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ORIGINAL ARTICLE
ORİJİNAL ARAŞTIRMA

Early Effects of Sleeve Gastrectomy on Ambulatory Blood Pressure and Protenuria

Sleeve Gastrektomi'nin Ambulatuar Kan Basıncı ve Proteinüri Üzerine Erken Etkileri

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ABSTRACT

Aim: Obesity is increasing in prevalence worldwide is a serious health problem that causes significant morbidity and mortality. One of these morbidity is hypertension. Our aim is to perform laparoscopic sleeve gastrectomy on obese patients and to observe the effects of surgery on ambulatory blood pressure and dipper or non-dipper hypertension. Also we evaluate the effect of laparoscopic sleeve gastrectomy on biochemical parameters such as urinary protein creatinin ratio fasting glucose.

Material and Method: 44 patients which laparoscopic sleeve gastrectomy planned by reason of obesity were included in the study. Ambulatory blood pressure monitoring has been recorded for obese patients before surgery and after surgery for three months. Demographic data and laboratory tests were scanned and saved before surgery and three months after the surgery.

Results: After laparoscopic sleeve gastrectomy surgery, at the end of the third month, significant decrease on the daytime diastolic and nighttime systolic and diastolic blood pressure on ambulatory blood pressure monitoring measurements has been observed. Also, we found a negative correlation between weight loss and diastolic blood pressure. After the surgery; the usage of antihypertensive medicines are decreased remarkably in comparison with before surgery. Indeed urinary protein/creatinine ratio (UPCR) declined significantly for patients at the end of third month after surgery. At the same time; white blood cell, neutrophils, platelet counts and fasting blood sugar are decreased.

Conclusions: After such a short time as three months of laparoscopic sleeve gastrectomy surgery, blood pressure and proteinuria decreased in morbid obese remarkably.

Keywords: ABPM, laparoscopic sleeve gastrectomy, obesity, proteinuria

ÖZ

Amaç: Obezite, dünya genelinde prevalansı giderek artan, önemli morbidite ve mortaliteye neden olan ciddi bir sağlık sorunudur. Bu morbiditelerden biri de hipertansiyondur. Amacımız obez hastalarda laparoskopik sleeve gastrektomi yapılan hastalarda cerrahinin ambulatuar kan basıncı ve dipper veya non-dipper hipertansiyon üzerine etkilerini gözlemlemektir. Ayrıca laparoskopik sleeve gastrektominin üriner protein kreatinin atılım oranı, açlık glukozu gibi biyokimyasal parametreler üzerindeki etkisini de değerlendirmeyi amaçladık.

Gereç ve Yöntem: Çalışmaya obezite nedeni ile laparoskopik sleeve gastrektomi planlanan 44 hasta dahil edildi. Hastalarda ameliyat öncesi ve ameliyattan 3 ay sonra ambulatuvar kan basıncı takibi yapıldı. Demografik veriler ve laboratuvar testleri ameliyattan önce ve ameliyattan üç ay sonra tarandı ve kaydedildi.

Bulgular: Laparoskopik sleeve gastrektomi ameliyatı sonrası üçüncü ayın sonunda ambulatuar kan basıncı monitör ölçümlerinde gündüz diyastolik ve gece sistolik ve diyastolik kan basınçlarında anlamlı düşüş gözlendi. Ayrıca kilo kaybı ile diyastolik kan basıncı arasında negatif bir ilişki bulduk. Ameliyattan sonra antihipertansif ilaç kullanımı ameliyat öncesine göre oldukça azaldı. İdrar protein/kreatinin oranı (UPCR), ameliyattan sonraki üçüncü ayın sonunda önemli ölçüde azaldı. Aynı zamanda; beyaz kan hücresi, nötrofil, trombosit sayısı ve açlık kan şekeri de düştü.

Sonuç: Laparoskopik sleeve gastrektomi ameliyatından üç ay gibi kısa bir süre sonra morbid obezlerde kan basıncı ve proteinüri önemli ölçüde azalma saptanmıştır.

Anahtar Kelimeler: ABPM, laparoskopik sleeve gastrektomi, obezite, proteinüri

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INTRODUCTION

Obesity is associated with an increase in mortality and with risk of many disorders, including diabetes mellitus, hypertension, dyslipidemia, heart disease, stroke, sleep apnea, cancer (1). Overweight is defined as a body mass index (BMI) of 25 to 29.9 kg/m^2; obesity is defined as a BMI of ≥30 kg/m^2. Severe obesity is defined as a BMI ≥40 kg/m^2 or ≥35 kg/m^2 in the presence of comorbidities (1). Treatment options for obesity; diet, exercise, and behavioral modification, pharmacologic therapy or bariatric surgery. For patients with BMI ≥40 kg/m^2 who have failed to lose weight with diet, exercise and drug therapy or individuals with BMI >35 kg/m^2 with obesity-related comorbidities who have failed diet, exercise, and drug therapy are also potential surgical candidates . The most commonly performed procedures are Roux-en-Y gastric bypass (RYGB), adjustable gastric banding (AGB), and sleeve gastrectomy (SG) (3). In addition to achieving weight loss, bariatric procedures result in marked improvement or resolution of many obesity-related health problems, such as type II diabetes, dyslipidemia, obstructive sleep apnea, gastroesophageal reflux disease, infertility and hypertension (4). Weight loss contributes to remission or improves obesity-linked hypertension. Bariatric surgery (BS) is currently the most effective therapy to achieve significant and long- term weight loss in obese individuals. Several series of BS in hypertensive patients have reported a remission or improvement in hypertension in %60 of the patients (9,10). According to the available data, sleeve gastrectomy is the most frequently performed bariatric surgery method in Western countries (5). The aim of current study, assessing whether laparoscopic sleeve gastectomy and thus induced weight loss have any effect on circadian blood pressure (BP) variation in morbidly obese hypertensive subjects with normal or impaired 24-h BP rhythm and evaluate on metabolic parameters and proteinuria in obese adults.

MATERIAL AND METHOD

Patients

Patients with severe obesity and hypertension undergoing laparoscopic were invited to participate in this prospective study. The following inclusion criteria were 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 or less antihypertensive drugs and normal renal function (creatinine 1.4 mg/dL in males or 1.3 mg/dL in females). Patients were excluded if they had secondary hypertension or established cardiovascular disease. All patients were evaluated 2 times: before SG and at 3 months postoperatively. The preoperative information obtained included: age, height (cm), weight (kg), BMI (kg/m^2), gender, full medication list, blood urea nitrogen (BUN), creatinin, fasting glucose, urine test, UPCR, low density lipoprotein (LDL). Postoperatively, body weight (BW) was measured and the BMI, body weight loss (BWL) were calculated and again, full medication list, BUN, creatinin, urine test, UPCR.

Ambulatory BP Monitoring

Ambulatory monitoring of BP (ABPM) was performed using a portable, automated, computer-programmed oscillometric device from Mobil-O-Graph NG Ambulatory 24 hour blood pressure monitoring system, Salzburg, Germany, 2009. The recorder was set to take a BP and pulse measurement every 20 min in the daytime and every 30 min at night. They were asked to go to bed no later than 23:00 hours and to arise no earlier than 07:00 hours. Each participant had the arm cuff positioned on the nondominant arm by a trained nurse at the hospital. The measurements were done on working days of average activity. BP load was defined as the percentages of BP measurements that were ≥130/80 mm Hg in the 24-hour period, 135/85 mm Hg during the daytime period, and 120/70 mm Hg during the nighttime period. All participants returned to the hospital after completion of the study the next day. All patients were evaluated 2 times: the first, within a week before the SG surgery and the second, three monthly after surgery. Patients, who in their first measurement, failed to produce minimum 10% decrease in nighttime systolic or diastolic BP were diagnosed as nondipper.

Definitions

Hypertension was defined as the permanent use of antihypertensive treatment and confirmed by ABPM when the mean 24-hour systolic blood pressure (SBP) and diastolic blood pressure (DBP) were 130/80 mmHg and remission of HT was defined as a mean 24h- hour SBP and DBP 130/80 mmHg associated with a discontinuation of all antihypertensive drugs. All patients provided written informed consent to participate. Our study was carried out in accordance with the Declaration of Helsinki Principles (https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/).

Laparoscopic Sleeve Gastrectomy (LSG) Technique

All patients were operated on using standardized operation techniques. In all patients, we used five trocars (three 5 mm, two10 -12 mm trocar) and a 38-Fr bougie along the lesser curvature for calibration of the gastric tube. A Harmonic Scalpel™ (Ethicon Endo-Surgery), was used for freeing the greater gastric curvature, and all stapling was performed using an Echelon 60 Compact Linear Cutter™ (60 mm), loaded with yellow and blue cartridges, which delivers 6 rows of stapling clips (Ethicon EndoSurgery). The longitudinal resection of the stomach began at 2-4 cm from the pylorus in the

patients. The staple line was not reinforced in any patient. We use surgical endoclips (Ethicon EndoSurgery) control the bleeding of the staple line when necessary. Hiatal hernias were explored and were repaired if present, with posterior closure of the crura using nonabsorbable stitches.

Statistical Analysis

Baseline data are given as either mean (standard deviation) or number (%). Paired t-tests was used to compare the changes within the groups. For evaluating the average age were analyzed using independent samples t-test. McNemar's test was performed to compare categorical variables. Pearson correlation was calculated. The results of these analyses are presented as OR (95%CI). All analyses were performed using SPSS 20.0 (SPSS, Inc.,Chicago, IL) and a p value of <0.05 was considered to be significantly different.

RESULTS

A total of 44 patients were included in the study. **Table 1** shows the demographic characteristics and laboratory data of the patient population at baseline.

Table 1. Comparison of demographic data and ABPM data before SG and after SG.

	Before SG	After SG	p
BW (kg)	124.9±15.4	100.4±12.2	<0.001
BMI (kg/m^2)	46.3±6.5	37.7±6.6	<0.001
24h Average SBP (mmHg)	124±15	117.3±9.3	<0.001
24h Average DBP (mmHg)	75.1±9.2	73.±8.5	0.06
Daytime SBP (mmHg)	125.2±15.2	119.3±9.2	<0.001
Nighttime SBP (mmHg)	122.3±18.6	111±12.6	<0.005
Daytime DBP (mmHg)	76.5±9.4	75.1±8.1	<0.001
Nighttime DBP (mmHg)	72.5±11.7	67.3±9.9	<0.001
Non-dippers	30	24	0.24
AntihypertensiveDrugs	0.72±1.18	0.09±0.4	<0.001
WBC (/mm^3)	9.12±2.39	7.81±2.35	0.01
Neutrophil (/mm^3)	5.8±2.36	4.5±1.83	0.01
Platelet (/mm^3)	308±58.2	281±59	0.01
Glucose (mg/dL)	123.2±64.2	98.3±23.4	0.03
LDL (mg/dl)	106±43	97.2±23	0.4
Urine protein: creatinine ratio (UPCR)	129±171	74±30.8	0.01

BW: Body weight, BMI: Body mass index, Cre: Creatinine, DBP: Diastolic blood pressure, LDL: Low density lipoprotein, SBP: Systolic blood pressure, SG: Sleeve gastrectomy, TP: Total protein

Before SG surgery average BW was 124.9±.4 kg. afterwards 100.4±12.2 kg (p<0.001). Average BWL was 24.5±6.1 kg. Before surgery BMI was 46.3±6.5 kg/m^2. after surgery 37.7±6.6 kg/m^2 (p<0.001). Average BMI difference was 9.1+1.84 kg/m^2. Average % weight loss was %19.5± 3.55 (p<0.001).

24h average SBP for patients before surgery was 124± mmHg, after surgery was 117.3±9.3 mmHg. After surgery SBP decreased significantly (p<0.001). 24h average DBP 75.1±9.2 mmHg, after surgery was 73.±8.5 mmHg. After surgery DBP was decreased however statistically it was insignificant p:0.06).

Before surgery while 14 patients had 24h average blood pressure >130/80 mmHg, after surgery 8 patients had 24h average blood pressure >130/80 mmHg (p:0.10).

ABPM daytime average SBP for patients before surgery was 125.2±.2 mmHg, average daytime DBP was 76.5±9.4 mmHg. After surgery daytime average SBP was 119.3±9.2 mmHg and daytime average DBP was 75.1±8.1 mmHg, after surgery daytime SBP (p<0,001) and daytime DBP (p<0.001) decreased significantly.

In comparison for ABPM nighttime blood pressure, before surgery nighttime average SBP was 122.3±18.6 mmHg. after surgery it was 111±12.6 mmHg (p:0.005). Before surgery average nighttime DBP was 72.5±11.7 mmHg. after surgery 67.3±9.9 mmHg. After surgery. nighttime DBP decreased remarkably (p<0.001).

Before surgery, 30 patients were showing non- dipper trend, after surgery it was 24. Overall, nondipper trend for the total number of patients were decreased however statistically it was insignificant (p:0.28). Prescribed antihypertensive drugs usage before surgery was (0.72±1.18), after surgery (0.09±0.4), significant decreased was observed (p< 0.001) (**Table 1**).

While 14 patients using antihypertensive before operation, 2 patients were using antihypertensive postoperatively. The number of patients using antihypertensive decreased significantly after surgery (p< 0.001).

In laboratory parameters evaluation; before and after surgery white blood cell (WBC) count (p:0,01), neutrophil count (p:0.01). platelet count (p:0.01) and fasting glucose levels (p:0.03) were significantly decreased. Change for other laboratory parameters were insignificant. Before surgery average fasting blood glucose was 119.8±64.1 mg/dl, after third month of the surgery it was 96.8±22.2 mg/dl, after surgery fasting blood sugar was lower (p:0.008). LDL levels for preoperation and post operation were also compared. Preoperative average LDL was 106±43 mg/dl, end of third month postoperative was 97.2±23 mg/dl. LDL level was decreasing after surgery but statistically it was insignificant (p:0.17) (**Table1**) .

We reported spot urine protein/creatinine ratio to decrease from 129±171 mg/dl to 74±30.8 mg/dl in three months (p:0.01). Weight loss. ABPM average nighttime DBP (Pearson correlation -0.29. p:0.04) before surgery versus after surgery values showed a negative correlation. BMI decrease; ABPM average nighttime DBP (Pearson correlation -0.38. p<0.01) and ABPM average DBP (Pearson correlation -0.30. p:0.04) before surgery versus after surgery values showed a negative correlation (**Figure 1**).

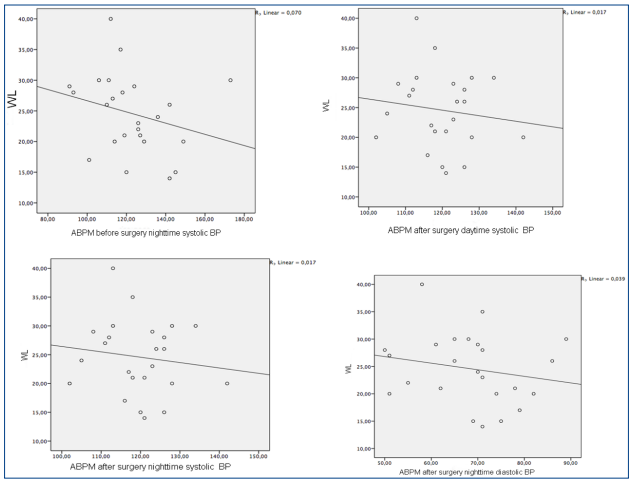

Figure 1. Correlation graffics between WL and ABPM

ABPM: Ambulatory Blood Pressure Monitoring, BP: Blood Pressure, WL: Weight Loss.

DISCUSSION

SG is a surgical bariatric operation in which removal of a large portion of the stomach along the greater curvature is practised. SG is currently the most frequently performed procedure worldwide (6,7). Along with RYGB, in SG first months of weight loss is the maximum, afterwards it has been observed as a steady state graph (8) . For our patient group, with SG at the end of third month weight loss was 2 4.5±6.1 kg ($p<0.001$) and decrease in BMI was 9.1+1.84 kg/m^2 ($p<0.001$). Different studies are showing SBP and DBP reduction during policlinic visits after BS . In 2005 study of Czupryniak et all. ABPM had been performed on 8 non- dipper hypertension and 8 normotensive patients after eight weeks of gastric by-pass surgery. They reported no change in the control group versus significant reduction for daytime/nighttime blood pressure values of hypertension patients and a steady circadian rhythm for non-dipper patients (9). Flores et all. performed ambulatory blood pressure measurements after fourth and twelfth months of post RYGB-SG surgeries in 37 obese patients. Their findings were consistent with ours where they reported insignificant decrease for non-dipper prevalence (10). In this study, only 6 of 30 patients with non-dipper blood pressure had been improved, but statistically it was insignificant (p:0.28). Nordstrant et all. had been reported a remarkable decline on 24 hour daytime/nighttime SBP and DBP after one year of post RYGB for 49 morbid obese pateints (11). In a study of 529 patients covering seven centers, it was observed that the rate of hypertensive patients decreased from 30.4% to 21.5% at 5-year follow-up (12) In a retrospective study conducted in Poland, 123 of 143 hypertensive patients before SG operation had complete or partial blood pressure control 12 months after the operation (13) We observed a similar significant decline but after 3 months of post SG on 24 hour daytime/nighttime SBP and DBP. However it was not statistically meaningul (p:0.29) for our patients even though daytime DBP was decreased. Proteinuria was not observed to change in diabetic and non-diabetic patients after twelve months of RYG, SG and gastric banding operations, versus in our study we reported spot urine protein/creatinine ratio to decrease from 129±171 mg/dl 74±30,8 mg/dl in three months (p:0.01) (14). Bonfils et al. post sixth week of RYGB, in 12 hypertension patients they observed a significant change in blood pressure during 24 hours ABPM. In our studies, post twelfth week SG, we reported significant decrease in blood pressure during 24 hours ABPM. Also, Bonfils et al. showed a significant decrease in prescribed antihypertensive medications after one year postoperation mean while we observed significant decrease of antihypertensive medication usage at the end of twelfth week post SG surgery ($p<0,001$) (15). Weight loss, ABPM average nighttime DBP (Pearson correlation -0.29, p:0.04)before surgery versus after surgery values showed a negative correlation. BMI decrease; ABPM average nighttime DBP (Pearson correlation -0.38, $p<0.01$) and ABPM average DBP (r: -0.30. p:0.04) before surgery versus after surgery values showed a negative correlation.

Effects of bariatric surgery on lipid profile has been shown in studies. In a retrospective study, LDL and triglyceride levels were observed to reduce significantly after RYGB (16) . In another study, one year remission was found to be more in hyperlipidemia for the post surgery of the patients of RYGB versus AGB and SG (17). Al and Taşkın, in their retrospective study that included mildly obese patients, observed a significant improvement in the lipid profile at the end of 12 months (18). In our studies, we observed LDL levels. LDL level was decreasing after surgery but statistically it was insignificant (p:0.4).

Leukocyte count (p:0.01). neutrophil count (p:0.01) and platelet count (p:0.01) were reduced significantly post surgery. In 2012 study of Dallal et all. WBC and platelet counts were observed to decrease in post RYGB patients (19) . Also in other studies, WBC and neutrophil counts were observed to reduce after bariatric surgery (20,21). With all information in hand, it can be concluded as obesity is an subclinical inflammation situation and post surgery; WBC, neutrophil and platelet count decrease results in drop back in inflammatory phase.

BS methods are shown to be effective for the control of DM and remission. HbA1C levels were observed to decrease and diabetic recovery were observed after RYGB, SG and AGB. In general these studies are performed after 12 months post surgery (22-24). In our study, we observed meaningful decline in fasting blood glucose three months after surgery versus preoperative results (p:0.03).

CONCLUSION

Hypertension that is related with obesity is the most important factor for developing renal dysfunction. In morbid obese, after short time of SG operation, although average BMI >35 kg/m^2, it can be concluded that the decrease has been observed for blood pressure controls and proteinuria..

ETHICAL DECLARATIONS

Ethics Committee Approval: In this research, the data before 2020 was used and the research was concluded before 2020. According to the Regulation on Clinical Researches published in the Official Gazette of the Republic of Turkey with the number 28617 dated 3 November 2015, the ethics committee approval was not obtained in accordance with the article "Retrospective studies are outside the scope of the regulation (article 2-(2))". This study was prepared in accordance with the Law on Protection of Personal Data, by anonymizing patient data and in accordance with the 2013 Brazil revision of the Helsinki Declaration and guidelines for Good Clinical Practice.

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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