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PREVALENCE AND EARLY DETECTION OF CARDIAC NEUROPATHY IN DIABETES MELLITUS AND ITS CORRELATES

CARDIOLOGY

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ABSTRACT

The proposed study is aimed to highlight the magnitude of the problem in Eastern India, to enrich the knowledge of onset of cardiac Sympathetic & Parasympathetic dysfunction in terms of duration of the type 2 diabetes, to correlate the cardiac autonomic neuropathy with other metabolic complications of type 2 diabetes and also the sensitivity for early detection of involvement of cardiac autonomic nervous system in the affected persons.

Data were analysed by using descriptive and inferential statistics. The statistical test employed were frequency and percentage, paired t test.

The result of the statistical test showed that some factors like age, duration of illness, chronic metabolic complications of type 2 diabetes mellitus were associated with cardiac autonomic neuropathy.

CAN is the most unpredictable life threatening complication and commonest cause of sudden cardiac death in type 2 DM by producing dangerous arrhythmias. Though incidence of CAN at onset of type 2 diabetes mellitus is very small, but it progresses relentlessly with advancing disease process. Assessment of CAN to be done routinely in all cases of type 2 diabetes mellitus particularly before anaesthesia and surgery.

KEYWORDS

Prevalence, Early Detection , Cardiac Neuropathy In Diabetes Mellitus

INTRODUCTION

Diabetes Mellitus refers to a group of common metabolic disorders that share the phenotype of hyperglycaemia which is preceded by a phase of abnormal glucose homeostasis as the pathogenic progresses. Type 2 diabetes mellitus is a heterogeneous group of disorders characterized by variable degrees of insulin resistance, impaired insulin secretion, and increased glucose production. Its prevalence is slightly greater in men > 60yrs and is rising much more rapidly because of increasing obesity and reduced activity levels.[1] It constitutes a growing concern to population all over the world because of its well known chronic complications particularly the triad of neuropathy, retinopathy and nephropathy which have close correlation with its metabolic abnormalities.

The International Diabetes Federation recently published findings revealing that in 2007, the country with the largest numbers of people with diabetes is India (40.9 million), followed by China (39.8 million), the United States (19.2 million), Russia (9.6 million) and Germany (7.4 million). Worldwide at least 171 million people have diabetes; this figure is likely to be more than double by 2030. Other alarming diabetes statistics include the fact that there is one person in the World dying of diabetes every ten seconds. Also, there will be two new diabetic cases in the world being identified every ten seconds. According to that by the year 2025, there will be seven million new diabetic cases in the world. In India, there are going to be eighty percent of all diabetics from the entire world, this makes India the diabetic capital of the world.[2]

Neuropathy is the most common complication in Diabetes.[3]Yet it remains the least investigated. Such prolonged lack of attention could lead to cardiac autonomic neuropathy which seldom contributes to mortality from diabetes although it is a frequent cause of disability & crippling.[4] One of the earliest manifestations of diabetic autonomic neuropathy is denervation of cardiovascular system.[5] Hence the assessment of cardiovascular reflexes affords a satisfactory evaluation. The prevalence of autonomic nervous system dysfunction in type 2 diabetes is not precisely known, however tests of autonomic function have shown impairment in nearly 20% - 30% of diabetic patients.[6]

So, the ADA recommends for screening for autonomic neuropathy at the time of diagnosis of type 2 DM. [7]

Presence of symptoms along with abnormal cardiovascular function tests suggest poor prognosis with increased incidence of silent myocardial infarction & sudden cardiac death.[8-13]

To highlight the magnitude of the problem in Eastern India present study was undertaken.

The study is proposed with the following objectives

1. To determine the prevalence of cardiac autonomic neuropathy in type 2 diabetes in patients by doing cardiac autonomic function tests.
2. To correlate the cardiac autonomic neuropathy in type 2 diabetes with its complications like retinopathy, nephropathy, insulin resistance and lipid profile.
3. To study the distribution of patients with type 2 diabetes mellitus.
4. Assessment of coexisting risk factors making regular check up of all these till discharge or death.

METHODOLOGY

The study was conducted in the Department of General Medicine OPD as well as Indoor, Institute of Post Graduate Education and Research (IPGME&R), Kolkata 20.

The Sample consisted of patients suffering from type 2 diabetes mellitus attending in General Medicine OPD and admitted in Indoor (within 72hrs of admission) in IPGME&R, Kol-20.

Sample size

Total 80 patients suffering from type 2 diabetes mellitus were selected as the sample for the present study. Of which 48 were males and 32 were females. Quantitative estimation of insulin was done in 20 patients.

1. Inclusion criteria:

- Male and female patients suffering from type 2 diabetes mellitus as per criteria recommended by ADA.
- Those who were available during study period.
- Those who were willing to participate in the study.
- Those who were able to read Bengali, English or Hindi.
- Patients were selected irrespective of therapeutic status.

2. Exclusion criteria:

- Those who were suffering from uncontrolled hypertension.
- Those who were suffering from overt heart failure.
- Those who were suffering from proliferative retinopathy.

Plan for Data Analysis

- Data were interpreted by computer programs and manually.
- Statistical analyses were expressed as mean, ± standard deviation, paired t test with unequal variance and standard error of proportion.
- A p value of < 0.05 was taken as significant.

RESULT AND ANALYSIS

This chapter dealt with the analysis and interpretation of data collected to identify the prevalence of cardiac autonomic neuropathy among the patients suffering from type 2 diabetes mellitus. A total number of 80 cases of type 2 diabetes mellitus patients were included in this study group after using proper exclusion criteria.

Statistical analysis reveals significant p value of < 0.05 in terms of sex distribution.

We found that maximum number of patients (30%) were in the age group of 51 to 60 years followed by age group of 61 to 70 years (27.5%). Younger patents (7.5%) in the age group 31 to 40 years constituted insignificant portion and maximum number of patients were suffering from type 2 diabetes mellitus (45%) for duration of 5 – 10 years and maximum of them were male (25%). Clinical features of autonomic neuropathy were assessed on the basis of presence or absence of various symptoms like dizziness, bladder dysfunction, abnormal sweating, impotence and dysphagia.

Our study showed that dizziness on standing was the most frequently encountered symptom (37.5%) followed by abnormal sweating (15%), diarrhoea (15%), bladder dysfunction (7.5%), impotence (7.5%) and dysphagia (5%). Dizziness on standing was not always associated with documented postural hypotension on formal testing.

It was found that regarding the various autonomic functions heart rate response to deep breathing was found to be the most sensitive test for detecting autonomic neuropathy. It was abnormal in 27 (33.75%) patients, borderline in 14 (17.5%) of cases and normal in 39 (48.75%) of cases. This was followed by abnormal heart rate response to standing (30:15 ratios). This was found abnormal in 22 (27.5%) of cases, borderline in 8 (10%) of cases and abnormal in 50 (62.5%) of cases. Abnormal handgrip test was in 10 (12.5%) of cases, borderline in 18 (22.5%) of cases and normal in 52 (65%) of cases. Valsalva ratio was abnormal in 14 (17.5%) of cases, borderline in 28 (65%) of cases and normal in 38 (47.5%) of cases. The postural drop was abnormal in 15 (18.75%) of cases, borderline in 20 (25%) of cases and normal in 45 (56.25%) of cases.

Our study showed that parasympathetic neuropathy was seen in 40 cases (50%) while sympathetic neuropathy was detected in 19 cases (23.75%). Statistical analysis reveals a p value of < 0.001 which is significant and increasing prevalence of autonomic neuropathy with increasing duration of diabetes. Statistical analysis reveals a p value of < 0.05 which is significant. In our, patients with CAN it was observed that all patients with sympathetic neuropathy (19 i.e. 23.75%) had parasympathetic neuropathy but the reverse was not true.

We found that insulin resistance was assessed in 20 patients by applying HOMA model of which 14 were male & 6 were female and prevalence of autonomic neuropathy was higher amongst insulin resistance group. Statistical analysis reveals a p value of <0.05which is significant, but level of p value for sex differences, IR was insignificant.

It was found that microalbuminuria was found in 28 (35%) cases. Of 28 patients 22 (78.57%) had cardiac neuropathy and microalbuminuria and rest 6 (21.43%) had microalbuminuria without any abnormal autonomic function testing. Statistical analysis reveals a p value of 0.001 which is significant and diabetic retinopathy was detected in 8 patients (10%), all of them had microalbuminuria and CAN. So, retinopathy was invariably associated with CAN but the reverse was not true.

Our study showed that HRV to deep breathing is the most sensitive parasympathetic cardiac autonomic function test, which detects CAN, followed by HRV to standing and HRV to Valsalva. Blood pressure response to postural hypotension is slightly more sensitive in sympathetic arm than that of blood pressure response to sustained hand grip. HDL levels gradually came down with increasing duration of type 2 diabetes.

DISCUSSION

This chapter dealt with the major findings of the study, discussions in relation with the findings of the other study, conclusion. The limitations were identified and the recommendations for further research studies were put forth for further consideration.

In this study Cardiac Autonomic Neuropathy (CAN) was found in 50% of cases. Parasympathetic neuropathy was found in 50% cases and sympathetic neuropathy in 23.75% cases. It is in conformity with Ewing et. al.,[14] and Nijwawan et. al.,[15]and John et. al.[16]Heart rate response to deep breathing was the most sensitive test, 33.75% in this study. This is also in conformity with reports of John et al.[16]

Symptoms of CAN were less commonly encountered in the present study. Dizziness on standing was encountered in 37.5% patients. Bladder symptoms, abnormal sweating and diarrhoea were other symptoms commonly encountered in this study. These results are also inconformity with the previous study reports by John et al. [16]

The earliest marker for alteration in autonomic function available was HRV standing which was significant. With increasing duration of diabetes this function doubles in group B (5 – 10 years duration) but unaltered in group C (>10 years duration). The most significant abnormality was HRV breathing. The sympathetic abnormality was absent in group A (< 5 years duration) and appeared in group B andsignificant in group C for BP response to standing but not for BP response to isometric hand grip. Very significant changes in HDL data was found between group A and C (p 0.0000059) with which there was also significant change between group A and C in HRV breathing, BP response to standing and isometric hand grip.

Retinopathy was detected with both background and pre proliferative in 10% of type 2 diabetes mellitus patients in the present study.

CAN was also correlated with patients with insulin resistance than without insulin resistance.

Microalbuminuria was noted in 35% of patients in the above study.

Microalbuminuria was also associated with CAN. Sheth et al.,[17] reported a higher incidence i.e. 42% of microalbuminuria.

The present study revealed the prevalence of cardiac autonomic neuropathy in 50% of type 2 diabetic population at random. CAN is detected by different cardiac autonomic function tests. Parasympathetic dysfunction is early to appear but does not increase linearly with duration.Sympathetic dysfunction appears late and expresses a partial liner increase.

With alteration in lipid parameters there is significant change in three of the parameters and is best correlated with low HDL but whether it has any correlation with CAN was not established. CAN symptoms are not as sensitive as autonomic function test to detect cardiac neuropathy.Assessment of autonomic cardiovascular reflexes affords a satisfactory method of evaluation of CAN. Parasympathetic cardiac autonomic function test are more sensitive for the detection of CAN than sympathetic test.

HRV deep breathing is the most sensitive parasympathetic cardiac autonomic neuropathy function test which detects CAN, followed by HRV standing and HRV valsalva manoeuvre. BP response to postural hypotension is slightly more sensitive than that of BP response to isometric hand grip.

Statistical analysis reveals CAN is strongly associated with microvascular complication of diabetes viz. retinopathy, microal buminuria and insulin resistance.

Conclusion

So, in conclusion, CAN is the most unpredictable life threatening complication and commonest cause of sudden cardiac death in type 2 DM by producing dangerous arrhythmias. Though incidence of CAN at onset of type 2 diabetes mellitus is very small, but it progresses

relentlessly with advancing disease process. Till now no telltale investigation to document the presence of CAN is available either to qualify or quantify the problem. Adequate therapeutic modalities are lacking except use of selective beta blockers.

Thus, assessment of CAN to be done routinely in all cases of type 2 diabetes mellitus particularly before anaesthesia and surgery. Simple clinical tests are very much predictive than sophisticated investigations and should be practiced as a routine procedure.

Table: Statistical significance comparing different groups according to age, lipid profile and autonomic reflexes (MEAN ± SD)

Group	Age	BMI	TC	HDL	TG	LDL	HRV standing	HRV valsalva	HRV breathing	Postural hypotension	BP response to isometric hand grip
0 to 5 years duration	45.83 ±15.86	25.38 ±3.33	165.63 ±20.21	51.44 ±5.66	111.24 ±21.64	96.61±21.35	1.30 ±0.04	1.21±0.06	16.11±2.11	3±2.2	18.61±2.30
5 to 10 years duration	50.61 ±9.6	25.38 ±2.61	165.52 ±27.05	47.70 ±7.72	128.73 ±46.45	92.11±26.23	1.01 ±0.05	1.14±0.10	12.67±4.54	14.06±14.25	15.06±3.66
> 10 years duration	54.11 ±11.48	25.30 ±2.94	178.96 ±20.65	41.73 ±6.62	132.54 ±29.98	109.23±17.31	1.02 ±0.05	1.14±0.06	11.16±4.20	17.85±14.41	14.23±3.58

REFERENCE

1. Fauci, Braunwald, Kasper, Hauser, et al: Harrison's Principles of Internal Medicine, 17th edition, New York: Mc Graw Hill; 2008, 2275 – 89. Vol II.
2. The diabetes monitor. Depression and diabetes. Available from: http:// www. dia bete smonitor.com.
3. Ellenberg M – Diabetic neuropathy in diabetes mellitus: Ellenberg M, Rifkin H, editors. Excerpta Medica Sec t – Amsterdam; Elsevier, 1983: 777 – 80.
4. Mehta S, Mathur D, Chaturvedi M: Incidence of cardiac autonomic neuropathy in NIDDM, JIMA 2002; 100: 141 – 3.
5. Stevens MJ, Watkins PJ – Diabetic autonomic neuropathy. Acta Diabetolnat 1991; 28: 105 – 12.
6. Hilstead J, Jensen SB – A simple test for autonomic neuropathy in juvenile diabetes. Acta Med Scand 1979; 205: 385 – 7.
7. Clarke BF, Ewing DJ, Campbell IW – Diabetic autonomic neuropathy. Diabetologia 1979; 17: 195 – 212.
8. Ewing DJ, Clarke BF – Diagnosis and Management of diabetic autonomic neuropathy; BMJ 1982; 285: 916 – 18.
9. Sandroni P, Benarroch EE, Low PA: Pharmacological dissection of components of the Valsalva maneuver in adrenergic failure. J Appl Neurology 46: 833 – 80, 1996.
10. Schumer MP, Joyner SA, Pfeifer MA: Cardiovascular autonomic neuropathy testing in patients with diabetes. Diabetes Spectrum: 11: 227 – 31, 1998.
11. Ewing DJ, Campbell IW, Murray H, Neilson JM, Clarke BF: Immediate heart rate response to standing: simple test for autonomic neuropathy in diabetes: BMJ 145 – 147, 1978.
12. Borst C, Weilling W, vnBrederode JFM, Hond A, DeRijk LG, Duning AJ: Mechanisms of initial heart rate response to postural change. Am J Physiol 243: H 676 – H681, 1982.
13. Ziegler D, Laux G, Dannehl K, Spuler M, et al: Assessment of cardiovascular autonomic function: age – related normal ranges and reproducibility of spectral analysis, vector analysis and standard test of heart rate variation and blood pressure responses. Diabet Med 9: 166 – 185, 1992.
14. Ewing DJ, Campbell IW, Burt AA, Clarke BF – vascular reflexes in diabetic autonomic neuropathy. Lancet 1973; ii: 1354 – 6.
15. Nijawan S, Mathur A, Singh V, Bhandari VM. Autonomic and peripheral neuropathy in non insulin dependent diabetes. J Assoc Physicians India 1993; 41: 565 – 6.
16. John L, Sharma RN, John G, Ganesh A. Assessment of cardiac autonomic neuropathy in type 2 diabetic subjects. J Asso Physician India 1986;34:264-7.
17. Sheth J, Trivedi B, Shah L, Sheth VS. Prevalence of microalbuminuria in diabetic subjects. J Assoc Physicians India 1993; 41: 562 – 4.