

New Diagnostic Tools for Diabetic Polyneuropathy

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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 93.94% NPV against standardised clinical examination for DPN [14].

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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

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