

Review Article

# State of the science in diabetic foot: subjective screening vs. objective diabetic neuropathy examination in primary care

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## Summary

Among the conditioning factors of Diabetic Foot (DF), neuropathy is considered the main factor, arteriopathy the aggravating factor, and foot deformities the triggering factor. The preventive interventions for DF and its complications are distributed by levels of care. At the higher level, hospital care focuses on reducing DF amputations. At the lower level, Primary Care (PC) and Podiatry, focused on preventing DF. PC is considered the ideal place to identify the conditioning factors of DF. In this area, prevention follows the recommendations of the International Working Group on Diabetic Foot (IWGDF) by screening neuropathy focused on the sensitive or insensitive foot. The American Diabetes Association (ADA) recommends person-centered assessment of neuropathy by clinical examination of symptoms and signs testing sensory, motor, and autonomic neuropathy. This controversy led us to investigate which methodology (screening or clinical examination) could be more accurate in identifying the conditioning factors of DF in a group of people recruited in the TERMOPIEDI study. Neuropathy was assessed following the definition of diabetic neuropathy, the Young MJ diagnostic criteria, and the Toronto Council diagnostic category. These results allowed us to know the applicability of this procedure in PC within nursing competencies, detecting a greater number of patients with neuropathy compared to the screening method. People with neuropathy presented higher plantar temperature, concluding that neuropathy interferes with foot thermoregulation.

## Introduction

In relation to foot problems in people with Diabetes Mellitus (DM), there are two well-differentiated clinical situations. On one hand, Diabetic Foot (DF) when an ulcer is present is defined as “Total destruction of the layers of skin located between the malleoli and toes”. On the other hand, Foot at risk or patient at risk (RP), when in the absence of an active ulcer there is a probability of ulceration secondary to peripheral neuropathy, structural deformities of the foot or arterial disease, coexisting DM [1-3].

The DF continues to be an important health problem, limiting the quality of life of these people and generating a high social and health cost whose mortality can reach 55% 5 years after major amputation. Although a reduction in major amputations has been observed in recent years, there is still a trend of increased reulcerations and minor amputations [4-7].

The complex pathophysiology of DF is multifactorial, making it difficult to approach this health problem. Therefore, epidemiological studies are heterogeneous with great variability of results depending on the geographical area, population, and scope of the study [8]. All of these, the multidisciplinary approach to DF at the hospital level, the advances in the local treatment of DF, and the new technologies open a hopeful path to the prevention of DF and its complications [7,9,10]. However, the prevention of DF has not followed the same evolution in the field of Primary Care (PC).

Currently, the American Diabetes Association (ADA) and the International Diabetic Foot Work Group (IWGDF) emphasize prevention as the only way to reduce the incidence of DF and its complications, distributing preventive interventions by care levels. At the higher level, specialized care is located in the hospital environment, whose main objective is to reduce amputations due to DF. At the lower level, Primary Care (PC)

## More Information

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and Podiatric care focus on identifying RP and controlling foot disorders, respectively. PC is considered the ideal setting in which to identify RP among the population treated for DM and to establish selective interventions for multidisciplinary prevention of DF [1-3].

This responsibility can lead to a controversy between the recommendations of the main groups of experts. The IWGDF recommends screening for RP focused on the sensitive or insensitive foot through two subjective sensory tests (Pressure and Vibration) considering neuropathy as absent or severe, the ADA recommends the identification of person-centered neuropathy through physical examination including symptoms and objective signs of neuropathy related to fine and thick fiber innervation [1,2,11].

The IWGDF screening model is a powerful predictor of DF. However, it may be insufficient for the diagnostic categorization of diabetic neuropathy, which could mean an underestimation of this complication in PC. Considering that a person with neuropathy presents a n RP due to neuropathy and, in the case of DF, a neuropathic ulcer, the ADA recommendations allow us to know the pathophysiological characteristics of this complication and its clinical manifestations codified in the International Classification of Diseases (ICD) related to DM [1,2,11-13].

It is known that diabetic neuropathy reduces or cancels the patient's ability to respond to small injuries to the feet that can lead to ulceration and subsequent complications [12,14,15]. Evaluation of sensory peripheral neuropathy is based on the physiological responses of sensory neuronal receptors in the dermis that can be stimulated, through direct contact with the foot, by selective manual instruments Figure 1.

- 1: Semens Westein 5.07 monofilament (pressor sensitivity).
- 2: Thermal discriminator (cold, less cold) (Thermal sensitivity).
- 3: Rydel Scheifer ruled tuning fork (Vibratory sensitivity).
- 4: Blunt tip needle (Painful sensitivity).
- 5: Reflex hammer (Achilles, patellar reflexes).

Stimulation Neuronal fine fiber receptors respond to thermal stimuli through the terminal bulbs of Krause



Figure 1: Instrumented Peripheral Neuropathy Evaluation. Note: Use of applied instruments: Selective.

(cold) and corpuscles of Rufini (heat). The sensitivity Pain, recognized by stimulation of free nerve fibers, to this day it is not been tested in PC. Large fiber neuronal receptors sense vibratory stimulation via Meisner's corpuscles and pressor stimulation is detected via Pacini and corpuscles (2.12). In relation to symptomatology, the symptoms expressed as "Pain, Burning or Cramps" are related to alterations of the sensitive peripheral nerves of fine fiber, and those expressed as "numbing or tingling", to thick fiber [2,12,15-19].

Based on this knowledge and the importance of early identification of RP in PC [1-3], we carried out the TERMOPIEDI study [17,18] oriented to Knowing the plantar temperature variations associated with the conditioning factors of the DF. Neuropathy was assessed following the definition of diabetic neuropathy [1,2] the Young M] assessment model [15] and the Toronto Council diagnostic category [16]. The joint score of the scales of signs of disability (Neuropathy Disability Score) NDS and scale of symptomatic reduced NSS (Neuropathy Symptoms Score) [15], allowed us to apply for the maximum diagnostic category of neuropathy that can be assumed in CP as "Probability" [16].

The NDS scale is made up of two domains (sensory and motor). The sensory items assess thermal, pain (fine fiber) vibration (thick fiber) sensitivities. The motor item is sensed through the Achilles reflex. As a novelty in the TERMOPIEDI study [17,18], pressor sensitivity (thick fiber) was incorporated into the NDS scale reinforcing the sensitive domain and following the recommendations of both groups of experts to identify RP in PC. This procedure makes it possible to assess symptoms and signs of sensory neuropathy in relation to the type of nerve fiber involved, demonstrating that the quantitative neuropathy scoring system is a better predictor of DF than the separate screening method [19]. In addition, the NDS scale discriminates between the right and left foot which allows knowing the sensory evolution over time and establishing a differential diagnosis between other types of non-diabetic neuropathy. The joint score of the NDS

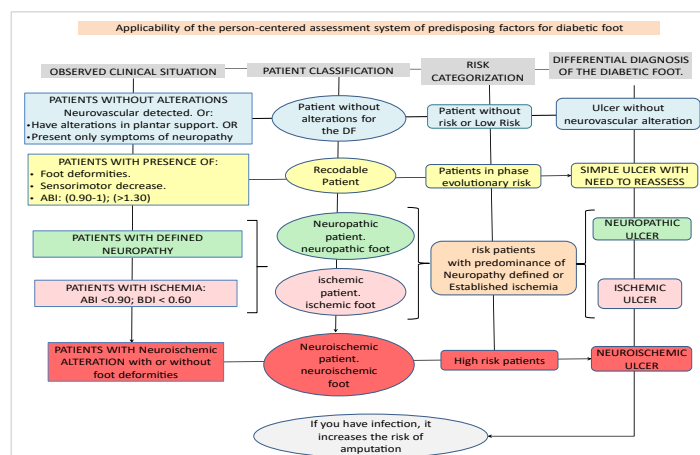


Figure 2: Algorithm of the clinical situations detected with the neurovascular assessment model of the TERMOPIEDI study. Note: Own elaboration. The neurovascular assessment model of the TERMOPIEDI study would allow an early diagnosis of the etiology of Diabetic Foot.



and NSS scales identifies different clinical manifestations of DM neuropathy, improving the categorization of risk and the etiological diagnosis of DF as shown in Figure 2.

The TERMOPIEDI [17,18], study, presented an objective evaluation model of conditioning factors for DF applicable in PC and manageable by Nursing. People with detected neuropathy presented a higher plantar temperature than people without this complication, associating neuropathy as a conditioning factor of foot thermoregulation. The TERMOPIEDI conclusions showed that the objective evaluation of RP detected neuropathy much better than the screening method.

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