

# Validation Of Neuropathy Symptoms Score (NSS) And Neuropathy Disability Score (NDS ) In The Clinical Diagnosis Of Peripheral Neuropathy In Middle Aged People With Diabetes

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## Abstract

Neuropathy is one of the most common long-term complication of diabetes which affects about 50% of diabetic patients. 1 Neuropathy is strongly associated with the duration and severity of hyperglycemia. Distal symmetrical polyneuropathy is the most common type of diabetic neuropathy and accounts for 75% of diabetic neuropathies. Painless paresthesia with impairment of vibration, joint position, touch and pressure sensations along with loss of ankle reflex is the characteristic feature of distal symmetrical polyneuropathy.2 Biothesiometer can quantify & pick up early cases of DPN & is an important diagnostic tool in clinical practice3. Principle is a vibrating probe, vibration amplitude can be changed by voltage adjustment. Biothesiometry is used in diagnosis of peripheral neuropathies with impaired vibratory perception threshold, mainly in diabetology and neurology.

## INTRODUCTION

Neuropathy is one of the most common long-term complication of diabetes which affects about 50% of diabetic patients. 1 Neuropathy is strongly associated with the duration and severity of hyperglycemia.

Distal symmetrical polyneuropathy is the most common type of diabetic neuropathy and accounts for 75% of diabetic neuropathies. Painless paresthesia with impairment of vibration, joint position, touch and pressure sensations along with loss of ankle reflex is the characteristic feature of distal symmetrical polyneuropathy.2

Biothesiometer can quantify & pick up early cases of DPN & is an important diagnostic tool in clinical practice3.

Principle is a vibrating probe, vibration amplitude can be changed by voltage adjustment. Biothesiometry is used in diagnosis of peripheral neuropathies with impaired vibratory perception threshold, mainly in diabetology and neurology.

Diagnosis

A crucial aspect of diagnosing diabetic neuropathy entails ruling out other etiologies for neuropathic pain 4

Diagnostic Criteria for Clinical Diagnosis of DPN

Young et al.5 criteria for clinical diagnosis of DPN (NSS + NDS Score > 8) can be used as bedside tool .

NSS (Neuropathy Symptoms Score) is burning, numbness or tingling, fatigue, cramping, aching, or nocturnal exacerbation & NDS (Neuropathy Disability Score) is calculated by ankle reflex, pinprick sensation, temperature sensation, vibration sense tested with tuning fork and monofilament test.

## AIMS & OBJECTIVES

This study was planned to validate the NSS+NDS as per "Young et al" criterion in clinical diagnosis with the standard well validated screening method of measuring vibration perception threshold (VPT) with a biothesiometer in middle aged people with Diabetes where foot care practices are scantily followed. Secondary aim of this study was to find co-association of DPN thus diagnosed (NSS+NDS Bed side evaluation ) with other diabetic complications

## RESEARCH DESIGN AND METHODS

855 Type-2 diabetes patients who got newly enrolled at

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“North Delhi Diabetes Centre,Rohini, New Delhi” between July 2011 to June 2012 were evaluated clinically by neuropathy symptom score (NSS) & Neuropathy Disability score (NDS) as suggested by “Young et al’5. Peripheral Neuropathy was diagnosed clinically if sum of NDS + NSS was > 10

135 patients out of total 855 patients who had NSS 5-6 (mild symptoms) or NDS 5-6 but if sum of NDS + NSS was > 10 were then evaluated by biothesiometry to validate this score . VPT> 15 volts was taken as cut off for mild DPN & VPT >25 volts was considered as significant DPN.

Detailed Diabetes Profile including their clinical profile namely Age, Sex, Mean duration of Diabetes, their personal habits smoking, dietary habits were evaluated. These patients were also evaluated for presence of Microalbuminuria, Retinopathy, PVD and Dyslipidaemia etc.

**RESULTS**

86 patients had monofilament impairment, 49 patients had normal monofilament test.

96 patients were detected to have DPN by VPT (60 severe, 36 mild to Moderate)

Hence, applying NDS+NSS >10 as per ” Young et al criterion “ could pick up early DPN in 96 out of 135 ( sensitivity of 71.1% & specificity of 90% ) This has a +ve predictive value of 57.14% & --ve predictive value of 94.32% as validated & documented by biothesiometer . Prevalence of DPN in total 855 patients evaluated clinically by NSS & NDS later tested by biothesiometry was found to be 15.4 %.

Mean FBS in the study group was 153.8 + 11.0 mg % as compared to 136.4 + 18.2 mg% in the comparison group . Mean PPBS was 231.9 + 17.4 mg % in the study group while PPBS in the comparison group was 194.7 + 25.4 mg . So on multiple regression analysis. DPN was associated with poor glycemic control in the study group. DPN also had a strong co-association with other complications like DR (44.1% Vs 19.2 %) and Microalbuminuria 61.3 % Vs 38 % on multiple regression analysis.

**Table 1**  
Demographic Characteristics

	Study Group n=133	Comparison Group n=720
No. of patients	135	720
Age (Years)	57.6 ± 9.2	55.6 ± 7.8
Sex Males	71.5 %	70.2%
Females	28.5 %	29.8%
FBS (mg%)	153.8 ± 11.0	136.4 ± 18.2
PPBS (mg%)	231.9 ± 17.4	194.7 ± 25.4
Systolic Blood Pressure (mmHg)	156 ± 12	142 ± 13
Diastolic Blood Pressure (mmHg)	94 ± 5	89 ± 7
Smokers	56.4 %	22.5%
CAD by ECG	6.8%	6.3%
PVD by Hand Doppler	4.2%	3.9%
Duration of Diabetes(Mean) Yrs	13.5 Yrs	Yrs

**Table 2**  
Complications

Microalbuminuria	61.3%	38 %
Dyslipidaemia	36.4 %	38 %
Retinopathy	44.1 %	19.2%
VPT > 15 volts	26.6% (N=36)	4.8%
VPT > 25 volts	44.4% (N=60)	5.2%
Prevalence of P-Neuropathy (Baye's Theorem)	15.4%	

**Table 3**  
Results

	NSS+NDS > 10 N=135 (Young et al)	NSS+NDS < 10 N=720	Total
VPT +ve	96	72	168
VPT -ve	39	648	687
	135	720	855
Sensitivity	96/135 = 71.1%		
Specificity	648/720 = 90%		
+ve Predictive Value	57.14%		
-ve Predictive Value	94.32%		

**DISCUSSION**

About one third of diabetic people are at risk of foot ulceration because of loss of protective sensation due to peripheral Neuropathy .The symptoms of neuropathy & the conventional assessment of it with Cotton wool, Vibrating tuning fork, pin prick and hot and cold sensation can give a qualitative diagnosis.

Diabetic neuropathy increases the risk of myocardial infarction and reduces the life span, resulting in death of 25–50% of patients within 5–10 years of disease existence 2 As per our own study 6, diabetic peripheral neuropathy (DPN) has strong co-association with other complications such as diabetic retinopathy (67% vs 21.2%) and micro albuminuria 51% vs 41%. It was also observed that 56%

patients with DM of less than 5 years had moderate/severe DPN

Large-fiber dysfunction, as measured by vibration perception threshold (VPT), predicts foot ulceration, lower-limb amputation, and mortality (7-9). Early in the natural history of DPN, patients are usually asymptomatic. Thus, reliable identification of individuals in the early stages of the neuropathic process is required so that more rigorous modification of risk factors and foot care education can be implemented. The best method to identify such patients is still a matter of some debate (10-13)

A number of approaches are available for the diagnosis of diabetic neuropathy . Sensory examinations and electrophysiological measurements include the evaluation of muscle power, sensations of pinprick, position of joints, touch, and temperature. These tests may lack adequate sensitivity in early stages of neuropathies due to scarce demyelination of neurons.<sup>4</sup> Hence, Neurological examination like NSS & NDS can be an important bedside tool in the clinics for early diagnosis of DPN ).

Our study has used VPT of >15 as early DPN & > 25 mV as the significant DPN for the diagnosis of neuropathy and the prevalence of peripheral neuropathy was 15.4 per cent. The use of VPT for the diagnosis of neuropathy has been well validated by clinical studies with a sensitivity and specificity of 80 and 98 per cent respectively<sup>14</sup>. This is further substantiated by large epidemiological prospective studies showing that a VPT more than 25 mV had a sensitivity of 83 per cent, a specificity of 63 per cent, a positive likelihood ratio of 2.2 (95% CI, 1.8-2.5), and a negative likelihood ratio of 0.27 (95% CI, 0.14-0.48) for predicting a foot ulceration over 4 years<sup>15</sup>.

86 patients in our study had monofilament impairment, 49 patients had normal monofilament test. 96 patients were detected to have DPN by VPT (60 severe, 36 mild to Moderate)

Hence, applying NDS+NSS >10 as per " Young et al criterion " could pick up early DPN in 96 out of 135 ( sensitivity of 71.1% & specificity of 90% ) This has a +ve predictive value of 57.14% & -ve predictive value of 94.32% as validated & documented by biothesiometer . Prevalence of DPN in total 855 patients evaluated clinically by NSS & NDS later tested by biothesiometry was found to be 15.4 %.

## CONCLUSIONS

Management of neuropathic complications in diabetes poses significant clinical challenge.

Symptomatic treatments are beneficial but may be insufficient.

These complications severely affect the quality of life in patients especially in late stages. Early screening and diagnosis of neuropathic complications assumes crucial importance.

Neurological examination like NSS & NDS can be an important bedside tool in the clinics for early diagnosis of DPN with a sensitivity of 71.1% & specificity of 90% . It is simple , acceptable, reproducible & validated as per our study .

DPN was associated with poor glycemic control in the study group & has a strong co-association with other complications like DR (44.1% Vs 19.2 %) and Microalbuminuria 61.3 % Vs 38 %

## References

1. Boulton AJM. Management of diabetic peripheral neuropathy. *Clin Diabet*. 2005;23:9-15.
2. Bansal V, Kalita J, Misra UK. Diabetic neuropathy. *Postgrad Med J*. 2006;82:95-100.
3. *Cas Lek Cesk*. 2002 Apr 12;141(7):223-5. Biothesiometry in the diagnosis of peripheral neuropathies
4. .Deshpande AD, Harris-Hayes M, Schootman M. Epidemiology of diabetes and diabetes-related complications. *Phys Ther*. 2008;88:1254-64
5. Young MJ, Breddy JL, Veves A, Boulton AJM. The prediction of diabetic neuropathic foot ulceration using vibration perception thresholds. A prospective study. *Diabetes Care*.
6. Chawla R. Study of prevalence of diabetic peripheral neuropathy by biothesiometric evaluation and its co-associations with other complications. *NNDU Proceedings 2004*
7. Carrington AL, Shaw JE, Van Schie CHM, Abbott CA, Vileikyte L, Boulton AJM.: Can motor nerve conduction velocity predict foot problems in diabetic subjects over a 6-year outcome period? *Diabetes Care* 2002;25:2010–2015. [PubMed]
8. Adler AI, Boyko EJ, Ahroni JH, Smith DG.: Lower-extremity amputation in diabetes: the independent effects of peripheral vascular disease, sensory neuropathy, and foot ulcers. *Diabetes Care* 1999;22:1029–1035. [PubMed]
9. Crawford F, Inkster M, Kleijnen J, Fahey T.: Predicting foot ulcers in patients with diabetes: a systematic review and meta-analysis. *Q J Med* 2007;100:65–86.
10. Perkins BA, Olaleye D, Zinman B, Bril V.: Simple screening tests for peripheral neuropathy in the diabetes clinic. *Diabetes Care* 2001;24:250–256. [PubMed]
11. Meijer JWG, Smit AJ, Lefrandt JD, Van De Hoeven JH, Hoogenberg K, Links TP.: Back to basics in diagnosing with diabetic polyneuropathy with the tuning fork. *Diabetes Care* 2005;28:2201–2205. [PubMed]
12. Dyck PJ, Davies JL, Wilson DM, Service FJ, Melton LJ, O'Brien PC.: Risk factors for severity of diabetic polyneuropathy. *Diabetes Care* 22:1479–1486. [PubMed]
13. Dyck PJ, Davies JL, Clark VM, Litchy WJ, Dyck PJB, Klein CJ, Rizza RA, Pach JM, Klein R, Larson TS, Melton LJ, O'Brien PC.: Modeling chronic glycemic exposure variables as correlates and predictors of microvascular complications of diabetes. *Diabetes Care*

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2006;29:2282–2288. [PubMed]

14. Perkins BA, Olaleye D, Zinman B, Bril V. Simple screening tests for peripheral neuropathy in the diabetes clinic. *Diabetes Care* 2001; 24 : 250-6. .

15. Meijer JW, Sonderen EV, Blaauwwekel EE, Links TP, Groothoff JW, Eisma WH, et al. Diabetic Neuropathy Examination: a hierarchical scoring system to diagnose distal polyneuropathy in diabetes. *Diabetes Care* 2000; 23 : 750-3.

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