

Association of autonomic imbalance with cardiovascular risk in diabetic patients of a tertiary care setting: An observational study

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Abstract

Background and Aims: The significant and rising incidence of type 2 diabetes and the associated vascular complications have been a growing concern. Cardiovascular complications are neglected and are the leading causes of deaths in the diabetic population. Autonomic Imbalance (AI) is a bother complication of the diabetes mellitus, related to aggravated risk of morbidity as well as mortality. Nevertheless, there are not many studies assessing this relationship and there are no studies especially of rural setting, hence we have undertaken this study for assessing the need of this association from an Indian rural setting.

Methods: A detailed questionnaire including the socio-demographic details, anthropometric data, history, clinical examination, investigations performed, and treatment undergoing was gathered from each patient. Special attention was extended for identifying the cardiovascular risk factors like hypertension, alcohol intake or smoking, family history of cardiovascular disease (CVD), Heart rate, etc.

Results: Autonomic Imbalance have been studied among the 158 diabetic patients, of which the mean age was 58 years, with male preponderance of around 58%. Good Glycaemic control was observed in one-fourth (40 patients) and 102 out of 158 of the study participants (type 2 diabetics) were hypertensives. The prevalence of autonomic imbalance identified using tests for autonomic function ranges from 50-70%, where the diagnosis of autonomic imbalance is achieved based on the outcomes of multiple autonomic tests with various components instead of a single test. The prevalence of autonomic neuropathy was on the rise as people got older.

Conclusions: Screening for autonomic function and the patient education could be the key factors among the patients with autonomic imbalance in order to prevent devastating events further.

Keywords: Autonomic imbalance, cardiovascular risk, diabetes, rural setting

Introduction

Diabetes Mellitus is a growing public health concern globally due to its rising prevalence and its association with the cardiac complications (both micro and macrovascular) seriously affect

the life's quality of the individual, presenting a huge burden on the healthcare system^[1]. The significant and rising incidence of type 2 diabetes and the associated vascular complications have been a growing concern. Cardiovascular complications are neglected and are the leading causes of deaths in the diabetic population. Autonomic Imbalance (AI) is a bother complication of the diabetes mellitus, related to aggravated risk of morbidity as well as mortality^[2, 3]. AI is observed to have a poor prognosis and may also lead to conditions like exercise intolerance, postural hypotension and elevated risk of silent myocardial infarction (MI) and cardiac ischemia, making the patients vulnerable to sudden cardiac death. Heart rate variability (HRV) is one of the crucial risk factors of the cardiovascular dysfunction, which is the direct measure of the cardiac dysautonomia^[4, 5]. Presence of the risk factors pertaining to the autonomic dysfunction and glycaemic control may influence the cardiac autonomic balance among the diabetics^[6]. Nevertheless, there are not many studies assessing this relationship and there are no studies especially of rural setting, hence we have undertaken this study for assessing the need of this association from an Indian rural setting.

Therefore, this study is aimed to evaluate the association of autonomic imbalance with the cardiovascular risk among the diabetic patients of a tertiary care and low resource setting.

Materials and Methods

This is an observational study which was carried out at the Physiology Department of a tertiary care setting on the outdoor patients attending medicine department from June 2018 to July 2019 for a period of 1 year. After getting necessary permissions from the Institutional Ethics Committee (IEC), the patients who were enrolled in the medicine out patient department, currently being treated regularly, those who have agreed to give consent and known case of diabetic for at least 1 year were included in the study by the random sampling method. Diabetics who are irregular to treatment, newly diagnosed cases (within 6 months), and severely morbid patients (people who underwent earlier cardiovascular or neurological intervention) were excluded.

A detailed questionnaire including the socio-demographic details, anthropometric data, history, clinical examination, investigations performed, and treatment undergoing was gathered from each patient. Special attention was extended for identifying the cardiovascular risk factors like hypertension, alcohol intake or smoking, family history of cardiovascular disease (CVD), Heart rate, etc. A "Systolic blood pressure (SBP) >140 mm of Hg and diastolic blood pressure (DBP) >90 mm of Hg was considered as hypertensives". Assessment of Variable Heart Rate (VHR) was done by recording an electrocardiogram (ECG) to analyse beat-to-beat heart rate following supine rest for a 5 min time period at least.

Systolic blood pressure (BP) was taken when the patient was lying down and 2 minutes later when he or she stood up. The study participants were asked to sit with their feet flat on the floor and Valsalva maneuver have been performed. The patients were advised to breathe relaxedly breathing for a span of 5 minutes, further 1 minute slowly with deep breaths. 5 back-to-back Valsalva maneuvers were performed after the patients took regular breathings for a span of 1 minute and then preceded by a 2-minute regular breathing. Finally, the participants were told to stand up and take a few deep breaths. The patient's pulse rate and blood pressure were recorded during the assessment. HRV responses to deep breathing (expiratory/inspiratory ratio; E/I), Valsalva manoeuvre (Valsalva ratio), and standing (postural ratio) were recorded as autonomic function measures.

Statistical analysis

The data was entered into an Excel spreadsheet, where a descriptive analysis was performed and the mean and standard deviation were calculated (SD). The GraphPad in Stat 3 software

was used to do all of the calculations required for the assessment (GraphPad software, Inc., California, USA). The statistical significance of the quantitative data in terms of mean distribution variations was determined using an unpaired Student's t-test. With 95 percent confidence interval, a p value of P 0.05 was judged statistically significant.

Results

Autonomic Imbalance have been studied among the 158 diabetic patients, of which the mean age was 58 years, with male preponderance of around 58%. Good Glycaemic control was observed in one-fourth (40 patients) and 102 out of 158 of the study participants (type 2 diabetics) were hypertensives. (Table 1) The autonomic function was measured, and VHR characteristics were compared based on blood pressure control among hypertensive diabetics, with the established diabetics having considerably lower VHR with deep breathing. When compared to the standard values, the established diabetics had a considerably lower Valsalva ratio. Mean heart rate was significantly more in patients with longer duration of diabetes and hypertension (78.9 ± 9.4 per minute) than those without hypertension (74.6 ± 4.8 per minute). Abnormal postural changes in the BP were detected in 78 participants (49.3%), predominantly in the people with prolonged duration of diabetes and autonomic imbalance. Systolic hypotension was observed among 43 participants (27.2%) and Diastolic hypertension was found in 29 participants (18.3%). (Table 2)

Table 1: Clinico-demographic Characteristics of Study participants

Total number	158	
HbA1C	<6.5% (Good control)	40 (25.3%)
	6.5-7.5 (Fair control)	96 (60.7%)
	>7.5 (Poor control)	22 (14%)
Hypertension	Present	102 (64.6%)
Age (in yrs.)	<40	4 (2.5%)
	40-50	21 (13.2%)
	50-60	68 (43.1%)
	60-70	49 (31.1%)
	>70	16 (10.1%)

Table 2: Prevalence of Autonomic Imbalance (AI) by different assessment among the study participants

Test (Method)	Number of patients
HRV: Reduced E/I ratio with deep breathing (<15 bpm).	68 (43.03%)
Resting tachycardia (pulse rate ≥ 100 bpm).	12 (7.5%)
Diastolic BP response to sustained hand grip (<15 mmHg).	54 (34.1%)
Abnormal postural index (≤ 1.0).	23 (14.5%)
Postural hypotension.	31 (19.6%)
Valsalva ratio: (<1.2).	28 (17.7%)

Discussion

The prevalence of autonomic imbalance identified using tests for autonomic function ranges from 50-70%, where the diagnosis of autonomic imbalance is achieved based on the outcomes of multiple autonomic tests with various components instead of a single test^[7]. The prevalence of autonomic neuropathy was on the rise as people got older^[8]. None of the people under the age of 40 had severe autonomic neuropathy, but 62 percent of those between the ages of 61 and 70 had severe autonomic neuropathy. In our investigation, the age

difference between the groups with and without autonomic neuropathy was not statistically significant. Pfeifer et al. found that the prevalence of autonomic neuropathy increases with age in previous research^[9]. In terms of gender prevalence, the autonomic imbalance was not noteworthy, with 64 percent of males and 56 percent of females sustaining the AI. Furthermore, it has been discovered that as the duration of diabetes increases, the prevalence of autonomic instability rises^[10].

Conclusion

The importance of autonomic imbalance as a predictor of cardiovascular disease is focussed in this study, which highlights the need for healthcare practitioners to be aware of individuals with clear autonomic imbalance and type 2 diabetes. Screening for autonomic function and the patient education could be the key factors among the patients with autonomic imbalance in order to prevent devastating events further. Patients with uncontrolled blood sugar levels may require much intrusive surveillance and further efforts.

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