The Investigation of Sympathetic Skin Response in Diabetic Neuropathy

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In 41 diabetic patients with clinical and electrophysiological evidences of motor sensory peripheral neuropathy and in 20 normal control subjects, sympathetic skin responses (SSRs) were recorded from both hands and feet by electrical stimuli to the median nerve at the wrist. The SSRs were present in all limbs of normal subjects, but were not be able to record at the feet in 14.6 % and the hands in 4.9 % of the diabetic patients. There were no significant associations between abnormalities of SSRs, age, duration and form of diabetes, signs of peripheral neuropathy and electrophysiological abnormalities. Absence of SSR in the feet was more frequent found in patients with symptoms of autonomic dysfunction as bladder dysfunction ($p< 0.05$), diarrhea ($p< 0.03$) and male impotence ($p< 0.05$). These results suggest that SSR is a valuable test in the assessment of autonomic involvement in diabetic peripheral neuropathy. [Journal of Turgut Özal Medical Center 1996;3(4):324-327]

***Key Words**: Sympathetic skin response, autonomic dysfunction, diabetes mellitus.*

Diabetik nöropatide sempatik deri cevabının araştırılması

Klinik ve elektrofizyolojik olarak duysal-motor periferik nöropati saptanan 41 diabetik hastada, mediyan sinirin bilekten elektriksel uyarımı ile el ve ayaktan sempatik deri cevabı (SDC) kaydedildi. Kontrol olgularının hepsinde, el ve ayaktan tüm uyarılarda SDC'ler mevcuttu. Diabetik hastaların %14.6'inde ayakta, %4.9'unda elde SDC'ler kaydedilemedi. Diabetik hastalarda SDC bozukluğu ile hastanın yaşı, diabetin tipi, süresi, periferik nöropatinin klinik ve elektrofizyolojik bulguları arasında anlamlı bir ilişki olmadığı görüldü. Ayaklarda SDC yokluğu mesane disfonksiyonu ($p< 0.05$), ishal ($p< 0.03$) ve erkeklerde impotans ($p< 0.05$) gibi otonomik disfonksiyon semptomlu hastalarda daha sık bulundu. Sonuçlar SDC'nin diabetik periferal nöropatili hastalarda otonomik tutulumu göstermekte değerli bir inceleme yöntemi olduğunu telkin etmektedir. [Turgut Özal Tıp Merkezi Dergisi 1996;3(4):324-327]

***Anahtar Kelimeler**: Sempatik deri cevabı, otonomik disfonksiyon, diabetes mellitus.*

Long latency electrical response obtained from the skin surface by supramaximal electrical stimulation of the peripheral nerve is known as the sympathetic skin response (SSR) and considered as an index of peripheral autonomic nerve fiber function (1-3). This test is easy to perform during routine electromyography (EMG) studies for peripheral nervous system function, needing only

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few minutes to do it (4,5). Autonomic dysfunction is well known in diabetic patients (1). It has been reported that the SSR is reduced or absent in diabetic patients with peripheral neuropathy (2,3,6-8). In this study, we evaluated the diagnostic value of the SSR in diabetic patients with peripheral neuropathy, and also attempted to correlate the absence or decreased amplitude of SSR with autonomic symptoms.

MATERIAL AND METHODS

Normal controls were 20 healthy subjects of both sexes (11 female and 9 male) with ages ranging between 35 and 49 years (45.5 ± 8.1) none of whom had any evidences of peripheral neuropathy or dysautonomia or had been taking medications which would affect the autonomic nervous system. We also investigated 41 consecutive diabetic patients (25 female and 16 male) with peripheral neuropathy.

Criteria for selection of diabetic patients were presence of pain and paresthesia in the extremities, and/or presence of motor weakness, and/or hypoestesia, and abnormality of vibration in the neurological examination, and abnormal nerve conduction velocities consistent with a diagnosis of motor sensory polyneuropathy. All diabetics were asked about the presence of features of autonomic derangement, including orthostatic hypotension, diarrhea, bladder dysfunction, male impotence, and sweating problems (hypohydrosis, hyperhydrosis, gustatory sweating).

All recordings were made on subjects lying on a bed in an air-conditioned room at a constant room temperature of 25°C. The SSR test was performed by applying disposable surface EMG electrodes to the palm and the dorsum of the hand and to the sole and dorsum of the foot. Recordings were obtained on a Dantec Cantata EMG with filter settings, including 0.5 - 1000 Hz bandpass, a sensitivity of 0.2 - 0.5 mV per division, and sweep speed of 1 second per division. The stimulus was a brief electrical pulse (0.2 msec duration and 15 mA intensity) delivered to the median nerve at the right wrist every 60 second or longer to avoid habituation. Skin temperature was 32°C or above at the site where the test done. The test was considered to be abnormal if no response was detected after at least ten stimulations. We selected the mean amplitude of the five largest SSRs and the mean latency of the shortest SSRs with a clear cut onset.

We measured the nerve conduction velocities in the upper (median motor and sensory) and lower (peroneal motor and sural sensory) limbs. Amplitude, conduction velocity and distal latency measurements for the nerves tested were summed for analysis of results.

'Systat 5.02 for Windows' was used in computing statistics. A value of (p) lower than 0.05 was considered statistically singnificant.

RESULTS

No demographic diferences existed between diabetics and control groups (Table 1). The SSRs were always present in the control groups in all stimuli. Eighteen diabetic patients with peripheral neuropathy were considered to have symptomatic autonomic neuropathy, defined as any or all of the followings: orthostatic hypotension (9/18), diarrhea (6/18), bladder dysfunction (9/18), male impotance (4/8), and sweating problem (4/18) (Table 2).

The SSR was absent in 6 of the 41 patients (%14.6) whom all had autonomic symptoms. This absent response was restricted to the lower extremities in 4 patients (% 9.8) and involved both upper and lower extremities in 2 patients (%4.9). The SSR results (the amplitude) obtained from control group and diabetic group with and without autonomic symptoms were summed up in Table 3.

Table 1. Distribution of descriptive factors (sex, age, duration, and type of diabetes) in control group and diabetic groups with and without autonomic symptoms.

Factor	Control group (n = 20)	Diabetic with autonomic symptoms (n = 18)	Diabetic without autonomic symptoms (n = 23)
Sex (Male/Female)	11 / 9	10 / 8	15 / 8
Age (years)	35 - 49 (45.5 ± 8.7)	28 - 70 (51.4 ± 11.8)	30 - 67 (47.8 ± 11.1)
Duration of diabetes (years)	-	1 - 30 (8.6 ± 7.8)	1 - 34 (7.2 ± 7.1)
Type of diabetes (IDDM*/NIDDM**)	-	3 / 15	4 / 17

* IDDM: Insulin dependent diabetes mellitus,

** NIDDM: Non - insulin dependent diabetes mellitus.

The amplitude of the response in normal controls was consistently greater than in diabetics ($p<0.05$). The difference in between diabetic groups was not significant.

There were no significant associations between absence of SSRs and age, duration and form of diabetes, signs of peripheral neuropathy, and electrophysiological abnormalities. In the diabetics with autonomic symptoms, absent SSRs in the feet correlated with the presence of bladder dysfunction ($p<0.05$), diarrhea ($p<0.03$) and impotence ($p<0.05$) (Table 2).

Table 2. Results of sympathetic skin response compared with the presence of clinical autonomic symptoms.

	Orthostatic hypotention	Bladder dysfunction	Diarrhea	Sweating problem	Impotence
Total (n = 18)	9 /41	9 / 41	6 / 41	4 / 41	4 / 25 *
Diabetic with autonomic symptoms	9 / 18	9 / 18	6 / 18	4 / 18	4 /10
Absent SSR in the foot	3 / 6	5 / 6 ∝	4 / 6 ∂	1 / 6	3 / 4 ∝

*: male patients,
∝: pearson chi - square, $p < 0.05$,
∂: pearson chi - square , $p < 0.03$.

DISCUSSION

Autonomic neuropathy which may affect several organ systems is one of the most disturbing and serious problems of diabetic neuropathy. Up to 40% of diabetics have been found to have autonomic dysfunction as determined by cardiovascular function test (9).

SSR is only simple noninvasive autonomic test and its easy performance on an electromyographic machine have made it routine autonomic assesments in several neurophysiological laboratories. Owing to its extreme variability, most studies have considered SSRs to be abnormal only when it is absent under 70 years of age (6,10). SSR represents a function of sympathetic sudomotor fibers wheras most of the other autonomic tests is mainly indicative of a parasympathetic function of the vagus nerve (6,11-13). Autonomic symptoms in diabetic patients are predominantly mediated by parasympathetic fibers, thereby it is expected that SSR does not correlate with these symptoms (7,8). However, most of the investigators reported a lack of correlation between SSR and autonomic symptoms (2,3,7,8). This study found that SSRs were recorded in all of the diabetic patients without autonomic symptoms. No relationship was found between clinical and electrophysiological findings of motor sensory neuropathy and absence of SSR. In diabetics with autonomic symptoms, significant relationship between absent SSRs in the feet and presence of bladder dysfunction, impotence, and diarrhea was noted. The reason that our results differ from those of other studies may be due to the fact that autonomic symptoms are highly equivocal and that only significant complaints are accepted as autonomic symptoms in our study.

In summary, the results of this study suggest that SSR is a noninvasive and simple test for evaluation of autonomic function in patients with diabetes and correlated with autonomic symptoms.

Table 3. SSR results (the amplitude) of control group and diabetic groups with and without autonomic symptoms.

Site of record	Control group (n = 20, μV)	Diabetics with autonomic symptoms Θ (n = 18, μV)	Diabetics without autonomic symptoms (n = 23, μV)	p*
Hand	2110 ± 963.6	791.9 ± 409.8	642.2 ± 289.9	< 0.05
Foot	912.5 ± 432.2	437.4 ± 244.5	372.8 ± 124.9	< 0.05

*: One way ANOVA,
Θ: In diabetics with autonomic symptoms 2 had no hand and foot SSR, 4 had only absent foot SSR.

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