



# Bariatric Surgery in the Elderly Patient: Safety and Short-time Outcome. A Case Match Analysis

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## Abstract

**Background** Indications and outcomes of bariatric surgery in the elderly remain controversial. We aimed to evaluate and compare safety and early outcomes of bariatric procedures in this age group.

**Study Design** We performed a retrospective case-control study of Mayo Clinic bariatric surgery patients from January 1, 2016, to January 31, 2018. Data collection included surgery type, sex, age, body mass index (BMI), and comorbidities (hypertension, diabetes mellitus, hyperlipidemia, and obstructive sleep apnea (OSA)). Patients aged 65 years old or older were matched with controls younger than 65 years by body mass index (BMI). We assessed length of stay (LOS), perioperative and early postoperative outcomes, short-term weight loss, and complications.

**Results** We included 150 bariatric patients, with a case-to-control ratio of 1:2. After laparoscopic sleeve gastrectomy, no significant difference was found in LOS between groups (2.4 vs 2.6 days;  $P = 0.52$ ), 1-month BMI difference (3.35 vs 3.88;  $P = 0.17$ ), mean nadir excess BMI loss (%EBL) (22.14 vs 23.2;  $P = 0.75$ ), or complication rate (0% vs 3.3%;  $P > 0.99$ ). Similarly, the laparoscopic or robotic-assisted Roux-en-Y gastric bypass (RYGB) cohort showed no difference in LOS (2.65 vs 2.54 days;  $P = 0.68$ ), 1-month BMI difference (4.72 vs 4.53;  $P = 0.68$ ), %EBL (31.7 vs 26.6;  $P = 0.13$ ), or complication rate (11.7% vs 5.71%;  $P = 0.43$ ).

**Conclusion** Although the sample size is small to draw definitive conclusions, bariatric surgery in patients 65 years or older seems to be safe, with similar outcomes and complication rates as in younger patients, regardless of procedure performed.

**Keywords** Bariatric surgery · Body mass index · Elderly patient · Laparoscopic robotic-assisted Roux-en-Y gastric bypass · Laparoscopic Roux-en-Y gastric bypass · Laparoscopic sleeve gastrectomy

## Introduction

Obesity is a prevalent condition in the USA, affecting about 78 million people, and does not discriminate by race, sex, or age group [1]. In a 2016 census of United States Bureau, approximately 49 million Americans were 65 years of age or older. The rate of obesity in this age group has been increasing, bringing massive burdens to patients and the health system [2]. Bariatric surgery has been proven to be the most effective and durable treatment for morbid obesity due to great induction and maintenance of weight loss. With the additional benefit of excellent

improvement in weight-associated comorbidities, this surgery has become a more popular treatment than medical therapy and lifestyle changes [3, 4]. Although bariatric surgery for patients older than 60 years has raised some concerns, these patients are being considered for bariatric surgery more often. Thus, the number of surgeries has increased from 2.7 to 10% between 1999 and 2013 within the University Health System Consortium Clinical Database [5–7].

There are conflicting data concerning bariatric surgery in the elderly patient, particularly regarding safety, augmented risk of complications, and mortality; however, recent systematic reviews have supported the use of bariatric surgery in the elderly, demonstrating comparable outcomes with the younger population [4, 8].

In various systematic reviews, authors have commented that more efficient and careful preoperative selection of individuals eligible for bariatric surgery has increased its safety in older patients [4, 9–11]. We aim to evaluate and compare the

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safety and early outcomes of bariatric surgery in elderly and younger patient populations.

## Methods

### Patient Selection

Our study complied with the Mayo Clinic Institutional Review Board–approved ethical guidelines of Mayo Clinic (ID: 18-001272). Patients were retrospectively selected between January 1, 2016, and January 31, 2018, and categorized into 2 groups, a case group of patients 65 years or older and a matched control group of patients younger than 65 years. Inclusion criteria were patients older than 18 years who underwent sleeve gastrectomy and gastric bypass surgery within our time frame. Patients were matched based on their BMI, and data collection also included age, surgical procedure (laparoscopic sleeve gastrectomy [LSG] and Roux-en-Y gastric bypass [RYGB], either laparoscopic or laparoscopic robotic-assisted technique), sex, and comorbidities.

### Clinical Variables and Indicators

We collected patient demographics (age, sex), surgical procedure (LSG, RYGB), BMI, and obesity-related comorbidities (hypertension, diabetes mellitus, hyperlipidemia, and OSA). Length of stay (LOS), early postoperative outcome, short-term weight loss (BMI difference and excess BMI loss [%EBL]), and complication rates were evaluated and compared between groups.

### Statistical Analysis

Nonparametric statistical analysis was performed. Continuous variables were evaluated using *t* test, reported as mean (SD), and categorical variables were evaluated using Fisher's exact test and  $\chi^2$  test, reported as frequency (%).  $P < 0.05$  was considered statistically significant. Statistical analysis was performed using GraphPad Prism 7.0 (Informer Technologies, Inc.).

## Results

### Patient Characteristics

After a detailed selection based on inclusion and exclusion criteria, we enrolled 150 patients, with a case-to-control group ratio of 1:2. They were categorized by procedure into 2 subgroups, patients who underwent LSG and laparoscopic or laparoscopic robotic-assisted RYGB. Demographic and clinical characteristics of both groups are shown in Table 1.

## Outcome

The LSG group showed no significant difference in LOS (2.4 vs 2.6 days;  $P = 0.52$ ), 1-month BMI difference (3.35 vs 3.88;  $P = 0.17$ ), mean nadir %EBL (22.14 vs 23.2;  $P = 0.75$ ), or low complication rate (0% vs 3.3%;  $P > 0.99$ ) between the cohorts. Similarly, the laparoscopic or robotic-assisted Roux-en-Y gastric bypass (RYGB) cohort showed no difference in LOS (2.65 vs 2.54 days;  $P = 0.68$ ), 1-month BMI difference (4.72 vs 4.53;  $P = 0.68$ ), %EBL (31.7 vs 26.6;  $P = 0.13$ ), or complication rate (11.7% vs 5.71%;  $P = 0.43$ ). None of the groups demonstrated significant differences in their early postoperative outcomes (Table 2).

## Discussion

Indications and outcomes of bariatric surgery in older patients suffering from morbid obesity remain controversial due to conflicting data regarding the effect of age on bariatric surgery outcomes; however, recent literature has shown that bariatric surgery is as safe and effective for weight loss for older patients as it is for younger patients [12, 13]. Our study demonstrated safety, early outcomes and complication rates in patients 65 years or older comparable to those of younger patients, confirming that age alone should not preclude elderly patients from getting the best surgical procedure [9, 14].

A bariatric surgery retrospective cohort study of 12,062 patients demonstrated that patients older than 55 years were statistically more likely to have longer hospital stays, greater complication rates, and more intensive care admissions compared to younger patients; however, short- (30 days) and long-term mortality was comparable between the groups, suggesting that bariatric surgery is favorable to older obese patients who have been cautiously selected [15]. Another systematic review of 8149 patients older than 60 years described a 0.01% mortality rate within the immediate postoperative period (30 days) and a 14.7% complication rate, concluding that outcomes of bariatric surgery in patients older than 60 years are comparable to those of younger patients [3]. Similarly, our cohort demonstrated comparable early postoperative outcomes and complication rates between older and younger patients (Table 2) with no significant difference in the LOS, as the equally low complication rate between the matched groups, demonstrating that bariatric procedures in elderly patients appear to be safe and feasible.

A multicenter retrospective review of bariatric surgery, with a total of 60,709 patients, demonstrated that 2.7% of all patients receiving bariatric operations from 1999 to 2005 were elderly patients, increasing to 10.1% from 2009 to 2013 [5]. In-hospital mortality was also significantly lower in the elderly from 2009 to 2013 (0.11%) compared with that in both the nonelderly (0.3%) and elderly (0.7%) groups from 1999 to

**Table 1** Baseline characteristics of case group and matched control group categorized by surgical procedure

| Characteristics                   | Case group, $\geq 65$ years old,<br>$n = 50$ | Control group, $< 65$ years old,<br>$n = 100$ | <i>P</i> value   |
|-----------------------------------|--|---|------------------|
| Sleeve gastrectomy, no. (%)       | 15 (30.0)                                    | 30 (30.0)                                     | 1:2 <sup>a</sup> |
| Sex, female, no. (%)              | 8 (53.3)                                     | 16 (53.3)                                     | 0.75             |
| Age, mean (SD), years             | 69.4 (3.54)                                  | 49.5 (9.02)                                   | $< 0.001$        |
| BMI, mean (SD), kg/m <sup>2</sup> | 42.4 (6.11)                                  | 41.8 (4.19)                                   | 0.69             |
| Comorbidities, no. (%)            |  |   |                  |
| Hypertension                      | 11 (73.3)                                    | 17 (56.6)                                     | 0.44             |
| Diabetes mellitus                 | 6 (40.0)                                     | 10 (33.3)                                     | 0.38             |
| Hyperlipidemia                    | 9 (60.0)                                     | 14 (46.6)                                     | 0.59             |
| OSA                               | 12 (80.0)                                    | 19 (63.3)                                     | 0.38             |
| RYGB, no. (%)                     | 35 (70.0)                                    | 70 (70.0)                                     | 1:2 <sup>a</sup> |
| Sex, female, no. (%)              | 23 (65.7)                                    | 51 (72.85)                                    | 0.59             |
| Age, mean (SD), years             | 69.94 (3.93)                                 | 45.94 (11.76)                                 | $< 0.001$        |
| BMI, mean (SD), kg/m <sup>2</sup> | 41.74 (7.73)                                 | 43.13 (5.36)                                  | 0.29             |
| Comorbidities, no. (%)            |  |   |                  |
| Hypertension                      | 27 (77.14)                                   | 39 (55.71)                                    | 0.05             |
| Diabetes mellitus                 | 17 (48.57)                                   | 22 (31.42)                                    | 0.13             |
| Hyperlipidemia                    | 21 (60.0)                                    | 31 (44.28)                                    | 0.18             |
| OSA                               | 22 (62.85)                                   | 34 (48.57)                                    | 0.23             |

BMI, body mass index; OSA, obstructive sleep apnea; RYGB, Roux-en-Y gastric bypass

<sup>a</sup> Ratio case:control

2005 [5]. The parallel trend of improved outcomes in elderly patients supports reduction of age-based limitations, making it possible for septuagenarians and possibly octogenarians to undergo bariatric surgery [16]. These results were corroborated in a retrospective review of 21,571 patients, comparing LSG patients older than 60 years with patients younger than 60 years, which established that LSG was a low-risk operation

with acceptable, not elevated perioperative morbidity and mortality rates in patients 60 years of age or older [17].

Several studies have compared weight loss outcomes between different types of bariatric surgeries in older patients, and others have analyzed different preoperative predictors, with controversial results [10, 18, 19]. A study comparing LSG and laparoscopic RYGB in 472 patients older than

**Table 2** Bariatric surgery outcome case group and match control group categorized by surgical procedure

| Characteristics             | Case group, $\geq 65$ years old,<br>$n = 50$ | Control group, $< 65$ years old,<br>$n = 100$ | <i>P</i> value   |
|-----------------------------|--|---|------------------|
| Sleeve gastrectomy, no. (%) | 15 (30.0)                                    | 30 (30.0)                                     | 1:2 <sup>a</sup> |
| LOS, mean (SD)              | 2.47 (0.52)                                  | 2.63 (0.93)                                   | 0.52             |
| Complication rate, no. (%)  | 0 (0.0)                                      | 1 (3.3)                                       | $> 0.99$         |
| Results, mean (SD)          |  |   |                  |
| BMI difference              | 3.35 (0.91)                                  | 3.88 (1.35)                                   | 0.17             |
| % EBL                       | 22.14 (10.42)                                | 23.26 (9.95)                                  | 0.75             |
| RYGB, no. (%)               | 35 (70.0)                                    | 70 (70.0)                                     | 1:2 <sup>a</sup> |
| LOS, mean (SD)              | 2.65 (1.41)                                  | 2.54 (0.68)                                   | 0.68             |
| Complication rate, no. (%)  | 4 (11.76)                                    | 4 (5.71)                                      | 0.43             |
| Results, mean (SD)          |  |   |                  |
| BMI difference              | 4.72 (2.43)                                  | 4.53 (1.51)                                   | 0.68             |
| % EBL                       | 31.72 (17.66)                                | 26.63 (11.47)                                 | 0.13             |

BMI, body mass index; EBL, excess BMI loss; LOS, length of stay; RYGB, Roux-en-Y gastric bypass

<sup>a</sup> Ratio case:control

65 years demonstrated significantly higher weight loss with laparoscopic RYGB, but with higher complication rates than LSG (30.5% vs 15.4%); mortality was similar between the 2 surgical procedures [20].

A recent retrospective study of 30 bariatric patients with a mean (SD) age of 67.1 (2.7) years and BMI of 55.9 (3.9) suggested that successful weight loss and metabolic improvement could be achieved safely in the high-risk population of super-obese elderly patients, reporting a mean weight loss after bariatric surgery of 44.5% over more than 3 years of follow-up, which could be considered less than ideal when considering arbitrarily defined successful weight loss cutoffs of greater than 50% [11]. However, the weight loss results reported on our study are consistent with the published long-term bariatric outcomes in obese patients from all age categories [11, 21].

Bariatric surgery can be a short-term effective and safe therapeutic option for obese elderly patients [22]. In our study, we measured early postoperative outcome and short-term weight loss based on BMI difference and %EBL as anthropometric indexes [23–26], with no significant difference between categories (Table 2).

In agreement with our results, a study of 1474 patients comparing safety, operative morbidity and outcomes of bariatric surgery in older ( $\geq 65$  years) and younger ( $< 65$  years) patients demonstrated a greater operative risk profile related to sleep apnea (45% vs 34%), diabetes mellitus (65% vs 33%), and hypertension (81% vs 57%) [27]. The operative outcomes were similar for the 2 groups as determined by operative time (70 vs 65 min), LOS (1.97 vs 1.3 days), 30-day readmission rate (6.0% vs 7.4%), and low postoperative complication rates [27]. The percentage of excess body weight loss was similar between the age groups at 12 (74.8% vs 77.8%) and 24 months (83.4% vs 78.5%) [27].

An important benefit of bariatric surgery is the reduction of comorbid conditions [28]; however, bariatric procedures in older patients carry a slightly greater risk of perioperative complications and lower success in achieving reduction of weight, mainly because of preexisting comorbidities [2, 29]. Still, comparing bariatric surgery with medical treatment, surgery has been associated with better long-term weight loss and lower risks of obesity-related comorbidities [28], suggesting that surgery should not be denied merely due to age.

We acknowledge the limitations of this study. Our population size is small; further studies with larger numbers of patients and extended follow-up need to be completed to confirm our findings and allow for identification of more subtle differences and deep evaluation of postoperative outcomes.

## Conclusion

In our study, bariatric surgery in patients older than 65 years has outcomes and complication rates similar to those seen in younger

patients, regardless of the procedure performed. Thus, bariatric techniques in elderly patients appear to be safe and feasible. However, to accurately assess these results, further trials based on larger sample size and multicentric studies are required.

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Drafting the manuscript: Dr. Vinan-Vega  
Critical review of the manuscript for important intellectual content: all authors  
Manuscript supervision: Dr. Elli  
Approval of the version to be published: all authors  
We certify that all authors of this manuscript have participated in conceptualizing the research or content of the manuscript, in writing or critically editing the manuscript, and/or in analysis of data presented in the manuscript. Consent to submit has been received from all co-authors.

## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflict of interest.

**Statement of Human and Animal Rights** For this type of study, formal consent is not required.

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