

A Comparative Study Of Cardiovascular Autonomic Function Test In Diabetes Mellitus Subjects And Controls

Dr. Bhavna A. Selot*, Dr. Bijal Mehul Shah*, Dr. Pankaj P. Taviad **

*Assistant Professor, Department of Physiology, **Assistant Professor,
Department of Microbiology, Medical College Baroda, Vadodara, India

Abstract: Background: Autonomic neuropathy is the most common complication of diabetes, whose severity is related to duration of diabetes and the degree of the metabolic control. The degree of loss of autonomic functions can be assess by series of autonomic tests. The aim of the present study was to find out the effects of diabetes mellitus on autonomic functions and the sensitivity of sympathetic tests in the early detection of autonomic dysfunction in Type 2 diabetics. Material and Methods: In this cross sectional study, 30 diabetics subjects were compared with 30 non-diabetics controls (plasma glucose level between 80-120 mg %) for their autonomic functions. Each subject was evaluated for cardiovascular autonomic neuropathy by isometric hand grip test & Blood pressure response to standing. Statistical analysis was performed using t test. Result: In Sustain hand grip test the mean difference in diastolic blood pressure was statistically significant $p < 0.01$ & Lying to standing blood pressure test has shown significantly altered autonomic functions amongst diabetics than non-diabetics. Conclusion: Diabetes mellitus is one of the systemic disease which leads to autonomic dysfunctions when compared to non-diabetes which may be because of increased blood glucose. [Selot B Natl J Integr Res Med, 2020; 11(3):19-22]

Key Words: Diabetes mellitus, Autonomic neuropathy, Autonomic function tests

Author for correspondence: Dr Bhavna A. Selot, 42, Saundarya bungalows, opp.raneshwar temple, Near St. Kabir School, Vasna Road, Vadodara 390015. Gujarat (India). E-Mail: bhavnaselot@yahoo.co.in Mobile: 9925045043

Introduction: Type 2 diabetes mellitus (formerly noninsulin-dependent diabetes mellitus (NIDDM) or adult-onset diabetes) is the most common metabolic and endocrine disorder¹. Type 2 diabetes is typically a chronic disease associated with a ten-year-shorter life expectancy and known to cause chronic complications particularly neuropathy, retinopathy, and nephropathy^{1,2}. The most common neurological disturbance in diabetes is the involvement of autonomic nervous system. Autonomic system is the part of peripheral nervous system and subdivided into the sympathetic and the parasympathetic nervous system that functions autonomously & continuously, without conscious effort³. This system controls visceral activities and oversees heart rate, blood pressure, breathing rate, body temperature, & other visceral activity that aid in maintaining homeostasis³.

Cardiovascular diabetic neuropathy is the most common and troublesome complication of diabetes mellitus, leading to the greatest morbidity and mortality and resulting in a huge economic burden for diabetes care. It is the most common form of neuropathy in the developed countries of the world, accounts for more hospitalizations than all the other diabetic complications⁴. We attempted to prove that sympathetic function tests in cases of type II diabetes mellitus by measuring the blood pressure response to standing from the supine

position and blood pressure response to sustained handgrip signifying their sensitivity in the early detection for diagnostic purposes.

Material & Methods: The study was conducted in S.S.G hospital, patient attending medicine OPD's and Diabetic clinic were selected for study. They were screened for inclusion in the study according to the "National Diabetes Data group and WHO" criteria for Diabetes. Written informed consent was obtained from each patient prior to inclusion in the study.

Inclusion Criteria: 1. Participants in our study were of two different categories 2. Control subjects who were normal subjects (n=30) must be non-diabetic who's plasma glucose concentrations was well within the normal limits 80 to 100 mg%. 3. All control subjects were free of hypertension and other systemic diseases and matched for age, sex as that of test group. 4. Diabetes subjects (n=30) who were known patients of diabetes and were under the medical treatment for control of blood sugar. These subjects were diabetic at least for duration of 5 years and more as referred from hospital case paper and were attending the diabetic clinic of S.S.G. hospital medical college Baroda.

Exclusion Criteria: 1. Case & controls subjects who did not give consent. 2. Subjects with hypertensive, suffering from renal failure,

suffering from disease that can cause autonomic neuropathy (leprosy, alcoholic neuropathy), neurological, history of tobacco smoking/chewing and alcohol consumption, thoracic skeletal deformities.

Parameters recorded: Following the selection of subjects, a general physical examination was performed and Standard anthropometrics measurements such as weight (kg), height (cms) were measured. Subjects were made to rest for 10 minutes and basal heart rate and blood pressure –systolic and diastolic were noted

1. Blood Pressure Response to Standing: The patients were asked to lie down in supine position and to relax completely. Basal blood pressure (mmHg) in right arm recorded by auscultatory method with a sphygmomanometer after 10 minutes of lying. Again participant was told to attain standing posture within 3 seconds and recordings were taken immediately.

For recording the systolic blood pressure (mm Hg), the first phase of korotkoff sound was considered and for recording the diastolic blood pressure the fifth phase, i.e. disappearance of korotkoff sound was considered.

Orthostatic hypotension is usually defined as a fall in blood pressure i.e. ≥ 20 -30 mm Hg systolic B.P. in response to postural change, from supine to standing⁵.

2. Sustained Hand Grip: The basal blood pressure was taken before the test. Blood pressure response to sustained hand grip was obtained by using Hand Gripe Dynamometer. The subject was asked to squeeze a Hand Grip Dynamometer to his maximum and maintained the gripe of 30% of his maximum at his voluntary contraction. Blood pressure was recorded after the termination of the test. The normal response is rise in diastolic blood pressure more than 16 mm Hg^{5,9}.

Results: Table 1 shows main anthropometric features which were comparable and well matched in diabetic and control group. The median age of the diabetic group was 58±7 years while control group was 56±7 years, and, mean weight of the diabetic group was 59± 8 kg, while control group was 58±4 kg. Similarly mean fasting glucose level were 139.93±55.18 and 92±11, mean postprandial blood glucose level 221.06±68 and 143±16 in both diabetic and control group

respectively. The mean Basal B.P. in diabetic and group and Basal H.R. were 139.69±23 mm Hg and 133±4 mm Hg respectively. Mean duration of diabetes in diabetic group was 8.85 years.

Table 1: Distribution Of The Study Population According To Different Parameters.

Sr. No	Parameters	Diabetic (N=30)		Non-Diabetic (N=30)	
		Mean	SD	Mean	SD
1.	Age (years)	58	7	56	7
2.	Height (cm)	162.30	5.04	164.44	6.69
3.	Weight (kg)	59	8	58	4
4.	FBS (mg/dl)	139.93	55.18	92	11
5.	PP ₂ BS (mg/dl)	221.06	68	143	16
6.	Basal Systolic B.P. (mm of Hg)	139.39	23	133	4
7.	Basal Diastolic B.P. (mm of Hg)	77.16	8.82	78	9
8.	Basal H.R./min.	84.33	10.5	81	12
9.	Duration of Diabetes (years)	8.85	3.05	-	-

Table 2: Autonomic Function Tests In Control And Cases Group.

Sr. No	Parameters	Diabetic (N=30)		Non-Diabetic (N=30)	
		Mean	SD	Mean	SD
1.	Supine SBP	139.39	23	133	14
	Supine DBP (mm Hg)	77.16	8.82	78	9
2.	3 Seconds. Standing SBP (mm Hg)	123.77	23.43	130	13
	3 Seconds. Standing DBP	68.47*	8.12	81	13
3.	Sustained Handgrip Test DBP (mmHg)	88.79*	11.72	99	10

* Indicate Statistically Significant P<0.01

Table 2 shows the mean value of supine systolic blood pressure (mm of Hg) in diabetic and control group were 139.39±23, 133±14 and mean value of supine diastolic blood pressure (mm of Hg) diabetic and control group were 77.16±8.82, and 78± 9 respectively.

Similarly, the mean value of systolic blood pressure (mm of Hg) within 3 seconds standing in diabetic and control group were 123.77±23.43 and 130±13 and mean diastolic blood pressure (mm of Hg) within 3 seconds standing were 68.47±8.12, and 81±13 in respectively. There was

mean difference found in SBP in supine ($p=0.15$) and standing position, ($p=0.17$) of two groups but it was not statistically significant. While significant mean difference was found in DBP within 3 seconds of standing ($p=0.0005$)

The mean values of diastolic blood pressure (mm Hg) during sustained hand grip test in diabetic and control group were 88.79 ± 11.72 and 99 ± 10 respectively. The mean difference in diastolic blood pressure was statistically significant $p < 0.01$.

Discussion: Among all the complications of diabetes, autonomic neuropathy is one of the most important challenging problems. The present study had been planned to find out the autonomic dysfunction that occur during diabetes. In this study the subjects selected were of diabetes mellitus and age matched non-diabetic as control subjects. The autonomic function tests were of blood pressure response to standing and sustained handgrip test.

People with diabetes can develop neuropathy within the first 10 years of diagnosis and risk increases with the duration of diabetes. Autonomic dysfunction can affect daily activities of individuals with diabetes and may invoke potentially life-threatening outcomes^{6,10}.

The result shows the values of parameters of autonomic function tests of the diabetic and non-diabetic subjects, in which parameters like orthostatic change in diastolic blood pressure and sustained handgrip shows highly significant differences when compared statistically between the groups. unpaired 't' test shows there was mean difference found in SBP in supine ($p=0.15$) and standing position, ($p=0.17$) of two groups but it was not statistically significant, while significant mean difference was found in DBP within 3 seconds of standing ($p=0.0005$). Morker B found that mean values decrease in diastolic blood pressure (mmHg) during postural change from lying to standing in diabetic and control group. The mean difference in diastolic blood pressure was statistically highly significant⁷. In patients with diabetes, orthostatic hypotension is usually attributable to damage to the efferent sympathetic vasomotor fibres, particularly in the splanchnic vasculature. The mean values of diastolic blood pressure (mm Hg) during sustained hand grip test in diabetic and control group were 88.79 ± 11.72 and 99 ± 10 respectively.

The mean difference in diastolic blood pressure was statistically significant $p < 0.01$. Ewing found handgrip test was useful in assessment of the integrity of the autonomic nervous system in diabetes mellitus.

Conclusion: Among all the complications of diabetes, autonomic neuropathy is one of the most important challenging problems. The present study had been planned to find out the autonomic dysfunction that occur during diabetes. The findings indicate that autonomic systems and deficits are common in diabetic mellitus. Orthostatic change in blood pressure and change in diastolic blood pressure in sustained handgrip test are the most sensitive parameters of autonomic function tests. They are the reflective parameters of sympathetic damage of autonomic nervous system¹¹. Uncontrolled level of diabetes and advancing duration of diabetes there is an increase in the occurrence of abnormal results of autonomic function tests. The early diagnosis of cardiac autonomic neuropathy can improve the prognosis and reduce adverse cardiac events⁸.

Acknowledgement: We express our sincere thanks to Dr. M.B. Jani for providing guidance and support.

References:

1. Chiranjeevi Kumar et al, A Comparative Study of Autonomic Function Sensitivity Testing in Type 2 Diabetes. International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 , Volume 4 Issue 4, April 2015
2. Komal Makwana et al, A Comparative Study Of Isometric Hand Grip Test in diabetics NJIRM; Vol. 3(4). September – October 2012 eISSN: 0975-9840 pISSN: 2230 – 9969
3. Michael Richter, PDF Autonomic nervous ...subsystems. Jan 1, 2012.
4. Victoria L Fisher et al' Cardiac autonomic neuropathy in patients with diabetes mellitus: current perspectives. Diabetes Metab Syndr Obes 2017; 10: 419–434.
5. Review article Agnieszka Zygmunt, Jerzy Stanczyk, Methods of evaluation of autonomic nervous system function, Arch Med Sci 2010; 6, 1: 11-18.
6. Aaron I. Vinik, Diabetic Cardiovascular Autonomic Neuropathy, diabetes care, volume 26, number 5, may 2003.
7. A Comparative Study of Autonomic Functions Between The Patients of Diabetes Mellitus

- And Controls Morker B,et al, IJBAP Vol. 2 Issue 1 .
8. Andrzej Bissinger Review Article Cardiac Autonomic Neuropathy. Published online Oct 29 , 2017
 9. D J Ewing et al, vascular reflexes in autonomic neuropathy,Volume,302,issue,7842, p1354-1356,December 15, 1973.
 10. Jan2007<https://doi.org/10.1161/circulationaha.106.634949>Circulation, Hindawi Journal of Diabetes Research Volume 2017, Article ID 5374176, 9 pages.
 11. Sidheshwar Virbhadrappa et al A Study of autonomic nervous system dysfunction among patient with diabetes mellitus: a cross sectional study, International Journal of Advances in Medicine , March-April 2017 , Vol 4 , Issue

Conflict of interest: None
Funding: None
Cite this Article as: Selot B, Shah B, Taviad P. A Comparative Study of Cardiovascular Autonomic Function Test in Diabetes Mellitus subjects And Controls. Natl J Integr Res Med 2020; Vol.11(3): 19-22