Original Research Article

Clinico-demographic profile of type 2 diabetes patients with cardiac autonomic neuropathy

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International Archives of Integrated Medicine, Vol. 4, Issue 6, June, 2017.

Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 15-05-2017 **Accepted on:** 20-05-2017
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: Kothai G, Prasanna Karthik S. Clinico-demographic profile of type 2 diabetes patients with cardiac autonomic neuropathy. IAIM, 2017; 4(6): 20-25.

Abstract

Background: Patients with diabetes mellitus (DM) are at an increased risk of dying from cardiovascular diseases, the reason for which is not completely understood.
Aim: To study the clinico-demographic profile of type 2 diabetes patients with cardiac autonomic neuropathy (CAN).
Materials and methods: This was a cross sectional study involving 100 patients attending the diabetic clinic of a tertiary care hospital. Demographic data was collected and autonomic function testing was done with Ewing and Clark's tests.
Results: The prevalence of CAN was 58 %. CAN had statistically significant association with increasing duration of diabetes ($p < 0.00001$), increasing values of HbA1c ($p < 0.00001$), and with combined use of insulin and oral medications ($p < 0.05$).
Conclusion: There is a high prevalence of CAN in the diabetic population providing a large pool of patients awaiting effective interventions.

Key words

Type 2 diabetes, Cardiac autonomic neuropathy, Clinico-demographic profile.

Introduction

Patients with diabetes mellitus (DM) are at an increased risk of dying from cardiovascular diseases, the reason for which is not completely understood. Excess cardiovascular risk in this population persists even after normalization for other conventional cardiovascular risk factors (hypertension, dyslipidaemia, physical inactivity, smoking) suggesting that there are other incompletely understood mechanisms which increase cardiovascular risk in diabetic patients. One such risk factor that has been emerging in recent times is cardiac autonomic neuropathy (CAN). Metabolic changes in DM leads to damage to the autonomic nerve fibres that innervate the heart and blood vessels and resulting in abnormalities of heart rate control and vascular dynamics [1]. In a review of several epidemiological studies among individuals with type 2 diabetes, the 5-year mortality rate was five times higher for individuals with CAN than for individuals without CAN [2]. In this background, the study was designed to identify the demographic and clinical profile of type 2 diabetes patients with CAN.

Materials and methods

The study was carried out after obtaining clearance from the Scientific Review Board and Institutional Ethics Committee. 100 consecutive patients attending the diabetes clinic were enrolled for the study after satisfying the inclusion and exclusion criteria. Patients were excluded from the study, if they were above 60 years of age, had previously been diagnosed to have ischemic, valvular or congenital heart disease, systemic hypertension and stroke or were on drugs known to affect the autonomic nervous system.

Detailed clinical examination was done for every patient and the findings were recorded. Each patient underwent a battery of five bedside tests (Ewing's and Clark Autonomic Function Test, **Table - 1**) and the results were interpreted according to **Table - 2** and the CAN score was calculated accordingly [3].

Table - 1: Ewing's and Clark Autonomic Function Tests.

TEST	MEASURE	METHOD
Valsalva manoeuvre	Valsalva ratio	The subject sits quietly and then blows into a mouthpiece at a pressure of 40 mmHg for 15 s. The ratio of the longest R-R interval shortly after the manoeuvre to the shortest R-R interval during the manoeuvre is calculated
Lying to standing heart rate response	30:15 ratio	The subject lies quietly on a couch and then stands up unaided. The 30:15 ratio is the ratio of the longest R-R interval around the 30th beat to the shortest R-R interval around the 15th beat after standing up
Heart rate response to deep breathing	Max – Min heart rate (beats/min)	The subject sits quietly and then breathes deeply and evenly at 6 breaths/min. The maximum and minimum heart rates during each breathing cycle are measured
Postural blood pressure change	Fall in systolic BP (mmHg)	The blood pressure is measured while the subject is lying down, and again after standing up. The difference in systolic BP is calculated
Sustained handgrip test	Rise in diastolic BP (mmHg)	Handgrip is maintained at 30% of the maximum voluntary contraction using a handgrip dynamometer up to a maximum of 5 min. The difference between the diastolic BP just before release of handgrip, and before starting, is calculated

Table - 2: Interpretation of Ewing's and Clark Autonomic Function Tests.

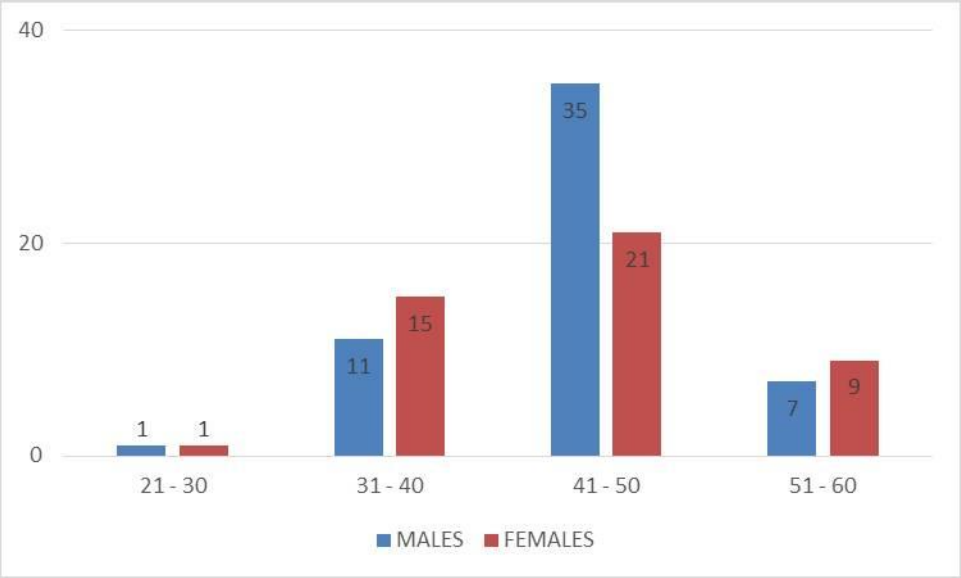
Score	HRV Test			BP Test	
	Deep breathing	Valsalva Ratio	Response to Standing	Response to Handgrip	Response to Standing
0	> 15	> 1.20	> 15	> 15	≤ 10
1	11-15	1.1-1.20	12-15	11-15	11-30
2	≤ 10	≤ 1.10	< 12	≤ 10	> 30

Statistical analyses were carried out using appropriate parametric tests for continuous variables (ANOVA, student's t test) and non-parametric tests for categorical variables (Chi square test) with the help of IBM SPSS version 22.

Results

A total of 100 patients were enrolled in the study. Majority of the patients were males (54%) and most of the patients were in the age group of 41 – 50. The age sex distribution is given in **Figure - 1**. The duration of the diabetes in the patients is given in **Figure - 2** which shows that most of the patients (56%) had the disease for a period of 6 – 10 years. The mean HbA1c of the patients was 7.84 ± 1.59. The mean CAN score of the study population was 1.26 ± 0.34 and its distribution is given in **Table - 3**. The distribution of CAN score according to the duration of diabetes is given in **Figure - 3** and its distribution according to HbA1c levels is given in **Figure - 4**. Distribution of medication use among various CAN categories was as per **Figure – 5**. Distribution of CAN score among various diabetic complications was as per **Figure – 6**.

Figure - 1: Age Sex Distribution of the patients.



Discussion

In this study, the prevalence of any form of CAN 64% while that of severe CAN was 22%. The true prevalence of cardiac autonomic neuropathy has not been well established because of the variations in the methods used for diagnosing it and the variations in the risk factors among patients enrolled for the studies. However the subcommittee of the Toronto Consensus Panel on Diabetic Neuropathy has concluded after extensive review of literature that the prevalence of confirmed CAN in unselected patient populations ranged around 25% though figures

as high as 65% had also been reported [4]. This is similar to the findings of our study.

Figure - 2: Duration of Diabetes in the patients.

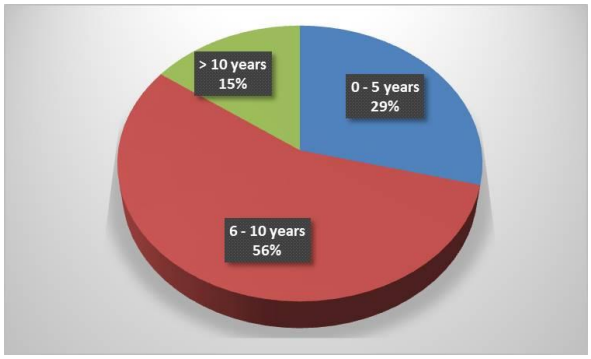


Table - 3: Distribution of the CAN score.

CAN score	Interpretation	Frequency
0 – 1	NO CAN	36
2 – 4	BORDERLINE CAN	42
5 – 10	SEVERE CAN	22

The prevalence of CAN increased as the duration of diabetes increased. This relationship was statistically significant. ($\chi 2$ = 28.6821, p < 0.00001) In a similar study from Romania, the prevalence of CAN increased as the duration of diabetes increased [5]. It was also found that the patients with higher HbA1c levels had higher scores on CAN testing and this relationship was also significant. ($\chi 2$ = 29.2753, p < 0.00001) The above findings also establish the findings from previous studies by various authors who found that as the duration of diabetes and HbA1c increased, there was a trend towards increasing severity of CAN [6-8].

The study also found that patients with severe CAN were more likely to be on combination of oral anti diabetic drugs and Insulin than other patients. ($\chi 2$ = 12.0796. p = 0.016769). It was also found that patients with CAN also had increased rates of diabetes related microvascular and macrovascular complications. This is in line with the findings reported in multiple previous trials [9-12].

Figure - 3: Distribution of CAN scores among duration of Diabetes.

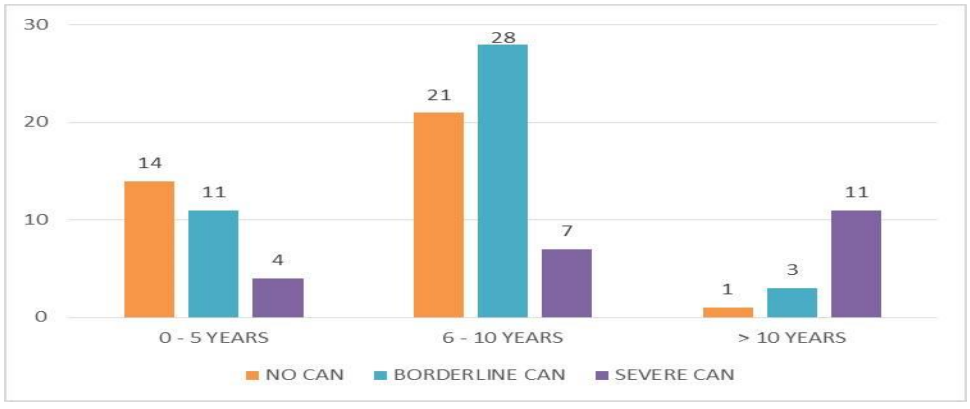


Figure - 4: Distribution of HbA1c values among various CAN categories.

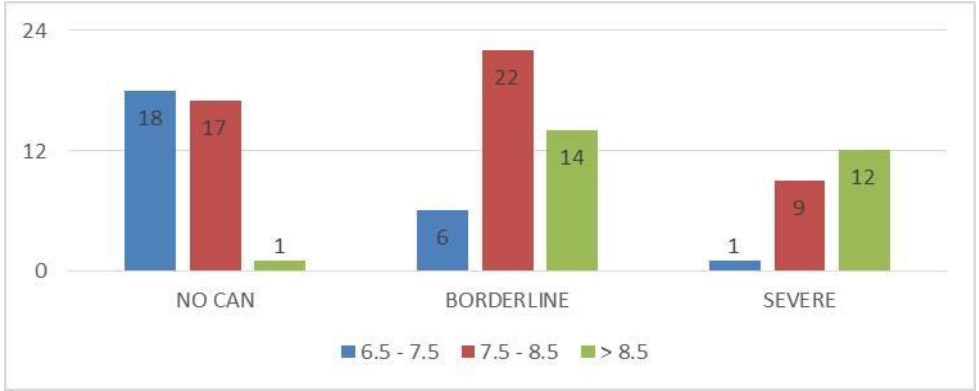


Figure - 5: Distribution of medication use among various CAN categories.

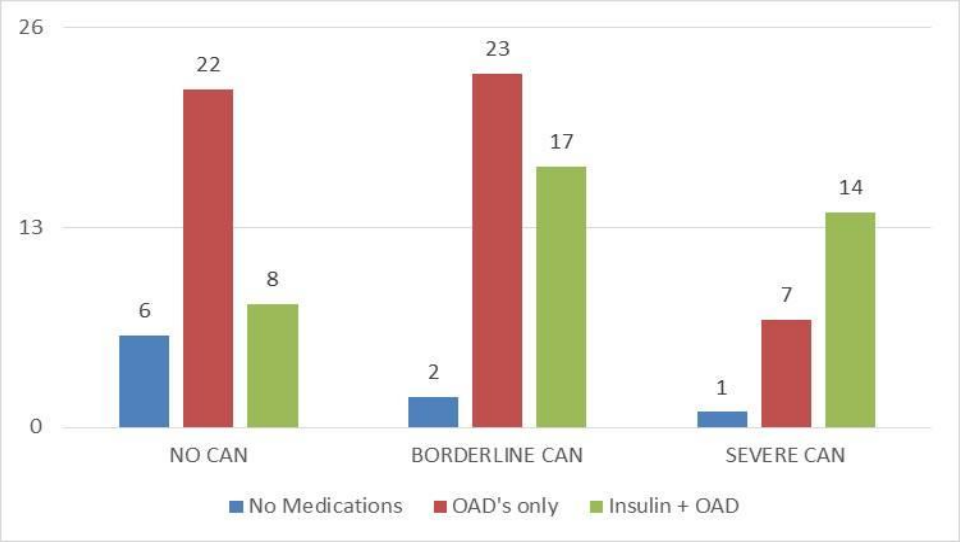
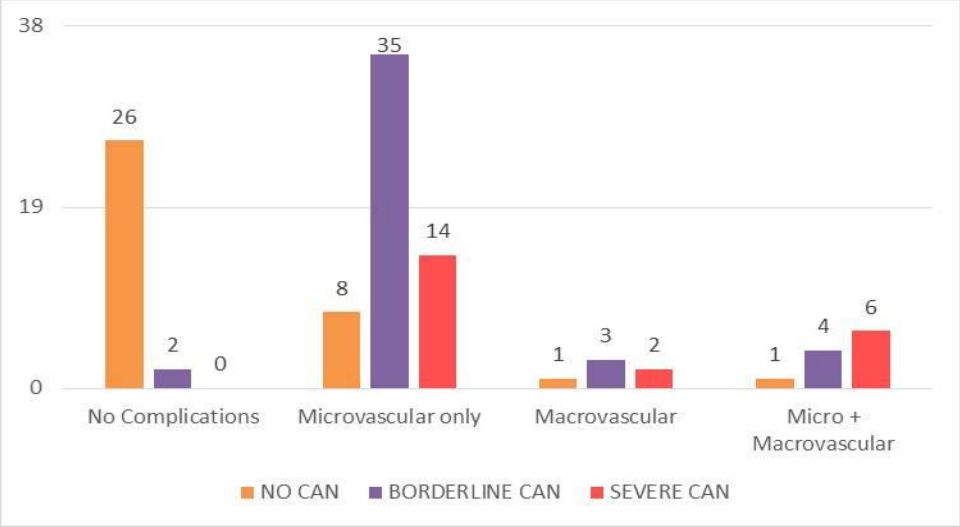


Figure - 6: Distribution of CAN score among various diabetic complications.



Conclusion

The study found that the prevalence of CAN and its association with various clinico-demographic parameters in a previously untreated population. The potential impact of treating such a high burden of patients with CAN has far reaching consequences with proven results in reduction in morbidity and mortality of such patients. Hence the future direction is to extend this small hospital based study to a large population group.

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