

A COMPARATIVE STUDY OF VARIOUS BEDSIDE METHODS IN DETECTION OF DIABETIC POLYNEUROPATHY IN TYPE 2 DIABETES PATIENTS

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ABSTRACT: Diabetes is a major public health problem. 285 million persons worldwide have diabetes, of these 51 million are in India. Diabetic peripheral neuropathy is a major microvascular complication of diabetes. Conventional methods used for the diagnosis of diabetic peripheral neuropathy in clinical practice have limited effectiveness. Since peripheral sensory neuropathy is a pivotal element in the causal pathway to both foot ulceration and amputation, screening and early identification of neuropathy offer a crucial opportunity for the patient with diabetes to actively modulate the course of suboptimal glycaemic control to currently recommended targets, and to implement improved foot care before the onset of significant morbidity. This study was carried out to evaluate the usefulness of simple bed side screening modalities for peripheral neuropathy like vibration perception threshold measurement with biothesiometer, 10g semmes-weinstein monofilament, diabetic neuropathy examination and symptom scores and ankle reflex testing in patients with diabetes mellitus and to seek an optimal screening method in diabetic clinic.

INTRODUCTION: Diabetes mellitus comprises a group of common metabolic disorders that share the phenotype of hyperglycaemia. The two broad categories of DM are designated as type 1 and type 2. Type 2 diabetes mellitus is a heterogenous group of disorders characterized by variable degrees of insulin resistance, impaired insulin secretion and increased glucose production. The number of patients with type 2 diabetes is increasing by epidemic proportions in the world, particularly in India. There is a long presymptomatic phase before the appearance of symptoms of type 2 diabetes. Therefore, Type 2 diabetes is frequently not diagnosed until complications have already occurred. Complications of DM are subdivided into microvascular (retinopathy, neuropathy, nephropathy) and macrovascular complications [coronary artery disease (CAD), peripheral arterial disease (PAD), cerebrovascular disease]. Lower extremity disease, including peripheral neuropathy, foot ulceration, peripheral arterial disease, or lower extremity amputation, is twice as common in diabetic persons compared with non-diabetic persons and it affects 30 per cent of diabetic persons who are older than 40 yr¹. Diabetic Neuropathy (DN) develops in about 4-10% of diabetic patients after 5 years and in 15% after 20 years².

AIMS AND OBJECTIVES: To evaluate the usefulness of the diabetic neuropathy examination score (DNE), diabetic neuropathy symptom (DNS) score, 10-g Semmes-Weinstein monofilament examination, ankle reflex and measuring vibration perception threshold (VPT) with a biothesiometer in the detection of diabetic polyneuropathy in type 2 diabetes patients and to seek an optimal screening method in diabetic clinic in the detection of diabetic polyneuropathy in type 2 diabetes patients.

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MATERIAL AND METHODS: 100 Patients of type 2 diabetes mellitus were included in the study after applying the inclusion and exclusion criteria.

Blood glucose estimation: GOD-POD method.

Criteria used for diagnosing diabetes: ADA Criteria 2011.

INCLUSION CRITERIA:All patients of type 2 diabetes mellitus aged between 40-70 years after applying exclusion criteria.

EXCLUSION CRITERIA:

- 1) Patients of type 1 diabetes mellitus.
- 2) Acutely ill critical patients.
- 3) History of stroke or myocardial infarction.
- 4) Chronic Renal Failure: serum creatinine>2
- 5) Neuropathy due to causes other than diabetes such as environmental toxins, leprosy, Guillain-Barre syndrome, chronic alcoholism, nutritional deficiencies, or side effects of certain medications.

All subjects had a detailed clinical assessment for peripheral neuropathy including Diabetic Neuropathy Examination (DNE) score, ankle reflex testing, diabetic neuropathy symptom (DNS) score, 10g Semmes-Weinstein monofilament examination and vibration perception threshold (VPT).

RESULTS: Out of 100 patients taken for the study, 72 were females representing 72% of the study group and 28 were males representing 28% of the study group. The prevalence of peripheral neuropathy was 52 percent based on vibration perception threshold (VPT) with the biothesiometer. When compared with VPT, ankle reflex was the most sensitive (88.46%) but had a poor specificity (56.25%). The monofilament examination had lower sensitivity (75%) but better specificity (89.58%) and accuracy (82%). DNE and DNS Scores had a sensitivity of 80.77 and 84.62% with a specificity of 85.42 and 43.75% respectively. Significant correlations were observed between the VPT score and the DNE($r = 0.661$, $P = .000$) and DNS ($r = 0.312$, $P = .002$) scores, monofilament sensation ($r = 0.650$, $P = .000$) and ankle reflex ($r = 0.475$, $P = .000$). The prevalence of peripheral neuropathy also correlated well with the age of the patient as well as duration of diabetes ($P < 0.05$).

DISCUSSION: The present study has used VPT of > 25 mV as the standard for the diagnosis of neuropathy and the prevalence of peripheral neuropathy was 52 per cent. VPT is considered as a gold standard for diagnosis of diabetic peripheral neuropathy. The measurement of vibration perception using a biothesiometer is a long-established method of screening diabetic patients for neuropathy³. A raised VPT has been found in diabetic patients with foot ulceration compared with nondiabetic and diabetic patients without foot ulcers⁴. VPTs are regularly measured in diabetic patients attending hospital clinics and have been shown to equate with clinical scoring systems of neuropathy^{5,6}. Many studies have taken VPT as a gold standard, comparing SWME, and clinical examination with VPT. 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 respectively⁷. 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

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4 years⁸. Nasser K and co-workers compared the reproducibility of nerve conduction studies and VPT and concluded that both NCS and VPT are reproducible methods to assess diabetic neuropathy. Since peripheral sensory neuropathy is a pivotal element in the causal pathway to both foot ulceration and amputation, selecting a quick, inexpensive, and accurate instrument to evaluate the high-risk patient is essential to make decisions. So, apart from VPT, we also assessed monofilament, ankle reflex, the DNS and DNE scores for evaluation of peripheral neuropathy. Sensitivity and specificity of the DNE and DNS scores, SWME and ankle reflex were calculated, taking VPT as gold standard. 52 of 100 subjects had neuropathy confirmed by VPT, while 48 did not have neuropathy. The DNE and DNS scores gave a sensitivity of 80.77 and 84.62% with a specificity of 85.42 and 43.75% respectively. The sensitivity of SWME was 75% and specificity was 89.58%. Ankle reflex yielded a sensitivity of 88.46% and a specificity of 56.25%. The present study showed significant correlations between the VPT score and the DNE ($r = 0.661$, $P < 0.001$) and DNS ($r = 0.312$, $P = 0.002$) scores, monofilament sensation ($r = 0.650$; $P < 0.001$) and ankle reflex ($r = 0.475$, $P < 0.001$). The findings are similar to a study conducted by Jayaprakash et al in 2011 in which the prevalence of peripheral neuropathy was 34.9% with VPT as measured with biothesiometer and significant correlations were observed between the VPT score and the DNE ($r = 0.532$, $P < 0.001$), monofilament sensation ($r = 0.573$; $P < 0.001$) and ankle reflex ($r = 0.377$, $P = 0.01$)⁹. Our study agrees with this study. Similarly, Mythili A et al in 2010 in a comparative study assessed hundred consecutive patients with type 2 diabetes. Sensitivity and specificity of for the DNE, SWME and VPT were calculated, taking NCS as gold standard. 71 of 100 subjects had neuropathy confirmed by NCS, while 29 did not have neuropathy. The DNE score gave a sensitivity of 83% and a specificity of 79%. The sensitivity of SWME was 98.5% and specificity was 55%. VPT yielded a sensitivity of 86% and a specificity of 76%. The study concluded that a simple neurological examination score is as good as VPT in evaluation of polyneuropathy in a diabetic clinic. It may be a better screening tool for diagnosis of diabetic polyneuropathy in view of the cost effectiveness and ease of applicability¹⁰. The findings were very similar to our study. Further, in the present study, the mean age and duration of diabetes was significantly higher in cases with neuropathy compared to cases without neuropathy which was statistically significant ($p < 0.05$), similar to a Spanish study, in which the prevalence of peripheral neuropathy increased from 14% at under five years duration to 44% at duration of more than 30 years¹¹.

CONCLUSION AND INTERPRETATION: The present study concludes that peripheral neuropathy is a common complication of type 2 diabetes mellitus with an insidious and often irreversible progression leading to foot ulceration and amputation. The severity of the disease is further aggravated by older age and duration of diabetes. Thus early and comprehensive neurological investigations for screening and early diagnosis of peripheral neuropathy in patients with diabetes are warranted. This stresses the need and the usefulness of various bedside methods like a simple clinical examination score, ankle reflex and monofilament testing which are simple, quick, easy to perform, accurate and are inexpensive and correlate well with the biothesiometer which requires expensive equipment.

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Neuropathy	Frequency	Percent
Absent	48	48.0
Present	52	52.0
Total	100	100.0

TABLE 1: CASES WITH NEUROPATHY BASED ON BIOTHESIOMETRY

Testing modality	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)	Accuracy (%)
DNE Score	80.77	85.42	85.71	80.39	83.00
DNS Score	84.62	43.75	61.97	72.41	65.00
Ankle Reflex	88.46	56.25	68.66	81.82	73.00
Monofilament	75.00	89.58	88.64	76.79	82.00

TABLE 2: DIAGNOSTIC ACCURACY OF DIFFERENT TESTS COMPARED TO VIBRATION PERCEPTION THRESHOLD (VPT)

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		DNE Score	DNS Score	Ankle Reflex	Monofilament
Biothesiometer	r value	0.661	0.312	0.475	0.650
	p value	0.000	0.002	0.000	0.000

TABLE 3: CORRELATIONS BETWEEN BIOTHESIOMETER AND DNE, DNS SCORES, ANKLE REFLEX AND MONOFILAMENT

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