Surg Endosc (2016) 30:2097–2102
DOI 10.1007/s00464-015-4465-6

Surgical management of super–super obese patients: Roux-en-Y gastric bypass versus sleeve gastrectomy

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Received: 6 May 2015 / Accepted: 22 July 2015 / Published online: 15 August 2015

Abstract

Introduction Among morbidly obese adult patients (BMI >40 kg/m^2), those who are super–super obese (BMI >60 kg/m^2) present particular challenges for bariatric surgeons. Surgical management of super–super obese (SSO) patients has been associated with higher morbidity and mortality and increased surgical risk. The optimal surgical management of these patients is controversial. The aim of this study was to compare perioperative outcomes, percent excess weight loss (%EWL), and percent weight loss (%WL) in super–super obese patients who underwent either SG or RYGB.

Materials and methods This study was a nonrandomized, controlled, retrospective review of 89 SSO patients who underwent SG or RYGB at the University of Illinois Hospital and Health Sciences System from January 2008 to June 2014. Patient demographics, pre-surgical comorbidities, perioperative parameters, post-operative complications (leak, conversion to open surgery, and 30-day mortality), and post-operative outcome months were examined.

Results Seventy-seven patients underwent SG (nine robotic sleeve and 68 laparoscopic sleeve gastrectomy), and 12 underwent RYGB. The mean pre-operative BMI was 63.4 kg/m^2 (SD = 3.7 kg/m^2). The mean operative time was 88.4 min (SD = 31.7) for the SG patients and 219.2 min (SD = 80.2) for the RYGB patients. There were no significant differences in complications or length of hospitalization between the groups. There were significant differences in %EWL and %WL at 12- and 24-month follow-up between groups (p's < 0.05).

Conclusions Based on the results from this sample of patients, SG and RYGB appear to be viable procedures for the surgical management of super–super obese patients. RYGB, however, provides a significantly higher %EWL and %WL at 12 and 24 months compared to SG, which in turn, yields acceptable but lower %EWL and %WL.

Keywords Super–super obese · Bariatric surgery · Sleeve gastrectomy · Roux-en-Y gastric bypass · Robotic-assisted

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Obesity is a multifactorial condition that arises as a result of genetic, cultural, social, and dietary factors [1]. In the USA, the obesity epidemic has reached record numbers, with greater than 30 % of the adult population being obese, and twice that number experiencing overweight or obesity [2]. With these alarming percentages, the management of obesity has become a public health priority and many options for weight loss are available for this population. Surgical intervention has been shown to be the most reliable and popular way to treat morbidly obese patients struggling with conservative treatments such as diet and exercise [1–3].

Among the population of morbidly obese adult patients (BMI >40 kg/m^2), super–super obese (BMI >60 kg/m^2) patients present particular challenges for bariatric surgeons. Among the common technical difficulties related to the size of super–super obese patients is that surgical navigation is more complex [4]. Moreover, thicker layers of abdominal wall and intraabdominal fat, longer distance between the xiphoid and the esophagus [3], and massive hepatomegaly are some of the surgical hindrances associated with this patient population. Surgical treatment of super–super obese patient has also been associated with higher surgical morbidity and mortality and increased surgical risk [3, 5]. In addition, higher BMI at the time of surgery has been linked with higher incidence of major surgical complications for certain bariatric procedures, as well as longer length of hospitalization, increasing rates of 30-day readmission, and rising treatment costs [6]. Initial surgical management options for these patients include the well-established and widely accepted Roux-en-Y gastric bypass (RYGB) surgery as well as sleeve gastrectomy (SG), a procedure that has gained recent popularity due to its simplicity and favorable complication profile [2].

When deciding which type of bariatric surgical procedure is the most appropriate for super–super obese patients, cost, operative time, pre-surgical comorbidities, and experience of the surgeon have to be considered. The rate of post-operative complications and the incidence of metabolic complications make the duodenal switch procedure less attractive, and it is performed in a small percentage of surgical patients [7]. Although RYGB that is performed in heavier patients can be more technically difficult, it also yields long-lasting weight loss [8, 9]. On the other hand, SG is a technically simpler procedure with a shorter post-operative hospitalization and fewer major complications, even in the case of super obese patients (BMI >50 kg/m^2) [10]. SG may require a second intervention if the initial weight loss is unsatisfactory [3]. Moreover, recent studies have shown that SG provides effective weight loss outcomes without the second malabsorptive step that occurs with the duodenal switch [11–14]. In a similar way, isolated single step RYGB has also shown positive weight loss outcomes in super obese patients [9, 15]. Overall, additional data are needed to examine post-surgical outcomes as well as to formulate recommendations regarding the surgical care of super–super obese patients. Therefore, the aim of this study was to compare perioperative outcomes, percent excess weight loss, and percent weight loss in SSO patients who underwent either sleeve gastrectomy or Roux-en-Y gastric bypass surgery.

Materials and methods

This study is a retrospective review of a prospectively maintained database with 750 patients, who underwent either a laparoscopic/robot-assisted sleeve gastrectomy (SG) or a robot-assisted Roux-en-Y gastric bypass (RYGB) at the University of Illinois Hospital and Health Sciences System between January 2008 and June 2014. This study was conducted with Institutional Review Board approval (IRB # 2011-1104).

All patients met the standard eligibility criteria for bariatric surgery. Specifically, these patients followed the National Institutes of Health Guidelines on obesity and had a body mass index (BMI) greater than 35 kg/m^2 with weight loss recalcitrant to nonsurgical measures with two or more comorbidities; or had a BMI $\geq$ 40 kg/m^2 without comorbidities [16]. The following variables were obtained from the electronic medical records (EMR) accessed from the University of Illinois Hospital and Health Sciences System: age, sex, height, weight, pre-surgical comorbidities, type of surgery, operative time, length of hospitalization, and post-operative complications (leak, conversion to open, and 30-day mortality). Body mass index (BMI), %EWL, and %WL at 6, 12, 24, and 36 months were calculated with data using height and weight at each visit.

Pre-operative evaluation

All patients completed pre-operative bariatric assessments that included medical, surgical, psychological, and nutrition evaluations. Patients were also evaluated by the bariatric surgery team to determine eligibility. Cardiologists, pulmonologists, and endocrinologists were involved if patients presented with any pertinent risk factors. The type of bariatric procedure was determined by the patient's BMI, pre-surgical comorbidities, past surgical history, and patient preferences with guidance from the surgeon. Age alone was not considered as a marker of increased risk. At the beginning of the surgeon's learning curve, patients with higher BMI and pre-surgical comorbidities were selected for the sleeve gastrectomy. As the surgeon's experience increased, the Roux-en-Y gastric bypass was performed at the surgeon's discretion in patients with a diagnosis of type 2 diabetes mellitus and BMI up to 65 kg/m^2. In patients with BMI >65 kg/m^2 and extensive prior abdominal surgeries, we performed sleeve gastrectomy. Patients' preference played an important role, with most of our patients requesting sleeve gastrectomy after extensive discussion of both surgical options.

Intraoperative management and post-operative management

Standard antibiotic and antithrombotic prophylaxis were provided. Laparoscopic/Robot-assisted SG or RYGB surgery was then performed, as described in detail in prior published papers [17, 18]. A few hours after the procedure, patients ambulated, an oral tolerance trial was completed, and most patients were discharged on post-operative day 2. Patients were seen in the bariatric surgery clinic for follow-up at 1, 3, 6, 9, 12, 24, and 36 months.

Statistical analysis

Data analyses were conducted using SPSS 22.0 (IBM, SPSS Statistics). Chi-square analyses were conducted for categorical variables, and Student's t tests and Fischer tests were conducted for continuous variables. Confidence intervals were set at 95 %, and a two-sided p value of <0.05 was considered statistically significant. Patients' demographics, pre-surgical comorbidities, perioperative parameters, post-operative complications (leak and conversions to open), %EWL, and %WL at 6, 12, 24, and 36 months post-surgery were evaluated.

Results

Out of 750 patients examined, a total of 89 patients were super–super obese. Patients were divided into two groups according to the type of surgery. As seen in Table 1, Group 1 included 77 patients who underwent a SG. Sixty-eight patients received laparoscopic SG, and nine patients received robotic-assisted SG. Group 2 included 12 patients who received robotic Roux-en-Y gastric bypass surgery. The overall mean age at the time of surgery was 40.9 years old (SD = 10.8). The mean age in Group 1 was 38.1 (SD = 10.1), and in group 2, it was 44.4 (SD = 9.9), revealing that patients who received RYGB were older than those who received SG ($p < 0.05$). The overall mean pre-operative BMI was 63.4 kg/m^2 (SD = 3.7 kg/m^2). The mean BMI was 64.9 (SD = 4.2) in group 1 and 64.2 (SD = 2.5) in group 2, with no significant differences between groups ($p = 0.604$). Hypertension, T2DM, dyslipidemia, and obstructive sleep apnea were also examined between groups. Results revealed no significant differences in pre-surgical comorbidities among those who received either SG or RYGB.

Perioperative and post-operative outcomes are shown in Table 2. Results revealed that there were no significant differences in complications between the SG and RYGB groups ($p = 0.747$). There were two complications in the SG gastrectomy group and none in the RYGB group with a total complication rate of 2.2 %. In the SG group, one patient had a suture leak on post-operative day 5 that required reoperation, drainage, and a stent placement. The patient recovered without any further sequelae. Another patient in the SG group had a prolonged post-operative ileus that required nasogastric tube placement to suction for several days until bowel function returned, and the patient was discharged home after a liquid diet tolerance.

In terms of perioperative parameters, there were significant differences in mean operative time, with SG having less operative time than the RYGB group [(88.4 min (SD = 31.7) vs. 219.2 min (SD = 80.2), respectively] ($p < 0.001$). There were no significant differences in the mean length of hospitalization in the SG group versus the RYGB group [(3.7 (SD = 8.4) vs. 3.0 (SD = 0.6), respectively] ($p = 0.783$).

As seen in Table 2, there were significant differences in %EWL and %WL between the SG and RYGB at 12-month and 24-month follow-up, with greater %EWL and %WL in

Table 1 Demographic information and comorbidities

Variables	Group 1: Sleeve gastrectomy ($N = 77$)	Group 2: Roux-en-Y gastric bypass ($N = 12$)	p value
Age (years) *M* (SD)	38.1 (10.1)	44.4 (9.9)	0.045*
BMI (kg/m^2) *M* (SD)	64.9 (4.2)	64.2 (2.5)	0.604
Hypertension % (*N*)	49.4 % (38)	75.0 % (9)	0.126
T2DM % (*N*)	31.2 % (24)	50 % (6)	0.209
Dyslipidemia % (*N*)	29.9 % (23)	16.7 % (2)	0.497
OSA % (*N*)	44.2 % (34)	66.7 % (8)	0.215

N patients eligible to be seen, *BMI* body mass index, *T2DM* type 2 diabetes mellitus, *OSA* obstructive sleep apnea

* $p < 0.05$

Table 2 Perioperative and post-operative outcomes

Variables	Sleeve gastrectomy ($N = 77$)	Roux-en-Y gastric bypass ($N = 12$)	p value
Perioperative outcomes			
Perioperative complications	2	0	0.747
Mortality	0	0	
Mean operative time	88.4 (SD = 31.7)	219.2 (SD = 80.2)	<0.001
Length of stay	3.7 (SD = 8.4)	3.0 (SD = 0.6)	0.783
Post-operative outcomes			
6 months after bariatric surgery	$N = 74$; $n = 48$	$N = 10$; $n = 4$	
	64.9 %	40 %	
Mean %EWL (SD)	31.8 (11.9)	29.2 (12.1)	0.682
Mean %WL (SD)	20.6 (6.7)	22.0 (4.3)	0.691
12 months after bariatric surgery	$N = 6$; $n = 48$ 78.7 %	$N = 10$; $n = 4$	
		40 %	
Mean %EWL (SD)	43.6 (13.8)	61.4 (18.4)	0.010*
Mean %WL (SD)	27.1 (8.1)	36.9 (10.1)	0.015*
24 months after bariatric surgery	$N = 53$; $n = 25$	$N = 10$; $n = 8$	
	47.2 %	80 %	
Mean %EWL (SD)	45.8 (19.2)	68.5 (16.8)	0.014*
Mean %WL (SD)	27.9 (10.9)	39.7 (9.6)	0.010*
36 months after bariatric surgery	$N = 30$; $n = 18$	$N = 8$; $n = 4$	
	60 %	50 %	
Mean %EWL (SD)	45.1 (18.8)	61.6 (25.5)	0.151
Mean %WL (SD)	27.3 (11.3)	37.5 (14.8)	0.138

N patients eligible to be seen, *n* patients actually seen, *%EWL* percent excess weight loss, *%WL* percent weight loss

* $p < 0.05$

the RYBG group than the SG group (both p's < 0.05). However, there were no significant differences between SG and RYGB in %EWL and %WL at 6- and 36-month follow-up.

Discussion

The burden of obesity in the health and wellness of modern society has prompted the development of novel medical, psychological, nutritional, and surgical management options to support the efforts of those wanting to lose weight. For super–super obese patients, establishing long-term weight loss as well as improving medical comorbidities is a long-standing goal. In this retrospective chart review, comorbidities, complications, and outcomes were examined in super–super obese patients who underwent either SG or RYGB surgery. Both procedures were found to be effective at promoting patients weight loss during our observation period with minimal post-operative complications, but %EWL and %WL was significantly higher in the RYGB group compared to the SG group at 12- and 24-month follow-up.

In our study, 77 patients underwent the SG (nine robotic sleeve and 68 laparoscopic sleeve gastrectomy), and 12 underwent RYGB. The mean percent excess weight loss in patients receiving SG was 31.8, 43.6, 45.8, and 45.1 % at 6, 12, 24, and 36 months, respectively. The %EWL for the 12-month time point is similar to the %EWL reported in other studies [2, 19]. The mean %EWL in these patients increased for the first 24 months. The failure to maintain weight loss after 24 months has also been observed in other studies of morbid and super obese patients [14]. In the case of the RYGB group, 29.2, 61.4, 68.5, and 61.6 %EWL was reported at 6-, 12-, 24-, and 36-month follow- up, respectively. These values were consistent with prior publications [20]. At 6-month follow-up, the SG group experienced a 31.8 %EWL and the RYGB group had a 29.2 %EWL, with no significant differences between groups. At 12 months, both the SG group and the RYGB group continued to experience a reduction in their %EWL. Despite the initial %EWL for both procedures, the % excess weight loss was only maintained by the RYGB group until the 36-month follow-up. This failure to maintain and increase %EWL after undergoing SG has been discussed in the past with respect to obese and super obese patients [13]. In the future, additional research is needed to explore patterns of post-bariatric surgery weight loss, weight maintenance, and weight regain among super–super obese patients in order to

determine how to maximize %EWL and %WL, regardless of the type of surgery.

In terms of post-operative outcomes, there were no significant differences in length of hospitalization in those who received SG or RYGB. Moreover, there were no significant differences in complications between groups. Overall, results from our study revealed that both procedures are effective single standing measures for short-term obesity management (less than 36 months) in super–super obese patients.

A possible limitation of this study is the sample size difference between groups. The reason for the difference in the sample size in this study is that the comorbidities and increased BMI of these patients led us to perform the SG due to its simplicity, adequate weight loss, and low surgical risk. Moreover, utilizing SG as a first-stage intervention in the management of super–super obese patients has been explored since 2003. Some of the first interventions reported first-stage SG before laparoscopic RYGB or duodenal switch [2]. A number of these patients underwent a SG as a first-stage surgical procedure which would help them to reduce their BMI to lower than 60 kg/m^2 and then possibly undergo a RYGB. However, none of the patients in this current study underwent a second bariatric surgery after receiving the SG during the follow-up time period described here. In addition, because SG is an acceptable option for the treatment of both morbid and super obesity, its implementation in the case of super–super obese patients allows the surgeons to perform a less complex procedure that allows them to gain experience with these cases while promoting weight loss, and making a second-stage procedure safer and easier to complete [11]. Finally, we believe that an advanced learning curve of surgeons performing bariatric operations as well as the experience afforded by conducting bariatric surgeries at large-volume surgical centers are also related to decreases in complications among super–super obese patients and yielded outcomes comparable to patients with a lower BMI.

The favorable outcomes achieved in this study may also be related to the use of robotics. The application of robotics to bariatric surgery may have the advantage of improving surgical navigation, decreasing the abdominal "torque effect," improving ergonomics, and allowing precise dissection and accurate suturing. This translates to a possible decrease leak rate in RYGB. In SG, the robot might be beneficial for those patients with a high BMI due to the reduction in the "torque effect." However, this area is in need of further investigation [17, 18, 21].

We acknowledge that we experienced significant loss to follow-up and have incorporated steps to increase our follow-up going forward. However, based on our data, with power calculated at 80 %, we had appropriate power to detect differences in %EWL at 12- and 24-month follow-up between groups in our study outcomes. Specifically, for %EWL at 12- and 24-month follow-up, we had 80 % power to detect a minimum 20.5 and 21.2 % difference in outcomes between SG and RYGB groups, respectively, which are comparable to our sample difference of 17.8 and 22.7 %. Unfortunately, our sample size did not provide enough power to detect between-group differences in %EWL at 6- or 36-month follow-up. In the future, a larger sample size, especially for RYGB group, is needed in order to make further inferential conclusions regarding the between-group difference in %EWL at 6- and 36-month follow-up.

In conclusion, both the SG and RYGB had a low rate of complications, with no significant differences between groups. Although single-stage RYGB is the procedure that yielded greater %EWL and %WL at 12 and 24 months, further investigation regarding the benefits and outcomes of two-stage SG followed by RYGB in this population should be examined. The weight loss benefits achieved after SG could potentially decrease the degree of intraoperative difficulty associated with a subsequent RYGB in super–super obese candidates. However, an additional operation also requires a second exposure to anesthesia and must also consider other potential complications of a second operation. In the future, a larger sample of patients, with more structured follow-up is necessary to better understand the outcomes and benefits of single-stage (SG or RYGB) versus two-stage (SG followed by RYGB) procedures for the management of super–super obese patients. Based on the results from this sample of patients, SG and RYGB appear to be viable procedures for the surgical management of super–super obese patients. RYGB, however, provided a significantly higher %EWL and %WL at 12 and 24 months, compared to sleeve gastrectomy, which in turn, yielded acceptable but lower %EWL.

Compliance with ethical standards

Disclosures Raquel Gonzalez-Heredia, Lisa Sanchez-Johnsen, Valeria S. M. Valbuena, Mario Masrur, Melissa Murphey, Enrique Elli have no conflicts of interest or financial ties to disclose.

References

1. Orlando G et al (2014) The role of a multidisciplinary approach in the choice of the best surgery approach in a super-super-obesity case. Int J Surg 12(Suppl 1):S103–S106
2. Eisenberg D, Bellatorre A, Bellatorre N (2013) Sleeve gastrectomy as a stand-alone bariatric operation for severe, morbid, and super obesity. JSLS 17(1):63–67
3. Zerrweck C et al (2014) Laparoscopic gastric bypass vs. sleeve gastrectomy in the super obese patient: early outcomes of an observational study. Obes Surg 24(5):712–717

4. Schwartz A, Etchechoury L, Collet D (2013) Outcome after laparoscopic gastric bypass for super-super obese patients. J Visc Surg 150(2):145–149
5. Regan JP et al (2003) Early experience with two-stage laparoscopic Roux-en-Y gastric bypass as an alternative in the super-super obese patient. Obes Surg 13(6):861–864
6. Villamere J et al (2014) Body mass index is predictive of higher in-hospital mortality in patients undergoing laparoscopic gastric bypass but not laparoscopic sleeve gastrectomy or gastric banding. Am Surg 80(10):1039–1043
7. Fazylov RM et al (2005) Association of super-super-obesity and male gender with elevated mortality in patients undergoing the duodenal switch procedure. Obes Surg 15(5):618–623
8. Bennett JC et al (2007) Quality of life and resolution of co-morbidities in super-obese patients remaining morbidly obese after Roux-en-Y gastric bypass. Surg Obes Relat Dis 3(3):387–391
9. Dresel A, Kuhn JA, McCarty TM (2004) Laparoscopic Roux-en-Y gastric bypass in morbidly obese and super morbidly obese patients. Am J Surg 187(2):230–232
10. Thereaux J et al (2014) Comparison of results after one year between sleeve gastrectomy and gastric bypass in patients with BMI $\geq$50 kg/m^2. Surg Obes Relat Dis. doi:10.1016/j.soard.2014.11.022
11. Lemanu DP et al (2012) Single-stage laparoscopic sleeve gastrectomy: safety and efficacy in the super-obese. J Surg Res 177(1):49–54
12. Al Falah HM et al (2013) An experience of laparoscopic sleeve gastrectomy in obese, morbidly obese, and super morbid obese patients. Saudi Med J 34(5):503–510
13. Hamoui N et al (2006) Sleeve gastrectomy in the high-risk patient. Obes Surg 16(11):1445–1449
14. Gagner M et al (2008) Laparoscopic sleeve gastrectomy for the super-super-obese (body mass index > 60 kg/m(2)). Surg Today 38(5):399–403
15. Sanchez-Santos R et al (2006) Is Roux-en-Y gastric bypass adequate in the super-obese? Obes Surg 16(4):478–483
16. Jackson TD et al (2014) Health inequity in access to bariatric surgery: a protocol for a systematic review. Syst Rev 3:15
17. Bindal V et al (2014) Technique evolution, learning curve, and outcomes of 200 robot-assisted gastric bypass procedures: a 5-year experience. Obes Surg 25(6):997–1002
18. Elli E et al (2014) Laparoscopic and robotic sleeve gastrectomy: short- and long-term results. Obes Surg
19. Almogy G, Crookes PF, Anthone GJ (2004) Longitudinal gastrectomy as a treatment for the high-risk super-obese patient. Obes Surg 14(4):492–497
20. Agrawal S et al (2010) Laparoscopic adjustable banded sleeve gastrectomy as a primary procedure for the super-super obese (body mass index > 60 kg/m2). Obes Surg 20(8):1161–1163
21. Bindal V, Gonzalez-Heredia R, Elli EF (2015) Outcomes of robot-assisted Roux-en-Y gastric bypass as a reoperative bariatric procedure. Obes Surg. doi:10.1007/s11695-015-1632-8