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Clinical Profile of Hypertension in Obese Adults

KEYWORDS

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ABSTRACT *Hypertension and obesity are both very important issues in healthcare of 21st century and have become two growing worldwide epidemics. Many epidemiological studies have shown a progressive increase in the prevalence of elevated blood pressure or hypertension with increasing obesity. Weight gain is almost invariably associated with increased blood pressure. A series of anthropological indices are used to measure the obesity and total fat content of the body which co-relates with increase in blood pressure of the individuals.*

Method:

Measurement techniques of body fat.

1) Underwater weighing

2) Whole-body air displacement plethysmography

3) Near-infrared interactanc

4) Bioelectrical impedance analysis

5) Anthropometric methods

A) Skinfold methods

6) Ultrasound

Results:

The present study was conducted in the Department of Internal Medicine, of a tertiary care center. 120 Obese (According to current International Body Mass Index criteria of WHO BMI>30KG/M2) and 120 non-obese (BMI<30KG/M2) hypertensives were selected for study. All were previously diagnosed hypertensives. The clinical profile of both obese and non-obese group were studied in detail along with anthropometric indices (Obesity indices), biochemical parameters, target organ damage signs, risk factors and compared. The clinical profile of obese adults is described and then compared with the similar parameter in non-obese group.

Conclusions:

The study included 120 obese (BMI>30kg/m2) and 120 non obese hypertensive patients, all were previously diagnosed hypertensives.

INTRODUCTION

Hypertension and obesity are both very important issues in healthcare of 21st century and have become two growing worldwide epidemics. Many epidemiological studies have shown a progressive increase in the prevalence of elevated blood pressure or hypertension with increasing obesity. Weight gain is almost invariably associated with increased blood pressure. A series of anthropological indices are used to measure the obesity and total fat content of the body which co-relates with increase in blood pressure of the individuals.

However, uncertainty regarding the most appropriate means by which to define body excess remains. Traditionally, Body Mass Index (BMI) has been the most widely used method by which to determine the prevalence of overweight in, and across, populations as well as an individual's level of risk. However, in recent years, measures of central obesity, principally waist circumference, waist: hip ratio and skin fold thickness, which more accurately describe the distribution of body fat compared with BMI have been suggested to be more closely associated with subsequent morbidity and mortality.

Obesity is rapidly turning into an epidemic afflicting much of the countries in the world. Epidemiological studies have revealed a strong relation between obesity and hypertension. Data from the National Health And Nutrition Examination Survey (NHANES) show remarkable and linear relationship between rise in body mass index and systolic , diastolic and pulse pressure. A BMI gain of 1.7 kg/m^2 in men and 1.25 k/m^2 in women or an increase in waist circumference of 4.5 cm for men and 2.5 cm for women corresponds to an increase in systolic blood pressure of 1mm Hg (Kissebah and Krakower, 1994) (1)

The Framingham Heart Study suggests that 78% of hypertension in men and 65% in women can be directly ascribed to obesity, and a meta-analysis of 25 randomized -controlled trials showed reductions in systolic and dias-

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tolic blood pressure(BP) of = 1mm Hg for each kilogram of weight loss.(2)

Obesity causes constellation of maladaptive disorders that individually and synergistically contribute to hypertension among other cardiovascular morbidity.

Obesity as an individual factor in causation of hypertension has been well studied via alteration in various bodily hemodynamic mechanisms. Various adipocyte related peptides and hormones like POMC (pro-opio melanocortins) and Leptin have been blamed in causation of increased blood pressure in various studies.

Obesity has reached epidemic in India in 21st century, with morbid obesity affecting 5% of the country's population. India is following a trend of other developing countries that are steadily becoming more obese. According to the NFHS, 10 percent of India's population was either overweight or obese in 2006. (3)

Unhealthy, processed food has become much more accessible following India's continued integration in global food markets. Indians are genetically susceptible to weight accusation especially around the waist.

Abdominal obesity is increasingly recognized as a major risk factor for cardiovascular disease (CVD). Compared with body mass index (BMI), anthropometric measures of abdominal obesity [e.g. waist circumference (WC), waist-to-hip ratio (WHR), sagittal abdominal diameter] appear to be more strongly associated with metabolic risk factors, incident CVD events, and death. The cardio-metabolic risk associated with abdominal obesity is attributed to the presence of visceral adipose tissue (VAT), which promotes insulin resistance, dyslipidaemia, and hypertension.(4)

Control of obesity may eliminate 48% of hypertension in white and 28% in blacks. More worldwide studies and researches are needed to understand obesity hypertension and form the basis for research in this field which will greatly impact human life.

AIMS AND OBJECTIVES

1) To study the clinical profile of hypertension in obese adults
2) To compare the clinical profile in obese hypertensives with non-obese hypertensive's. (Including anthropometric obesity indices, risk factors, target organ damage, biochemical parameters).
3) To study the correlation of different obesity indices and hypertension in obese and non-obese individuals

MATERIALS AND METHODS

Study Design
Cross sectional study

Study Place
The present study was conducted in the department of internal medicine, of a tertiary care center.

Study Population
All the obese (obesity standards as per the current Body Mass Index definition of WHO with BMI> 30kg/m2) and non-obese hypertensive adults visiting OPD or IPD of this tertiary care center.

Sample Size
Minimum 100 sample size each for both obese and non-obese group was kept as sample size, total 120 obese and 120 non obese patients were studied.

Study Period
The study was from Dec 2012 to Nov 2014

Inclusion criteria
All the obese hypertensive patients above the age of 18 years (obesity standards as per Body Mass Index definition of WHO with BMI> 30kg/m2) and non-obese hypertensives. All the patients were of known hypertensive status.

Exclusion criteria
Those who are not willing to participate in the study.

Ethical consideration
1) An informed and written consent was taken before the start of study.
2) Ethical clearance was also obtained from institutional ethical committee.

Clinical evaluation and procedures
All the obese and non-obese adult hypertensive patients attending OPD or IPD of the tertiary care center are included in study. (Obesity standards as defined by WHO with BMI of >30 kg/m2. Patients in both the groups were thoroughly taken history details including lifestyle risk factors, examined clinically and with appropriate laboratory investigations, routine lab work including random blood sugar, lipid profile (total serum cholesterol and serum triglyceride only according to the institutional availability) , urinary analysis with routine biochemistry and microscopy, fundus examination and ECG as well as their anthropological obesity indices (Body mass index, waist circumference, waist:hip ratio and skin fold thickness with Herpenden's caliper) were measured and recorded.

Materials and methods
The anthropological indices and the blood pressure of the cases will be recorded with the help of standard instruments.

A) Anthropometric Measurements: Methodology of various measurement-

a) Body mass index
For calculating body mass index (BMI), calibrated scale for measuring height in centimeter which was converted into meter and measuring weight in kilograms were used. For measuring the weight, the study subjects were requested to stand in the centre of the platform of the weighing machine, with the body weight evenly distributed between both the feet. Shoes, wallet, and belt were removed.

For measuring the height, the study subjects were requested to be bare foot. They were made to stand on a flat surface, with weight distributed evenly on both feet, heels together, and the head positioned so that the line of vision was perpendicular to the body. The arms hung freely by the side, and the head, back, buttocks, and heels were contact with the vertical board. The individuals were asked to inhale deeply and maintain a fully erect position. The movable headboard was brought onto the topmost point on the head with sufficient pressure to compress the hair. The height was recorded to the nearest 0.1cm. BMI was calculated using the formula: wt (kg) / Ht (m2).

b) Waist circumference
For measuring the waist circumference, the study subjects were requested to stand comfortably with their height

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evenly distributed on both feet, And the feet about 25-30 cm apart. The measurement was taken midway between the inferior margin of the last rib and the crest of the ileum, in a horizontal plane. Each landmark was palpated and marked, and a midpoint determined with a tape, measured and marked. The observer sat by a side of the subject and fitted the tape snugly but not so tightly so as to compress underlying soft tissues. The circumference was measured to the nearest 0.1 cm at the end of normal expiration.

c) Hip circumference

For measuring the hip circumference, wearing as little clothing as their culture permits, the study subjects were requested to stand erect with the arms at the sides and feet together. The investigator sat at the side of the subject so that the level of maximum extension of the buttocks could be seen, and placed the tape around the buttocks in a horizontal plane. The tape was snug against the skin but did not compress the soft tissues. The measurement was recorded to the nearest 0.1cm.

d) Skinfold thickness

Skinfold thickness of the subjects was calculated with the help of Herpenden's caliper (Dial type of skinfold caliper). Average skinfold thickness of four sites (Mid-Biceps, Mid-Triceps, suprailliac and subscapular) was recorded

e) Percentage Body Fat

The percentage body fat was calculated with the help of the age related charts of body fat percentage according to the skinfold thickness calculated with linear body density equations. Charts were provided in the operating Manual of Herpenden,s caliper only.

B) Blood pressure

Blood pressure was measured after 5 min of relaxation by using the standard sphygmomanometer with the cuff tied on the right arm and the subject comfortable in sitting position with the arm out stretched and supported. Systolic and diastolic pressure are defined by the first and fifth Korotkoff sounds, respectively. Three successive readings were taken at an interval of 5 minutes and the average was recorded as the blood pressure.

C) Biochemical measures

Routine investigations such as haemogram (hemoglobin, total count, and differential count), renal, liver function test, random blood sugar, urine routine and microscopy were done. The serum level of total cholesterol, triglycerides, random blood sugar were measured using commercially available reagent kits on a semi-automated analyzer.

RESULTS

The present study was conducted in the Department of Internal Medicine, of a tertiary care center. 120 Obese (According to current International Body Mass Index criteria of WHO BMI>30KG/M2) and 120 non-obese (BMI<30KG/M2) hypertensives were selected for study. All were previously diagnosed hypertensives. The clinical profile of both obese and non-obese group were studied in detail along with anthropometric indices (Obesity indices), biochemical parameters, target organ damage signs, risk factors and compared. The data obtained was tabulated and analyzed as below

The clinical profile of obese adults is described and then compared with the similar parameter in non-obese group.

Table II) Age group distribution of the cases studied across two study groups.

Age Group (years)	Obese Group (n=120)	Non Obese Group (n=120)	P-value
<35	6 (5.0)	6 (5.0)	0.514 (NS)
35 – 44	28 (23.3)	24 (20.0)	
45 – 54	44 (36.7)	37 (30.8)	
55 – 64	34 (28.3)	38 (31.7)	
>=65	8 (6.7)	15 (12.5)	
Total	120 (100.0)	120 (100.0)	

Values are n (% of cases). P-values by Chi-Square test. P-value<0.05 is considered to be statistically significant. S: Statistically Significant, NS: Statistically Non- Significant.

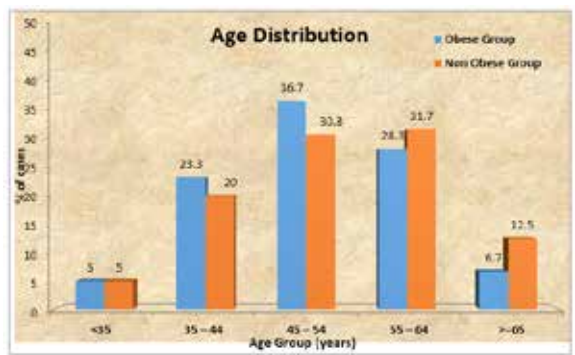

Figure II) Age distribution of the cases studied across two study groups.

a) Age group distribution did not differ significantly between two study groups (Pvalue>0.05).
b) Obese and Non-Obese group were comparable as per the distribution of the age groups.
C) The majority of the population in both the groups was between 35-65 yrs.

Table III) Sex distribution of the cases studied across two study groups.

Sex	Obese Group (n=120)	Non Obese Group (n=120)	P-value
Male	64 (53.3)	63 (52.5)	0.897 (NS)
Female	56 (46.7)	57 (47.5)	
Total	120 (100.0)	120 (100.0)	

Values are n (% of cases). P-values by Chi-Square test. P-value<0.05 is considered to be statistically significant. S: Statistically Significant, NS: Statistically Non- Significant.

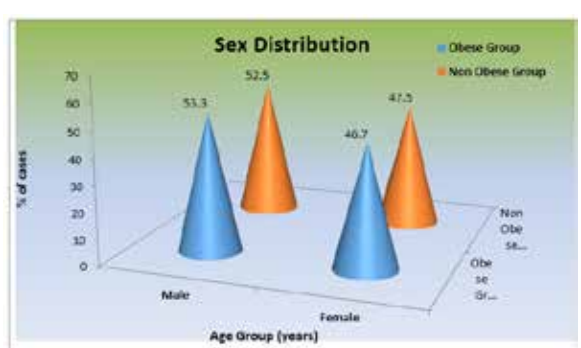

Figure III) Sex distribution of the cases studied across two study groups.

a) Sex distribution did not differ significantly between two study groups (P-value>0.05).
b) Obese and Non-Obese group were comparable for sex distribution.

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Table IV) Distribution and comparison of blood pressure across two study groups.

Blood pressure (mmHg)	Obese Group (n=120)	Non Obese Group (n=120)	P-value
Systolic BP	154.4 ± 11.7	149.7 ± 8.7	0.001 (S)
Diastolic BP	93.2 ± 7.6	90.9 ± 6.1	0.043 (S)

Values are Mean ± Standard Deviation. P-values by independent sample 't' test after confirming the underlying normality assumption. P-value<0.05 is considered to be statistically significant. S: Statistically Significant, NS: Statistically Non- Significant.

Figure IV) Distribution of blood pressure across two study groups.

1) Average systolic blood pressure in obese group was 154.4 ± 11.7 mmHg and in non-obese group was 149.7 ± 8.7 mmHg (P-value 0.001); Average diastolic blood pressure in obese group was 93.2 ± 7.6 mmHg and in non-obese group was 90.9 ± 6.1 mmHg (P-value 0.043).
2) Average systolic blood pressure is significantly higher obese group compared to non-obese group (P-value<0.05).
3) Average diastolic blood pressure is significantly higher obese group compared to non-obese group (P-value<0.05).
4) The significant difference was equally present through all age groups and both sexes.

Table V) Distribution and comparison of Dietary patterns across two study groups.

Diet	Obese Group (n=120)	Non Obese Group (n=120)	P-value
Veg	40 (33.3)	70 (58.3)	0.002 (S)
Non-veg (Mixed)	80 (66.7)	50 (41.7)	

Values are n (% of cases). P-values by Chi-Square test. P-value<0.05 is considered to be statistically significant. S: Statistically Significant, NS: Statistically Non- Significant.

Figure V) Distribution of Dietary patterns across two study groups.

a) The dietary pattern in obese hypertensive groups was 66.7% non-vegetarian diet whereas only 33.7% obese hypertensives were Vegetarian.
b) It was observed that obese group patient had significantly higher percentage of non-vegetarian eating pattern.
c) Whereas non obese group consisted mainly of vegetarians.
d) Vegetarian included only those who never had meat or egg or fish in their lifetime.

Table VI) Distribution of lifestyle risk factors across two study groups.

Risk factors	Obese Group (n=120)	Non Obese Group (n=120)	P-value
Family History	62 (51.66)	33 (27.5)	0.032 (S)
Smoking	16 (13.3)	23 (19.2)	0.221 (NS)
Alcohol	38 (31.66)	18 (15.0)	0.555 (NS)
Tobacco	12 (10.0)	12 (10.0)	0.999 (NS)
Sedentary Lifestyle	65(54.166)	20 (16.66)	0.001 (S)

Values are n (% of cases). P-values by Chi-Square test. P-value<0.05 is considered to be statistically significant. S: Statistically Significant, NS: Statistically Non- Significant.

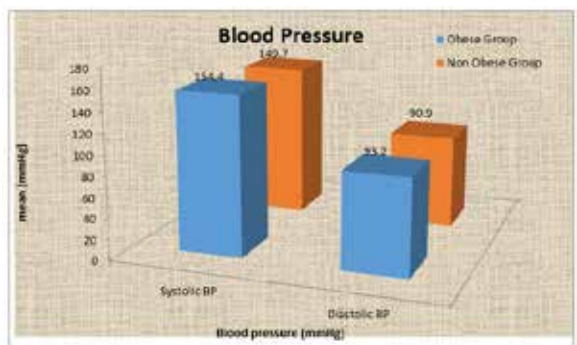

Figure VI) Distribution of risk factors across two study groups.

1) Amongst the obese group of hypertensives there was a strong positive family history of hypertension with 51.66% of having history of hypertension in at least one of the first degree relatives.
2) The prevalence of sedentary lifestyle or physical inactivity was seen in more than half of the obese hypertensives with 54.16% having physically inactive lifestyle.
3) The prevalence of sedentary lifestyle or physical inactivity was significantly higher in obese group as compared to non-obese group (p value <0.05)
4) Sedentary lifestyle or physical inactivity was said when there is less than 30 minutes of daily regular exercise or moderate to heavy daily work like walking or household work
5) Prevalence of risk factors such as family history and sedentary lifestyle was significantly higher in obese group compared to non-obese group (P-value<0.05).
6) Prevalence of risk factors such as smoking, alcohol, tobacco did not differ significantly between two study groups (P-value>0.05).
7) For risk factors such as alcohol, smoking and tobacco, history of consumption or use of any of these anytime in life was taken as positive history or presence of that risk factor.

DISCUSSION

THE COMPARISON OF AGE AND SEX DISTRIBUTION IN OBESE AND NON OBESE GROUP

This study was done in a tertiary care center hospital where 120 obese and 120 non obese hypertensives classified on the basis of current international WHO criteria BMI >30 kg/m2 as obese were studies with regards to their clinical profile and compared. All the patients enrolled in the study were of known hypertensive status, also both the groups were comparable to the age and sex distribution of the sample population to avoid age and sex bias. As both

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the groups were comparable (p value >0.05) to age and sex , the results of the study could be explained without age and sex differentiation. The clinical profile of obese hypertensives was studied and simultaneously compared to non-obese hypertensives.

THE COMPARISON OF LEVELS OF BLOOD PRESSURE IN OBESE AND NON-OBESE GROUP.

Our study included 120 obese and 120 non obese adult hypertensives with age and sex matching. In our study while comparing the mean systolic and diastolic blood pressure of both the groups it was found that the systolic as well as diastolic blood pressure levels both were significantly higher in obese as compared to non-obese group. (p value <0.05).

In a large population based cohort study done by Alejandro de la Sierra et al in spain (48) they studied the ambulatory and office blood pressure in 68,045 hypertensive patients from Spanish ABPM registry, out of which 24,303 (35.7%) were obese i.e. BMI>30kg/m2. They observed progressive increase in clinical and ambulatory systolic blood pressures with increased BMIs and this increase was most significant in obese group compared to normal or overweight BMIs. However they could not find significant difference in the level of diastolic blood pressures. They also observed obese group to have longer standing and severe hypertension with increase in target organ damage.

COMPARISON LIFESTYLE RISK FACTORS, ADDICTIONS AND PHYSICAL ACTIVITY IN OBESE AND NON OBESE GROUP

All the patients in both groups were inquired about the positive family history, history of substance use or addiction and about their physical activity. There was a significantly higher percentage of obese people having sedentary lifestyle or physical inactivity, there also was a significant difference in the family history of hypertension in both the groups with higher percentage of obese people having positive family history of hypertension. Rest of the risk factors like smoking, tobacco and alcohol did not differ significantly in both the groups. As the groups were having equivalent percentage of males and females, also the age distribution of the two groups also did not differ much, the risk factors could be analyzed overall in two groups.

a) Comparison of positive family history of hypertension in obese and non-obese group of hypertensives

In our study it was observed that positive family history of hypertension was significantly associated with obese people and its associated worsened clinical profile.

This study matches with both study findings in respect that obese hypertensives had higher percentage of family history and thus it can be said vice versa that having family history of hypertension was a significant risk factor for worse clinical profile of hypertension and obesity.

b) Comparison of physical activity in obese and non-obese group of hypertensives.

It was seen that obese group of hypertensive people were having significantly higher prevalence of physical inactivity or sedentary lifestyle. It was seen that 54.16% of the obese group of people spent less than 25- 30 minutes daily in active physical work like walking or ambulatory household work.

c) Comparison of other lifestyle risk factors including smoking, tobacco and alcohol use in obese and non-obese group

In our study we could not appreciate any significant difference in the lifestyle risk factors like smoking, tobacco use and alcohol in obese and non-obese group of hypertensives. Although studies of Canoy D et al (212) and Rhee MY et al (213) implicate smoking to be causing more hypertension and altered fat distribution via arterial stiffening and free radicals we did not find any significant difference in the smoking habits of obese and non-obese hypertensives. Also the studies of Puddy IB et al (214) concluded alcohol to be associated with increasing blood pressure level and Sayon Orea C et al (216) found alcohol to be responsible for increasing weight and BMI, but we did not find any significant difference in alcohol consumption prevalence of obese and non-obese individuals. Although alcohol consumption is associated with different effect on cardiovascular profile at different doses we only took the positive history of alcohol consumption as a risk factor as the moderate consumption of alcohol is not seen in Indian settings where it is more of a substance abuse.

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