et al. (2008) detected subclinical distal sensory deficits in 15 low back pain patients without a dermatomal pain distribution or pain below the knee, and no motor or reflex abnormalities.

4.1 Limitations and strengths

The present population was small and selected from patients referred from primary to secondary health care and may not be representative of the average patient with low back-related leg pain. Thus, the present study has limitations regarding external validity. However, baseline characteristics were comparable with previous studies on patients with low back-related leg pain in secondary health care (Atlas et al., 2005; Weinstein et al., 2006; Haugen et al.,

2012). The patients were consecutively included through regular referral routines, and not through advertising or other channels. Thus, we believe the potential for selection bias due to the process of recruitment was low. One single examiner collected the data used for grading according to the 2016 NeuPSIG grading system, and the same person was involved in data analysis, which may introduce bias. However, the examiner was blinded to the painDETECT data during the data collection phase. Missing data on the painDETECT Questionnaire could potentially influence the classification; however, we found less than 2% missing entries. Further, no validation or reliability study of the Norwegian painDETECT version has been published. Moreover, the bedside examination could reflect normal side-to-side variability in some patients and increase the likelihood of false-positives (Treede and Baron, 2008). Contrary, there is also the possibility that we underreported the actual proportion of sensory loss, as all tests were subjectively compared to the contralateral reference area, and sensory changes can manifest in the asymptomatic side (Nygaard and Mellgren, 1998). Further, we cannot rule out that a more sensitive quantitative sensory assessment technique might have detected sensory signs in those six patients were no abnormalities could be ascertained by the bedside examination. Finally, we used the findings from the patients' own contralateral test area to calculate SD for comparing sensory and vibration detection thresholds. Findings of sensory loss would likely have been greater using a larger sample of reference tests.

5. Conclusion

In the present study, 50 patients with low back-related leg pain and an MRI confirmed disc herniation was examined by sensory testing and graded according to the 2016 NeuPSIG grading system. Six (12%) fulfilled the criterion for *probable* and 44 (88%) for *definite* NP using the 2016 NeuPSIG grading system. None were graded with *unlikely or possible*. Using the 2016 NeuPSIG grading system as a reference standard, the ability of the painDETECT Questionnaire to identify patients with neuropathic pain was very poor. Our results do not support the use of painDETECT as a screening tool to classify or grade neuropathic components in patients with low back-related leg pain. The present work warrants research using similar methods to assess whether other self-report measures are useful to classify NP in low back-related leg pain.

Author contributions

All authors were involved in conception and design of the study, interpretation of the data and revising the manuscript for its intellectual content. E.H. was responsible for practical acquisition of data. E.H. and L.G. drafted the manuscript. All authors have approved the submitted version.

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