

New Diagnostic Tools for Diabetic Polyneuropathy

This article was published in the following Scient Open Access Journal:

Journal of General and Emergency Medicine

Received : June 28, 2018; **Accepted** July 05, 2018; **Published** July 10, 2018

Theano Penlioglou and Nikolaos Papanas*

Diabetes Centre, Second Department of Internal Medicine, Democritus University of Thrace, University Hospital of Alexandroupolis, Greece

The commonest manifestation of diabetes in the nervous system is distal symmetrical sensorimotor polyneuropathy (or simply diabetic polyneuropathy, DPN) [1,2]. DPN may develop in both type 1 and type 2 diabetes mellitus, while recent evidence suggests that it may even be manifest during pre-diabetes [3]. DPN is associated with increased morbidity and is a main factor leading to diabetic foot lesions [4].

Thus, it is important to diagnose DPN early [1-4]. Diagnosis rests on clinical examination [1]. This should assess both large (reflexes, vibration, muscle strength) and small fibre function (temperature and pain sensation) [1]. To facilitate early identification of DPN, a number of diagnostic and screening tools have been introduced [5,6]. Among these, the indicator test Neuropad, the NC-stat/DPNCheck and VidraTip are very useful and will be herein discussed.

Neuropad

Neuropad is a new and simple diagnostic test that measures plantar sweat production based on a colour change [7]. The latter is based on absorption of water from sweat secretion by the blue anhydrous cobalt II salt, which changes to pink cobalt II salt with water [7]. Neuropad is a patch placed on a callus-free area on the plantar aspect of the foot, between the first and second metatarsal head [7]. A normal response is defined as complete bilateral colour change from blue to pink within 10 minutes after application [7]. Absent or incomplete colour change is abnormal [7]. Neuropad exhibits a high sensitivity (65.1-100%) and negative predictive value (NPV) (63-100%) against standardised clinical examination for DPN [7].

Alternatively, for research purposes, the complete time to colour change of Neuropad can be measured [8]. This is a measure of DPN severity [8]. A more recent research idea has been measurement of Neuropad's area changing colour over a specified period of time [9]. Other time thresholds (mainly 15 minutes) have been attempted as well, but they have not gained wide acceptance [7].

Importantly, abnormal Neuropad response is significantly and independently associated with diabetic foot ulceration [10]. It may also contribute to earlier detection of DPN in patients with normal clinical examination [11]. Its other advantages include: simplicity of application; contribution to patient education as a comprehensible visual test; high reproducibility; ability to be used by the patients themselves for self-examination at home [7,12,13].

NC-stat/DPNCheck

NC-stat/DPNCheck is a portable, non-invasive device for automated nerve conduction study (NCS) of the sural nerve [14,15]. This device is particularly simple, enabling its use by all health care professionals after minimal training [15]. The examination involves providing an electrical stimulus at the malleolar area and reading the result on the screen of the device, as recorded in the middle of the calf [14,15]. The device can only measure sensory nerve action potential and sensory nerve conduction velocity of the sural nerve [14,15]. Measurements have been shown to correlate with full NCS (gold standard) [16,17]. Interestingly, normal values of the 2 aforementioned NCS parameters can be used: in this way, DPN can be very simply and quickly categorised as present/absent [14]. This approach yields very high sensitivity (90.48%), specificity (86.11%) and specificity, 79.17% positive predictive value (PPV) and NPV (93.94%) against standardised clinical examination for DPN [14].

*Corresponding Author: Prof. Nikolaos Papanas, Diabetes Centre, Second Department of Internal Medicine, G. Kondyli 22c, Alexandroupolis 68100, Greece, Tel: +30 2551074713, Fax: +30 25510 74723, Email: papanasnikos@yahoo.gr

VibraTip

VibraTip is a new hand-held, battery-operated device evaluating vibration perception threshold on the hallux of the foot [18-20]. It has been shown to correlate well with the established 128 Hz tuning fork and Neurothesiometer [19]. Very high sensitivity (79-100%), specificity (82-97%) and NPV (85-100%) against various established clinical tests (tuning fork, monofilament, Neurothesiometer) have been reported [18-20]. Its additional advantages include the very small size (it can be placed in the physician's pocket), the low cost and the very easy use [18-20].

Conclusions

These 3 diagnostic tools for DPN are valuable for improved and quicker diagnosis of DPN. All of them are simple to use. Neuropad is also useful for patient education and self-examination. Arguably, their greatest advantage is the ability to exclude DPN by virtue of their high NPV. It is anticipated that they will be used more widely in the future [7,21].

Conflicts of Interest

This editorial was written independently. The authors did not receive financial or professional help with the preparation of the manuscript. NP has been an advisory board member of TrigoCare International, Abbott, AstraZeneca, Elpen, MSD, Novartis, Novo Nordisk, Sanofi-Aventis and Takeda; has participated in sponsored studies by Eli Lilly, MSD, Novo Nordisk, Novartis and Sanofi-Aventis; received honoraria as a speaker for AstraZeneca, Boehringer Ingelheim, Eli Lilly, Elpen, Galenica, MSD, Mylan, Novartis, Novo Nordisk, Pfizer, Sanofi-Aventis, Takeda and Vianex; and attended conferences sponsored by TrigoCare International, AstraZeneca, Boehringer Ingelheim, Eli Lilly, Novartis, Novo Nordisk, Pfizer and Sanofi-Aventis.

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