

# Nocturnal neuropathic pain in diabetic patients may be caused by spinal stenosis

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Accepted 11 February 2005

## Abstract

**Background** Nocturnal exacerbation of neuropathic symptoms (NENS) is a recognized symptom of diabetic peripheral neuropathy (DPN). Symptoms are often worse in bed, may not be controlled with medication and disrupt sleep patterns. NENS can also be present in patients with spinal stenosis (SS), with or without concomitant peripheral neuropathy and may be related to sleep position. Extension position of the spine decreases the diameter of both the central canal and lateral recesses, which may compress or otherwise affect nerves controlling sensation from the feet and legs. Altering sleep position can reduce or eliminate symptoms. Modifications include sleeping in a recliner, with a pillow underneath the thighs if sleeping on the back, between the thighs if sleeping on the side, or under the stomach transversely if sleeping on the stomach. In addition, reducing nerve compression during the day by full-time use of a wheeled walker set to induce lumbosacral flexion may reduce NENS.

**Methods and results** Retrospective patient review identified patients presenting with DPN including NENS, who noted alteration of NENS by changing body position, who also had walking and standing limitations consistent with SS. They underwent 'positional testing', involving modification of sleep position, and full-time 3-day use of a rollator walker, which may reduce symptoms of SS. Most reported good or excellent improvement of NENS.

**Conclusions** NENS, especially if affected by body position, or if accompanying a pattern of walking limitation improved with wheeled support, should lead to suspicion of SS. Positional testing should be considered in possible cases. Clinical use and further investigation are indicated.

Diabet. Med. 22, 1763–1765 (2005)

**Keywords** spinal stenosis, diabetic neuropathy, peripheral neuropathy, nocturnal pain, walker

**Abbreviations** DPN, diabetic peripheral neuropathy; NCS, nerve conduction studies; NENS, nocturnal exacerbation of neuropathic symptoms; SS, spinal stenosis

## Introduction

Nocturnal exacerbation of neuropathic symptoms (NENS) is a recognized symptom of diabetic peripheral neuropathy

(DPN). Nocturnal symptoms involving pain and paresthesiae are often severe and can disrupt sleep patterns [1] and may or may not be well controlled with medication. NENS in the feet and/or legs and/or thighs can also be present in patients with lumbar spinal stenosis (SS), with or without concomitant peripheral neuropathy, and may be related to sleep position [2,3]. Investigations such as nerve conduction studies (NCS), electromyography studies and spinal imaging, may determine the presence of a medical condition, but may not determine if

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SS [4] or DPN [5] is the cause of individual symptoms, especially in patients with multiple conditions. The effect of spinal position on symptoms may clarify this diagnostic dilemma [6].

When the spine is in the extension position, the diameter of both the central spinal canal and lateral recesses is decreased [7]. This may possibly compress or otherwise affect the nerves controlling sensations to the lower extremities. In patients with SS, compression may cause or exacerbate symptoms such as paresthesiae, burning, shooting pain or aching in the feet, legs, or thighs. Flexion of the spine can reverse this effect. Altering sleep position may therefore reduce or eliminate NENS. Modifications include sleeping in a recliner [3] or in a similar position in an adjustable bed, or with a pillow underneath the thighs if sleeping on the back, or with a pillow between the thighs, in a fetal position, if sleeping on the side. In addition, reducing nerve compression during the day, which may be accomplished by use of a wheeled walker set to induce lumbosacral flexion, may reduce NENS. The exact walker height necessary to induce comfortable lumbosacral flexion must be used [6]. This approach has previously been reported to frequently improve or eliminate both lower extremity neuropathic symptoms and walking limitation caused by SS [3,6,8]. It has not been significantly helpful in our patients with arterial claudication, space occupying lesions such as herniated discs or spinal tumours, DPN, or demyelinating neuropathy, in the absence of SS.

## Patients and methods

The following numbers are not submitted to suggest that they present statistical relevance, but rather to support that this approach, which has been developed over 3.5 years, is based upon significant clinical experience. A 1-year record review of a single-handed private practice (in which over 300 new patients were seen for a primary concern of lower extremity neuropathic symptoms) identified 11 diabetic patients, with SS (confirmed by spinal imaging showing stenosis in areas corresponding to lower extremity symptoms), who reported moderate to severe NENS present on most nights for at least 3 months duration. Each patient also had symptoms causing standing and walking limitation consistent with neurogenic claudication (in the legs) or neurogenic positional pedal neuritis (in the feet) [3], relieved by sitting or lumbosacral flexion. None of the seven patients with a prior diagnosis of SS initially related their NENS to SS, rather presenting with peripheral neuropathy (PN) as the cause of their nocturnal symptoms. Three had NENS only in the feet, while the other eight also had NENS in the legs and/or thighs. Four reported NENS within 15 min of lying down, while in the others it usually appeared later in the night. Five of the eight patients who reported moderate to excellent improvement of NENS with positional testing also had DPN, with reduced neuropathic symptoms after treatment of SS.

All patients underwent 'positional testing'. This consists of both modification of sleep position (as described above), and full-time 3-day use of a 3- or 4-wheeled rollator walker whose handle height was set to induce slight lumbosacral flexion. Full-time use was generally maintained for 1 week in patients

with improvement. Patients then gradually reduced use to that required in their own judgement.

Success in the treated patients was classified based upon self-reported walking capabilities and subjective description of uncomfortable symptoms. Patients reported claudication distance prior to use and with use of the walker, and were classified as having excellent (over 400%), good (250–399%), moderate (100–249%) or poor (99% or less) improvement in uninterrupted walking distance. While improvement in both ambulation and pain is expected within 1–3 days, the claudication distance improvement considered is based upon walking capabilities after at least 2 weeks. Consistent improvement after 2 weeks was deemed necessary to document success, as claudication distance of SS patients is often inconsistent. Discomfort improvement (reported at or after the third day, but maintained with extensive use of the walker) was based upon overall pain reduction using a verbal analogue pain scale (1–3/10 = mild pain, 4–7/10 = moderate pain, 8–10/10 = severe pain), with improvement classified as excellent (75–100%), good (50–74%), moderate (25–49%), or poor (less than 24%) reduction in discomfort stemming from SS. Although these classifications are inexact, and based upon subjective criteria, when combined with the patient's expression of overall improvement of symptoms and activity level, they are felt to reflect the overall success of improvement with positional testing.

## Results

Five of the 11 patients (one of whom received an epidural steroid injection for spinal stenosis the same week) reported excellent improvement of NENS, one reported good improvement of NENS, and three reported moderate improvement of NENS. Two had no improvement; one had severe SS, and the other had both moderate SS and severe axonal and demyelinating peripheral neuropathy confirmed by NCS. Six of the eight patients who had good to excellent improvement in standing and walking capability, usually experienced in the first day, also reported good to excellent reduction in both nocturnal and daytime neuropathic symptoms. All patients successfully contacted at 3-month follow-up reported maintenance of improvement by long-term use, as necessary, of a walker and sleep position modification.

## Discussion

Within this notes review, we also identified six non-diabetic patients with confirmed SS, NENS, and similar symptoms with ambulation, five of whom who improved with positional testing. Seven additional diabetic and non-diabetic patients with similar symptoms reported satisfactory reduction of NENS with positional testing, but refused confirmatory spinal imaging, either because of insurance limitation, satisfaction with clinical improvement, or contraindication to invasive therapy. Some patients refused positional testing, either because of a failure to see immediate improvement in walking with use of a walker in our office, as is often reported, or because of emotional resistance to using a walker.

Clinical experience with these patients supports the observations that (i) SS is a possible cause of NENS in diabetic patients, (ii) many patients with SS and NENS also have standing and walking limitation caused by SS, which should be considered an essential point to question, (iii) positional testing may provide rapid improvement in lower extremity neuropathic symptoms caused by SS, (iv) a positive response to positional testing supports the diagnosis of SS contributing to symptoms, and is a good prognostic indicator of long-term success with a combination of sleep position modification and use of a walker as needed. Failure to improve with positional testing does not, however, negate the diagnosis of spinal stenosis.

Clinical use and further investigation of this approach are indicated.

### Competing interests

None declared.

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