JMBS
Journal of Metabolic and Bariatric Surgery

J Metab Bariatr Surg 2018;7(2):58-63
https://doi.org/10.17476/jmbs.2018.7.2.58

ORIGINAL ARTICLE

Characteristics of Bariatric Surgery Patients in a Single University Hospital

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Purpose: The study aimed to analyze changes in patient indicators and surgical indices in relation to bariatric surgery performed at a university hospital and determine the development direction of its obesity center. **Materials and Methods:** From December 2010 to June 2018, a total of 35 obese patients underwent surgery at the center. Patients' height, weight, body mass index (BMI), abdominal circumference, and hip circumference before surgery were measured. Laboratory tests were performed to observe changes before and after surgery. Patients underwent Roux-en Y gastric bypass (RYGB) or laparoscopic sleeve gastrectomy (LSG), and postoperative complications were analyzed. **Results:** A total of 35 patients underwent obesity surgery: 23 with RYGB and 12 with LSG. Postoperative complications occurred: bleeding in one case, abscess in one case, respiratory failure in one case, and incisional hernia in two cases. The mean preoperative weight was 105.1±27.2 kg and postoperative weight was 84.3±19.9 kg. The difference was 20.7±13.5 kg. BMI also decreased from 38.3±8.4 preoperatively to 31.0±6.4 postoperatively by 7.3±4.6. **Conclusion:** Through our study, we determined that in this hospital, a multidisciplinary team approach to postoperative weight management and health care should be undertaken as well as continuous and systematic management after surgery.

Key Words: Morbid obesity, Bariatric surgery, Weight loss

INTRODUCTION

Obesity has recently become a serious health problem. Globally, obesity has been steadily increasing since the 1980s and its pace accelerating [1]. According to Korea National Health and Nutrition Examination Surveys, 31.5% of Koreans in 2014 were obese with BMI >25 [2]. Obesity increases the incidence of cardiovascular disease, type 2 diabetes, hypertension, stroke, dyslipidemia, osteoarthritis, sleep apnea, and some cancers, and this may lead to an increase in socioeconomic costs [3,4].

In the past, improvements in lifestyle and medical interventions were the main treatments, but recent advances in surgical techniques have led to an increase in bariatric surgery. Lifestyle modification and medical interventions were less long-term effective than bariatric surgery. Medical treatment is often followed by weight gain, but after bariatric surgery, long-term weight reduction is well maintained [5,6]. Bariatric surgery has been shown to be the predominant treatment option for weight loss in several studies and may result in a reduction in comorbidities and mortality [7].

Herein, we will present the direction of an obesity center by describing the profile of bariatric surgery patients in a university hospital. Therefore, we analyzed changes in patient indicators and surgical indices in relation to

Received: September 18, 2018, Revised: October 4, 2018, Accepted: October 9, 2018
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bariatric surgery performed at the hospital.

MATERIALS AND METHODS

This study included a total of 35 patients who underwent bariatric surgery at a university hospital from December 2010 to June 2018. All patients were examined for underlying diseases and surgical history through preoperative surveys. Their height, weight, body mass index (BMI), abdominal circumference (AC), and hip circumference (HC) were measured, and biochemical analysis was done.

Surgery was divided into two methods: Roux-en Y gastric bypass (RYGB) and laparoscopic sleeve gastrectomy (LSG). In these patients, weight, BMI changes, biochemical profile changes, and postoperative complications were analyzed during the follow-up period through electronic medical record review.

Most patients visited the outpatient clinic every 3 months after surgery, and they were then examined. Their height, weight, etc., were measured, and changes in their biochemical profile were observed. Further, changes in obesity-associated symptoms were investigated.

We analyzed the characteristics of patients by t-test for continuous variables and chi-square test for categorical variables. The Wilcoxon signed rank test was used to compare treatment methods and to compare preoperative and postoperative differences.

Table 1. Demographics of the patients

	Mean
n	35
Gender	
Male	9 (25.7)
Female	26 (74.3)
Age	45.8±13.0
20-39	9 (25.7)
40-59	23 (65.7)
>60	3 (8.6)
Height (cm)	164.9±9.1
Weight (kg)	105.1±27.2
BMI (kg/m^2)	38.3±8.4
<25	1 (2.9)
≥25, <30	1 (2.9)
≥30, <35	9 (25.7)
≥35	24 (68.5)
Waist circumference (cm)	120.5±14.4
Hip circumference (cm)	121.5±17.7
Systolic blood pressure (mmHg)	134.3±21.8
Diastolic blood pressure (mmHg)	82.8±16.3
Fat (kg)	41.5±13.9
Fat percent (%)	39.2±7.9

BMI = body mass index.

RESULTS

A total of 35 patients were included, with 26 women and 9 men. The mean age was 45.8±13.0 years. Twenty-three patients (65.7%) were in the 40-59 age group, nine patients (25.7%) were in the 20-39 age group, and three patients (8.6%) were in the >60 age group. The mean body weight was 105.1±27.2 kg, mean BMI was 38.3±8.4 kg/m^2. 34 patients had a BMI greater than 25, but one patient had a BMI of less than 25 and the patient underwent bariatric surgery for uncontrolled diabetes. The mean AC was 120.5±14.4 cm, and mean HC was 121.5±17.7 cm. The fat measured by bioelectrical impedance was 41.5±13.9 kg, and the percentage fat was 39.2±7.9% (Table 1).

Hypertension was present in 19 (54.3%) and diabetes were present in 14 (40%) of 35 patients. There were 13 cases (37.1%) of sleep apnea, 11 cases (31.4%) of arthritis symptom, and 10 cases (28.6%) of dyslipidemia. Three patients (8.6%) had myocardial infarction, two patients (5.7%) had stroke history, and one patient (2.9%) had cancer (Table 2).

Twenty-three patients (65.7%) underwent RYGB and 12 patients (34.3%) underwent LSG. All but two patients underwent laparoscopic procedures, but two of the patients undergoing RYGB underwent open surgery because of severe adhesion due to prior surgical history. The operation time was 183.9±62.6 min in RYGB and 125.4±48.2 min in LSG (P=0.003). Five patients developed complications after

Table 2. Coexisting conditions of the patients

Coexisting condition	N (%)
Hypertension	19 (54.3)
Diabetes	14 (40.0)
Sleep apnea	13 (37.1)
Arthritis symptom	11 (31.4)
Dyslipidemia	10 (28.6)
Previous myocardial infarction	3 (8.6)
Previous stroke	2 (5.7)
Previous cancer	1 (2.9)

surgery. Incisional hernia occurred in two patients, that is, one case in RYGB and LSG. One patient developed bleeding and intra-abdominal abscess after RYGB. In one patient who underwent LSG, postoperative respiratory failure occurred (Table 3). No patient died during the last follow-up visit.

Baseline biochemical studies included fasting blood sugar (FBS), lipid profile, anemia profile, vitamin, parathyroid hormone (PTH), creatinine, liver function tests, etc. Differences in biochemical profiles before and after the operation are shown in Table 4. FBS decreased from 124.4±54.4 before surgery to 104.1±30.7 after surgery, and hemoglobin A1c decreased significantly from 6.7±1.6 to 5.9±0.9 (P=0.001). Lipid profile was mostly improved, and significant changes were observed in high-density lipoprotein, low-density lipoprotein, triglyceride, and uric acid except total cholesterol. Hemoglobin decreased from 13.5±1.7 to 12.2±1.9 (P=0.008) and iron decreased from 80.0±32.2 to 70.8±40.9 (P=0.07) after surgery. Vitamins did not show significant difference; only vitamin B12 showed significant decrease from 705.6±414.2 to 443.0±248.6 (P=0.01). 25(OH) vitamin D increased from 14.5±5.8 to 19.1±12.4 (P=0.13). PTH significantly changed from 44.8±21.1 to 56.8±21.3 (P=0.02). Creatinine and estimated glomerular filtration rate significantly changed from 0.79±0.20 to 0.73±0.19 (P<0.001) and from 95.8±23.0 to 99.2±18.4 (P=0.004), respectively. In the liver function test, alanine aminotransferase changed significantly from 38.3±21.2 to 26.0±24.6.

Table 4. Initial and post-operative biochemical profiles

	Initial	Post-operative	P-value
Fasting blood sugar (mg/dl)	124.4±54.4	104.1±30.7	0.09
Hemoglobin A1c (%)	6.7±1.6	5.9±0.9	0.001
Total cholesterol (mg/dl)	196.7±44.3	177.3±39.8	0.06
HDL (mg/dl)	44.2±11.4	52.1±16.0	0.005
LDL (mg/dl)	125.7±41.2	103.7±29.0	0.02
Triglyceride (mg/dl)	151.6±69.2	112.9±46.3	0.002
Uric acid (mg/dl)	6.1±1.6	5.9±2.7	0.01
Hemoglobin (g/dl)	13.5±1.7	12.2±1.9	0.008
Iron (ug/dl)	80.0±32.2	70.8±40.9	0.07
TIBC (ug/dl)	341.2±62.8	356.5±56.2	0.63
Folate (ng/ml)	9.8±5.1	11.7±6.3	0.10
Vitamin A (umol/L)	1.5±0.4	3.1±7.4	0.90
Vitamin B12 (pg/ml)	705.6±414.2	443.0±248.6	0.01
Vitamin E (umol/L)	29.8±9.1	24.5±6.0	0.05
25(OH) Vitamin D (ng/ml)	14.5±5.8	19.1±12.4	0.13
Intact PTH (pg/ml)	44.8±21.1	56.8±21.3	0.02
Creatinine (mg/dl)	0.79±0.20	0.73±0.19	<0.001
eGFR	95.8±23.0	99.2±18.4	0.004
Bilirubin (mg/dl)	0.6±0.2	0.6±0.2	0.09
AST (U/L)	32.2±14.4	28.9±18.8	0.23
ALT (U/L)	38.3±21.2	26.0±24.6	0.01

HDL = high density lipoprotein; LDL = low density lipoprotein; TIBC = total iron-binding capacity; Intact PTH = intact parathyroid hormone; eGFR = estimated glomerular filtration rate; AST = aspartate aminotransferase; ALT = alanine aminotransferase.

Table 3. Operation time, ASA score and complication

	Total	RYGB	LSG	P-value
N	35	23 (65.7)	12 (34.3)	
Operation time (m)	158.6±65.9	183.9±62.6	125.4±48.2	0.003
ASA score				
1	2 (5.7)	1 (4.3)	1 (8.3)	
2	22 (62.9)	13 (56.5)	9 (75.0)	
3	11 (31.4)	9 (39.1)	2 (16.7)	
Complication (n)				
Total	5 (14.3)	3 (13.0)	2 (16.7)	
Intestinal leak	-	-	-	
Bleeding	1 (2.9)	1 (4.3)	-	
Ileus	-	-	-	
Abscess	1 (2.9)	1 (4.3)	-	
Wound infection	-	-	-	
Incisional hernia	2 (5.7)	1 (4.3)	1 (8.3)	
Respiratory failure	1 (2.9)	-	1 (8.3)	

RYGB = Roux-en Y gastric bypass; LSG = laparoscopic sleeve gastrectomy; ASA score = American society of anesthesiologists score.

Table 5 shows the changes in patient characteristics after bariatric surgery. Baseline and last follow-up data were compared. Weight loss was 20.2±13.9 kg in RYGB patients and 24.8±11.4 kg in LSG patients (P=0.12). BMI changes were 7.2±5.0 in RYGB patients and 8.7±3.4 in LSG patients (P=0.11). The total AC decreased by 15.1±10.0 cm and HC by 9.3±9.9 cm, and fat decreased by 13.0±8.6 kg and 5.6±6.7%. There was no significant difference in the preoperative and postoperative differences in terms of weight, BMI, AC, HC, and fat composition

Table 5. Characteristics of the patients at last follow up

	Total	RYGB	LSG	P-value
Weight (kg)				
Initial	105.1±27.2	103.8±24.8	112.0±31.7	0.28
Post-operative	84.3±19.9	83.5±18.5	87.5±24.7	0.73
▽Difference	20.7±13.5	20.2±13.9	24.8±11.4	0.12
BMI (kg/m^2)				
Initial	38.3±8.4	37.5±6.8	41.5±10.6	0.11
Post-operative	31.0±6.4	30.2±5.0	33.2±8.8	0.35
▽Difference	7.3±4.6	7.2±5.0	8.7±3.4	0.11
AC (cm)				
Initial	120.5±14.4	122.1±12.2	119.3±19.6	0.57
Post-operative	101.3±13.0	102.4±12.9	99.9±14.7	0.88
▽Difference	15.1±10.0	17.7±9.8	9.8±10.0	0.29
HC (cm)				
Initial	121.5±17.7	118.4±13.0	127.2±24.2	0.23
Post-operative	107.8±12.2	106.6±12.0	110.2±13.9	0.79
▽Difference	9.3±9.9	9.2±11.9	9.5±4.1	0.95
Fat (kg)				
Initial	41.5±13.9	38.7±11.8	47.5±16.6	0.10
Post-operative	27.1±6.8	26.3±7.6	29.4±5.5	0.70
▽Difference	13.0±8.6	13.8±9.1	9.0±2.2	0.39
Fat (%)				
Initial	39.2±7.9	37.2±8.5	43.6±4.2	0.03
Post-operative	33.5±6.4	32.0±6.8	37.0±4.6	0.26
▽Difference	5.6±6.7	6.1±7.1	2.9±2.5	0.45

RYGB = Roux-en Y gastric bypass; LSG = laparoscopic sleeve gastrectomy; BMI = body mass index; AC = abdominal circumference; HC = hip circumference.

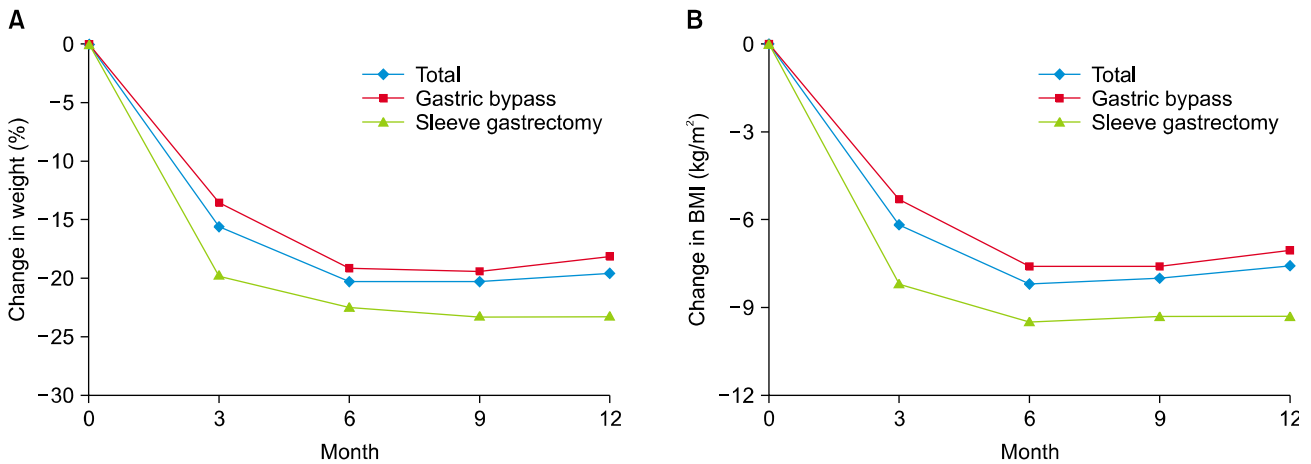

Fig. 1. Weight (%) and BMI (kg/m^2) change. (A) shows the change in body weight at 3, 6, 9, and 12 months for gastric bypass and sleeve gastrectomy in percentage and (B) shows the change in BMI in the same way.

between the two operation methods.

Weight change (%) and BMI change in RYGB patients and LSG patients are well documented in Fig. 1. Of the 35 patients, 34 were followed for 3 months, 28 for 6 months, 21 for 9 months, and 19 for 12 months. Weight loss was observed at 15.6% at 3 months, 20.3% at 6 months, 20.3% at 9 months, and 19.6% at 12 months. In 12 months after surgery, weight loss was 18.2% in RYGB patients and 23.3% in LSG patients. There was a 7.6 reduction in BMI, 7.1 in RYGB patients RYGB and 9.3 in SLG patients.

DISCUSSION

Morbid obesity has recently become an important health problem globally, and the resulting increase in mortality and comorbidity has been supported by a number of studies [3,8]. In addition to lifestyle changes and medical interventions, bariatric surgery has been widely spread as a treatment for morbid obesity, and the excellent effects of reducing mortality, decreasing comorbidity, and reducing socioeconomic costs due to hospital use have been widely studied [4,7,9-13].

However, unlike these excellent effects, complications such as gastrointestinal stenosis, gastric ulcer, intestinal obstruction, incisional hernia, dumping syndrome, and diarrhea can cause many problems after bariatric surgery [14].

In this study, we investigated the characteristics, body weight changes, and surgical indices of bariatric surgery patients in one obesity center. The weight change was 18.2% in RYGB patients and 23.3% in LSG patients, which is less than other studies ([3,8], 24.7%-34.8%). Most patients maintained their reduced weight for more than 1 year. However, many patients were lost to follow-up after weight loss.

Postoperative complications occurred in four patients. One RYGB patient underwent remnant stomach resection with bleeding from remnant stomach 10 days after the operation. After the second operation, intra-abdominal abscess developed, and he was treated with antibiotics. One LSG patient underwent ventilator care in the intensive care unit due to respiratory failure after the operation. This patient was then improved and discharged after weaning from the ventilator. Two incisional hernias occurred in two groups, one underwent hernia repair, and the other was not treated.

In the biochemical profiles at the last follow-up, the FBS, hemoglobin A1c, and lipid profiles showed improved patterns compared to baseline. There were numerous reports on the improvement of postoperative diabetes and dyslipidemia in obese patients; although the number of samples was small in this study, similar results were obtained [12].

There are many reports of vitamin D deficiency and PTH elevation in obese patients. Similar to other studies, vitamin D deficiency was observed in the patients in this study, and the tendency was improved after surgery [15].

In the future, along with the global trend, bariatric surgeries at this hospital will increase even more. In the treatment of obesity, diet, exercise, behavior modification, and medical intervention are important management after bariatric surgery and multifaceted feedback on postoperative complications and periodic observations of various comorbidities are needed. To be more effective and systematical, these need to be supervised by a multidisciplinary team, and more caution should be done during regular postoperative follow-up.

ACKNOWLEDGMENTS

We would like to thank Editage (www.editage.co.kr) for English language editing.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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