

SINGLE-FIBER CONDUCTION VELOCITY TEST ALLOWS EARLIER DETECTION OF ABNORMALITIES IN DIABETES

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ABSTRACT: *Introduction:* The purpose of this study was to determine whether single-fiber conduction velocity (SF-CV) of a small number of axons increases sensitivity for identification of motor nerve conduction alterations in patients with diabetes. *Methods:* Twenty-one consecutive diabetic patients in good metabolic control were studied. For each patient, conventional (C-CV) and SF-CV results were correlated with the presence of neuropathic symptoms. *Results:* Nine of 21 patients reported symptoms suggestive of mild nerve impairment. Three patients had abnormal sural nerve CV, 1 of whom also had abnormal motor nerve conduction. Eighteen patients had normal findings on conventional tests, 3 of whom had slowing of SF-CV. *Conclusions:* SF-CV is able to detect mild myelin damage with higher sensitivity than conventional tests. The use of SF-CV may be a helpful tool in the early identification of diabetic polyneuropathy, and it may be useful for tailoring an approach to diabetic polyneuropathy.

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Diabetic polyneuropathy (DP) is the most common neurological complication of diabetes.¹ DP is a progressive process characterized by a long asymptomatic stage that is often difficult to identify and manage. Many of the DP consequences (pain, imbalance, foot deformity, risk for infection, ulcerations, and amputations) can be prevented by appropriate clinical management, including early diagnosis, intensification of glycemic control, and checking for foot complications.² Therefore, identification of DP at its earliest stages is a major challenge in the clinical care of diabetes.

Nerve conduction velocity (NCV) is the most commonly used and reliable method to assess myelin nerve function. Usually, NCV is measured using a surface electrode (conventional conduction velocity, C-CV). C-CV does not optimally assess the overall conduction properties of a nerve, because it reflects mainly the fastest conducting subset of the alpha motor axon population.³ However, in its early stages, polyneuropathy does not affect nerves

uniformly.⁴ This reduces the sensitivity of C-CV in the evaluation of polyneuropathies that involve mainly slow-conducting fibers or polyneuropathy with only partial involvement of the nerve fibers.

Single-fiber CV (SF-CV) evaluation is a technique based on the use of a single-fiber electromyography (SFEMG) electrode. The procedure, which entails recordings from different sites in the muscle, allows study of the CV of a small sample of axons. SF-CV may be useful in detecting early, mild, or partial myelin damage, because it can detect abnormalities in a few axons and may show nerve conduction slowing when conventional tests are normal.⁵

The aim of this study was to determine whether SF-CV could improve detection of mild motor nerve function abnormalities in the early stages of DP.

METHODS

Patient Sample. Twenty-one consecutive Caucasian patients affected by type 2 diabetes, who had been in good metabolic control for at least 1 year and did not have glutamic acid decarboxylase autoantibody, were enrolled in the endocrinology unit of the Hospital “A. Gemelli,” Catholic University of Rome. Informed consent was obtained from all participants. The study was approved by local ethics committee. Glycated hemoglobin (HbA_{1c}; 2 days before the neurophysiological tests) and fasting plasma glucose (FPG; the same morning) were measured in all patients. Only participants with HbA_{1c} <8% and fasting glucose <140.0 mg/dl (7.8 mmol/L) were included. Other exclusion criteria were: (1) neuropathy with etiology different from diabetes; (2) peripheral arterial disease (documented by lower limb echo color Doppler) with arterial stenosis >30%; and (3) other concurrent neurological diseases. Individuals who had previous foot ulcer, toe amputation, or pre-ulcers (pre-ulcer is defined as intact skin but a high-risk foot because of dense callus with or without pre-ulcerative macerating changes)⁶ were excluded. Anthropometric parameters, lipids, creatinine, and urinary albumin-to-creatinine ratio were also measured in all subjects. Before neurological examination and neurophysiological tests, all patients completed a

Abbreviations: C-CV, conventional conduction velocity; CMAP, conventional compound muscle action potential; CV, conduction velocity; DP, diabetic polyneuropathy; FPG, fasting plasma glucose; HbA_{1c}, glycated hemoglobin; NCV, nerve conduction velocity; SF-CV, single-fiber conduction velocity; SFEMG, single-fiber electromyography; SW-DOM, Semmes-Weinstein dominant; SW-NDOM, Semmes-Weinstein non-dominant

Key words: diabetes, diabetic polyneuropathy, electrodiagnosis, neurophysiology, SFEMG, single-fiber conduction velocity

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