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ORIGINAL ARTICLE

Assessment of cardiac autonomic neuropathy in long standing type 2 diabetic women



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KEYWORDS

Cardiac autonomic neuropathy;
Heart rate variability;
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Abstract *Background:* Patients with long standing DM undergoing surgical interventions are put under great challenge as they may have cardiovascular and/or cardiac autonomic neuropathy (CAN). CAN is serious, often overlooked and under diagnosed, with possible arrhythmias and silent ischemia that threaten life.

Objectives: Assessment of CAN in long standing type 2 diabetic women undergoing major surgery. *Study design:* Cross sectional study.

Patients and methods: One hundred and six type 2 diabetic women scheduled for major surgery were assessed by the autonomic function tests. Only one hundred cases completed the study. CAN was assessed by analyzing HR variations during three standard tests (deep breathing, lying to standing and valsalva maneuver). Sympathetic functions were assessed by checking orthostatic hypotension. The CAN score of each patient was analyzed. Continuous 24 hour ECG monitoring (Holter) was done to evaluate ischemia, arrhythmia, QTc and QTd. Transthoracic Doppler echocardiography, stressing on LVH, diastolic and systolic dysfunctions were carried out. Cases were classified as mild (with only one abnormal test) or severe CAN when two or more abnormal function tests were present. Exclusion criteria include any systemic illness that can affect the study results or the autonomic functions, smoking and HTN.

Results: CAN was detected in 70% of the studied cases, and 70% were severe CAN. Postural hypotension was detected in 34% of the studied cases. QTc prolongation and QT dispersion were frequent. ECG and Doppler echocardiography changes of LVH were more prevalent among patients with CAN. Diabetics with CAN were significantly older had longer duration of DM

Abbreviations: CAN, cardiac autonomic neuropathy; LVH, left ventricular hypertrophy; DM, diabetes mellitus; HTN, hypertension; SBP, systolic blood pressure; DBP, diastolic blood pressure; HRV, heart rate variability

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and higher HbA1-c, higher pulse pressure, triglyceride, uric acid and urinary albumin excretion rate. They also had significant increased LVM index, diastolic dysfunction and myocardial ischemia.

Conclusion: Middle aged women with long standing diabetes are vulnerable to CAN with postural hypotension and prolonged QTc intervals, QT dispersion, and increased LVMI and myocardial ischemia. Identification of CAN is crucial to exercise prevention against hazards of CV insults during stressful situation as surgery.

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1. Introduction

Autonomic neuropathy, although not rare, is one of the most insidious complications of diabetes mellitus (DM) especially if long standing and poorly controlled. Cardiac autonomic neuropathy (CAN) is often overlooked both in diagnosis and treatment simply because there is no widely accepted single approach to its diagnosis.¹ CAN embraces exercise intolerance, intraoperative cardiovascular liability, orthostatic syndromes and silent myocardial ischemia.²⁻⁴ These clinical manifestations can result in life threatening outcomes which unquestionably associate the presence of CAN with the increased risk of CV morbidity and mortality in DM.

In the Eurodiab prospective study on type one diabetes mellitus CAN was among the strongest risk markers of future total and CV mortality exceeding the effect of traditional risk factors as age, obesity, hypertension, dyslipidemia, inflammatory and prothrombotic emerging cardiac risk factors.^{4,5} In a Meta analysis of 12 published studies Vinik et al.⁶ reported a constant association between CAN and silent myocardial ischemia and in the DIAD study, on type 2 DM CAN was a stronger predictor of silent ischemia and subsequent cardiac events.⁷

QTc interval and QTd have been considered as a marker of cardiac autonomic dysfunction and have been demonstrated as an independent predictor of CV mortality and all cause mortality risk in type 2 DM patients.⁴ Combined abnormality in HRV and QT index was a strong predictor of mortality independent of conventional risk factor.^{8,9}

Action to Control Cardiovascular Risk in Diabetes (ACCORD trial) in the presence of CAN at baseline was an independent contributor to the higher CV mortality risk in both the intensive and standard glycemic arm treatment. Individuals with baseline CAN were two times more likely to die compared with individuals without CAN.^{10,11} A lot of attention has been given to the CV aspect of autonomic dysfunction especially with the view regarding very tight glycemic control with increased mortality. ACCORD trial¹² attributed increased mortality to hypoglycemia induced arrhythmias.¹

There is no widely accepted single approach to the diagnosis of CAN, however during the 1970s Ewing et al.,¹³ advised a number of simple bedside tests of short term RR difference to detect CAN including changes in RR with deep breathing, RR response to standing which induces reflex tachycardia followed by bradycardia and Valsalva ratio which evaluates cardiovagal function in response to a standard increase in intrathorathic pressure. HRV is a physiological phenomenon that reflects the influence of autonomic nervous system on the heart work.¹³ HRV can be defined as the phenomenon of oscillation in the intervals between the consecutive heart beats as well as the oscillation between consecutive instantaneous heart rates.^{13b}

Orthostatic hypotension with its many troublesome symptoms ranging from light headedness to near syncope that may be associated with poor quality of life with fall in systolic BP ≥ 20 mmHg and ≥ 10 mmHg in diastolic BP during 3 minutes of standing and resolving with sitting or lying down is characteristic of CAN.^{14,15}

The clinical symptoms of CAN may be late, however sub-clinical CAN manifest as changes in HRV may be detected within one year of diagnosis of type 2 DM.¹⁶

Pop Bussi and coworkers,¹⁷ reported that the prevalence of CAN ranges from as low as 2.5% (DCCT) to as high as 90% in long standing DM and should be instituted at diagnosis of type 2 DM and after 5 years of diagnosis of type 1.¹⁸ Vinik and Ziegler,¹⁹ reported that, the detection of CAN is a must before exposing patients with long standing DM to stressful situation and also before planning exercises. Diabetics must be tested with a cardiac stress test before undergoing an exercise program. Patients with CAN need to rely on their perceived exertion and not heart rate to avoid the hazardous levels of exercise intensity.¹⁹

2. Aims

Assessment of cardiac autonomic dysfunction in middle aged women with long standing type 2 DM who are going to be exposed to stress in the form of major surgery.

3. Design

Cross sectional study.

4. Subjects and methods

The studied cases included one hundred and six women. They are known to be diabetics and were under oral hypoglycemic agents (70 cases) and 30 cases were under combined insulin and sulfonylurea. All were receiving metformin 1.7 gm/day. Their age ranged from 40 to 60 years (mean 52.4 ± 3.7 years). The mean duration of DM was 10 ± 2 years ranging from (6–14 years). BMI ranging from 25.1 to 29.2 (mean 27.1 ± 1.1). They were scheduled for hysterectomies and/or classical repair.

All medications that can affect the result of the autonomic functions (anticholinergic agents, adrenergic antagonists, vasoconstrictive agents) were withheld during and one week preceding the clinical assessment of autonomic functions.

Examinations were undertaken in the morning at least 2 h after a light breakfast and no caffeine was allowed. The patients were asked about symptoms suggestive of autonomic neuropathy, postural hypotension and myocardial ischemia.

Diabetic complications as retinopathy were checked and peripheral neuropathy, and sudomotor neuropathy were

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