Effect of Duration of Diabetes patient on Valsalva Ratio

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ABSTRACT

Introduction: Autonomic neuropathy is a serious complication of diabetes mellitus which is least recognized & most frequent. Cardiac autonomic neuropathy is associated with not only fatal intra-operative liability but also morbidity in life style. . In this study we are going to evaluate diabetic autonomic neuropathy using Valsalva ratio. **Objective:** To observe & compare Valsalva ratio in diabetic cases & healthy controls. To evaluate the effect of duration of diabetes on Valsalva ratio. **Material and method:** After proper application of inclusion & exclusion criteria 100 subjects were chosen from Sir T. Hospital. 50 with diagnosed diabetes mellitus, and 50 age and sex matched healthy control. This 100 subjects were examined and Valsalva ratio assessment evaluation was done by instrument cardiac autonomic nervous system analyzer -304

Results: The mean of test group and control group were 2.25 and 3.63 respectively. This mean values decreases and percentage of subjects with autonomic dysfunction increases as duration of disease increases.

Conclusion: The parasympathetic system imbalance is more prevalent in diabetics & its condition worsens as the duration of disease increasing.

Key words: Diabetic autonomic neuropathy, Valsalva ratio

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INTRODUCTION

Diabetes is an iceberg disease & silent killer as well. Probability is that, in 2025, Diabetic cases which are around 150 million will be almost doubled in world. In 2025, India will be one of the leading countries in this epidemic of diabetes. [1,2]

Diabetic neuropathy is one of the most frequent symptomatic complications of diabetes. The consequences of diabetic neuropathy can extend to several other systems including ANS.[3] many cases may be asymptomatic which may lead to liability like intra operative complication, silent MI, & chronic fatigue syndrome. This autonomic

dysfunction can be recognized only by focused testing, which include quantitative sensory and autonomic function testing. [3,4]

Valsalva ratio is a part of ANS testing. To understand Valsalva ratio, first we must know the Valsalva-Weber maneuver. To perform the maneuver, the subject is asked to blow after a full inspiration against the resistance represented by one mouthpiece tubing connected to an aneroid manometer to maintain a constant expiratory effort equivalent to an intra oral pressure of 40 mmHg during a certain period of time.[5]

The Valsalva-Weber maneuver consists of four phases of changes in acute short-lasting heart rate and blood pressure changes. In Phase I (with onset of strain) there is Rise in BP without any change in HR due to increase in intra thoracic pressure. In phase II (during straining phase) venous return decrease, so cardiac output and BP decreases. This leads to baroreceptor inhibition, so inhibition in pressure area RVLM in medulla decreases. These cascades leads increased sympathetic discharge. This increased sympathetic tone is responsible for tachy cardia and peripheral vasoconstriction in phase II. [5, 6,7.] Phase III (release of strain) intra thoracic pressure decreases -displacement of blood to pulmonary vascular bed- transient decrease in BP but there is no change in heart rate. Phase IV (further cessation of strain) - in this there is secondary rise in BP & overshoot phenomenon which ultimately leads to baroreceptor stimulation. So, BP & heart rate come to lower level. [5, 6,7.]

Valsalva ratio- (ratio of the longest RR interval after the manoeuvre divided by the shortest RR interval during the test). A ratio of greater than 1.45 is normal. Balance of Baroreceptor mediated tachycardia in phase II and bradycardia in phase IV determines if cardiovagal reflexes are intact. [6,7,8.] Valsalva ratio has to domain, blood pressure & heart rate changes. CANS- 304 is measuring the heart rate changes only & indicate parasympathetic imbalance. That's why we haven't included the changes of BP in this study.

MATERIALS AND METHOD

After IRB approval 100 study subjects were chosen from SIR T. Hospital, Bhavnagar to participate in this observational, cross sectional, comparative study. After taking the informed consent & examination by Physician, Subjects were divided into two groups, 50 with diagnosed Diabetes mellitus, and 50 age and sex matched healthy control. Inclusion criteria for case: Male or female patient age being between 30 to 70 years & Known case of diabetes. Exclusion criteria for case: Patient who did not give consent, Patient who is hypertensive or suffering from renal failure, or having any other disease or taking any drugs which might affect the ANS. In this 100 subjects Valsalva

ratio evaluation was done by instrument **CARDIAC AUTONOMIC NERVOUS SYSTEM ANALYZER -304** by Diabetic Foot Care India Pvt. Ltd. This instrument belongs to Autonomic function Lab, Physiology Dept.

PRECAUTION- We have taken care that this autonomic nervous testing was done in the morning, in ANS lab of physiology lab. We have make sure that all the factors that affect ANS like temperature, exercise, drugs & medication, anxiety, sleep don't interfere the Valsalva ratio examination.[9,10] The quantitative Valsalva manoeuvre is performed by blowing with an open glottis into a mouthpiece connected to the Valsalva input. A minimum 40 mmHg pressure is maintained for 15 seconds & continuous ECG recording is done by instrument only, than person slowly releases the blowing pressure. [7,11] During this procedure there is continuous recording of R-R interval. After the end of test CANS-304 gives value of Valsalva ratio. Normal value: a ratio of greater than 1.45 is considered normal. Abnormal ratio is less than <1.20, 1.20 to 1.45 is considered border line. Failure of heart rate to increase during strain suggest a sympathetic dysfunction and failure of HR to slow during BP overshoot suggest a parasympathetic disturbances. [6, 7, 8]

OBSERVATION AND RESULTS

Result was compared between the controls and patients of diabetes mellitus. Statistical tools: Data were entered and analyzed with the Graph Pad.com. Statistical tests used for comparison is Student's t-test. Results are presented as mean (SD) and number (%) of cases as appropriate. The level of significance was set at $P < 0.05$, and 95% confidence intervals were calculated for the main outcome measures.

Table 1: Distribution according to Duration of diabetes

Duration of exposure in years	Number of subject	Percentage
<5years	18	36%
6-10 years	15	30%
>10 years	17	34%

Table 2: Comparison of Valsalva ratio in test & control group

Groups	Mean ± SD	t	P
Test	2.25±1.38	4.27	<0.05
Control	3.63±1.81		

Table 3: Valsalva ratio in controls and cases (groups according to duration of disease, groupI-0 to 5 year, groupII-6 to 10 year, group III- more than 10 year)

Tests	controls	Group I	Group II	Group III
VR(Valsalva ratio)	3.63±1.81	2.73±1.27	1.92±1.00	2.04±1.69
P value		0.054	0.008	0.002
T value		1.95	3.51	3.20

Table 4: Subject who showed abnormal Valsalva ratio in each group according to duration of disease.

Groups	Percentage of subjects who showed abnormal Valsalva ratio
Controls	12%
Cases- less than 5years of duration of diabetes	22%
Cases- 6 to 10 years of duration of diabetes	46%
Cases- greater than 10 years duration of diabetes	52%

DISCUSSION

Diabetes mellitus is a strong risk factor for cardiovascular disease. DAN is a risk factor that independently increases cardiovascular risk in people with diabetes mellitus. DAN is progressive condition due to which ANS dysfunction is not only more prevalent in diabetics but also worsens as the disease progress [4,12-16] The mean of test group and control group were 2.25 and 3.63 respectively. This mean values decreases and percentage of subjects who get abnormal results (<1.45) increases as duration of disease increases. Table 2 and 3 shows that group1 has mean value -2.73(22% gave abnormal value), group2 mean value -1.92(46% gave abnormal value), group3-mean value -2.04 (52% gave abnormal value). Present study shows that Valsalva ratio is lower in diabetic patients than normal persons this reflects decreased parasympathetic function due to decreased vagal tone. Vagal tone is further decreasing as duration of disease is increasing. [17,18] The heart rate response to Valsalva maneuver relies to some extent on the integrity of sympathetic as well as parasympathetic pathways. Parasympathetic fibers being the longest fibers are affected first due to atherosclerotic changes of vasanervosum. In diabetes, microalbuminuria is associated with a cluster of metabolic and

hemodynamic abnormalities which includes a disadvantageous lipid profile, and altered diurnal blood pressure rhythm.[19] This multiple factors leads to autonomic imbalance & autonomic neuropathy in diabetes. [17]

CONCLUSION AND SUMMARY

Our study indicates that value of Valsalva ratio decreases and percentage of subjects who get abnormal results (<1.45) increases as disease advances. Probably, heart rate response to breathing is decreased only in diabetics due to impaired vagal tone as consequence of CAN and this response decreases as duration of diabetes increases due to progressive nerve damage.

ACKNOWLEDGEMENT

I will be always indebt of Department of Physiology, Government Medical College, Bhavnagar for their help. I am heartily thankful to our former respected dean sir Dr B.D.Parmar who created opportunities for us in research. I am thankful to IRB committee& Dr C.B. tripathi for their guidance regarding our research. I am thankful to Department of Medicine & pharmacology for their help in study.

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