Role of Isometric Hand Grip Test and Resting Blood Pressure Measurement In Diagnosing Cardiovascular Autonomic Neuropathy In Patients with Diabetes Mellitus

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Abstract: Background: Diabetes is an iceberg disease with many complications like cardiovascular disease & diabetic neuropathy. Diabetic autonomic neuropathy is least recognized & most frequent complication. Cardiac autonomic neuropathy is associated with fatal outcome like silent myocardial ischemia & intra-operative liability. With this background we have evaluated the cardiac autonomic neuropathy in diabetic patients using resting blood pressure measurement & isometric hand grip test. Aim:Aim of the study is to analyze the role of handgrip test of & resting blood pressure in diagnosing Cardiac Autonomic Neuropathy. Materials And Methods: A Present cross sectional study was carried out in 50 diabetic patients & 50 controls(age and sex matched) at Sir T. Hospital Bhavnagar. Each subject was evaluated for cardiovascular autonomic neuropathy by isometric hand grip test & resting blood pressure.Diabetic patients were divided in 3 groups according to duration of disease(groupI-< 5 year, II-6 to 10 year, III- > 10 year) to evaluate the impact of duration of disease on autonomic nervous system.We have used student's T test for comparisons of result between 2 groups. Result:The mean value of resting systolic blood pressure(RSBP) & resting diastolic blood pressure (RDBP)is comparatively higher in diabetic patients compared to controls &the mean value of BP is increasing with duration of diabetes. Isometric hand grip test failure rate was higher in diabetic group than controls. Conclusion: outcome of the study indicates that cardiac autonomic neuropathy is seen in diabetic patients which progresses with duration. Implication of study: isometric hand grip test & resting BP measurement is effective diagnostic tool for cardiac autonomic neuropathy & it also show association with duration of disease.[Makwana k et al NJIRM 2012; 3(4) : 57-60]

Key Words: Isometric Hand Grip Test, autonomic dysfunction,cardiovascular autonomic neuropathy

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Introduction: India faces a grave health care burden due to the high prevalence of type-2diabetes and its complication like cardiovascular disease, retinopathy, nephropathy, and neuropathy. Diabetic Autonomic Neuropathy (DAN) is among the least recognized and least understood complication despite its significant impact on survival and quality of life in people with diabetes.The early recognition and appropriate management of diabetic neuropathy is important.[1,2]

Cardiovascular autonomic neuropathy leads to hampered life of patients due to dizziness because of postural hypotension, unawareness of hypoglycemic symptoms which make him more liable to various injuries, exercise intolerance, chronic fatigue, enhanced intra operative cardiovascular liability, increased incidence of asymptomatic ischemia, myocardial infarction, and decreased likelihood of survival after myocardial infarction.[3]

Purpose of this study was to evaluate the autonomic nervous system in diabetic patients and healthy subjects using resting blood pressure measurement and isometric hand grip test and compare the results between two groups. We have also analyzedthe effect of duration of disease on autonomic functions in diabetic patients.

Material and Methods : A Present cross sectional study was started on 25th October, 2010 with the permission of IRB committee. 100 study subjects were chosen from medicine outpatient department of Sir Takhtasinhaji hospital. Sample size was decided with the help of stastical programme RAOSOFT with the help of prevalence rate of diabetic autonomic neuropathy based on study done.[3]We have chosen 50 patients with diagnosed diabetes mellitus as case, and 50 age and sex matched healthy control. Each group contains 25 males & 25 females. The diabetic group was subdivided in three groups according to duration of disease.Group I(0- 5 year),Group II(5-

10 year), Group III(10-15) year. Instrument used is CANS-304 (cardiac autonomic nervous system analyzer -304) which is product of company Diabetic Foot Care India Pvt. Ltd, Hyderabad.

Inclusion criteria for cases was of any sex patient age being between 30 to 70 years & known case of diabetes.

Inclusion criteria for control was subject must be non-diabetic, matched for age, sex as that of test group are included as controls.

Exclusion criteria for case& controls subjects who did not give consent, hypertensive, suffering from renal failure, suffering from disease that cancause autonomic neuropathy (leprosy, alcoholic neuropathy, multi system atrophy thyroid disorders)suffering from any other disease (amyloidosis, beriberi, HIV, TB, leprosy),taking any drug that can cause neuropathy or affect Autonomic function testsSubjects who has addiction like nicotine, alcohol.[4]

PrecautionWe had taken care that Autonomic nervous system evaluation was done in every subject in morning between 9am to 1pm only, subject had adequate sleep the night before the day of examination, that subject had neither eat, nor smoked or taken alcohol prior 3 hour of testing.We had ensure that subject had stopped any drug taking that affect ANS functioning (like B blocker) before adequate duration. Because ANS system is widely affected by time of day, sleep, posture, fasting, smoking, caffeine.[5,6]

Consent of subject was taken, and then case report Performa was filled up by subject. Subject had pass through history taking and questionnaires.

Subject was given 5 minute rest and then systolic and diastolic BP measurement is done in right brachial artery by instrument only. Greater than or equal to 130 mmHg systolic BP and 85 mmHg of diastolic BP is considered abnormal or pre hypertensive.Subjects generated a maximum handgrip with handgrip dynamometer. There after a percentage of this maximum, often 30% of maximum value is sustained for a period of time or until exhaustion, 1 minute. And at the end of exercise post-test BP measurement is done. Hand grip test was repeated for 3 times for the reliability of result & subjective effort.

Normal value A value of more than 15mmHg rise in diastolic BP is taken as normal. Less than 10 mmHg rise in diastolic BP is taken as sympathetic insufficiency.10-15 mmHg is considered as borderline.[7]

Statistical tools: Data were entered and analysed with the Graph Pad.com. Statistical tests used for comparison is Student's t-test. Results are presented as mean (SD) and number (%) of cases as appropriate. The level of significance was set at $P < 0.05$, and 95% confidence intervals were calculated for the main outcome measures.

Result: The observations made were tabulated and analysed using appropriate statistical tools as shown in table and graph below. Each table is showing the result of unpaired T test & values are in mean & standard deviation of BP unit (mmHg). We have divided the patients according to duration of disease.groupI-0 to 5 year, groupII-6 to 10 year, group III- more than 10 year) Table 1 is showing the distribution of percentage of patients in each group.

Table1: Distribution according to Duration of diabetesmellitus

Duration of exposure in years	Number of subject	Percentage
<5years	18	36
6-10 years	15	30
>10 years	17	34

Table 2:comparison of Resting Systolic Blood Pressure in test and control groups and results of t-test(mmHg)

Groups	Mean ± SD	T	P
Test	127.8±11.74	4.54	<0.05
Control	117.48±10.94		

Table 3:Comparison of Resting Diastolic Blood Pressure in test and control groups and results of t-test(mmHg).

Groups	Mean ± SD	T	P
Test	81.26±10.95	3.95	<0.05
Control	73.84±7.48		

Table 4: Comparison of rise in DBP on handgrip test in test and control groups and results of t-test(mmHg):

Groups	Mean ± SD	T	P
Test	6.32±7.55	4.976	<0.05
Control	13.3±6.42		

Table 5: Autonomic Function Test in controls and cases (groups according to duration of disease)

Tests	controls	Group I	Group II	Group III
Resting SBP mmHg	117.48 ±10.94	124.88± 10.62	128.93± 10.29	129.88 ± 13.98
P value		0.01	0.05	0.01
RDBP mmHg	73.84± 7.48	79.94± 10.32	82.66± 10.76	81.44± 12.20
P value		0.08	0.006	0.0003 1
Rise in DBP on hand grip test mmHg	13.3± 6.42	6.5±7.5	10.26± 9.36	2.64± 3.06
P value		0.04	0.15	3.06

Table 6: Autonomic Function Test in controls and cases(showing percentage of subjects with autonomic dysfunction)

Tests	controls	Group I	GroupII	Group III
RSBP ≥130 mmHg	28%	44%	53%	76%
RDBP ≥ 85mmHg)	16%	38%	46%	52%
Abnormal handgrip test (<15 mmHg)	46%	77%	60%	100%

Discussion: Diabetes mellitus is a strong risk factor for cardiovascular disease. Diabetic autonomic neuropathy is a risk factor that independently increases cardiovascular risk in people with diabetes mellitus. Cardiovascular autonomic function tests are widely used to detect, verify and quantify the cardiovascular autonomic dysfunction. They have been tested for their validity and reliability. Against this background, the present study was undertaken to evaluate the Resting BP & Hand grip test in diabetes and match the data so obtained with healthy non diabetic individuals as controls.

The mean resting systolic blood pressurein test group and control group were 127.8 mmHg and 117.48 mmHg respectively. Present study shows that the resting systolic blood pressure was higher >130 mmHg in 28% control, 44% group 1, 53% group 2, and 76% group 3 diabetic patients. This means resting systolic blood pressure remains higher in diabetic than normal one and the resting systolic blood pressure increases as duration of diabetes increases.The mean value of resting systolic blood pressure is also increasing with duration of diabetes(group 1- mean value -124.88 mmHg , group 2- mean value -128.93 mmHg, group 3- mean value -129.88) One important cause is that dysfunction of the vascular endothelium causes cardiovascular disease.[8] Increased resting systolic blood pressure may indicates here increased sympathetic tone. These may be due to imbalance between sympathetic and parasympathetic system. This imbalance may be due to damaged vagal nerve due to diabetes.[9]

The mean resting diastolic pressure of test group and control group were 81.26 and 73.84 respectively. Present study shows that the resting diastolic blood pressure was higher >85 mmHg in 16% control, 38% group 1, 46% group 2, and 52% group 3 diabetic patients. This means resting systolic blood pressure remains higher in diabetic than normal one. The mean value of resting diastolic blood pressure also increases as duration of diseases increases (Group 1- mean value -79.94 mmHg , group 2- mean value -82.66 mmHg, group 3- 81.44 mean value) .

As diastolic blood pressure is purely sympathetic function (diameter of blood vessel is maintained by sympathetic system mainly) [10], increased resting diastolic blood pressure may indicates here increased sympathetic tone. These may be due to

imbalance between sympathetic and parasympathetic system. This imbalance may be due to damaged vagal nerve due to diabetes.[9]

The meanof rise in diastolic blood pressure by isometric exercise (hand grip test)of diastolic blood pressure in test group and control group were 6.32 and 13.3 respectively. Present study shows that the rise in diastolic blood pressure on handgrip test was abnormal (persons who failed to show rise in DBP≥ 15 mmHg) in 46% control, 77% group 1, 60% group 2, and 100% group 3 diabetic patients. It is noticed that all the diabetic patients with duration of diabetes > 10 year failed to show rise in diastolic blood pressure more than 15 mmHg. The mean value of rise in diastolic blood pressure on hand grip test also decreases as duration of diseases increases. results shows that group 1- mean value -6.5 mmHg , group 2- mean value -10.26 mmHg, group 3- mean value 2.64 mm hg).

This result indicate impaired sympathetic functions in diabetics, as diastolic blood pressure is purely sympathetic function. As we have discussed the resistance vessel which are responsible for maintaining diastolic blood pressure have only sympathetic nerve supply. [10]

In a study it was found that in patients with type II diabetes showed a decline in exercise induced pressure response in subjects with CARDIAC AUTONOMIC NEUROPATHY.[11]Our study show similar finding to study done by Nazeema khatoon[3] Limitation of study: diabetic autonomic neuropathy is very wide domain. We have covered only cardiac domain. Even though our sample size was not very large, it had been statistically adequate enough to make our study relevant and representative.

Conclusion: this study indicates that mean resting blood pressure remains high in diabetic group& isometric hand grip test failure rate is more in diabetic patients. Outcome &Implication of study: The cardiac autonomic neuropathy is seen in diabetic patient which progresses with duration of disease. It can be diagnosed effectively with simple, bed side, non-invasive test like Resting BP & isometric hand grip test. The early diagnosis & treatment of cardiac autonomic neuropathy will be very beneficial as it progresses with duration of disease.

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