

## ELECTROPHYSIOLOGICAL FINDINGS IN NEWLY DIAGNOSED NON-INSULIN-DEPENDENT DIABETICS: A PROSPECTIVE STUDY

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This study reports the electrophysiological findings in patients with newly diagnosed non-insulin-dependent diabetes mellitus (NIDDM) studied in the Neurodiagnostic Laboratory of the King Fahd Hospital of the University (KFHU), Al-Khobar, Saudi Arabia. Twenty-nine patients (22 males, 7 females, mean ages 47 and 37 years, respectively) were studied within four weeks of establishing the diagnosis. They were all given nerve conduction studies by the same examiner. Comparison was made with data from a group of 64 normal control subjects. In the study patients, the mean distal sensory peak latency in milliseconds (ms)  $\pm$  standard deviation (SD) was  $3.5 \pm 0.41$  ms in 35 median nerves,  $3.2 \pm 0.72$  ms in 35 ulnar nerves,  $1.9 \pm 0.34$  ms in 23 superficial radial nerves and  $3.5 \pm 0.61$  in 36 sural nerves. The mean distal motor latency  $\pm$  SD was  $4.6 \pm 0.95$  ms in 39 median nerves,  $3.5 \pm 0.58$  ms in 38 ulnar nerves,  $4.8 \pm 1.02$  ms in 44 tibial nerves and  $6.0 \pm 1.08$  ms in 36 peroneal nerves. The electromyogram examination was performed on 24 patients and showed evidence of denervation and/or chronic reinnervation in seven (29%). The frequency of abnormalities in the studied peripheral nerves was 60% for median, 63% ulnar, 33% peroneal, 16% tibial and 8% sural. *Ann Saudi Med* 1997;17(4):399-401.

The main complications of diabetes mellitus include neuropathy, retinopathy, nephropathy and vasculopathy.<sup>1-3</sup> Diabetic neuropathy includes mononeuropathy, multiple mononeuropathies, distal polyneuropathy and autonomic neuropathy.<sup>4</sup> The prevalence rates of diabetic neuropathy vary widely throughout the world.<sup>5-8</sup>

Recent community-based studies from the Kingdom of Saudi Arabia reported rising prevalence rates of NIDDM.<sup>9-13</sup> Previous studies on diabetic neuropathy from the Kingdom were carried out on patients with diabetes of durations ranging from 1 to 30 years.<sup>14-18</sup> However, no electrophysiologic studies on asymptomatic newly diagnosed NIDDM patients, to our knowledge, have been reported from Saudi Arabia.

The aim of the present study was to examine electrophysiologically a group of asymptomatic newly diagnosed patients with NIDDM in a University Hospital in the Eastern Province of Saudi Arabia.

### Patients and Methods

A total of 29 consecutive patients (22 males and 7 females with a mean age of 47 and 37 years, respectively) were studied electrophysiologically within four weeks of the endocrinologic

diagnosis of NIDDM,<sup>19,20</sup> between June 1992 and June 1995. The patients were free of neuropathic symptoms and all gave informed consent to the tests. King Fahd Hospital of the University is a referral tertiary care hospital for the entire Eastern Province, which has an estimated population of three million.

The nerve conduction studies (NCS) were performed by the same examiner using standardized techniques on a Nicolet Spirit Electromyography System (Nicolet Instrument Corporation, Madison, Wisconsin, USA). The recorded electrophysiological parameters included the distal motor latency (DML), compound muscle action potential amplitude (CMAP), motor conduction velocity (MCV), distal sensory latency (DSL), and sensory nerve action potential amplitude (SNAP). The distal latencies were obtained for the median and ulnar nerves (8 cm distance for motor, and 14 cm for sensory measurements respectively); peroneal and tibial nerves (9 cm for motor); superficial radial, sural nerves (10 and 14 cm respectively for sensory conduction). All measurements were carried out at room temperature with no provision for measurement of skin temperature. Each nerve conduction study included a minimum of one tibial, peroneal, sural, median and ulnar nerve.

The electromyogram was recorded with concentric needle electrodes from the medial head of the gastrocnemius and the tibialis anterior muscles of 24 patients (18 males and 6 females). The recorded conduction studies data was compared with that obtained previously in the laboratory by the same examiner for a control group of 64 normal subjects (33 males and 31 females with mean ages of 37 and 43 years, respectively<sup>21</sup>). The *t*-test statistic was used to compare the

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means of two independent samples at the 5% level of significance after testing for homogeneity of variance using Levene's test.

### Results

Table 1 shows the summary of the mean values of the motor and sensory latencies, CMAPs, MCVs and SNAPs for the median, ulnar, superficial radial, peroneal, tibial and sural nerves. The mean distal motor latencies and motor conduction velocities were significantly different in the diabetic group. The mean distal sensory latencies for the median and ulnar nerves were significantly longer in the diabetics. The mean amplitude of SNAPs in the studied sensory nerves were comparable to those from the control group.

Table 2 gives the numbers and percentages of studied nerves with abnormal measurements in the upper and lower extremities. Abnormal sensory latencies were noted in 60% of median, 63% of ulnar and 8% of sural nerves.

The abnormal distal motor latencies were observed in 59% of median, 47% of ulnar, 28% of peroneal and 16% of tibial nerves. The electromyogram results obtained from 24 patients revealed evidence of denervation and/or chronic reinnervation in seven patients (29%).

### Discussion

Recent reports from Saudi Arabia indicate a rising prevalence of diabetes mellitus.<sup>9-13</sup> A rise in the prevalence of the commonly associated complications, namely the various forms of diabetic neuropathy, is therefore anticipated. The present study focused on a group of newly diagnosed type II diabetic patients who were neurologically normal.

Recommendations for standardized classification of diabetic neuropathy made by the American Diabetic Association and Academy of Neurology include measurement of at least one parameter of five main categories: symptom profile, neurologic examination, quantitative sensory testing, nerve conduction studies and autonomic function testing.<sup>22,23</sup> Other authors have suggested a limited number of criteria.<sup>24</sup>

The affected nerve conduction parameters in our diabetic group were the distal latencies and conduction velocities, whereas the amplitudes of sensory and motor responses were not significantly different from the control. This suggests that the early diabetic effects on the peripheral nerves are mainly demyelinating.

It is notable that the percentage abnormality of affected nerves in our series was 59% for median, 47% for ulnar, 28% for peroneal and 8% for sural. These values contrast with those reported from Finland in a similar study by Lehtinen et al.<sup>25</sup> where abnormalities were found in 21.3% for median, 11.6% for superficial radial, 28.6% for peroneal and 17.9% for sural. The frequency of peripheral nerve involvement tends to vary in the Western literature depending on the studied populations.

TABLE 1. The electrophysiological measurements given as mean±SD (no. of nerves) in newly diagnosed NIDDM patients and normal controls.

	Parameter	NIDDM	Normal	P-value
Median nerve	DML (ms)	4.62±0.95 (39)	3.60±0.32 (71)	<0.000
	CMAP (mV)	9.71±5.76 (39)	8.85±2.33 (71)	NS
	MCV (m/s)	50.62±6.55 (39)	60.24±5.87 (71)	<0.000
	DSL (ms)	3.50±0.41 (35)	2.98±0.38 (30)	<0.000
	SNAP (uV)	30.03±17.24 (35)	34.20±7.41 (30)	NS
Ulnar nerve	DML (ms)	3.47±0.58 (38)	2.74±0.35 (66)	<0.000
	CMAP (mV)	9.32±2.30 (38)	9.25±2.31 (66)	NS
	MCV (m/s)	55.31±8.46 (38)	61.02±5.65 (66)	<0.000
	DSL (ms)	3.19±0.72 (35)	2.72±0.14 (21)	<0.001
	SNAP (uV)	30.36±14.39 (35)	32.43±9.61 (21)	NS
Superficial radial nerve	DSL (ms)	1.90±0.34 (23)	2.33±0.31 (53)	NS
	SNAP (uV)	31.63±17.79 (23)	34.57±6.87 (53)	NS
Tibial nerve	DML (ms)	4.80±1.02 (44)	3.39±0.58 (11)	<0.000
	CMAP (Mv)	13.32±7.55 (44)	14.27±5.96 (11)	NS
	MCV (m/s)	40.91±7.45 (44)	46.94±4.70 (11)	<0.014
Peroneal nerve	DML (ms)	5.98±1.08 (36)	4.44±0.66 (8)	<0.000
	CMAP (mV)	6.38±4.02 (36)	6.19±2.07 (8)	NS
	MCV (m/s)	41.67±5.88 (36)	51.70±7.52 (8)	<0.000
Sural nerve	DSL (ms)	3.46±0.61 (36)	3.50±0.67 (10)	NS
	SNAP (Mv)	13.36±3.88 (36)	16.65±8.13 (10)	NS

NS=not significant; DML=distal motor latency; CMAP=compound muscle action potential; MCV=muscle conduction velocity; DSL=distal sensory latency; SNAP=sensory nerve action potential.

TABLE 2. Percentage of abnormalities in the studied nerves given as mean±SD (no. of nerves).

	Parameter	Abnormal	N	%
Median nerve	DML (ms)	5.20±0.75	23	59
	CMAP (mV)	8.99±4.88	23	59
	MCV (m/s)	48.89±6.78	23	59
	DSL (ms)	3.77±0.26	21	60
	SNAP (uV)	26.90±11.08	21	60
Ulnar nerve	DML (ms)	3.94±0.40	18	47
	CMAP (mV)	14.12±5.72	18	47
	MCV (m/s)	51.57±8.48	18	47
	DSL (ms)	3.54±0.68	22	63
	SNAP (uV)	31.60±16.58	22	63
Tibial nerve	DML (ms)	6.63±0.51	7	16
	CMAP (Mv)	9.24±3.72	7	16
	MCV (m/s)	41.47±6.34	7	16
Peroneal nerve	DML (ms)	7.38±0.54	10	28
	CMAP (mV)	4.00±2.56	10	28
	MCV (m/s)	37.86±7.70	10	28
Sural nerve	DSL (ms)	4.57±0.06	3	8
	SNAP (uV)	11.33±1.17	3	8

In a study of 45 NIDDM patients with a median age of 54 years and a median diabetic duration of 9 years, Ziegler and co-workers<sup>26</sup> reported abnormal conduction velocities in median (13.6%), peroneal (59.1%) and sural nerve (52.3%).<sup>27</sup> The distal polyneuropathic pattern is characteristically

associated with long-standing diabetes mellitus.<sup>26,28</sup> Albers et al.<sup>29</sup> reported a 34% frequency of median mononeuropathy in patients with NIDDM in the early diabetes intervention trial (EDIT). The difference in the pattern of diabetic involvement of peripheral nerves between early and late complications is probably related to possible underlying pathogenetic mechanisms, these being either insufficient metabolic control initially and/or multiple factors, including vasculopathies in long-standing diabetes.<sup>30-32</sup>

The predominance of male gender in the present group is comparable to results reported recently by Albers et al.<sup>33</sup> The neuropathic pattern in our patients indicates a predominant mononeuropathic involvement of vulnerable peripheral nerves in newly diagnosed Saudi diabetics.

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