Original Article JCMCTA 2022 ; 33 (2) : 126-132

Short Term Outcome of Obesity on Cardiovascular Responses in Patient Sample with SBP, DBP and Heart Rate

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Abstract

Background: Etiology of hypertension plays a key role for the management of hypertension and prevention of hypertension. Sympathetic over activity and reduced parasympathetic control are triggering factors for the high blood pressure. Obesity is considered in daily clinical practice as one of the main health problems widely distributed over the world. Furthermore, hypertension is main cause of ischemic heart disease and cerebrovascular accidents. To assess the effect of obesity on cardiovascular responses in patient sample with SBP, DBP and Heart Rate.

Materials and methods: This is a cross sectional study. A Selected patients from those visiting the Outpatient of Cardiology Department of Shaheed Tajuddin Ahmad Medical College Hospital who suffer from primary hypertension and randomly distributed into two groups: Obese hypertensive and Hypertensive without obesity. A third group who are non-hypertensive obese patients also randomly selected from a group of patients who are visiting outpatient of medicine for viral diseases like acute self-limiting illness. A control group of seemingly healthy individuals involved doctors and a health staff in the hospital.

Results: A highly significant of the mean systolic blood pressure of patient with hypertension and obese hypertensive patients than of both the obese and control "groups [$p<0.05$]. A highly significant mean diastolic-blood pressure of patient with hypertension and obese hypertensive-patients than that of both the obese and control groups [$p < 0.05$] highly significant mean heart rate of patients with hypertension and obese patients with hypertension than that of both obese and control groups [$p < 0.05$]". Also, after extreme workout and 15 min. following rest there was significantly different in hemodynamic reaction after extreme workout and 15 minutes following rest between groups.

Conclusion: After extreme workout and 15 minutes after rest a significant difference was found among the groups.

Key words: Cardiovascular responses; DBP; Heart Rate; Obesity and SBP.

Introduction

Etiology of hypertension plays a key role for the management of hypertension and prevention of hypertension. Sympathetic over activity and reduced parasympathetic control are triggering factors for the high blood pressure. Lifestyle modifications and drug therapy are the treatments prescribed for hypertension management. Lifestyle modification to maintain elasticity of vascular wall is need of time. However, antihypertensive drug therapy is costly to the health-care system and often results in undesirable side effects. Obesity, overweight considerably associated with major health problems like ischemic heart disease, diabetes mellitus and many of malignant disease.[1] One of most frequent cause of the high mortality and morbidity correlated with obesity is insufficient function of cardiorespiratory system, muscle weakness and a defect in autonomic nervous system.[2] The obese patients as compared with normal subjects shown in many studies to have lower variability of the heart rate and reduction in sensitivity of baroreflex.[3,4] The standard graded exercise test is the most easier and cost effective method to evaluate the connections between the autonomic nervous system and cardiovascular system during the phase of rest, exercise and the phase of improvement.[5] A blood pressure response to physical stress depends on various factors such as gender, body mass, baseline blood pressure, diet, and physical activity. Blood pressure response to stress test is different in individuals with same homogeneity. Blood pressure response to stress test is either normal or abnormal. Rise in Systolic Blood Pressure (SBP) and Heart Rate (HR) is physiological adaptation of body to mechanical stress and this is protective mechanism of supply

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Submitted on : 20.09.2022
Accepted on : 29.11.2022

extra blood to exercising muscles. Also, the reaction of body to this test in terms of the heart rate changes regarded as an important pointer for risk of mortality and morbidity combining cardiovascular system.[6] The reaction of obese and overweight people to standard graded exercise test is not completely understood.[7] Isometric handgrip exercise test is performed to check blood pressure reactivity by static contraction of a small muscle mass with significant changed in blood pressure with relatively small increase in HR and the cardiac output by producing a pressure load on the heart. It is one of the simple and reliable tests to check cardiovascular responses to stress.[8] In contrast, the best way to treat obesity and its associated problems is regular exercise. Decreasing the weight is a chief consequence intended by the overweight individuals who are performing it; though, number of health related enhancements have recorded with performing exercise even with no significant weight loss.[9] Some of the benefits which are observed, enhancement in cardio-respiratory capability and strength of muscle are the primary high-lighted results in available studies.[10,11] Primary-hypertension is considered as the highly frequent cardiovascular complaints and a main worldwide risk factor for cerebrovascular accidents and IHD.[12,13]. The effect of regular exercise in hypertensive patient is studied by a number of unplanned controlled trails.[14] Furthermore, the consequences of these unplanned controlled trails are studied by a number of meta-analysis to make the picture clearer.[15,16] To assess the effect of obesity on cardiovascular responses in patient sample with SBP, DBP and Heart Rate.

Materials and methods

A case control hospital based cross sectional study was conducted during the period from 02.01.2021 to 31.12.2021 at Shaheed Tajuddin Ahmad Medical College Hospital, Gazipur, with following criteria

Inclusion criteria

i) Patient with primary hypertension
ii) At least two measurement above normal Blood pressure range (120/80 mmHG)
iii) Obese and non obese both are included
iv) Male and female both are include.

Exclusion criteria

i) Patient who are not hypertensive
ii) Patient who did not give consent.

Patient were randomly allocated in two groups from those who are regularly visiting the Outpatient of cardiology in patients with obesity and hypertension and patient with hypertension but without obesity. The patient with number one was selected randomly according to a number randomly created by the computer and every other 5 patients the other patients selected. The third group who are obese not hypertensive patients was also randomly selected from those patients who are visiting the outpatient of medicine for a self-limiting acute viral illness. From seemingly healthy subjects including the doctors and health staffs in the hospital, the control group were included. Our sample at last were categorized into subsequent groups: the control healthy subjects (n =60) the patients with hypertension (n=40), the obese patients (n=44) and those obese with hypertension patients (n=32).

The test was held out at room-temperature (About 25-℃) and a treadmill was used to complete the practical work of this study. The SBP and DBP was determined by using the arm-cuff sphygmomanometer whereas heart rate recorded by using ECG monitoring. The phases which are included in the study are: a standard reading of heart rate and DBP and SBP, readings of extreme workout and finally the read out were repetitive 15 min following the rest.

Using Statistical Package for Social Sciences SPSS /23 and the [Microsoft Excel software]-2010, the statistical evaluation and analysis of the data obtained were made. Discrete-variables were stated as a "number and percentage, while continuous-variables were stated on mean and SD. One-way analysis of variance and (Post hoc LSD)-tests were done to study difference of mean between groups". A p-value ≤0.05 was considered. All require permission taken from proper authority for this research work.

Results

Table I demonstrations the demographic features of the study and control-groups. There was not significantly difference in mean age for control and hypertension group ($p > 0.05$), also, no difference in mean of age between obese and

obese hypertensive groups (p> 0.05), but the mean age of obese and obese hypertensive was significantly higher than of both control and patient with hypertension groups (p < 0.05). Regarding mean BMI of control and hypertensive patients (p > 0.05) no significant difference, "also no significant difference in mean BMI between obese and obese hypertensive groups (p > 0.05) but the mean BMI of obese and obese hypertensive patients was significantly higher (p < 0.05) than the mean BMI of both control and hypertensive groups. No difference in mean body fat among control and patient with hypertension (p > 0.05) also there was no significant difference in mean body fat % among obese group and obese hypertensive group as p-value> 0.05. The mean body fat percent of obese hypertensive and obese patients was significantly higher (p < 0.05) than the mean body fat percent of both control group and hypertensive groups. There was no significant difference in mean waist circumference between control and hypertensive groups (p > 0.05) also there was no significantly different in mean waist circumference among obese and obese hypertensive groups (p-value > 0.05). The mean waist circumference of obese and obese hypertensive patients was statistically, significantly high [p-<0.05] than mean waist circumference of both control and hypertensive groups".

There was no important difference in mean baseline SBP between obese patients and control-group (p > 0.05) "also significantly no difference in the mean SBP between hypertensive patients and obese hypertensive patients (p- value > 0.05) but the mean SBP of hypertensive and obese hypertensive patients was higher than that of both control and obese groups (p < 0.05). No significant difference in mean baseline DBP between obese patients and control group (p > 0.05) also no significant difference in mean DBP between the hypertensive patients and obese hypertensive patients (p > 0.05) but the mean diastolic blood pressure of hypertensive and hypertensive obese patients was significantly higher than that of both control and obese groups (p < 0.05). no significant difference in the mean baseline heart rate between obese patients and the control group (p > 0.05) also the mean heart rate of not significantly different in hypertensive patients as of that of obese hypertensive patients (p > 0.05) but the mean HR was significantly higher in hypertensive and hypertensive obese patients than that of both control and obese groups (p < 0.05) as shown in Table I. At the period of extreme exercise, the evaluation of mean SBP, DBP and the HR between study and control groups is shown in Table II a significantly higher mean- systolic blood pressure was in hypertensive obese patients followed by obese hypertensive patients and that of control patients at last. A significantly higher mean DBP was in hypertensive obese patients then obese and hypertensive patients and at the last the control subjects. A significantly lower mean heart rate in all groups of the study in contrast with that of control group (p-value<0.05) though, no significant difference was in mean HR among study-groups (p > 0.05) as shown in Table II. 15 minutes after rest, the comparison of the mean SBP, DBP and the Heart rate between control and the groups of study shown in Table III. A significantly higher "mean systolic blood pressure was in hypertensive obese patients then followed by obese and hypertensive patients and control subjects at last, also significantly higher mean DBP in hypertensive obese patients then followed by both obese and hypertensive patients and by control subjects at the last. Significantly lowest mean heart rate among all study groups in contrast with that of control group (p <0.05) though, no significant difference in mean HR between study groups (p more than 0.05) as shown in Table III.

Table I Demo-graphic features of the study groups

Feature	Control (n=61)	Hypertensive (n=40)	Obese (n=44)	Hypertensive & Obese (n=32)
Age (Years)	20.01± 3.25	22.21 ± 3.02	29.21 ± 4.71	28.29± 4.10
B	B	A	A	
BMI (kg/m2)	22.02 ± 1.62	23.41 ± 2.23	33.29 ± 3.39	33.41 ± 3.20
B	B	A	A	
Body fat percentage (%)	17.8 ± 3.8	20.9 ± 3.8	32.8 ± 7.1	35.8 ± 4.8
B	B	A	A	
Waist circumference (cm)	84.21 ± 5.72	84.80 ± 7.19	110.21 ± 9.12	109.40 ± 8.03
B	B	A	A	
SBP baseline (mm Hg)	121.81 ± 14.80	140.69 ± 10.80	126.46 ± 9.18	144.81 ± 11.93
B	A	B	A	
DBP baseline (mm Hg)	72.51 ± 7.98	81.25 ± 11.11	76.93 ± 12.85	84 ± 10.15
B	A	B	A	
Heart rate baseline (Beat/min)	69.80 ± 15.04	75.06 ± 11.01	69.87 ± 11.86	77.84 ± 11.88
B	A	B	A	

n: number of cases, "BMI: Body Mass Index SBP: Systolic Blood Pressure DBP: Diastolic Blood Pressure. Capital letters were used for explanation of the results of (Post hoc LSD) multiple comparison test consequently similar letters, direct no significant-difference at $p > 0.05$, while different letters designate significant difference at $p \leq 0.05$; letter (A) being the highest value".

Table II Heart rate and blood pressure during extreme exercise

Feature	Control (n =60)	Hypertensive (n =40)	Obese (n =44)	Hypertensive & Obese (n =32)
SBP (mm Hg)	164.84 ± 25.86	174.89± 22.95	172.92 ± 23.93	180.87± 21.97
	C	B	B	A
DBP (mm Hg)	75.42± 10.25	83.21± 15.11	79.98 ±16.10	87.10 ± 10.06
	C	A	B	A
Heart rate (beat/min)	160.92 ± 20.20	154.86 ± 18.64	153.02± 20.07	153.04 ± 11.93
	A	B	B	B

n: number of cases, "SBP: Systolic Blood Pressure DBP: Diastolic Blood Pressure. Capital letters were used to explain the results of (Post hoc LSD), multiple comparison test so that similar letters indicate no significant difference at $p > 0.05$, whereas different letters indicate significant difference at $p \leq 0.05$, letter (A) being the highest value".

Table III measurements of heart rate and blood pressure 15 minutes after rest.

Feature	Control (n=25)	Hypertensive (n=20)	Obese (n=17)	Hypertensive & Obese (n=11)
SBP (mm Hg)	164.99 ± 25.87	174.94± 22.88	172.89 ± 24.17	181.25± 22.01
	C	B	B	A
DBP (mm Hg)	76.09 ± 10.07	84.21± 13.98	80.26 ±16.19	86.83 ± 10.05
	C	A	B	A
Heart rate (beat/min)	161.10 ± 20.23	155.20± 18.06	152.78 ± 20.18	153.03 ± 12.29s
	A	B	B	B

n: number of cases, "SBP: Systolic-Blood Pressure DBP: Diastolic-Blood Pressure. Capital-letters were used to explain the results of (Post hoc LSD multiple comparison-test) so that similar letters indicate no significant difference at $p > 0.05$, whereas different letters indicate/significant difference at $p \leq 0.05$, letter (A) being the highest value"

Discussion

It has been improved in literatures which established on long term follow up the importance of regular exercise for treatment of obesity and hypertension though short term complications have established little consideration. The mean standard SBP of patient with hypertension and hypertensive/ obese patients in the present study was statistically significantly higher than that of control group and within the hypertensive range of more than 140 mm Hg, which indicate that the control of blood pressure of those patients was poor in spite of they have being managed for many years for hypertension. Mean DBP of the patient with hypertension and hypertensive obese patients on the other hand was also highly significant than that of control-group, but the mean DBP was in normal usual range less than 90 mm Hg. Also baseline-mean HR was of all groups was in normal usual limit (60 to100 beat/minute) in spite of some significant difference between groups. In our study the demonstrations the demographic features of the study and control-groups.

There was not significantly different in mean age for control and hypertension group ($p > 0.05$) also, no difference in mean of age between obese and obese hypertensive groups ($p > 0.05$) but the mean age of obese and obese patients with hypertension was significantly higher than of both control and patient with hypertension groups ($p < 0.05$). However, various studies came out with the higher percentage of hypertension in men than women.[17,18] Under controlled BP in patients with hypertension joined in this study can be explained by insufficient compliance with drug treatment, in-adequate dietary salt intake or to a lesser scope, due to compassionate flooding in this medical situation. In fact strict blood pressure is compulsory for those patients so to avert life threatening cardiovascular and cerebrovascular problems. Our results were not supported by other documented studies. Steven observed that hypertensive patients responded similarly to sustained handgrip exercise with the normotensive patients. Their hemodynamic changes returned to baseline levels soon after completion of the exercise.[19] In extreme exercise, SBP and DBP mean from hypertension patients have got the highest levels compared to the control and obese

patients groups, the later also experienced more than usual mean diastolic and SBP but the level was lower than high blood pressure patients. In terms of HR, it was lower in patients with hypertension and obese patients compared to the control groups, where the lowest level in hypertension group. Though, after 15 min, it was noted that high blood pressure and obese patients unable to return to baseline readings. This was also the case for the control group; yet the BP readings were higher in patient with hypertension /obesity than in control group while meaning of HR was lower in patients than in control group. Systolic and DBP shown to reduced following regular exercise in patients with high BP and is usually suggested by inter-national guidelines.[20-22] However, guide-lines do not reveal anything about exercise counsels for patients with resistant hypertension and high BP/ obese patients. Continued physical action is associated with lower risk of mortality and cardio-vascular problems in high BP patients who are shown to be impervious to the usual guidelines of the management.[23] Though still no proof for the benefits of frequent physical activity for resistant hypertensive patients, a number of studies have been conducted that have yielded promising results. A 8- 12 weeks program with an aerobic exercise, which contained of routine walking established with an interval training pattern, three times per week, will reduce 24 hrs SBP by about (5.4±12.2) mmHg and 24-hour DBP by about "(2.8±5.9) mmHg.[24] Furthermore, reduction of systolic and diastolic blood pressure at daytime by (5.9±11.6) mmHg and {3.3±6.5} mmHg and reduction of systolic and DBP at nighttime by 3.8±17.1 mmHg and 1.9±8.2 mmHg, respectively.[24] This reduction in BP was also seen in succeeding researches with training exercise based on heated water.[25,26,27] Even with these suggestions regarding the advantage of do exercises, we saw in the present study, temporary improvement of peaks in BP which may be convoluted by life threatening conditions like dissection of aorta and thrombo-embolism. so, we are recommended that exercise in obese and patients with high blood pressure should started regularly with continuous ambulatory monitoring in order that unnecessary rapid elevation of BP levels is prevented.

Limitation

In this study there are some limitation. It will be better if we include more participants and increase the duration. If we add more variable with obesity like Life style, DM etc. that will be more fruitful. I think in future we can able to search other variable more precisely.

Conclusion

Hypertension is major risk factor for many devastating cardiovascular disease like stroke, IHD etc. Obesity is a condition sometime we overlook. But Obesity act as risk factor for for hypertension and many other diseases. There was not significantly different in mean age for control and hypertension group ($p > 0.05$) also, no difference in mean of age between obese and obese hypertensive groups ($p > 0.05$) but the mean age of obese and obese patients with hypertension was significantly higher than of both control and patient with hypertension groups ($p < 0.05$). However, various studies came out with the higher percentage of hypertension in men than women. Uncontrolled BP found due to insufficient compliance with drug treatment, in-adequate dietary salt restriction, unhealthy food habit. Continued physical action is associated with lower risk of mortality and cardio-vascular problems in high BP patients who are shown to be impervious to the usual guidelines of the management.

Recommendation

Obesity is very common condition associated with many adverse cardiovascular effect. Hypertension most commonly found in obese patient. Ischemic heart disease and cardiovascular related death most commonly related to obese patient. So we should maintain healthy life style to maintain our ideal Basal Metabolic Index (BMI).

Acknowledgement

The authors pay their gratitude to all the patients, included in this study.

Contribution of authors

MAR- Conception, acquisition of data, drafting & final approval.

MDH- Acquisition of data, data analysis, critical revision & final approval.

FA- Design, interpretation of data, drafting & final approval.

MB- Interpretation of data, critical revision & final approval.

AH- Acquisition of data, drafting & final approval.

MRI-Data analysis, interpretation of data, critical revision & final approval.

MEH- Data analysis, critical revision & final approval.

Disclosure

All the authors declared no conflicts of interest.

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