

Assessment of Sympathetic Activity Using Hand Grip Test in Obese Type 2 Diabetes Mellitus Patients

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Abstract

Aim: The aim of the study is to assess sympathetic activity in Obese type 2 Diabetes mellitus patients

Objectives: To investigate any changes in sympathetic activity in obese type 2 diabetes mellitus patients using hand grip test

Methods: 50 subjects of both the genders with type 2 Diabetes mellitus of 10-15 years duration and BMI > 25kg/m² were selected as study group. In sitting posture the subject was asked to apply pressure on hand grip dynamometer at 30% of maximum voluntary contraction (MVC) for 1 minute. BP was recorded simultaneously from non-exercising arm. The procedure was repeated thrice with 5 minutes interval in between. The average increase in DBP was noted as the test response and comparison was made with readings of hand grip test from nonobese nondiabetic subjects which were selected as control group.

Results: Statistical analysis was done using unpaired t test. Increase in diastolic blood pressure with handgrip test in study group was significantly reduced compared to control group.

Conclusion: Sympathetic neuropathy is seen in obese diabetic patients. Obesity could be involved in the impairment of CAN function in type 2 diabetics and body weight control could provide an approach to reducing neuropathic complications.

Keywords: Hand grip test, sympathetic activity, Obese, Type 2 diabetes mellitus.

Introduction

Autonomic nervous system dysfunction is one of the significant complications of diabetes mellitus and this is generally associated with a poor prognosis¹. The autonomic nervous system (ANS) has a role in the regulation of long and short term energy balance, and ANS deregulation is implicated in the pathogenesis of obesity and Type 2 Diabetic mellitus (T2DM)². However, debate exists on the initiation of the pathogenic process: whether ANS deregulation is a pathogenic factor in the development of T2DM or whether, conversely, chronic

hyperglycaemia and hyperinsulinaemia lead to ANS dysfunction.

Obesity and its early complications (i.e. insulin resistance and impaired fasting glucose) are associated with overstimulation of the sympathetic nervous system (SNS) and decreased tone of the parasympathetic nervous system (PNS)³. Once T2DM has developed, chronic hyperglycaemia and persistent increase in sympathetic activity downregulate peripheral β -adrenergic receptors⁴ resulting in inability of the SNS to enhance energy expenditure⁵.

The sympathetic nervous system modulates both hepatic glucose production and the glucose uptake in peripheral tissues⁶. Some studies demonstrated that the increase of plasma insulin level was related to increased urinary⁷ and plasma norepinephrine.

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Sympathetic activity was assessed using Hand grip test which causes Isometric exercise. Exercise, in which contraction principally causes a change in the tension of the muscle with little change in the length, is termed as isometric or static. Isometric muscle contraction evokes large increase in mean arterial pressure, heart rate and muscle sympathetic nerve activity(MSNA) with a minor rise in central hemodynamics. The increases in MSNA are thought to result, primarily from activation of the muscle metaboreflex or exercise pressor reflex in the exercising muscle. This reflex originates in sensory receptors which appear to be sensitive to ischemic metabolites generated during muscular contraction, via small myelinated or unmyelinated (group III or IV) afferent fibers, and elicits cardiovascular and vasomotor reflexes.

Materials and Method

The study was carried out in Mahavir institute of Medical sciences, Vikarabad.

Study group:

50 subjects of both the genders with type 2 Diabetes mellitus of 10-15 years duration and BMI > 25kg/m² were selected as study group

Control group:

50 Nonobese and Nondiabetic subjects of both the genders were selected as control group

Inclusion criteria for study group:

1. Diabetic for the past 10-15 years
2. BMI > 25Kg/m²

Inclusion criteria for control group:

1. Nondiabetic
2. BMI between 18.5kg/m² and 25 kg/m²

Exclusion criteria:

1. Any History of Asthma
2. Smokers
3. History of alcohol intake

All the subjects were explained about the test and an informed consent was taken.

Hand grip test:

The resting BP of the subject was recorded in sitting posture. Then the subject was asked to apply pressure on hand grip dynamometer at 30% of maximum voluntary contraction (MVC) for 1 minute. BP was recorded simultaneously from non-exercising arm. The procedure was repeated thrice with 5 minutes interval in between. The average increase in DBP was noted as the test response.

Statistical Analysis:

Statistical analysis was done using unpaired t test

P value < 0.05 was considered as statistically significant

The results were expressed as Mean ± standard deviation

Findings

Table 1. Comparison of Sympathetic activity in study and control group

Variable	Study group		Control group		P-Value
	Mean	SD	Mean	SD	
Increase In DBP(mmHg) with Hand grip test	2.7	8.4	8.1	10.1	0.004

On Analysis,

Increase in diastolic blood pressure with handgrip test in study group was significantly reduced compared to control group.

Discussion

In our study, we found that the Increase in diastolic blood pressure with handgrip test in obese diabetic subjects was significantly reduced compared to Nonobese nondiabetic subjects indication sympathetic neuropathy in obese diabetic subjects.

Diabetic neuropathy((DAN) is the main cause of neuropathy in the world⁸. The most common and studied manifestation of DAN is cardiovascular autonomic neuropathy (CAN), owing to its life-threatening

complications (arrhythmias, silent myocardial ischemia, and sudden death) and to its relation with other microangiopathic comorbidities. CAN is defined as the impairment of autonomic control of the cardiovascular system⁹.

Cardiac alterations initially start with a relative increase of the sympathetic tone, since diabetic neuropathy firstly affects longest fibers as those of parasympathetic system (like the vagus nerve). Sympathetic denervation begins at the following stage, by affecting the heart from the apex toward the base, gradually impairing ventricle function and resulting in cardiomyopathy¹⁰.

Conclusion

Sympathetic neuropathy is seen in obese diabetic patients. Obesity could be involved in the impairment of CAN function in type 2 diabetics and body weight control could provide an approach to reducing neuropathic complications.

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Ethical Clearance: Taken from Scientific Ethical committee, Mahavir Institute of Medical Sciences, Vikarabad, Telangana.

Conflict of Interest – Nil

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