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Role of Central Obesity in Autonomic Functions in an Obese Student Population

Medical Science

KEYWORDS : Central Obesity, BMI,Waist to hip ratio & Cardiac Autonomic Neuropathy

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ABSTRACT

Objective: To evaluate the role of central obesity in autonomic functions. Methods: The study was conducted on 30 obese students in the age group of 18-24 years, from the Dr D. Y. Patil University, Pune. Cardiac autonomic function tests were carried out in all subjects. Results: Resting heart rate was significantly elevated in the obese group indicative of cardio-vagal dysfunction. However, no significant difference was found in heart rate variability (HRV) & Orthostatic Tolerance test (OTT) in obese subjects. Conclusion: Central obesity plays an important role in autonomic dysfunction

1.Introduction

Obesity is a significant health hazard with rising standards of living and has reached epidemic proportions in many nations. Most of these findings have been based on measurement of obesity by the body mass index (BMI). However, BMI gives no indication of the distribution of body fat. Centralized or upper body fat carries an increased risk for metabolic complications.[1]The index of abdominal obesity is therefore regarded as a more important predictor than that of general obesity, and is a risk factor for ischemic heart disease,Type 2 diabetes mellitus, and cardiovascular mortality.[2-7] It has also been observed that abdominal obesity is related to the derangement in the autonomic functions. In this study we investigated the heart rate variability (HRV) in a sub population of subjects with BMI indicative of obesity but a normal waist to hip ratio (WHR) to identify the role of central obesity in the autonomic derangement.

2.Methods

60 male students aged 18-24 years, from the Dr.D.Y.Patil University, Pune were selected for the present study. Height and weight were taken by using scales on bare foot. Their Body mass index (BMI) and Waist Hip Ratio (WHR) were calculated. Thirty students who had BMI > 258 were categorized as obese.30 students with BMI < 25 formed the non obese group. Glucose (glucose oxidase method) and lipid levels (enzymatic end point method)[9] .Resting heart rate, Systolic and Diastolic blood pressures were measured.

The following autonomic function tests10 were also performed using computerized polyrite-D (ModalDSMP0410,RMS,Chandigarh,India) at 25 0 C -27 0 C.

Heart-rate response to Valsalva manoeuvre(Valsalva ratio)

The subject blows into a mouthpiece connected to a modified sphygmomanometer and holds the pressure at 40 mm Hg for 15 seconds while a continuous electrocardiogram was recorded. The manoeuvre was performed three times with one minute intervals between. The result was expressed as the Valsalva ratio, which is the ratio of the longest R-R interval after the manoeuvre to the shortest R-R interval during the manoeuvre. The highest of the three Valsalva ratios(VR) was taken as the final value.

Heart-rate variation during deep breathing or Deep Breath Difference (DBD)

The subject sits quietly and breathes deeply at six breaths a minute (five seconds in and five seconds out) for one minute. An electrocardiogram was recorded throughout the period of deep breathing, with a marker used to indicate the onset of each inspiration and expiration. The result is then expressed as the mean of the difference between maximum and minimum heart rates for the six measured cycles.

Blood-pressure response to standing or Orthostatic tolerance test(OTT)

The test is performed by measuring the patient's blood pressure with a sphygmomanometer while he is lying down quietly and again when he stands up. The postural fall in blood pressure is taken as the difference between the systolic blood pressure lying and the systolic blood pressure standing.

The study was approved by the institutional ethics committee. Computations were performed using Sigma-Stat statistical package (Jandel Scientific, version 4 for Windows, SPSS Inc., Chicago, USA).

3.Results

The fasting BSL was elevated in the obese group but was not significant .Total cholesterol (TC) & Triglyceride (TG) levels were significantly higher in obese subjects (p=0.0156 &p=0.0175 respectively).LDL was also high in obese subjects but was not significant. Resting pulse was significantly higher in the obese group as compared to the non-obese (p=0.0001). Diastolic pressure was also significantly higher in obese group (p=0.0060). HRV & OTT were not statistically significantly in obese subjects .

4. Discussion

Most studies on obesity have used BMI as the reference point for its role in IHD & type 2 diabetes .This study tried to identify the role of central obesity in the development of autonomic complications.

Total Cholesterol (TC) & Triglyceride levels were significantly higher in the obese group,LDL was higher in the obese group but was not significant but HDL levels were similar. This closely resembles the Indian scenario.As urbanization occurs, increase in BMI, dietary changes and reduced physical activities result in an elevation of TC & TG.[11]

The pulse rate was significantly higher in the obese group indicative of early cardiovagal dysfunction. Increased RHR is considered as an independent risk factor and a prognostic factor for cardiovascular and non-cardiovascular related diseases.[12,13] It has been shown that an increase in heart rate by 10 beats per minute was associated with an increase in the risk of cardiac death by at least 20%, and this increase in the risk was similar to the one observed with an increase in systolic blood pressure by 10 mm Hg.[14,15]

No difference was observed in the systolic pressures but diastolic pressure was significantly higher in the obese group probably due to an increase in the peripheral resistance. No significant differences were observed between two groups when the HRV tests (VR & DBD) & OTT were compared. An important aspect of this study was that ,though the students were obese as per

the BMI criteria, when WHR was taken into consideration,these students were not centrally obese. However,in another study, we found a significant decrease in HRV in obese subjects of the same age group.In the same study,in the Orthostatic tolerance test (OTT),fall in systolic blood pressure was found to be significantly higher in the obese group, indicative of early autonomic dysfunction in these obese students[16].These subjects were centrally obese but in the present study they had a normal waist to hip ratio. This is indicative that central obesity (WHR) seems to be better correlated with autonomic dysfunction than generalized adiposity (BMI).

In a prospective cohort study of women, the waist-to-hip ratio was found to be a better predictor of the risk of death than the body mass index.7 They showed that the indices of autonomic nervous modulation correlated significantly with the indices of abdominal obesity. The waist circumference and waist to- hip ratio, suggested that it is the abdominal obesity rather than the generalized obesity that is pathophysiologically related to the higher sympathetic and lower vagal modulations and therefore the higher risk of mortality. Abdominal obesity is considered to be more dangerous than general obesity because the visceral fat has been shown to secrete certain cytokines and chemicals that are involved in atherogenesis and alterations in the autonomic balance.[17]

5.Conclusion

Central obesity (WHR) is a better predictor of autonomic dysfunction than generalized adiposity (BMI).

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Table.1:Anthropometry & Biochemical Profile

PARAMETERS	OBESE	NON-OBESE	p-VALUES
BMI(Kg/m^2)	28.0	21.5	0.001
Waist Hip Ratio	0.825	0.812	0.613
BSL-Fasting(Mg/dl)	85.1+/-1.467	82.3+/-0.83	0.0970
TotalCholesterol (Mg/dl)	147.3 +/- 4.40	128.8 +/- 5.85	0.0156*
Triglyceride (Mg/dl)	102.4+/- 5.71	84.6 +/- 4.38	0.0175*
HDL(Mg/dl)	54.0+/- 1.17	54.9 +/- 1.04	0.6042
LDL(Mg/dl)	81.0+/- 4.36	71.0 +/- 3.30	0.0744

Table 2: Autonomic Function Tests

PARAMETERS	OBESE	NON-OBESE	p-VALUES
Resting Heart Rate(beats/min)	81.5+/-1.545	71.2+/-0.916	0.0001*
Diastolic BP (mm of Hg)	74	70	0.0060*
Systolic BP (mm of Hg)	125	124	0.445
Valsalva Ratio (VR)	1.38	1.41	0.2855
Deep Breath Differenc(DBD)	28.9+/-1.14	29.5+/-1.05	0.7049
OTT	07	06	0.4886

Results are expressed as mean +/-SEM for normally distributed variables or as median and interquartile range when data was not normally distributed. Difference between groups was tested by Student's t-test, Mann Whitney test or Chi-square as appropriate.

*Indicates significance

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