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RESEARCH LETTER

Validity of the Diabetic Neuropathy score and Diabetic Neuropathy Examination score as screening tools for the detection of distal symmetrical diabetic neuropathy

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Sri Lanka is a developing country in which one of five adults has either diabetes or prediabetes. Complications of diabetes, especially diabetic neuropathy, place a considerable burden on the country's health care system[1] and so there is a dire need for an easy to perform, cheap, and validated tool for the early detection of diabetic neuropathy among Sri Lankan patients.

Many validated scoring systems are available in Western countries for the screening of distal symmetrical diabetic neuropathy (DSPN), which accounts for 75% of all diabetic neuropathies,[2] with the two most common being the Diabetic Neuropathy Symptom (DNS) and Diabetic Neuropathy Examination (DNE) scores.[3,4] The DNS score incorporates information from four questions related to medical history. The maximum score is 4 points, with scores >1 considered abnormal. The DNE score is based on a hierarchical physical examination consisting of eight items. The maximum score is 16 and scores >3 are considered abnormal. However, we were unable to find a similar screening tool validated for the local Sri Lankan population. Thus, we undertook the present study to examine the clinical utility of the commonly used DNS and DNE scores for diagnosing diabetic neuropathy among our local population of diabetics.

Patients with diabetes attending medical clinics in the Teaching Hospital (Galle, Sri Lanka) were recruited to the study, which was approved by the Ethical Review Committee, Faculty of Medicine (University of Ruhuna, Galle). All participants provided informed consent. Demographic and disease-related data were collected using a pretest questionnaire. The DNS and DNE scores were obtained separately by two researchers who were blinded to the score obtained using the other tool. Both DNS and DNE scores were obtained as per the recommended guidelines.[3,4] The Semmes–Weinstein monofilament (SW-MF) and vibration perception threshold (VPT) determined using a biothesiometer were considered as reference standards for the detection of diabetic neuropathy. Both these tests were performed on the same as the DNS and DNE questionnaires by another medical officer who did not know the results of the DNS and DNE scores.

The SW-MF test was applied with 10 g pressure and standard "yes/no" responses. It was applied to five sites on each foot: plantar surface of the first toe, the plantar surfaces of the first, third, and fifth metatarsal heads, and the plantar surface of the heal.[5] The VPT was performed using a hand-held biothesiometer (Madras Engineering Services, Chennai, India). The VPT was determined over the dorsal aspect of the hallux on the interphalangeal joint. The voltage of the vibration was increased from 0 to 50 V until the patient perceived a vibration. The mean of three measurements was used as the value for each patient as was compared against age-adjusted reference values.[6] Values higher than the mean + 2 SD were considered abnormal.[6]

In all, 314 diabetic patients (98 men) were screened. The mean ($\pm$SD) age and duration of the disease were 62.0 $\pm$ 10.5 and 9.4 $\pm$ 5.3 years, respectively. The prevalence of neuropathy in the study population determined by the SW-MF and VPT tests was 49.5% and 89.6%, respectively. The sensitivity and specificity of the DNS and DNE scores in determining DSPN are given in Table 1.

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Table 1 Sensitivity, specificity, positive predictive value, and negative predictive value of the Diabetic Neuropathy Symptom and Diabetic Neuropathy Examination scores

Reference method	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Diabetic Neuropathy Symptom score				
SW-MF	76.3	68.6	71.3	73.9
VPT	57.0	88.9	98.8	11.5
Both	76.5	67.9	70.1	74.6
Diabetic Neuropathy Examination score				
SW-MF	98.7	41.2	63.1	96.9
VPT	83.9	88.9	99.2	25.8
Both	99.3	41.0	62.3	98.5

PPV, positive predictive value; NPV, negative predictive value; SW-MF, Semmes–Weinstein monofilament; VPT, vibration perception threshold; Both, satisfying both VPT and SW-MF definitions of neuropathy.

Table 2 Area under the curve for Diabetic Neuropathy Symptom and Diabetic Neuropathy Examination scores in determining distal symmetrical diabetic neuropathy

Neuropathy score	Reference method	AUC	95% CI	*P*
Diabetic Neuropathy Symptom score	SW-MF	0.725	0.67–0.78	<0.001
	VPT	0.779	0.72–0.83	
Diabetic Neuropathy Examination score	SW-MF	0.699	0.64–0.76	<0.001
	VPT	0.863	0.81–92	

SW-MF, Semmes–Weinstein monofilament; VPT, vibration perception threshold; AUC, area under the curve; 95% CI, 95% confidence interval.

Receiver operating characteristic analysis revealed that both DNS and DNE scores were able to discriminate individuals with DSPN (Table 2). The present study was designed to validate two easy-to-use diabetic neuropathy-screening scores compared with two standard methods of evaluating diabetic neuropathy. Both reference standards are semi-quantitative methods with proven predictive value for lower limb complications.[7] Mythili et al.[8] have proven that these scores are applicable to the Asians population.

We observed acceptable sensitivity values for both DNS and DNE scores (Table 1). Construct validity of DNS and DNE in relation to SW-MF and VPT tests have been evaluated by Meijer et al., who designed these two scores.[3,4] They found that the DNS had a sensitivity of 81% compared with the SW-MF and VPT tests and specificities of 56% and 58%, respectively.[3] Validation of the DNE by the same group against the SW-MF and VPT tests revealed high sensitivity (96% and 97%, respectively) but low specificity (51% and 59%, respectively).[4] The sensitivity and specificity we obtained for the DNS and DNE compared with the SW-MF and VPT test are similar to those reported by Meijer et al.[3,4]

In conclusion, we have demonstrated that the DNS and DNE scores, sensitive screening tools used in other countries, are able to screen for DSPN among diabetic patients and can thus be used effectively for screening the diabetic population in Sri Lanka.

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Disclosure

The authors declare they have no conflicts of interest.

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