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ORIGINAL RESEARCH

Cardiac Autonomic Neuropathy and its corelation with Duration of Diabetes Mellitus and HBA1C levels

[1]Dr. Anupam Anand, [2]Dr. Manuj Shukla, [3]Dr. Bhumesh Tyagi, [4]Dr. Nikhil Gupta, [5]Dr. Brinder Mohan Singh Lamba, [6]Dr. Adeshji Kishanji Gadpayle

[1,2]Post Graduate Resident, [3]Associate Professor, [4]Assistant Professor, [5]Professor, [6]Professor and Head, Department of Medicine, Sharda Hospital and School of Medical Sciences and Research, Sharda University Greater Noida, India

Corresponding Author
Dr. Nikhil Gupta
Assistant Professor, Department of Medicine, Sharda Hospital and School of Medical Sciences and Research, Sharda University Greater Noida, India

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Abstract

Aim: To evaluate the cardiac autonomic neuropathy and its correlation with duration of diabetes mellitus and HBA1C levels.

Methods: This cross-sectional study was carried out at Sharda Hospital from August 2022 to March 2024 with a study population of 50 patients of diabetes mellitus who met the inclusion criteria and provided informed written consent. Beat-to-beat HRV, Heart rate response to standing,Systolic blood pressure response to standing and Diastolic blood pressure response to isometric exercise were the parameters recorded for evaluation of cardiac autonomic function.

Results: The age of population under study ranged from a minimum of 40 years to a maximum of 74 years. The mean age of the study population was 58.52 ± 8.64 years. The minimum duration of diabetes mellitus in study group was 2 years and maximum duration was 18 years. The mean duration was 8.84+/-4.17 years. The minimum value of HBA1c was 6.7% and maximum value was 12.8%. The mean value is 8.62+/-1.49 %. The median value was 8.4% and variance was 2.21 indicating poor glycaemic control. It was observed that out of 50 patients only 31 patients were suffering from cardiac autonomic neuropathy. The male to female ratio was 1.21. Duration of Diabetes was correlated with Beat to Beat HRV, Beat to Beat R-R interval, Heart Rate response to standing and Valsalva maneuever, fall in systolic blood pressure response to standing, and diastolic blood pressure response to isometric handgrip exercises.Increase in HBA1C values did not seem to effect Beat to Beat HRV, Beat to Beat R-R interval, Heart Rate Response to Standing and Valsalva Maneuverer. or Diastolic Blood Pressure response to Isometric Exercises. It was discovered that HbA1c did not have a significant association with CAN, which shows that inadequate control of glucose levels in the short term does not have a correlation with the prevalence of CAN.

Conclusion: Cardiac Autonomic Neuropathy is an important, life threatening yet underdiagnosed complication of Diabetes Mellitus. Early detection must be the aim of physicians and cardiologists. Measuring for orthostatic hypotension should be a routine practice in Diabetes Mellitus patients. These can be helpful in screening for CAN and performing other CARTs to confirm presence of CAN. Duration of Diabetes has the most significant effect on development of Cardiac Autonomic Neuropathy. Early detection of Diabetes Mellitus and performing Fasting Blood Sugar in patients attending OPD, who may

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be symptomatic or otherwise can be of great help.Glycaemic Control did not show to have enough impact on development of Cardiac Autonomic Neuropathy.
Keywords: Cardiac Autonomic Neuropathy, Diabetes Mellitus and HBA1C levels.

Introduction

American Diabetes Association defines Diabetes Mellitus as a group of metabolic illnesses that are characterised by hyperglycaemia and are brought on by abnormalities in either the action or secretion of Insulin.[1] There are approximately 62 million reported instances of Diabetes in India, which indicates that the disease has the potential to become a pandemic .Wild et al[2] forecast that the prevalence of diabetes will more than double by the year 2030, going from 171 million in the year 2000 to 366 million in the year 2030. India is expected to experience the greatest growth in this regard.

There have not been enough studies conducted on the prevalence of diabetes and the complications that it causes, despite the fact that this condition is quite common. It has been found that even when Indians have a low body mass index, they are still at risk for additional disorders like high visceral fat, increased waist–hip ratio, raised waist circumference, enhanced insulin resistance, high prevalence of dyslipidaemia, and early β-cell malfunction.

There are several factors that contribute to the difficulty of disease management. These factors include low levels of awareness, a high incidence of diseases that go undetected, the high expense of care, and a shortage of skilled medical care. Neuropathy remains one of the most common complications that can arise from diabetes. Based on the findings of a study, sixty-six percent of individuals diagnosed with IDDM were impacted by neuropathy. It is approximately as prevalent for those with NIDDM and IDDM to experience neuropathy. Nevertheless, neuropathy symptoms were present in 28 percent of patients. According to the findings of the GOAL A1C study[3], clinical evaluation was only able to identify 38 percent of patients who had mild neuropathy and approximately 61 percent of patients who had severe neuropathy.

Cardiac Autonomic Neuropathy (CAN) is one of the important but often neglected cardiovascular complications of diabetes.[4]It's the impairment of the autonomic regulation of the cardiovascular system in the absence of other causes. It's usually becomes symptomatic only in the later stages and is usually irreversible at that stage. Early detection of CAN, when the disease is in subclinical stage, by doing cardiac reflex testing is important as intensive intervention like stricter glycaemic control and lifestyle modification may delay the disease course or may even reverse it. Demonstration of an augmented sympathetic tone is the mainstay of diagnosing subclinical CAN. There is a lacuna of studies conducted in India which define the prevalence and characteristics of CAN in patients with diabetes. We conducted this study to identify the prevalence of CAN in our study population and also to correlate it with glycaemic control and the duration of DM.

Materials and methods

Study area: Sharda Hospital, Department of General Medicine. Study population: - Patients attending OPD (Out Patient Department) and IPD (In Patient Department) at Sharda Hospital, Greater Noida.

Inclusion criteria for case:

- Diabetes mellitus patients on basis of ADA 2018 Criteria.
- Non-Critically ill, T2DM patients of either sex with age >35 years.
- Patients who give consent for study.

Diabetics are taken according to ADA 2018 criteria ● HbA1C > 6.5% ● FPG ≥ 126mg/dl ● 2-hr Plasma Glucose ≥ 200 mg/dl during a oral glucose tolerance test or ● In a patient with

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classic symptoms of hyperglycaemia or hyperglycaemic crisis, a random plasma glucose ≥200 mg/dL.

Exclusion criteria for cases

● Critically ill patients, patients in sepsis ● Patients with Chronic Renal failure, Liver diseases, Pregnancy, Lactation ● Patients with acute or chronic diarrheal/malabsorption states ● Autoimmune diseases like rheumatoid arthritis, Guillain-Barré syndrome, lupus, and Sjogren's syndrome. Lyme disease. HIV, GB Syndrome ● Known patients of Amyloidosis and Cerebrovascular Accident

Sample Size: 50 cases of Diabetes Mellitus based on ADA 2018 criteria who are non-critical patients of either sex age>35years

Study Design

● Analytical study ● Cross sectional Study duration This will be a One & half year study, from August 2022 to March 2024. Method of measurement of outcome of interest

● Standard statistical methods have been used to measure the outcome.The relation between HbA1C and Cardiac Autonomic Neuropathy / Duration of Diabetes and Cardiac Autonomic Neuropathy has been calculated using Karl-Pearson Co-efficient and a regression analysis has also be done.

● Sample Size calculated using Cochran's formula- ● Where: e is the desired level of precision (margin of error) p is the (estimated) proportion of the population which has the attribute in question, q is 1 – p. Using this formula with Z= 1.96, Prevalence= 11.8% and precision around 9%, sample size will be 50.

Data collection method● Patient's detailed history has been taken along with thorough physical examination and relevant investigations will be done. Investigations will include ● CBC ● LFT ● KFT ● RBS ● FBS ● PGBS (2hr) ● HbA1C ● Urine routine and microscopy ● Chest X-ray PA view ● ECG Special Tests to determine Cardiac Autonomic Neuropathy:

Test technique normal response and value

Beat-to-beat HRV

With the patient at rest and supine, heart rate is monitored by ECG while the patient breathes in and out at 6 breaths/min, paced by a alarm timer every 10 seconds. A difference in heart rate of > 15 bpm is normal and < 10 bpm is abnormal. The lowest normal value for the expiration inspiration ratio of the R-R interval is 1.17 in patients aged 20–24; this value decreases with age.

Heart rate response to standing

During continuous ECG monitoring, the R-R interval is measured at beats 15 and 30 after standing. Typically, a tachycardia is followed by reflex bradycardia. The 30:15 ratio should be > 1.03. Heart rate response to Valsalva maneuverThe subject forcibly exhales into the mouthpiece of a manometer to 40 mm Hg for 15 s during ECG monitoring. Healthy subjects develop tachycardia and peripheral vasoconstriction during strain and an overshoot bradycardia and rise in blood pressure with release. The normal ratio of longest to shortest R-R is > 1.2.

Systolic blood pressure response to standing

Systolic blood pressure is measured in the supine subject. The patient stands, and the systolic blood pressure is measured after 2 min. Normal response is a fall of < 10 mm Hg; borderline is a fall of 10–29 mm Hg; abnormal is a fall of > 30 mm Hg with symptoms.

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Diastolic blood pressure response to isometric exercise

The subject squeezes a handgrip dynamometer to establish a maximum. Grip is then squeezed at 30% maximum for 5 min. A normal response for diastolic blood pressure is a rise of > 16 mm Hg in the opposite arm.

Statistical Analysis

- Master chart extracting data from entire study population has been created using their clinical and laboratory records.
- All the data obtained has been analysed statistically using software like Microsoft Excel, IBM SPSS.
- Appropriate standard statistical analysis methods will be used to determine factors associated with the outcome.
- A 'p' value of <0.05 was considered significant.

Results

The age of population under study ranged from a minimum of 40 years to a maximum of 74 years. The mean age of the study population was 58.52 ± 8.64 years. Majority of the study participants belonged to 51-64years, which corroborates with the international statistics.There were 27 males and 23 females in the study group., Majority of the study participants were males in this study, with the M: F of 1:17**.** The minimum duration of diabetes mellitus in study group was 2 years and maximum duration was 18 years. The mean duration was 8.84+/-4.17 years. The minimum value of HBA1c was 6.7% and maximum value was 12.8%. The mean value is 8.62+/-1.49 %. The median value was 8.4% and variance was 2.21 indicating poor glycaemic control. The minimum and maximum HBA1C% values were 6.8% and 11.1% respectively in males and for females, it was 6.7% and 12.8% respectively. The mean HBA1C % in males were 8.38% and in females was 8.9%. It was observed that out of 50 patients only 31 patients were suffering from cardiac autonomic neuropathy. The male to female ratio was 1.21. It is observed that beat to beat Heart Rate variability. It changes by one unit, the value of the variable Duration of Diabetes (in yrs) changes by -1.02 units. The p-value is<.001. Thus, there is significant positive correlation with CAN and duration of diabetes.

	Unstandardized Coefficients	**Standardized Coefficients**				**95% confidence interval for B**	
Model	**B**	**Beta**	**Standard error**	**t**	**P**	**lower bound**	**upper bound**
(Constant)	19.74		1.18	16.67	<.001	17.36	22.12
Beat to Beat HRV	-1.02	-0.81	0.11	-9.63	<.001	-1.23	-0.8

It is observed that Heart rate variability is standing position with duration of Diabetes having positive correlation (p -<0.001). It changes by one unit, the value of the variable Duration of Diabetes (yrs) changes by -36.16 units. The p-value is <.001.

	Unstandardized Coefficients	**Standardized Coefficients**				**95% confidence interval for B**	
Model	**B**	**Beta**	**Standard error**	**t**	**P**	**lower bound**	**upper bound**
(Constant)	1.1		0.02	57.39	<.001	1.06	1.14

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Duration of Diabetes (yrs)	-0.01	-0.64	0	-5.73	<.001	-0.02	-0.01

The correlation of duration of diabetes with heart rate variability was studied. The unstandardized coefficient B indicates the expected change in the dependent variable Heart Rate Response to Valsalva Manoeuvre for each one-unit increase in the respective independent variable. The p-value is <0.001, indicating that this coefficient is statistically significantly different from zero, which means that we have evidence that Duration of Diabetes (yrs) impacts the dependent variable.

	Unstandardized Coefficients	**Standardized Coefficients**				**95% confidence interval for B**	
Model	**B**	**Beta**	**Standard error**	**t**	**P**	**lower bound**	**upper bound**
(Constant)	1.41		0.06	25.18	<.001	1.29	1.52
Duration of Diabetes (yrs)	-0.03	-0.57	0.01	-4.78	<.001	-0.04	-0.02

While studying Correlation of Duration of Diabetes Mellitus with Fall in Systolic Blood Pressure Response to Standing it was found that for every one unit increase in Duration of Diabetes (yrs), the log-odds of the outcome increase by 0.29 . The odds ratio of 1.34 suggests a 33.84% increase in the odds of the outcome for each additional unit of Duration of Diabetes (yrs). The p-value of .016 is below the conventional 0.05 threshold, suggesting that Duration of Diabetes (yrs) is statistically significant at the 5% level.

	Coefficient B	**Standard error**	**z**	**p**	**Odds Ratio**	**95% conf. Interval**
Constant	-5.11	1.56	3.28	.001	0.01	0 - 0.13
Duration of Diabetes (yrs)	0.29	0.12	2.42	.016	1.34	.06- 1.69

While studying correlation of Duration of Diabetes Mellitus with Diastolic Blood Pressure response to Isometric handgrip exerciseit was found thatfor every one unit increase in Duration of Diabetes (yrs), the log-odds of the outcome decrease by -0.02 . The odds ratio of 0.98 suggests a 1.51% decrease in the odds of the outcome for each additional unit of Duration of Diabetes (yrs). The p-value of 0.872 is above the conventional 0.05 threshold, suggesting that Duration of Diabetes (yrs) is not statistically significant at the 5% level.

	Coefficient B	**Standard error**	**z**	**p**	**Odds Ratio**	**95% conf. Interval**
Constant	-4.51	2.53	1.78	.075	0.01	0 - 1.57
Duration of Diabetes (yrs)	0.07	0.23	0.28	.778	1.07	.68- 1.68

There is a weak positive, yet significant correlation of HbA1c with Systolic Blood Pressure Response to Standing, while there is insignificant weak negative correlation with Diastolic Blood Pressure Response to Isometric Exercises.

	Unstandardized Coefficients	**Standardized Coefficients**				**95% confidence interval for B**	
Model	**B**	**Beta**	**Standard error**	**t**	**P**	**lower bound**	**upper bound**

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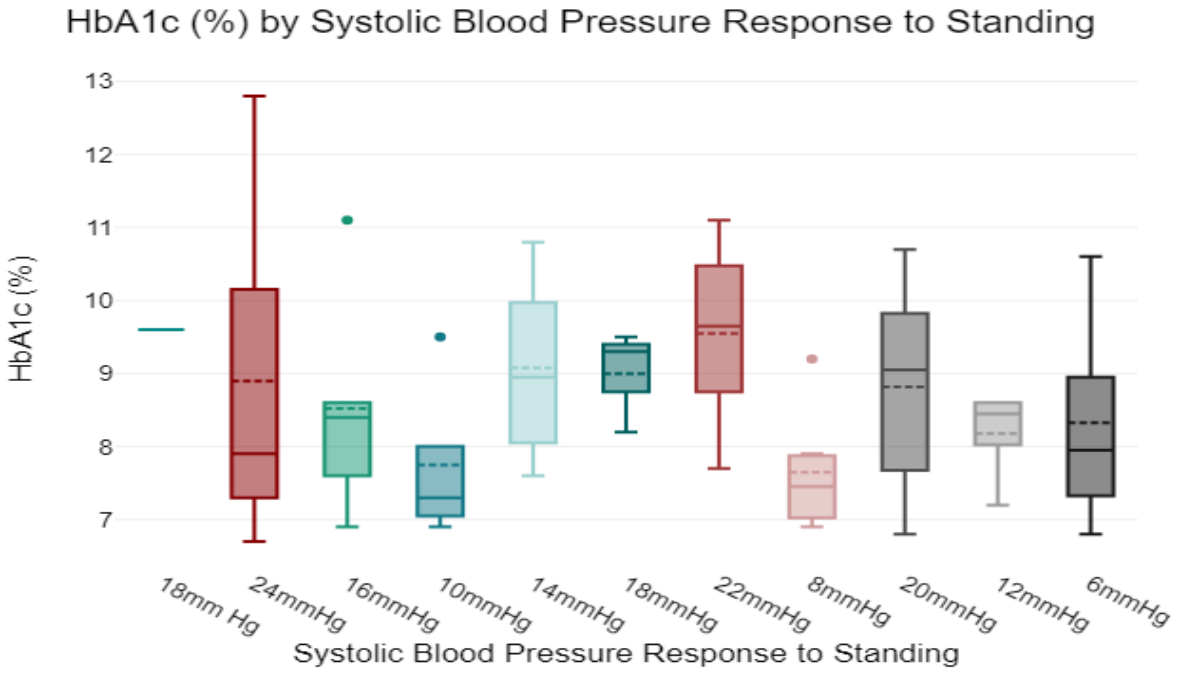
(Constant)	15.17		2.75	5.52	<.001	9.64	20.7
HbA1c (%)	-0.52	-0.23	0.31	-1.64	.107	-1.15	0.12



PEARSON'S CORRELATION WITH HBA1C	R VALUE	P VALUE
Systolic Blood Pressure Response to Standing	0.3206	0.023212
Diastolic Blood Pressure Response to Isometric Exercises	-0.1445	0.318429

If the value of the variable HbA1c (%) changes by one unit, the value of the variable Beat to Beat HRV changes by -0.52 units. The p-value is .107, indicating that this coefficient is not statistically significantly different from zero, which means we cannot confidently say that HbA1c (%) impacts the dependent variable.

	Unstandardized Coefficients	Standardized Coefficients				95% confidence interval for B	
Model	B	Beta	Standard error	t	P	lower bound	upper bound
(Constant)	1.16		0.02	65.53	<.001	1.13	1.2
HbA1c (%)	0	0.1	0	0.95	.347	0	0.01
Duration of Diabetes (yrs)	-0.01	-0.73	0	-6.65	<.001	-0.01	0

While correlating HBA1C with Beat to Beat R-R interval using regression analysis, it was found that if the value of the variable HbA1c (%) changes by one unit, the value of the variable Beat to Beat R-R Interval changes by 0 units. The p-value is .418, indicating that this coefficient is not statistically significantly different from zero, which means we cannot confidently say that HbA1c (%) impacts the dependent variable.

Model	B	Beta	Standard error	t	P	lower bound	upper bound
(Constant)	15.17		2.75	5.52	<.001	9.64	20.7

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HbA1c (%)	-0.52	-0.23	0.31	-1.64	.107	-1.15	0.12

	Unstandardized Coefficients	**Standardized Coefficients**				**95% confidence interval for B**	
Model	**B**	**Beta**	**Standard error**	**t**	**P**	**lower bound**	**upper bound**
(Constant)	1.16		0.02	65.53	<.001	1.13	1.2
HbA1c (%)	0	0.1	0	0.95	.347	0	0.01
Duration of Diabetes (yrs)	-0.01	-0.73	0	-6.65	<.001	-0.01	0

HBA1C% was also correlated with Heart Rate response to standing and Valsalva Manouever. The regression analysis for HBA1C with Heart Rate Response to Valsalva Manouever showed that If the value of the variable HbA1c (%) changes by one unit, the value of the variable Heart Rate Response to Valsalva Manouver changes by -0.02 units. The p-value is .268, indicating that this coefficient is not statistically significantly different from zero, which means we cannot confidently say that HbA1c (%) impacts the dependent variable.

	Unstandardized Coefficients	**Standardized Coefficients**				**95% confidence interval for B**	
Model	**B**	**Beta**	**Standard error**	**t**	**P**	**lower bound**	**upper bound**
(Constant)	1.35		0.17	8.03	<.001	1.01	1.69
HbA1c (%)	-0.02	-0.16	0.02	-1.12	.268	-0.06	0.02

The regression analysis of HBA1C% with Heart Rate response to Standing showed that if the value of the variable HbA1c (%) changes by one unit, the value of the variable Heart Rate Response to Standing changes by -0.02 units. The p-value is .019, indicating that this coefficient is statistically significantly different from zero, which means that we have evidence that HbA1c (%) impacts the dependent variable.

	Unstandardized Coefficients	**Standardized Coefficients**				**95% confidence interval for B**	
Model	**B**	**Beta**	**Standard error**	**t**	**P**	**lower bound**	**upper bound**
(Constant)	1.14		0.06	19.36	<.001	1.02	1.26
HbA1c (%)	-0.02	-0.33	0.01	-2.43	.019	-0.03	0

Discussion

This study was performed at Sharda Hospital on OPD and IPD patients, who met the inclusion criteria and provided written informed consent. This was a cross sectional, analytical study to establish correlation between Cardiac Autonomic Neuropathy (CAN) and its correlation between HBA1C and duration of diabetes mellitus.

A total of 31 patients, or 62%, who had type 2 diabetes were found to have CAN in our study. This is slightly less when compared to other studies where there was higher prevalence of CAN. In M. Matta[5] et al nearly 70% had CAN. In another Indian studies among North Eastern population the prevalence was also 70%. The study population is more than our study hence there may be difference in prevalence. In another study by Pappachan et al[6] done in South India the prevalence was 60%, which was similar to the findings in our study.

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Several studies examined the prevalence of CAN in patients with type 1 DM (T1DM) and type 2 DM (T2DM) These studies showed a large variation in CAN prevalence: 17%–66% in patients with T1DM and 31%–73% in patients with T2DM. This is thought to be due to discrepancies and variation in the criteria used to diagnose CAN, study populations, and variation in CAN risk factors, etc.

A study by Richard Migisha et al.[7] showed CAN was detected in 156/299 (52.2%) of the participants on the basis of one or more abnormal cardiovascular autonomic reflex tests. Our study showed 62% prevalence of Cardiac Autonomic neuropathy which was similar to international studies. The prevalence was more with increasing duration of Diabetes Mellitus and also with age.

The mean age of the study population was 58.52 ± 8.64 years. Majority of the study participants belonged to 51-64years, which corroborates with the international statistics. In a study by Bhuyan et al,[8] in a total of 100 patients were enrolled in this study, the mean age of the patients was 53.3 ± 10.37 years (range: 36–72 years). This was slightly higher in the overall population in our study; however, this was similar to the age distribution in patients with CAN in our study.

In our study, 23 were females and 27 were males. The prevalence of CAN did not differ significantly between the sexes. In a study by Birajdar et al[9], there were 70 males and 30 females with a male to female ratio of 2.3:1. In a study by Bhuyan et al[8], however, there were 60 males and 40 females, which is similar to the gender ratio as compared to our study. The gender ratio in our study was 1.17 and it was quite similar to study of Bhuyan et al which was 1.5. The reason for this could be due to the higher incidence of post-menopausal women in the present study. It is also possible that Indian women, especially housewives, do not monitor their blood sugars as well as others, and hence, the uncontrolled diabetes could contribute to this.

The mean Beat to Beat Heart Rate Variability in males was 11.66+/-3.22 / min and in females, the mean Beat to Beat Heart Rate Variability was 9.66+/- 3.33/ min. Females with Cardiac Autonomic Neuropathy showed an impaired Beat to Beat HRV as compared to males with Cardiac Autonomic Neuropathy in the study group. It can again be attributable to late detection of Diabetes Mellitus in women leading to impaired Beat to Beat HRV on presentation.

The mean Beat to Beat R-R interval was 1.13+/- 0.03. A value of E: I>1.17 is considered normal. Individuals with Cardiac Autonomic Neuropathy exhibited a significant reduction in E:I ratio (<1.17). However, with age this ratio decreases but even after factoring in the effect of advancing age, the difference in Heart Rate in inspiration and expiration was <10/ min in individuals detected with CAN.

In a study by Birajdar et al[9], they noted that among the abnormal cardiovascular autonomic reflex test, resting tachycardia (heart rate ≥100 beats per minute) was present in 17%, abnormal E:I difference in 56%, abnormal 30:15 ratio in 42%, abnormal Valsalva ratio in 32%, orthostatic hypotension 11%, and abnormal blood pressure response to sustained handgrip in 19% cases.

In our study, while correlating HBA1C with Beat-to-Beat R-R interval using regression analysis, it was found that if the value of the variable HbA1c (%) changes by one unit, the value of the variable Beat to Beat R-R Interval changes by 0 units. The p-value is .418, indicating that this coefficient is not statistically significantly different from zero, which means we cannot confidently say that HbA1c (%) impacts the dependent variable. More precisely the null hypothesis that the coefficient of HbA1c (%) is zero in the population is not rejected.

The regression analysis of HBA1C% with Heart Rate response to Standing showed that if the value of the variable HbA1c (%) changes by one unit, the value of the variable Heart Rate

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Response to Standing changes by -0.02 units. The p-value is .019, indicating that this coefficient is statistically significantly different from zero, which means that we have evidence that HbA1c (%) impacts the dependent variable.

Our study finding are similar to study mentioned by Victoria L Fisher- 2017.[10] The effects of intensive glycaemic control on CAN in patients with T2DM is still unclear. The Veterans Affairs Cooperative Study suggested no impact of intensive glycaemic control on CAN. In another randomized controlled trial (RCT), intensive glycaemic control in newly diagnosed T2DM in primary care did not have an impact on CAN prevalence at 6-year follow-up.[11] Conversely, the STENO-2 trial[12] demonstrated that intensive multifactorial treatment (including behaviour modification and intensive therapy targeting hyperglycaemia and CVD risk factors) lowered progression to AN (based on HRV during paced breathing and orthostatic hypotension) in T2DM (OR 0.32, 95% CI 0.12–0.78) these benefits were sustained at the 2-year follow-up. Another possibility is that HbA1c is not a good indicator of blood glucose variability promoting hypoglycaemic stress that was associated in a recent study with reduced heart rate variability independent of glycaemic control as assessed by HbA1c Thus, it could be suggested that glucose variability rather than glucose levels contributes to cardiovascular autonomic dysfunction among adults with type 1 diabetes.

There is a weak positive, yet significant correlation of HbA1c with Systolic Blood Pressure Response to Standing, while there insignificant weak negative correlation with Diastolic Blood Pressure Response to Isometric Exercises. The fall in systolic blood pressure on standing was greater at higher HBA1C% levels This was corroborated by the findings in the study by Bhuyan et al[8], Birajdar et al[9] and Agarrwal et al. [13]

Rank-Spearman correlation analysis done in a study of Chaerul Acmad et al.[15]showed a significant moderately positive correlation between HbA1c and CARTs score (r = 0,454, CI 95% 0,187-0,772, P = 0,004) and also mean HbA1c within the last 2 years with CARTs score (r = 0,564, IK 95% 0,289-0,839, P = 0,000). Multivariate analysis, mean HbA1c remained correlated significantly with CARTs score even after adjustment toward age, gender, duration of diabetes, and diabetic therapy. There was significant moderately positive correlation between glycaemic control and cardiac autonomic neuropathy in type 2 diabetic patients. Our study has almost similar results with significant correlation between HBA1c and systolic blood pressure response to standing.

Stepwise logistic regression in a study done by Yun Ru Lai et al[16]. showed that HbA1c-SD and retinopathy were risk factors that were independently associated with the presence of CAN. A longitudinal study is required to confirm whether controlling blood glucose level is effective in reducing CAN progression.

In a study by Kempler et al[17] confirms the inverse association between handgrip test abnormality and hypertension among patients with diabetes. Higher values of ambulatory blood pressure monitoring (ABPM) parameters are associated with greater increases in diastolic blood pressure during isometric handgrip exercise. Furthermore, associations of handgrip outcomes with higher parameters of ABPM and with diminished HRV measures of parasympathetic autonomic function imply that results of the handgrip test are rather marker of sympathetic over activity accompanying hypertension. They also observed that mostly in elderly type 2 diabetic patients, prevalence of CAN based on the presence of at least 2 abnormal cardiovascular reflex tests was 42.3%.

By comparing our analysis with other studies, it is possible that the high incidence of CAN in our study could be attributed to the fact that we included patients who had been diagnosed with diabetes for long duration (mean duration over 08 years). In India, especially in case of Diabetes Mellitus, people seek medical attention only when they become symptomatic. This holds true specially for rural areas. Consequently, detection of early Cardiac Autonomic Neuropathy becomes difficult. The authors Aggarwal et al. reported a prevalence rate of

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autonomic neuropathy that was comparable to the one described above. The positive link between Cardiac Autonomic Neuropathy and the length of time a person has had diabetes has been revealed by Ahire et al[18]. They demonstrated that patients who have had diabetes for more than five years are more likely to have definite and severe Cardiac Autonomic Neuropathy compared to individuals who have had that condition for less than five years. However, Ahire et al.[18] also discovered that early Cardiac Autonomic Neuropathy was frequently present in individuals who had been diagnosed with type 2 diabetes for a shorter period of time. They came to the conclusion that all newly diagnosed patients with type 2 diabetes should undergo screening for Cardiac Autonomic Neuropathy.

Conclusion

Cardiac Autonomic Neuropathy is an important, life threatening yet underdiagnosed complication of Diabetes Mellitus. Early detection must bethe aim of physicians and cardiologists. Simple cost-effective tests like Diastolic Blood Pressure response to Isometric Handgrip Exercise test using a handgrip dynamometer can serve as important cost effective tool to diagnose CAN. Making it a part of OPD practice should be of paramount importance.

Measuring for orthostatic hypotension should be a routine practice in Diabetes Mellitus patients. These can be helpful in screening for CAN and performing other CARTs to confirm presence of CAN.

Duration of Diabetes has the most significant effect on development of Cardiac Autonomic Neuropathy. Early detection of Diabetes Mellitus and performing Fasting Blood Sugar in patients attending OPD , who may be symptomatic or otherwise can be of great help.

Glycaemic Control did not show to have enough impact on development of Cardiac Autonomic Neuropathy. The caveat being, that a single value of HBA1C does not speak much about long term glycaemic control. Also the pattern of glycaemic control is important. A single reading may not suffice. Longitudinal studies are required to prove any association between HBA1C levels and CAN.

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