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Study of Cardiac Autonomic Activity in Obese Patients in a Tertiary Care Hospital

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ABSTRACT

Obesity has become an epidemic and is associated with numerous complications. Several clinical studies have evaluated the issue of hormonal changes associated with obesity and consistently reported changes in thyroid function parameters in obese subjects. Obesity as has also been linked to a spectrum of cardiovascular changes and significant abnormalities of the cardiac autonomic regulation. It is important to detect these changes early, as it is possible to reverse them with treatment in the early stages of the disease. In our study we have assessed the impact of obesity and cardiac autonomic activity in obese patients. A total of 60 patients with BMI of more than 25 after informed consent were studied. Bedside tests for cardiac autonomic activity, Height & weight, RBS and ECG were performed using standard methods. Obesity was more common in female subjects (81.6%). highest prevalence was seen in the age group of 31-40 years (38.3%). cardio vagal disfunction was seen in 15% and cardiac adrenergic dysfunction was seen in 11.6% of the subjects. Thus we can conclude from our study that dysfunction in cardiac autonomic activity both parasympathetic and sympathetic disfunction is prevalent in significant no.of obes patients.

KEYWORDS : Autonomic nervous system, body mass index, cardiac autonomic neuropathy.

INTRODUCTION:

Obesity is a state of excess adipose tissue mass. With continued rise in standards of living obesity is emerging as a global academic in both children and adults. The prevalence of obesity has increased worldwide since the mid 1970's. This has been called new world syndrome and is a reflection of massive social, economic and cultural problems currently facing developing and developed countries[1]. The most widely used method to measure obesity is the BMI, anthropometry (skin fold thickness), densitometry (under water weighing), CT or MRI and electrical impedance. obesity occurs when caloric intake exceeds energy expenditure and the excess calories are stored in the adipose tissue is suggested to be an imbalance between energy intake and expenditure resulting from complex interaction of genetic, physiological, behavioral and environmental factors[2] . Appetite is influenced by many factors that are integrated by the brain most importantly with in the hypothalamus. Obesity is associated with an increased risqué of diabetes, dyslipidemia, kidney disease, and cardiovascular disease, all-cause mortality and cancer. Thus sevior obesity is an imported cause of premature mortality among middle aged adults[3]. ANS is also involved in energy metabolism and regulation of cardiovascular system. It is convincible that one or more subgroup of obesity have an alteration in their ANS that may promote obesity and account for several clinical consequences. The activity of sympathetic nervous system is a determinant of energy expenditure. It has been observed that individuals with low resting muscle sympathetic nerve activity may be at risqué for body weight gain resulting from lower metabolic rate[4]. Over feeding is found to be associated with sympathetic activation and there is evidence that adrenergic mechanism contribute to cardio vascular complications[5] .the present study has been conducted using autonomic function tests, Height & Weight, RBS and ECG as diagnostic tools.

MATERIALS AND METHODS:

60 obese patients were selected from medical wards, SVRRGGH, TIRUPATHI with medical problems from October 2015 to March 2016 Patients were selected randomly and it is a cross sectional study. Prior informed consent was taken from all the subjects.

INCLUSION CRITERIA:

1. Subjects aged above 18 years.
2. BMI [6] more than 25 kg/m^2.

EXCLUSION CRITERIA:

1. Subjects aged less than 18 years
2. Known hypertensives, Diabetics, Thyroid disorders, IHD, CHF.
3. Subjects who are on steroids.
4. Alcoholics.

EVALUATION AND INVESTIGATIONS:

1. Height & Weight
2. RBS
3. ECG
4. HR (Heart Rate) response to Valsalva Maneuver(6)
5. HR variation during deep breathing
6. immediate HR response to standing
7. BP response to standing
8. BP response to sustained hand grip.

Tests for assessment of cardiac autonomic activity:

On the day of testing patients were instructed not to ingest caffeine containing products. All recordings were done 5 – 8 hours post prandial. BP was recorded manually using standard sphygmomanometer. The Heart rate variation was calculated using standard heart rate monitor, pulse oxymeter and continuous ECG recordings. The bedside tests for assessing the autonomic nervous system were performed. All patients were subjected to the five tests as described below.

HR response to Valsalva Maneuver[7]

The subject was seated quietly and then asked to blow into the empty barrel of a 20 ml syringe attached to a mercury sphygmomanometer, to maintain a pressure of 40 mm of Hg for 10 seconds. The ratio of the maximum HR during blowing to the minimum HR during the compensatory bradycardia after stopping is calculated. The maneuvers was repeated three times with one minute interval in between and results were expressed as

Valsalva ratio = Maximum HR / Minimum HR

The mean of the three - Valsalva ratios was taken as the final value.

HR variation during deep breathing

The subject was asked to breathe deeply at six breaths / min (five seconds inspiration and five seconds expiration) for one minute. The average HR difference is calculated while the patient breaths deeply for 1 minute. The results were expressed as the mean of the difference between maximum and minimum HR for six measured cycles in beats / minute.

immediate HR response to standing

The test was performed with the subject lying quietly on a couch. The HR increase was recorded 15 seconds after standing from lying position.

BP response to standing

This test measured the subject's BP with a sphygmomanometer while he was supine. The BP was again measured after 1 minute of standing. The postural fall in BP was taken as the difference between the systolic pressure lying and the systolic pressure standing. The test was performed three times and the mean systolic BP was calculated.

BP response to sustained hand grip

The BP of the patient was taken three times before the maneuver. A modified sphygmomanometer was used to sustain handgrip. The patient was asked to grip the inflatable rubber and apply maximum voluntary pressure possible. A reading from the attached mercury manometer was taken during maximum voluntary contraction[8]. There the patient was asked to maintain 30 % of maximum voluntary contraction for as long as possible up to five minutes. BP was measured at one minute intervals during the hand grip. The results were expressed as the difference b/w the highest diastolic BP during the hand grip exercise and the mean of the three diastolic BP readings before the handgrip began[7].

The subjects were assessed for cardio vagal and adrenergic dysfunction. Cardio vagal dysfunction was assessed based on HR variation to standing, deep breathing and valsalva maneuvers. Adrenergic dysfunction was assessed based on BP response to standing and sustain handgrip.

RESULTS:

The present 6 months cross sectional study was conducted in Dept. of General Medicine, SVRRGGH, S V Medical Collage, Tirupathi. The study group consisted of 60 individuals who were more than18 years of age with BMI > 25 kg/m^2.the data obtained was coded entered into Microsoft Excel Worksheet and analyzed.

Table 1: Age distribution in the study.

S. No.	Age (in years)	No.	%
1.	20 – 30	13	21.6
2.	31 – 40	23	38.3
3.	41 – 50	18	30
4.	51 – 60	6	10
Total	20 – 60	60	100

In this study max. Number of subjects were in the age group of 31 – 40 (38.3%), followed by 41 – 50 (30%). The mean age of the patient in this study is 38.5 years. In the study population females outnumbered males, females were 81.6% while males were 18.3 %.

Table 2: Gender distribution in the study.

S. No.	Gender	No.	%
1.	Female	49	81.6
2.	Male	11	18.3
	Total	60	100

In this study maximum number of subjects were in the BMI range of 25.0 – 29.9 kg/m^2 (50%), followed by 30.0 – 34.9 kg/m^2 (30%). The mean BMI of this study subjects is 30.7 kg/m^2.

Table 3: BMI distribution in the study.

S. No.	BMI (in kg/m^2)	No.	%
1.	25.0 – 29.9	30	50
2.	30.0 – 34.9	18	30
3.	35 or more	12	20
	Total	60	100

Table 4: Dysfunction of Cardio vagal tests in this study group.

S. No.	Cardio vagal function	No.	%
1.	Normal	51	85
2.	Abnormal	09	15
	Total	60	100

Cardio vagal dysfunction was seen in 15% of the study population and adrenergic dysfunction was seen in 11.6 % of the population.

Table 5: Adrenergic dysfunction in this study group.

S. No.	Cardiac Adrenergic function	No.	%
1.	Normal	53	88.3
2.	Abnormal	07	11.6
	Total	60	100

DISCUSSION:

The present study included 60 obese subjects with BMI of >25kg/m2 who were asymptomatic and with no other known co-morbidities. Cardiac autonomic function tests were determined in all the subjects. The age group of the patients in our study ranged from 20-60 years with majority of the subjects in 31-40 age groups. Females 81.6% while males were 18.3%of the body group.

Cardiac autonomic dysfunction was noted in the study subjects, 15% had cardio vagal dysfunction, and 11.6% had adrenergic dysfunction.

Cardiac autonomic dysfunction noted in our study is similar to another study conducted by simran et al[1], where both sympathetic and parasympathetic dysfunction was noted in obese subjects using bedside tests for cardiac autonomic function as diagnostic tools.

In other studies conducted by valensi P et al [9] and laderach Hofmann K et al[10], similar results were shown with respect to cardiac autonomic dysfunction in obese.

In a study conducted by P valnesi, PT Bich et al[4], high prevalence of alterations in HR variability suggesting cardiac parasympathetic dysfunction was noted in non-diabetic obese patients.

In a study conducted by pushpa Krishna et al[11], using frequency domain heart rate variability parameters, results showed that the HRV is decreased in overweight young adults especially men indicating sympathovagal imbalance. Changes in the autonomic nervous activity begin in the overweight and may become more prominent in the obese thus indicating increased cardiovascular risk. Overweight adults are found to have higher prevalence of many chronic disease with prevalence ratios greater in younger than in older adults[12], [13].

In Hugh R Peterson et al, body fat and the activity of autonomic nervous system was studied[14].

In another study conducted by K Laederacher – Hofmann et al[15] wherein autonomic cardiovascular regulation was assessed by use of HR variability and continuous BP recordings; a depression in sympathetic and parasympathetic activity together with a significant reduction reflex functioning was noted.

Similar results were also shown in a study conducted by Archana Damodaran et al[16], impaired cardiac autonomic function by increased sympathetic and parasympathetic activity. Hence autonomic e was noted in obese individuals in the form of sympathetic overdrive and parasympathetic withdrawal.

CONCLUSION:

Obesity was seen more commonly in females than males and in middle age group. In this study significant number of obese non-diabetic subjects had cardiac autonomic dysfunction, both cardio vagal and adrenergic dysfunction. Obesity being a risk factor for cardiovascular morbidity and mortality, we have to consider the assessment of cardiac autonomic activity in obese subjects even though the subjects may be asymptomatic. This could lead to early diagnosis to prevent further complications.

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