Indian J Physiol Pharmacol 1995; 39(2): 149-153

SYMPATHETIC SKIN RESPONSE AND AUTONOMIC DYSFUNCTION IN DIABETES

SANJEEV JHA* AND D. NAG**

Departments of Neurology,
** Sanjay Gandhi Postgraduate Institute of Medical Sciences*
Lucknow - 226 014
and
***KG's Medical College,*
Lucknow - 226 003

(Received on April 11, 1994)

Abstract: Study was conducted on 34 middle aged (35-52 years) diabetics of either sex to compare autonomic function in patients having and not having symptoms of dysautonomia. Fifteen age/sex matched healthy non-diabetic volunteers were control. No symptom of autonomic insufficiency was present in 19 (55.8%) while 15 (43%) diabetics had dysfunction in form of episodic syncope, vertigo, and palpitation, all on postural change. Tests of autonomic functions were restricted to evaluation of salivation, lacrimation, sweating, pilomotor response, reflex erythema and blood pressure changes with valsalva, posture and cold pressor. SSR was elicited using 5 stimuli on programmed Neuropack II and IV model machine. In asymptomatic diabetics, tests of autonomic functions were normal and comparable to controls but SSR was not recordable in 8 (42%). In remaining 11 (58%) asymptomatic diabetics, it was recordable. In 15 subjects who had symptoms of autonomic dysfunction, 6 (40%) had positive test of autonomic function but SSR was normal in only 5 (34%) and not recordable in 10 (66%) subjects. We conclude that SSR can be used as a easy, sensitive and probably early indicator of autonomic functions.

Key words: diabetic neuropathy, sympathetic skin response, autonomic function, autonomic dysfunction

INTRODUCTION

Diabetes mellitus is the most common human metabolic disease affecting about 200 million people in world. Neuropathy is its commonest complication. Formerly autonomic impairment was considered its small and obscure association but now it constitutes one of most distressing, serious and important component affecting 40% of diabetic (1). Because symptoms are insidious and vague, catastrophy like silent myocardial ischaemia and cerebrovascular accident come unheralded. Interpretation and identification of non-specific symptoms, pertaining to dysautonomia with asymptomatic diabetic autonomic neuropathy has been greatly aided by screening tests based on parasympathetic and sympathetic cardiovascular reflexes (2). We conducted this study of autonomic functions in uncomplicated, adequately controlled diabetics and compared the autonomic function tests including sympathetic skin response (SSR) in diabetic who were symptomatic and non-symptomatic for autonomic involvement.

METHODS

Nineteen male and fifteen female biochemically confirmed diabetics in age range of 35-52 years were subjects (mean age 43.2±13.1 yrs), 15 age and sex matched healthy volunteers were control. They were patients of non-insulin dependent diabetes (NIDDM). All were diagnosed at least 4-5 years prior to registration and were adequately controlled on oral

*Corresponding Author

hypoglycemics. After a detailed clinical evaluation, which included history suggestive of autonomic dysfunction (syncope, bowel, bladder and sexual dysfunctions, orthostatic hypotension, dyspepsia) necessary and relevant investigations were done to monitor target organ damage (cardiac, hepatorenal, opthalmic evaluation, nerve conduction studies and electromyography). Patients with evidence of target organ damage and hypertension were not selected. Patients requiring insulin were excluded. Evaluation of autonomic functions was restricted to standard tests of salivation, lacrimation, sweat test, pilomotor response, reflex erythema along with changes in blood pressure and RR interval variation (RRIV) with posture, Valsalva, respiration and cold pressor. They are standard reproducible and internationally accepted methods (3). Sympathetic skin response (SSR) was then measured using a variety of stimuli to prevent adaptation (since repeated use of same stimulus produces quick adaptation and erroneous response) on a Neuropack II and IV model of EMG machine supplied by NIHON KOHDEN, Japan. Measurements were done using cursors and markers of the machine, which had a computer, specially programmed to analyse response and results of SSR.

Dysautonomia for our study was defined by positivity of any two tests.

RESULTS

Our observations are summarised in Table I. In all subjects with clinical features of dysautonomia showing impairment of autonomic functions, the SSR was not elicitable and no patient with evident dysautonomia had a positive SSR (Fig. 1). We found that SSR was not recordable in 67% and recordable in only 33% of symptomatic diabetics. In the asymptomatic group also we observed that SSR was not recordable in 42% diabetics while the autonomic functions were normal and comparable to control.

DISCUSSION

We compared autonomic dysfunction in diabetic with and without symptoms of dysautonomia. Our aim was to observe if electrophysiologic documentation was more sensitive than conventional tests. We found that in 7 diabetics (44%), the SSR was not recordable (Fig. 1) while the patient had no symptom and

TABLE I :Comparison of autonomic functions and SSR in diabetic with and without symptoms of dysautonomia.

Parameter	*Symptomatic N=15*	*Asymptomatic N=19*	*Control N=15*
Vertigo	7 (47%)*	-	-
Syncope	4 (26%)*	-	-
Palpitation	6 (40%)*	-	-
Sweating test impaired	5 (33%)*	-	-
Orthostatic hypotension	6 (40%)*	-	-
RRIV with respiration	5 (33%)*	-	-
Valsalva positive	6 (40%)*	-	-
Cold pressor positive	6 (40%)*	-	-
SSR elicitable	5 (33%)*	11 (58%)	15 (100%)
SSR not elicitable	10 (67%)*	8 (42%)	0 (0%)

*P<0.01

autonomic functions were normal. We presume that SSR is a sensitive test and can be beneficial in detecting early autonomic dysfunction since abnormalities of distal sympathetic function occur in history of diabetic autonomic neuropathy (4). This response may be impaired while other bed side tests of autonomic nervous system may be normal as we observed in our study. This may serve an important marker in the prevention of major catastrophies like mortality from stroke, silent myocardial infarction and complications of autonomic insufficiency produced by diseases like polyneuropathies, alcoholism and ageing.

A large number of physiological changes occur in diabetics including decreased baroreceptor sensitivity, altered hemodynamic reflexes and catecholamine sensitivity which may contribute to higher unexplained mortality and increased vulnerability of hypoxic and ischaemic insults seen in diabetics with cardio and cerebrovascular accidents (3,4). The morphological basis of diabetic autonomic neuropathy is possibly due to both axonal loss and segmental demyelination (5) with enlargement and vacuolation of neurones. Autonomic dysfunction is often present in diabetic

NO	AMPLIFIER SENS (V/Div)	HI-F (Hz)	LO-F (Hz)	ACQUISITION ANLY (ms)	DLY (Dly)	CNT	WAVE	STIMULATOR (ELECTRIC) RATE (Hz)	DLY (ms)	INT1 (mA)	INT2 (mA)	DUR (ms)
1	1m	20	1	5K	0	1	S		0	0.0	0.0	0.2
2	1m	20	1	5K	0	1	S		0	0.0	0.0	0.2
3	1m	20	1	5K	0	1	S		0	28.2	0.0	0.2
4	1m	20	1	5K	0	1	S		0	28.2	0.0	0.2
5												
6												
7												
8												

NO	MEASUREMENT LATENCY (FROM TRIGGER) (SEC) L1	L2	L3	L4	L5	L6	L7	INTERVAL (SEC)	AMPLITUDE L1~L2
1	1.60	2.46							781μ
2	1.68	2.54							312μ
3									
4									
5									
6									
7									
8									

No	SCV (m/9) L1~L2	Dist (mm)	Temp (°C)	Area	V-Range (V-Div)
1					1.00m
2					1.00m
3					1.00m
4					1.00m
5					
6					
7					
8					

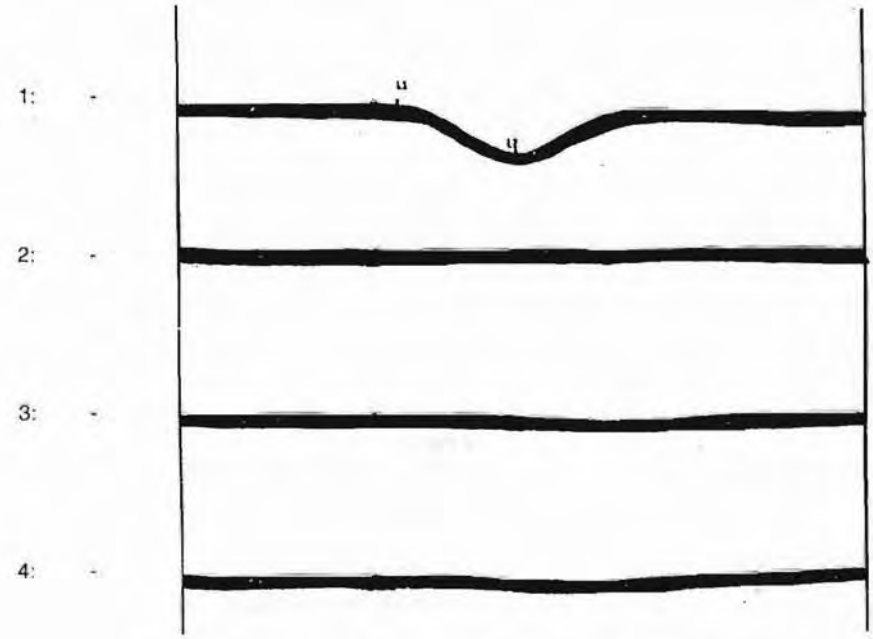

Fig. 1 : Normal S.S.R (Curve 1) and absent S.S.R. (Curve 2, 3 & 4) of a diabetic.

NO	AMPLIFIER SENS (V/Div)	HI-F (Hz)	LO-F (Hz)	ACQUISITION ANLY (ms)	DLY (Diy)	CNT	WAVE	STIMULATOR (ELECTRIC) RATE (Hz)	DLY (ms)	INT1 (mA)	INT2 (mA)	DUR (ms)
1	1m	20	1	5K	0	1	S		0	0.0	0.0	0.2
2	1m	20	1	5K	0	1	S		0	23.6	0.0	0.2
3	1m	20	1	5K	0	1	S		0	30.0	0.0	0.2
4	1m	20	1	5K	0	1	S		0	30.0	0.0	0.2
5	1m	20	1	5K	0	1	S		0	30.0	0.0	0.2
6												
7												
8												

NO	MEASUREMENT LATENCY (FROM TRIGGER) (SEC) L1	L2	L3	L4	L5	L6	L7	INTERVAL (SEC)	AMPLITUDE
1	1.38								
2	1.44								
3	1.38								
4	1.32								
5	1.28								
6									
7									
8									

No	SCV (m/9) L1–L2	Dist (mm)	Temp (°C)	Area	V-Range (V-Div)
1					1.00m
2					1.00m
3					1.00m
4					1.00m
5					
6					
7					
8					

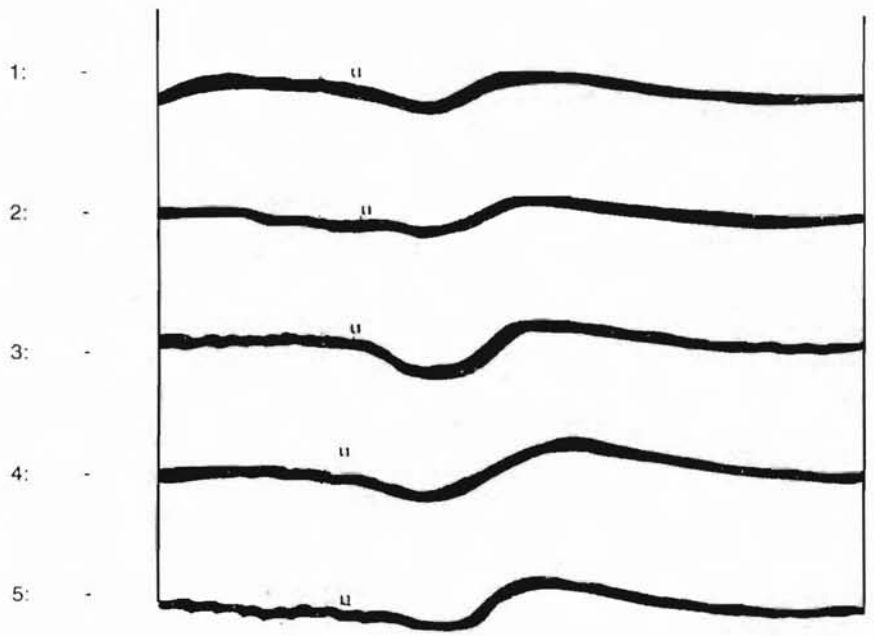

Fig. 2 : Normal well defined S.S.R. (marked L1) with different stimuli in control.

individuals without autonomic symptoms (6). Evaluation of cardiovascular reflex responses to various stimuli is the best diagnostic aid till date (7) but our results show that SSR may be impaired before any cardiovascular reflex heralded autonomic dysfunction. Many studies have, however, indicated a poor life expectancy once clinical disease is apparent (8). Though electrophysiological abnormalities may occur in patients without obvious neuropathy, the SSR has been well studied but not adequately standardized (9). Besides sensitivity, it is a simple, rapid and inexpensive procedure. It follows the all or none principle i.e. it is elicitable fully (Fig. 2) or is not elicitable (5), hence standardization is easy and erroneous measurements of latency, amplitude and reproducibility can be prevented.

REFERENCES

1. Ewing DJ, Clark BF. Diabetic autonomic neuropathy a clinical viewpoint. In: Diabetic neuropathy (ed) Dyck PJ, Thomas PK, Ashbury AK. Philadelphia, WB Saunders 1987; 66-88.
2. Ewing DJ, Martyn CN, Young RJ, Cark BF. The value of cardiovascular autonomic function tests, 10 years experience in diabetes. *Diabetes Care* 1985; 8: 491-498.
3. Bannister R, Mathies C. Testing autonomic reflexes. In: Autonomic Failure eds. Bannister R. Oxford University Press 1988; 289-307.
4. Low PA, Zimmerman BR, Dyck PH. Comparison of distal sympathetic with vagal function in diabetic neuropathy. *Muscle Nerve* 1986; 9: 592-596.
5. Low PA, Walsh JC, Huang CY, McLeod JG. The sympathetic nervous system in diabetic neuropathy - a clinical and pathological study. *Brain* 1975; 98: 341-356.
6. Pfeifer MA, Cook D, Brodsky J. Quantitative evaluation of cardiac parasympathetic activity in normal and diabetic mass. *Diabetes* 1982; 31: 339-345.
7. Ewing DJ, Clark BF. Diabetic autonomic neuropathy, present insights and future prospects. *Diabetes Care* 1986; 9: 648-656.
8. Ewing DJ, Campbell IW, Clark BF. The natural history of diabetic autonomic neuropathy. *Quarterly J of Med* 1980; 49: 95-108.
9. Knezevic WV, Bjado S. Peripheral autonomic surface potential. A quantitative technique for recording sympathetic conduction in man. *J Neurol Sci* 1985; 67: 239-242.