ORIGINAL PAPER

Correlation Short-Term Minimal Weight-Loss and Blood Pressure Control in Obese Patients with Hypertension

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Abstract

Background: International studies have shown a two-way relationship between obesity and hypertension, increased morbidity, increased risk of complications and poor compliance to treatment.
Aim: The aim of the present study was to assess whether short-term weight loss had had any effects on blood pressure control in obese patients with stage 1 hypertension who were not under treatment.
Methodology: Initially, the sample comprised of 265 obese patients newly diagnosed with stage 1 hypertension that were not under treatment. 157 of them had to be excluded, since they did not comply with the study inclusion criteria; consequently, the final sample comprised of 108 patients. All participants were given a low-sodium diet. The SPSS 15.0 was used for the statistical analysis and the significance level was set to $p< 0.05$.
Results: Our sample (n=108) consisted of 46 males and 62 females with an average age of 52±1.8 years and 50.3±1.5, respectively. Two weight measurements were taken, the second one took place after six months of diet and showed the following differences: the average BMI decreased from 33.7kg/m^2±0.9 to 31.9±0.8 (males), and from 31.2±0.7 to 29.9±0.7 in females ($p <0.001$); also, waist circumference (WC) decreased from 119.6 ±1.8 cm to 113.4 ±1.6 cm in males, and from 101.9± 1.3 cm to 97.2±1.2 cm in females ($p <0.001$). Systolic blood pressure (SBP) also decreased from 149 mmHg±2.4 to 134 mmHg±1.6 (males), and from 144 mmHg±1.8 to 138 mmHg±1.3 (females) ($p <0.001$), and diastolic blood pressure (dbp), was also lower from 80 mmHg±1.8 to 76 mmHg±1.6 in males, and from 74 mmHg±1.2 to 73 mmHg±1.1 in females ($p<0.001$).
Conclusions: Decreasing waist circumference in obese patients with stage 1 hypertension, combined with a diet targeted at reducing calories and sodium, could lead to short-term blood pressure control in accordance with international guidelines.

Key Words: weight loss, blood pressure, BMI, obesity, waist circumference, sodium intake, hypertension

Background

Increased body weight has become widespread in Western societies and is an important risk factor for cardiovascular disease (Pappas & Karaouli, 2010). According to epidemiological studies, 500 million people worldwide are overweight and 250 million are obese (Ogden et al., 2006). Most relevant studies have suggested a correlation between body mass and blood pressure levels, while 60% of overweight and obese patients have been found to suffer from hypertension as well. Several studies have found that 30% of patients with high blood pressure are obese, and 40% are overweight (Field et al., 2001; Harsha & Bray, 2008).

Obese people with hypertension have a higher risk of developing cardiovascular disease than overweight or normal-weight people, and have higher mortality rates compared to patients with either obesity or hypertension alone (Chobanian et al, 2003). Data from NHANES II (National Health and Nutrition Examination Survey II), suggest that the relative risk of hypertension, dyslipidemia and diabetes is higher in overweight adults aged 20-45 years, compared to overweight adults aged 45-75 years (Egan et al, 2008). According to the same survey, waist circumference (WC) is more closely related to cardiovascular risk factors than Body Mass Index (BMI) (Zhu et al, 2002). In the Framingham Offspring study, those participants who lost ≥ 6.8 kg also decreased risk of hypertension by 22% compared to participants that did not lose any weight at all. Categorized into quintile groups according to their BMIs, the participants (both females and males) showed increased blood pressure levels in accordance with obesity levels (Moore et al., 2005).

Higher blood pressure could lead to increased body weight in the future, a tendency that seems more likely regarding people with hypertension and increased sympathetic function (Julius et al, 2000). According to the 4-year long Treatment of Mild Hypertension Study, TOMHS (n=902), lifestyle changes such as more exercise, and a low-sodium, alcohol-free diet can regulate stage 1 hypertension without resorting to medications (Grimm et al., 1997). Although several studies have shown that weight loss can lead to a moderate blood pressure decrease, there are no studies assessing comparatively the effect of weight loss and waist circumference decrease on blood pressure levels, and also whether a diet-related blood pressure decrease can be on target (viz. <140mmHg and <90mmHg for systolic and diastolic blood pressure respectively) (Elmer et al., 1995; Lasser et al., 1995; Mulrow et al., 2008).

The aim of the present study was to assess the effects of weight loss (over a six-month period) on blood pressure levels and its regulation in obese patients newly diagnosed with stage 1 hypertension who did not take any blood pressure medication.

Methodology

This was a six-month long observational, intervention study.

Study Design

I. Initial study population

The initial study population consisted of 269 obese patients who visited an out-patient hypertension clinic of a hospital in an urban area. Their main characteristics were: BMI >30 kg/m^2 and a recent diagnosis of hypertension (average systolic blood pressure 140-159 mmHg, diastolic pressure 90-99 mmHg), who did not take any hypertension medication. 224 persons were diagnosed with stage 1 hypertension, with an average blood pressure >140/90mmHg on three successive visits to the clinic which was later confirmed by a 24-hour blood pressure monitoring (blood pressure over 135/85 mmHg).

II. Exclusion criteria

From the total number of patients diagnosed with stage 1 hypertension (n=220), the following had to be excluded:

- Patients with white coat (n=32) and masked (n=13) hypertension;
- Patients with a history or clinical/laboratory evidence of a recent infection, or patients who received treatment up to a month prior to the

study including hypolipidemic treatment, steroid anti-inflammatory drugs, and/or hormone substitution treatment (n=30);

- Patients with diabetes under treatment, or glucose levels higher than 125 mg/dl (n=16), glucose metabolism disorder, fasting blood glucose higher than 110mg/dl, as well as impaired glucose tolerance (n=20);

- Patients with a history of cardiovascular disease (n=12), secondary hypertension, sleep apnea syndrome (n=8), and any other comorbidity, such as thyroid, mental, renal, respiratory, liver or gastrointestinal disease (n=5);

- Patients who fulfilled all the inclusion criteria and had verbally agreed to participate, yet they did not grant written consent (n=21).

III.Final Population Study

After the preliminary evaluation of the initial sample based on the inclusion criteria, the final study population was composed of 112 obese patients with stage 1 hypertension who did not receive any hypertension treatment and fulfilled all the inclusion criteria. During the six-month long course of the study, four patients failed to participate in the follow-up (response rate 96.4%), hence the final study population comprised of 108 patients.

Intervention

All participants were put on a weight loss diet combined with low sodium intake by providing each participant with a 15gr salt sachet for daily use (cooking, salads, etc). The nutritional intervention was aiming at lowering calorie intake by reducing fats, sugar and alcohol consumption. All participants were encouraged to carry on with their daily routines without imposing them any physical exercise. During the six months of the study, the researchers had had regular telephone contacts with the participants (once a month), in order to help them overcome difficulties regarding the diet and to remind them the initial instructions by stressing them the need to use exclusively the

salt sachet provided for their daily needs. Six months later, blood pressure and other somatometrics were recorded for the last time, in order to assess the impact of the diet on the blood pressure levels (systolic blood pressure <140mmHg and diastolic <90mmHg).

Study ethics

The research protocol was submitted for approval by the scientific committee of the Hospital, and also the department chief granted his approval. Patients were given written informed consent forms before the study, according to the Declaration of Helsinki (as revised in Seoul, 2008).

During the study, the patients' participation was on a voluntary basis and the hospital's services were not disrupted in any way. There was no financial burden for the hospital because of the study, and strict anonymity and confidentiality was observed.

Statistical Analysis

All the descriptive continuous variables are presented as means and SDs if normally distributed (Shapiro-Wilk test), otherwise medians and value range were used. Categorical variables are described as absolute and relative frequencies. Significant differences among the groups were identified by t-test, after the variables had been tested for equality by Levene and ANOVA tests.

Then, two regression analyses took place in order to establish whether body mass was a decisive factor in blood pressure control. For the first analysis the explanatory variables were age, gender, average systolic and diastolic blood pressure at the beginning of the intervention, waist circumference (WC) and median WC (base-line WC as measured in the beginning compared to the one measured during the follow-up). For the second regression analysis, WC was replaced by base-line BMI and median BMI (base-line WC as measured in the beginning compared to the one measured during the follow-up), while the rest of the variables remained the same. The SPSS 15.0 software was used for the statistical analysis. Significance level was set to p<0.05.

Results

The final sample (n=108) consisted of 46 males and 62 females with an average age of 52±1.8 years and 50.3±1.5, respectively. Average BMI at the beginning was 33.7±0.9 Kgr/m^2 (males) and 31.2±0.7 Kgr/m^2 (females). The average waist circumference for men was 119.6±1.8 cm, and for women 101.9±1.3 cm. Average systolic and diastolic blood pressure for men was 144 mmHg±1.8 and 74 mmHg ±1.2, and for women 149 mmHg±2.4 and 80 mmHg±1.8 respectively. After the initial measurements had been taken, the participants followed a low-sodium diet, by using the salt sachet provided for their daily needs.

Six months later, the follow-up measurements showed a significant decrease in every parameter. More specifically, average BMI for men went down to 31.9±0.8 (from 33.7±0.9), and for women it was 29.9±0.7 (from 31.2±0.7). Waist circumference had also decreased to 113.4±1.6 from 119.6 ±1.8 (for men), and 97.2±1.2 cm from 101.9±1.3 cm (for women) (p <0.001). The men's systolic blood pressure went down to 134 mmHg±1.6 (from 149 mmHg±2.4), and the females' were measured at 138 mmHg±1.3 (from 144 mmHg±1.8) (p <0.001). Accordingly, the males' diastolic blood pressure was found to be 76 mmHg±1.6 from 80 mmHg±1.8, and the females' was 73 mmHg ±1.1 from 74 mmHg±1.2 (p<0.001). Table 1 offers an overview of the sample's demographics and clinical characteristics at the beginning and at the end of the intervention.

Regarding waist circumference, guided logistic regression analysis showed that blood pressure control is affected by base-line WC (OR: 0.78, 95% CI: 0.44 – 0.92, p = 0.035), median WC (OR: 1.21, 95% CI: 1.11 – 1.37, p = 0.011), male gender (OR: 2.9, 95% CI: 01.08 - 05.03, p = 0.02), base-line systolic blood pressure (OR: 0.76, 95% CI: 0.55 – 0.94, p = 0.005), as well as base-line diastolic blood pressure (OR : 0.65, CI: 0.35 – 0.87, p <0.001). According to the same analysis, blood pressure control is significantly affected by male gender (OR: 2.5, 95% CI: 01.04 - 04.09, p = 0.005), average systolic (OR: 0.82, 95% CI: 0.60 – 0.89, p = 0.004) and diastolic blood pressure (OR: 0.77, CI: 0.47 – 0.92, p = 0.042), and not by the BMI.

Table 1. Demographics and clinical characteristics of the study population at the beginning ('base-line measurements') and at the end of the intervention, 6 months later

	MEN			WOMEN		
n	**46**			**62**		
Age	**52±1.8 yrs**			**50.3±1.5 yrs**		
	Base-line measurements	**6 months later**		**Base-line measurements**	**6 months later**	**P value**
BMI	**33.7±0.9 Kgr/m^2**	**31.9±0.8 Kgr/m^2**		**31.2±0.7 Kgr/m^2**	**29.9±0.7 Kgr/m^2**	**p<0.001**
Waist Circumference	**119.6±1.8 cm**	**113.4 ±1.6 cm**		**101.9±1.3 cm**	**97.2±1.2 cm**	**p<0.001**
Systolic BP	**149 mmHg ±2.4**	**134 mmHg ±1.6**		**144 mmHg ±1.8**	**138 mmHg ±1.3**	**p<0.001**
Diastolic BP	**80 mmHg ±1.8**	**76 mmHg ± 1.6**		**74 mmHg ±1.2**	**73 mmHg ±1.1**	**p<0.001**

Discussion

A basic characteristic of the present study was that the study population consisted of obese patients newly diagnosed with stage 1 hypertension who did not take any hypertension medication. The six-month-long intervention reduced their body weight and it seems to have kept their blood pressure within limits. Waist circumference turned out to be an important factor for blood pressure control, but BMI cannot be considered a valid prognostic marker for blood pressure control. Leaving aside the well-known effects of a healthy diet on the patients' hemodynamics, our findings agree with those of other studies in that short-term decrease of waist circumference can at least delay the prescription of medication to obese patients with moderate hypertension (Elliot et al., 1996; Cutler et al., 1997; Whelton et al., 2002).

Several epidemiological studies in patients with normal pressure and hypertension have established a relationship between sodium intake and hypertension regulation, as well as the positive effects of short-term interventions on blood pressure levels. Randomised studies that took place for a year and even more, have shown that salt restriction can lower blood pressure levels in persons with high normal blood pressure and in persons with mild hypertension (Sacks et al., 2001; He &Mac Gregor, 2002; Fine et al., 2003; Geleijnse et al., 2003).

Waist circumference could be a more reliable marker for monitoring hypertension in obese patients, compared to BMI, as previous studies have already suggested (Fitzwater et al, 1991; Wadden et al, 1992). The American Expert Committee (NCEP- ATP III) has suggested a waist circumference of <102 cm for men and <88 cm for women is the limit above which the risk of cardiovascular conditions increases (NCEP, 2001, Rekliti & Sapountzi-Krepia, 2009). The higher prognostic value of waist circumference should be tested on a larger group of patients with hypertension, mainly for the benefits that lifestyle –and mainly diet-changes can bring.

Some study limitations should be noted. The final study population was small, mainly because of the strict inclusion criteria; also our sample is geographically limited in an urban area. Consequently, our findings cannot be said to apply to other areas with different eating habits. Nevertheless, our strict protocol and our inclusion criteria helped eliminating irrelevant factors. Also, no physical activities were included and our findings somewhat reflect different levels of physical activity on behalf of the participants. In the present study the combination of physical exercise and diet was not included. Finally, monitoring was continued for a limited period of time, so it is hard to show whether the initial positive results have remained for a longer period of time.

As a conclusion, obesity in patients with hypertension is a common situation that renders hypertension treatment insufficient. Consequently, weight loss should be a main target, not just a prevention method, because it can delay the prescription of hypertension drugs and also help patients under treatment to regulate their blood pressure even more efficiently. The present study has shown that a small short-term weight loss can cause a significant blood pressure decrease, and keep it within normal range, while reducing waist circumference in obese patients with stage 1 hypertension in combination with a low-calorie, low-sodium diet can lead to short-term blood pressure control, in accordance with the WHO and other institutions' guidelines (Mancia et al., 2007; WHO, 2007; Practical Guidelines for Hypertension, 2008).

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