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A Clinical Study on Cardiac Autonomic Neuropathy (CAN) in Diabetes Mellitus

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ABSTRACT

BACKGROUND Cardiovascular diseases are a common cause of morbidity and mortality in diabetic patients. Cardiac autonomic neuropathy , a clinically important type of diabetic autonomic neuropathy can be a significant cause of mortality in diabetic patients. AIMS AND OBJECTIVES

a) To study the prevalence and risk factors for CAN in Type 1 and Type 2 DM.

b) To study the sensitivity and specificity of corrected QT interval (QTc) in the ECG in diagnosis of CAN in DM.

MATERIALS AND METHODS

This is a cross-sectional study done among patients attending Diabetic clinic under the Department of General Medicine, Government Medical College Calicut. Tests were done to look for cardiac autonomic neuropathy and assess the prevalence and risk factors. The data was obtained after informed consent and analysed by EPI INFO (Ver 3.4.1)

RESULTS The prevalence of CAN among the patients with DM in our study was 73%. An association of prevalence of CAN with increase in duration of the DM was found to be statistically significant.

CONCLUSIONS CAN is a common complication of both type 1 & type 2 DM. Longer duration of DM and coexistent peripheral neuropathy and prolongation of QTc interval in ECG was associated with high prevalence of CAN in type 1 DM. Higher age, longer duration of DM and coexistent peripheral neuropathy are associated with higher prevalence of CAN in type 2 DM.

KEYWORDS

INTRODUCTION

India is frequently referred to as the diabetic capital of the world and the incidence of Diabetes Mellitus (DM) is rising in alarming proportions. In India, it is estimated that the prevalence of diabetes is likely to go up to 57.2 million by the year 2025[1]. The metabolic dysregulation associated with DM leads to secondary pathophysiologic changes in multiple organ systems, which are associated with high morbidity and impose a tremendous burden on the health care system, if they are not treated timely and adequately.

Among these, cardiovascular disease is one of its most common complications that increase mortality in these patients. The cardiovascular complications of DM can be classified into three groups: atherosclerotic coronary artery disease, diabetic cardiomyopathy, and cardiac autonomic neuropathy (CAN)[2]. CAN is a common form of diabetic autonomic neuropathy that causes abnormalities in heart rate control as well as central and peripheral vascular dynamics. CAN is the most studied and clinically important form of diabetic autonomic neuropathy, as it is associated with increased risk of mortality.

Prolongation of the corrected QT interval (QTc) in the electrocardiogram (ECG) is found to be an indicator of CAN, but its reported sensitivity varied widely in different studies[3]. As ECG is a common, simple and cost effective test it can be used as a test for assessing cardiac risk in patients with DM.

OBJECTIVES OF THE STUDY

a) To study the prevalence and risk factors for CAN in Type 1 and Type 2 DM.

b) To study the sensitivity and specificity of corrected QT interval (QTc) in the ECG in diagnosis of CAN in DM.

METHOD OF STUDY

This is a Cross-sectional study conducted among patients attending the diabetic clinic under the Department of Medicine, Calicut Medical College. The data was collected from random sample of 100 patients after screening them for inclusion in the study. All patients diagnosed previously as type 1 or type 2 DM, attending the diabetic clinic was considered for inclusion in the study. Diabetic patients with known cardiac, respiratory, renal, hepatic and cerebrovascular diseases, hypertension, electrolyte abnormalities, previous ECG abnormalities, were excluded from the study because these diseases and abnormalities can interfere with the tests for CAN and with the QTc interval. Those who are not willing to participate in the study were also excluded.

Each participant was interviewed and examined in detail. Baseline hematological and biochemical laboratory investigations were done in all patients. The following five tests for detecting CAN were performed as described by Ewing et al[3] in each of the enrolled participants: 1) Resting heart rate (heart rate >100 beats/min is taken as abnormal). 2) Blood pressure for postural or orthostatic hypotension (blood pressure is recorded in the supine posture and just after 2 min of standing; a fall in the systolic blood pressure >20 mm Hg and/ or diastolic blood pressure >10 mm Hg are considered abnormal). 3) Heart rate response to Valsalva manoeuvre (ECG is continuously monitored during the procedure and the ratio of the longest RR interval during the release phase to the shortest RR interval during the straining phase is calculated and a value <1.2 is considered abnormal). 4) Heart rate response to deep breathing (ECG is recorded continuously while the patient is taking breath at a regular rate of 6–12 breaths/min. A difference in heart rate <15 beats/min between expiration & inspiration is taken as abnormal). 5) Diastolic blood pressure response to an isometric exercise (the patient is asked to squeeze a small ball in his/her left hand for about 5 min and an increase in diastolic blood pressure < 15 mm Hg is considered abnormal)

The results of each of the above five tests are classified into three separate groups based on the severity of abnormality detected,

and each of them is given a definite point as described by Bellavere et al[4]. The total points from each of these five tests are added together and the cardiac autonomic neuropathy score (CAN score) is categorized as follows: CAN score 0 (total points 0), CAN score 1 (points 0.5–1.5), CAN score 2 (points 2–3), and CAN score 3 (points >3.5). CAN is considered absent, early, definite or severe if the CAN scores are 0, 1, 2 or 3, respectively.[2]

Each participant is examined for the presence or absence of peripheral neuropathy during the neurological examination by testing for monofilament test or abnormal pin-prick sensations in the limbs or abnormality of position sense in the big toes or the absence of Achilles' tendon reflex. A 12 lead surface ECG is taken and QTc interval is calculated using Bazette's formula.

RESULTS

The prevalence of CAN among the patients with DM in our study was 73%. An association of prevalence of CAN with increase in duration of the DM was found to be statistically significant. In type 1 DM, CAN was present in all patients with duration of disease more than 10 years and 52% of patients with duration of 10 years or less. In patients with type 2 DM, CAN was present in all of the patients with duration of disease more than 10 years and 71% of patients with duration of 10 years or less.

We observed a statistically significant association between higher age and CAN in type 2 DM. CAN was present in 95% of the patients with age of more than 60 and in 68 % of the patients with age of 60 or less. CAN was absent in 5% of the patients with age of more than 60 and in 32 % of the patients with age of 60 or less. The association of age and CAN was not evaluated in patients with type 1 DM, as all of them in our study were less than 25 years of age.

Higher prevalence of CAN was seen in those with peripheral neuropathy in both type 1 and type 2 DM. In type 1 and type 2 DM, CAN was present all patients with peripheral neuropathy and in 47% and 63% of patients without peripheral neuropathy respectively.

In type 1 DM, CAN was present all with QTc prolongation in ECG >440 ms and in 43% of patients without QTc prolongation and the statistical association was significant. In patients with type 2 DM, CAN was present in 88% of patients with QTc prolongation in ECG and in 69% of patients without QTc prolongation, but the statistical association between QTc prolongation in ECG and CAN in type 2 DM was not significant.

QTc prolongation > 440 ms has reasonable sensitivity and specificity for detecting CAN in types 1 DM. But less sensitive in type 2 DM. The sensitivity of QTc prolongation for the diagnosis of CAN in type 1 diabetics was 62.5% in our study and specificity was found to 100%. The sensitivity and specificity of QTc prolongation for CAN in type 2 DM was 44.9 % & 80 % respectively. The sensitivity for type 2 DM in our study was very low. This may be because patients with renal, cardiac complications and hypertension, who have type 2 DM, were excluded from the study. These patients are likely to have a higher risk for CAN and more severe forms of CAN associated with QTc prolongation.

CONCLUSIONS:

1. CAN is a common complication of both type 1 & type 2 DM. CAN have a Prevalence of 73% in our study group.
2. Longer duration of DM and coexistent peripheral neuropathy and prolongation of QTc interval in ECG was associated with high prevalence of CAN in type 1 DM.
3. Higher age, longer duration of DM and coexistent peripheral neuropathy are associated with higher prevalence of CAN in type 2 DM.
4. Gender differences did not show association with CAN in both types of DM
5. The prolongation of the QTc interval in the ECG has reasonable sensitivity, specificity for the detection of CAN in type 1 DM. But, it is less sensitive but has good specificity in type 2 DM

Table 1: . Determination of the CAN score (Bellavere et al)

Autonomic function test	Points
1. Resting heart rate	
<100 beats/min	0
100–110 beats/min	½
>110 beats/min	1
2. Postural hypotension (fall in systolic blood pressure)	
<20 mm Hg	0
20–30 mm Hg	½
>30 mm Hg	1
3. Valsalva ratio (longest RR interval: shortest RR interval)	
>1.2	0
1.2–1.10	½
<1.10	1
4. Heart rate variability on deep breathing	
>15 beats/min	0
15–10 beats/min	½
<10 beats/min	1
5. Increase in diastolic blood pressure during sustained handgrip	
>15 mm Hg	0
15–10 mm Hg	½
<10 mm Hg	1

REFERENCES:

1. Pradeepa R, Deepa R, Mohan V. Epidemiology of diabetes in India – current perspective and future projections. J Indian Med Assoc 2002;100:144–8.
2. J M Pappachan, J Sebastian, B C Bino: Cardiac autonomic neuropathy in diabetes mellitus: prevalence, risk factors:: ***Postgrad. Med. J.*** 2008;84;205-21
3. Ewing DJ, Martyn CN, Young RJ, et al. The value of cardiovascular autonomic function tests: 10 years experience in diabetes. Diabetes Care 1985;8:491–8.
4. Bellavere F, Bosello G, Fedele D, et al. Diagnosis and management of diabetic autonomic neuropathy. BMJ (Clin Res Ed) 1983;287:61