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Original article

Effect of weight loss on abnormal 24-hour blood pressure patterns in severely obese patients

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Abstract

Background: Nocturnal hypertension (night systolic [S]/diastolic [D] blood pressure [BP] ≥120/70 mm Hg), nondipper status (nocturnal BP fall <10% of daytime values), and pulse pressure ([PP]; difference between 24-h SBP and DBP readings) are associated with increased risk of cardiovascular disease. We evaluated the 1-year effect of significant surgical weight loss (WL) on abnormal BP patterns in patients with and without hypertension and identified the factors involved.

Setting: University hospital, Spain.

Methods: This prospective study included 42 patients (28 normotensive [NT] and 14 hypertensive [HT]), 71% women with a mean age (standard deviation [SD]) of 48 (11) years undergoing bariatric surgery (BS): 22 laparoscopy Roux-en-Y gastric bypass (LRYGB) and 20 sleeve gastrectomy (SG). SG: 20. Before and 12 months post-BS, anthropometric data, BP (24-h ambulatory BP measurement), and metabolic parameters were determined. At 12 months post-BS ultrasonographic carotid assessment was performed in a subgroup of patients (22).

Results: Both groups experienced significant WL (percent of excess body weight loss [%EBWL] 68%), a fall in 24-h SBP of −13 (11)/DBP −3 (7) mm Hg, and improvement in all the metabolic parameters evaluated and the homeostatic model assessment of insulin resistance (HOMA-IR). However, nondipper status remained high in NT (54%) and HT (64%) as well as 60% of the patients with carotid plaque. Additionally, in HT patients nocturnal hypertension and PP remained significantly higher, and basal fasting insulin values and the HOMA-IR score were significantly higher in those not normalizing dipper status.

Conclusion: Surgery-induced WL was associated with a sizeable decline in BP and metabolic parameters improvement. However, independent of the presence of hypertension, the prevalence of abnormal 24-h BP patterns remained high, and thus, cardiovascular risk continued to be high in these patients. (Surg Obes Relat Dis 2015;▮:00–00.) © 2015 American Society for Metabolic and Bariatric Surgery. All rights reserved.

Keywords: Blood pressure; Hypertension; Nondipper status; Weight loss; Bariatric surgery; Pulse pressure

It is well known that the data obtained from ambulatory blood pressure (BP) monitoring (ABPM) is more highly associated with target organ damage than with office BP readings. In addition to information on BP levels over the

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full 24 hours or during the day or night alone, ABPM provides information on diurnal variation and helps to identify nocturnal hypertension (HT) [1]. The absence of a physiologic nocturnal decrease in BP is known as nondipping, in contrast to dippers who experience a normal reduction in BP rhythm at night [2]. Previous studies have found that in hypertensive and even normotensive patients nondippers are more likely than dippers to present silent, as well as overt hypertensive target organ damage, including cerebrovascular disease, chronic heart disease, and renal damage. In addition, independent of daytime levels, nocturnal HT has also been found to be a predictor of death and cardiovascular disease (CVD) [3]. Finally, pulse pressure (PP) is considered to be a surrogate measure of arterial stiffness and an important risk factor for adverse cardiovascular outcomes in normotensive and hypertensive patients. In some studies it has been reported that obesity enhances arterial stiffness. Indeed, all of these phenomena are reportedly as more prevalent in obese patients regardless of the presence of HT [4]. Therefore, at any given level of BP, it is now clear that optimal results should be obtained by controlling BP over the full 24 hours by both lowering elevated values and restoring normal circadian BP patterns.

A number of studies have shown that nonsurgical weight reduction is associated with a significant improvement or remission of HT. Therefore, the current guidelines related to HT recommend a reduction in weight to control BP [5]. However, bariatric surgery (BS) is currently the most effective therapy to achieve marked and long-term weight loss in severely obese individuals. Several series of BS in hypertensive patients have reported a remission or improvement in HT in $>60\%$ of the patients as well as a decrease of BP levels even in normotensive patients after BS [6–8]. Surprisingly, to date, little attention has been given to the effects of surgically induced weight loss on impaired BP rhythm, with only 2 reports in normotensive and hypertensive patients experiencing a restoration in nocturnal dip in BP and a decrease in the prevalence of nocturnal HT after gastric bypass [9,10]. However, no study has evaluated the factors involved in the restoration of circadian BP patterns.

The aim of the present study was to evaluate the 1-year effect of significant surgical weight loss on abnormal BP patterns (nocturnal HT, high 24-h PP, and nondipper status) in patients with and without HT and identify the factors involved.

Methods

The study group included 42 severely obese patients (normotensive = 28 and hypertensive = 14) with nondipper status in whom BS (laparoscopic Roux-en-Y gastric bypass [LRYGB) or sleeve gastrectomy [SG]) was performed from 2012 to 2013 in a tertiary hospital. Impaired BP rhythm was established by ABPM performed during the preoperative evaluation. In hypertensive patients the ABPM was performed without antihypertensive medication for 1 week. In addition to nondipper status, the following inclusion criteria were also used: age between 18 and 65 years, fulfilment of criteria for BS defined as body mass index (BMI) ≥ 40 kg/m^2 or 35−40 kg/m^2 with major obesity-associated co-morbidities, antihypertensive treatment with ≤ 3 hypotensor drugs, normal renal function (creatinine <1.4 mg/dL in men or <1.3 mg/dL in women), and successful excess weight loss $\geq 50\%$ determined at 12 months after BS. The exclusion criteria were secondary HT, established cardiovascular disease, previous BS, and a preoperative dipper status in the records of ABPM.

Definitions

The normotensive state was defined as an average 24-hour systolic BP and diastolic BP $\leq 130/80$ mm Hg determined by ABPM associated with office BP $\leq 140/90$ mm Hg.

Hypertension was defined as the permanent use of antihypertensive treatment and confirmed by ABPM when the mean 24-hour systolic and diastolic BP were $>130/80$ mm Hg, and remission of HT was defined as a mean 24-hour systolic and diastolic BP $\leq 130/80$ mm Hg associated with a discontinuation of all antihypertensive drugs. The nocturnal BP profile was assessed as nocturnal HT when night systolic and diastolic BP were $\geq 120/70$ mm Hg and as nondipper status with a nocturnal BP fall of $<10\%$ of daytime values. Finally, 24-hour PP was defined as the difference between 24-hour systolic and diastolic BP readings, and high PP was considered when the values were >50 mm Hg. Diabetes remission was defined as a fasting plasma glucose and glycosylated hemoglobin (HbA1c) below the diabetes diagnostic thresholds (<126 mg/dL and $<6.5\%$, respectively) in the absence of antidiabetic medication [11].

The study was approved by the institutional review board. All patients provided written informed consent to participate.

Study design

All patients were evaluated twice: before BS and at 12 months postoperatively. For patients receiving antihypertensive agents, the medications were withheld for 1 week before the clinical workup. The preoperative information obtained included age, height (cm), weight ([kg], body weight [BW]), BMI: (kg/m^2), waist circumference (WC), gender, full medication list, medical history, and the percentage of excess BW (%EBW), which was calculated according to the ideal BW for a BMI of 25 kg/m^2. After surgery BW was measured and the BMI, BW lost (BWL), excess body weight lost (%EBWL), and excess BMI (EBMI) lost in excess of >25 kg/m^2 were calculated.

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