Original Research Article

A study of the correlation between clinical grading and nerve conduction in diabetic foot

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Abstract

Introduction: Diabetes mellitus is a metabolic disorder characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. It may be accomplished by other biochemical disturbances and the presence of progressive diabetic tissue damage with micro and macro vascular complications. Diabetes is the leading cause of end-stage renal disease, a major cause of non-traumatic amputations, responsible for 30 % of the preventable blindness and a leading cause of cardiovascular mortality **Methodology:** This proposed study was carried out as a prospective, randomized clinical trial in 50 patients diagnosed diabetic foot; in department of Surgery Institute of Medical Sciences and Research, Mayani, Tq-Khatav, Dist-Satara-415102, after getting approval from Ethics Committee **Result:** Most of the patients from the study belonged to Lesions of Skin intact (40%) and Deeper, full-thickness extension of ulcer(12%), Deep abscess or osteomyelitis associated with ulcer(10%) by Wagner and Brodsky grading . Majority of the patients were having Mixed type of Neuropathy 38 (76%), followed by Axonal (16%), Demyelinating (6%), Normal(2%) . The number of patients with bilateral neuropathy detected by NCV study is 77.00% is more than that detected clinically 23.00%. By applying test of significance, chi-square test, the difference is significant ($p<0.05$) **Conclusions**: Number of patients with bilateral neuropathy detected by NCV study in our study is more than that detected clinically. Hence, NCV is a better study to detect nerve condition abnormalities than clinical examination in diabetic foot.

Keywords: Diabetic neuropathy, Nerve Conduction Velocity (NCV).

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INTRODUCTION

Diabetes mellitus is a metabolic disorder characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both. It may be accomplished by other biochemical disturbances and the presence of progressive diabetic tissue damage with micro and macro vascular complications. Diabetes is the leading cause of end-stage renal disease, a major cause of non-traumatic amputations, responsible for 30 % of the preventable blindness and a leading cause of cardiovascular mortality[1]. Diabetes mellitus is broadly classified into two types. Type 1 diabetes which is either immune mediated or idiopathic resulting in absolute insulin deficiency. Type 2 diabetes which ranges from predominantly insulin resistance with relative insulin deficiency to a predominantly secretory defect with insulin resistance. Certain other specific types include various causes like diseases of the exocrine pancreas, endocrinopathis, drug-induced, infection-induced or genetic defects[2]. Criteria for the diagnosis of DM include symptoms of diabetes (polyuria, polydipsia, weight loss) plus random (defined as without regard to time since the last meal) blood glucose concentration ≥ 11.1 mmol/L (200 mg/dL) OR fasting (defined as no caloric intake for at least 8 hours) plasma glucose ≥ 7 mmol/L (126 mg/dL) OR two hour plasma glucose ≥ 11.1 mmol/L (200MG/dL) during an oral glucose tolerance test[3]. Micro vascular complications include diabetic retinopathy, nephropathy and neuropathy. Macro vascular complications include coronary artery disease, peripheral vascular disease and

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cerebrovascular disease. There are certain other complications like gastro paresis, sexual dysfunctions, infections, glaucoma, etc.[4]. Diabetic foot, is characterized by the classic triad of neuropathy, ischemia and infection. It is mainly classified into two types; neuropathic foot, in which neuropathy dominates; and neuro-ischaemic foot, in which occlusive vascular disease dominates although neuropathy is present[5]. Other diabetic neuropathies found are mononeuropathies, cranial mononeuropathies , isolated and multiple mononeuropathies, truncal mononeuropathy, proximal motor neuropathy (diabetic amyotrophy), automatic neuropathy [6]. The distance between electrodes and the time it takes for electrical impulses to travel between electrodes are used to determine the speed of the nerve signals[7]. Normal body temperature must be maintained. Temperature significantly influences the conduction velocity and the amplitude of compound muscle action potential. Low temperature results in slowing of nerve conduction velocity and increases the amplitude. For each degree Celsius fall in temperature, the latency by 0.3 ms. On increasing the temperature the velocity increases by 5 % per degree from 29-38 ^{0} C. The laboratory temperature, therefore, should be maintained between 21-23 ^{0} C. If skin below 34 ^{0} C, the limb should be warmed by warm water immersion[8]. Wei-Chih Hsu *et al* (2007)[11]. A study of simplified Electro diagnostic Criteria of Diabetic polyneuropathy in Field study This study concluded that sural SNAP and personal MCV together serve as a good diagnostic criteria for diabetic polyneuropathy and can be used as a simplified criteria in studies.

AIMS AND OBJECTIVES

To find the correlation between the clinical grading of diabetic foot and nerve condition study.

MATERIALS AND METHODS

This proposed study was carried out as a prospective, randomized clinical trial in 50 patients diagnosed diabetic foot; in department of Surgery, Krishna Institute of Medical Sciences, Karad after getting approval from Ethics Committee.

Inclusion Criteria

Patients of both sexes diagnosed as diabetic foot admitted in Krishna hospital were included in the study after obtaining a written informed consent.

Exclusion Criteria

Patients with cardiac defibrillator or pacemaker or any electrical machine in or traumatic or Hansen's neuropathy.

RESULTS

Table 1: Number of patients in different Wagner and Brodsky Depth-Ischemia Classification of Diabetic Foot Lesions

	Grade	Number of patients	Percentage of patients
Wagner and Brodsky Depth-Ischemia Classification of Diabetic Foot Lesions	0-A	20	40
	0-B	1	2
	0-C	1	2
	0-D	0	0
	1-A	4	8
	1-B	4	8
	1-C	0	0
	1-D	0	0
	2-A	1	2
	2-B	6	12
	2-C	1	2
	2-D	0	0
	3-A	2	4
	3-B	3	6
	3-C	5	10
	3-D	2	4
	4	0	0
	5	0	0
	Total	**50**	**100**

Grade: Wagner and Brodsky Description of Classifications are**:** 0-Skin intact, 1-Superficial ulcer, 2-Deeper, full-thickness extension of ulcer, 3-Deep abscess or osteomyelitis associated with ulcer, 4-Partial forefoot gangrene with ulcer, 5-Extensive foot gangrene with ulcer so from table it is clear that most of the patients from the study belonged to Skin intact (40%) and Deeper, full-thickness extension of ulcer (12%), Deep abscess or osteomyelitis associated with ulcer (10%).

Table 2: Number of patients in different types of neuropathy

Type of neuropathy	Number of patients
Axonal	8 (16%)
Demyelinating	3 (6%)
mixed	38 (76%)
normal	1 (2%)

From Table 2: Majority of the patients were having Mixed type of Neuropathy 38 (76%), followed by Axonal (16%), Demyelinating(6%), Normal(2%) .

Table 3: Number of patients according to gender

Gender	Number of patients	P value
Male	35 (70%)	Z= 4, p<0.05
Female	15 (30%)	

From Table 3: Diabetic neuropathy was significantly higher in Male 35 (70%) and Female 15 (30%) as compared to female.

Table 4: Side affected clinically and according to NCV

Side affected	Clinically side affected	Side affected according to NCV	p-value
Right	21 (75.00%)	7 (25.00%)	χ^2=chi-Square= 6.979, df=2, p < 0.05
Left	17 (85.00%)	3 (15.00%)	
Bilateral	12 (23.00%)	40 (77.00%)	

From Table 4**:** This table shows that the number of patients with bilateral neuropathy detected by NCV study is 77.00% more than that detected clinically 23.00%. By applying test of significance, chi-square test, the difference is significant. Hence, NCV is a better study to detect nerve conduction abnormalities than clinical examination.

DISCUSSION

'Wagner and Brodsky' is a clinical classification of various grades of Diabetic Neuropathy various descriptions of Description of Classifications are**:** 0-Skin intact, 1-Superficial ulcer, 2-Deeper, full-thickness extension of ulcer, 3-Deep abscess or osteomyelitis associated with ulcer, 4-Partial forefoot gangrene with ulcer, 5-Extensive foot gangrene with ulcer so from table it is clear that most of the patients from the study belonged to Skin intact (40%) and Deeper, full-thickness extension of ulcer(12%), Deep abscess or osteomyelitis associated with ulcer(10%). Majority of the patients were having Mixed type of Neuropathy 38 (76%), followed by Axonal (16%), Demyelinating (6%), Normal (2%). These findings are in confirmation with Kiziltan ME *et al* (2007)[12]. This study concluded that patients with diabetes mellitus have a predisposition to develop chronic inflammatory demyelinating polyneuropathy and this also facilitate formation of diabetic foot. Diabetic neuropathy was significantly higher in Male 35 (70%) and Female 15 (30%) as compared to female, it could be because other risk factors of diabetes like stress, addictions and very reluctant to dietary modifications for glycemic control. This table shows that the number of patients with bilateral neuropathy detected by NCV study is 77.00% more than that detected clinically 23.00%. By applying test of significance, chi-square test, the difference is significant. Hence, NCV is a better study to detect nerve conduction abnormalities than clinical examination. These findings are in confirmation with Absulsalam A *et al* (1997)[13]. Twenty-nine patients and 64 normal subjects all subjected to nerve condition studies. This study concluded that the frequency of abnormalities in the studied peripheral nerves was 60 % for median, 63 % ulnar, 33 % peroneal, 16 % and 8 % sural by nerve conduction study. Pierluigi Bertora *et al* (1998)[14]. This study concluded that CVD is a more sensitive method than the standard electro diagnostic study to detect subclinical abnormalities of the motor and sensory nerve fibers; this method can be very useful as a diagnostic tool and in research, in the study of progression of diabetic neuropathy.

CONCLUSIONS

Number of patients with bilateral neuropathy detected by NCV study in our study is more than that detected clinically and the difference is significant by applying the test of significance. Hence, NCV is a better study to detect nerve condition abnormalities than clinical examination in diabetic foot.

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