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Roux-en-Y Gastric Bypass is Safe in Elderly Patients: A Propensity-Score Matched Analysis

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Abstract

Background—Numerous studies have established the effectiveness of Roux-en-Y gastric bypass (RYGB) for weight loss and comorbidity amelioration. However, its safety and efficacy in elderly patients remains controversial.

Objectives—To evaluate outcomes in patients age 60 and older who underwent RYGB compared to nonsurgical controls with the hypothesis that RYGB provides weight-loss benefits without differences in survival.

Setting—University-affiliated tertiary center.

Methods—All patients who underwent RYGB from 1985-2015 were identified and divided into elderly (age ≥60) and non-elderly (age <60) groups. A non-surgical elderly control population was identified using a clinical data repository of outpatient visits to propensity match elderly patients 4:1 on demographics, comorbidities, and relevant preoperative substance/medication use. Unpaired appropriate univariate analyses compared each stratified group. Kaplan-Meier survival curves were fitted based on social security death data.

Results—A total of 2,306 patients underwent RYGB. The 107 elderly patients had lower median body mass index (BMI) (47.0 vs. 49.9; $p=0.007$) and higher rates of comorbidities. Rates of complications did not differ between elderly and non-elderly patients. Elderly surgical patients were propensity matched 4:1 (10,044 controls) yielding 428 well-matched non-surgical controls. The elderly group demonstrated significant percent reduction in excess BMI compared to the control group (81.8% vs. 10.3%; $p<0.001$). Kaplan-Meier survival analysis with log-rank test demonstrated no difference in mid-term survival ($p=0.63$).

Conclusions—A significant weight reduction benefit was identified after RYGB in elderly patients without a difference in mid-term survival compared to propensity-matched controls, suggesting RYGB is a safe and efficacious weight-loss strategy in the elderly.

Keywords

Obesity; Bariatric; Elderly; Roux-en-Y gastric bypass (RYGB); Weight loss

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Disclosures

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Introduction

The developed world has experienced a rapid and sustained increase in life expectancy over the past several decades, resulting in a steady expansion of the population aged 60 years and older [1]. However, increased lifespan does not necessarily translate to improved quality of life. The rate of medical comorbidities—including hypertension, heart disease, and diabetes mellitus—as well as nutritional deficiencies, cognitive impairment, and frailty all increase with age [2, 3]. Many of these conditions are exacerbated by morbid obesity, a health issue that is also increasing within the aging population with resulting strain on the health care system [4, 5].

Bariatric surgery is an effective treatment for morbid obesity, leading to substantial weight loss and amelioration of medical comorbidities superior to that of medical therapy alone [6, 7]. Despite these benefits, surgical treatment of morbid obesity has been limited in the elderly population due to concern regarding increased perioperative morbidity and mortality. In addition, studies have suggested that older patients may experience less weight loss and decreased comorbidity amelioration compared to younger counterparts [8, 9].

Several studies have assessed safety, weight loss, and comorbidity resolution following bariatric surgery in elderly populations; however, all prior studies compared these outcomes between younger and older cohorts of patients undergoing surgical treatment of morbid obesity [10]. Due to inherent differences in overall health and surgical risk, these comparisons suffer from significant bias. In order to better address the utility of bariatric surgery in the elderly, we compared weight loss and mid-term survival between elderly patients with morbid obesity who did and did not undergo Roux-en-Y gastric bypass (RYGB) with the hypothesis that surgical treatment would provide a significant weight loss benefit without a difference in overall survival.

Materials and Methods

Patients

All patients age who underwent RYGB for morbid obesity at a single academic institution between 1985 and 2015 were retrospectively identified from a prospectively maintained database [11]. This surgical group was divided into elderly (age ≥ 60 years) and non-elderly (age < 60 years) patients. In order to select an appropriate elderly control group, an institutional clinical data repository (CDR) of all routine outpatient visits from 2005 to 2015 was utilized to identify a non-surgical cohort of 10,044 patients with morbid obesity age 60 and older who did not undergo weight-loss surgery. Propensity matched groups were then generated to facilitate adjusted comparisons between the two elderly cohorts. This study was approved by the Institutional Review Board (#17132) with waiver of consent.

Data collection

Patient demographics, body mass index (BMI), and obesity-related comorbidities were captured through the institutional CDR for all patients. These baseline patient characteristics were collected at the time of initial diagnosis of morbid obesity (BMI ≥ 35 kg/m²) for the

non-surgical elderly control group and at the time of preoperative appointment for the elderly and non-elderly surgical groups. Surgical outcomes—including complications within 30 days—for the elderly and non-elderly surgical patients were collected from a prospectively maintained database. Patient BMI was evaluated based on medical record review at time of last follow up, and these values—along with an ideal BMI of 25 kg/m²—were used to calculate percent reduction in excess BMI (%REBMI). Current survival status (including death date) was collected from the CDR, as provided by social security death data from the state Department of Health.

Statistical analyses

Using the psmatch2 package, propensity scores were generated using a logistic model, and all model variables were selected *a priori* [12]. These included demographics (e.g., age), comorbidities (e.g., diabetes mellitus), and relevant preoperative substance/medication use (e.g., tobacco, glucocorticoids). Patients were matched using a 4:1 nearest-neighbor algorithm without replacement and imposition of common support. Standardized differences in means, or standardized bias, of included covariates was used to determine adequacy of the model [13].

The primary outcome was %REBMI for the elderly RYGB and control groups. Secondary outcomes included overall survival and length of follow-up. Univariate analyses were performed using appropriate parametric and non-parametric tests to assess for statistical differences in demographics and outcomes between the elderly and non-elderly surgical patients, as well as between the elderly surgical and control groups. Kaplan-Meier survival analysis with log-rank test was performed to assess for differences in mid-term survival between the elderly surgical and control groups. Statistical significance was defined with the standard alpha value of <0.05. Statistical analyses were conducted using Stata version 14 (StataCorp, College Station, TX) and SAS version 9.4 (SAS Institute, Cary, NC).

Results

A total of 2,306 patients underwent RYGB during the study period, and 107 patients were elderly at time of surgery. Elderly patients had a lower median preoperative BMI (47.0 vs. 49.9 kg/m²; $p=0.007$) compared to the non-elderly surgical patients, and all relevant comorbidities were more common among the elderly patients (Table 1). There were no significant differences in rates of postoperative complications—including bleeding, infection, and anastomotic/staple line leaks—between the elderly and non-elderly patients. However, more elderly patients underwent laparoscopic RYGB as compared to non-elderly patients. Elderly patients did have greater %REBMI (83.8 vs. 61.1%; $p<0.001$), though with a shorter time of follow up (Table 2).

Query of the institutional CDR identified 10,044 patients initially diagnosed with morbid obesity at age 60 or older. The elderly surgical and non-surgical patients were significantly different in almost every measured baseline characteristic (Supplemental Table). To achieve a more appropriate control population, a 4:1 propensity score matching was performed, ultimately including 428 patients as nonsurgical elderly controls. Univariate analyses identified no baseline differences in median age (62.0 vs. 61.0 years; $p=0.11$), BMI (47.0 vs.

46.7 kg/m²; $p=0.38$), or medical comorbidities between the elderly RYGB and the matched non-surgical control groups (Table 3).

The elderly RYGB patients exhibited a significantly higher %REBMI when compared to the non-surgical group (83.8 vs. 4.9%; $p<0.001$). The vast majority of patients in both groups were alive at time of most recent follow up, and there was no difference in the percentage of patients alive between the surgical and non-surgical cohorts (90.7 vs. 93.5%; $p=0.31$). Median follow-up time (in months) was longer for surgical patients (43.3 vs. 31.5%; $p<0.001$) (Table 4). However, Kaplan-Meier survival analysis with log-rank test demonstrated no significant difference in mid-term survival between the two groups ($p=0.81$) (Figure 1).

Discussion

This single institution study of adults with morbid obesity identified higher rates of preoperative medical comorbidities in elderly patients undergoing RYGB when compared to non-elderly patients; however, the groups did not differ in rates of postoperative complications. While the elderly patients experienced a greater %REBMI, their time of follow up was less than that of their younger counterparts. Among the matched cohorts of elderly patients, RYGB resulted in superior %REBMI when compared to the non-surgical controls. Despite the substantial weight loss, no difference in mid-term survival was detected.

The overall prevalence of obesity among adults continues to rise [14, 15]. With the concomitant increase in life expectancy, morbid obesity is also becoming a problem in the elderly population [1, 16]. Bariatric surgery is increasingly performed to combat the obesity epidemic, as it results in both substantial and durable weight loss and comorbidity resolution [7, 11, 17]. Despite these benefits, only 4.6% of RYGB procedures at our institution were performed in patients over age 60 during the study period, similar to the national average [18].

While the explanation for decreased rates of RYGB in the elderly population with obesity is multifactorial, much of the hesitation is based on concern for increased surgical risk related to an increased prevalence of obesity-related comorbidities in older patients [18, 19]. Our elderly RYGB patients did have higher rates of all obesity-related comorbidities—including diabetes mellitus, hypertension, and congestive heart failure—as compared to the younger surgical patients. Our results are comparable to previous studies examining the safety and effectiveness of bariatric surgery in the elderly with rates of comorbidities predictably higher among older patients, highlighting the inherent risk difference between the younger and older cohorts in these studies [20, 21].

Early investigation noted an increased rate of postoperative complications and mortality in elderly patients following bariatric surgery, which has also impacted its delayed acceptance in the elderly population with morbid obesity. However, it is important to note that these early studies included predominately open procedures or laparoscopic surgeries early in the minimally invasive learning curve [22, 23]. Recent literature has revealed a more favorable

safety profile in the elderly, supporting the belief that bariatric surgery can be safe in the elderly population—likely a result of advancements in both surgical techniques and overall perioperative care [21, 24, 25]. Similarly, we did not find any difference in rates of common postoperative complications between our elderly and non-elderly patients undergoing RYGB during the study period. Of note, the increased frequency of laparoscopic surgery over the past decade, with its known improvements in postoperative recovery, likely also contributed to more elderly patients undergoing RYGB later in the study period [26]. This helps account for the significant difference in follow-up time noted between the elderly and non-elderly patients included in this study.

The decreased utilization of bariatric surgery in elderly patients is also attributed to literature suggesting decreased efficacy of bariatric surgery in the elderly [21, 23]. In contrast, a comparison of our institution's RYGB patients found that %REBMI was in fact higher among the 107 elderly patients as compared to the younger cohort, though this is subject to bias given differences in baseline demographics such as race. While the time of follow up is shorter among our elderly patients, this is potentially reflective of an increasing institutional willingness to perform RYGB in older populations paralleling increasing bariatric surgical experience [18].

The significant differences in baseline characteristics among elderly and non-elderly patients—as highlighted by our results—make it challenging to derive a meaningful comparison of outcomes between these two groups. Despite this, all previous studies examining the safety and effectiveness of bariatric surgery in older patients compared their postoperative outcomes to those of younger cohorts of surgical patients with morbid obesity. This inherent inequality between the overall health and perioperative risk in younger and older patients makes it more challenging to conclude a favorable balance between benefit and risk for bariatric surgery in elderly patients. In contrast to existing literature, the current study additionally compared outcomes between elderly patients undergoing surgical treatment of morbid obesity with a BMI- and comorbidity-matched cohort of non-surgical elderly patients. Given the baseline similarities between these groups, we were better able to assess the effectiveness and benefit of RYGB in elderly patients. The RYGB group had a significant weight loss benefit comparable to that previously established in younger populations, and far superior to the medically-managed non-surgical group [11]. In addition, mid-term survival did not differ between the RYGB and non-surgical groups, indicating that RYGB is both safe and effective in the elderly population.

The limitations of this study include the retrospective design; however, the use of propensity matching accounted for important baseline characteristics in both groups, including BMI and comorbidities common in patients with obesity. The retrospective nature also prohibited accurate collection of data regarding comorbidity resolution for the elderly and non-elderly surgical patients as well as the elderly surgical and matched elderly controls. Despite this shortcoming, we were able to address short-term surgical safety and weight-loss efficacy. Additionally, the sample size is small, though it does represent an inclusive depiction of long-term practice patterns at a busy bariatric center.

While this study represents the first comparison of elderly bariatric patients to an appropriate control population, we have limited information on the control group regarding their weight loss experience. While the RYGB and control groups are similar at baseline, we do not know if the control patients were ever offered bariatric surgery, or if they would have been considered good candidates. The control group patients also had a shorter available follow up with a study period starting later than the surgical group due to introduction of an electronic medical record in 2005. While there is the possibility for bias in choosing a later start date for the control population, the improvement in medical care that occurred in the interim time period should bias toward an increased difference between the control and surgical groups, making it more likely for the non-surgical patients to have superior outcomes compared to the surgical patients. Additionally, we did control for the duration of follow up time in the propensity match, and so the duration of time a patient had a particular comorbidity should be less impactful. Finally, caution must be paid in generalizing these results to the entire population of elderly patients with morbid obesity as this analysis represents single institution results.

Conclusions

This study of adults with morbid obesity identified higher rates of preoperative comorbidities among elderly patients undergoing RYGB as compared to non-elderly patients without a difference in postoperative complications. Additionally, a major weight loss benefit in elderly patients with morbid obesity was identified following RYGB compared to a non-surgical group of matched controls without a difference in overall mid-term survival. These data help to more clearly define the role of bariatric surgery in the elderly population, supporting the use of RYGB to achieve safe and effective %REBMI without impacting mortality.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Highlights

- Similar rates of complications following RYGB in elderly and non-elderly adults
- Weight loss benefit for elderly patients after RYGB versus non-surgical controls
- No survival difference for elderly patients after RYGB versus non-surgical controls

Figure 1.
Kaplan Meier curve showing survival for surgical and non-surgical elderly patients.

Table 1

Baseline Characteristics Between Elderly and Non-elderly Surgical Patients.

	Elderly Patients	Non-elderly Patients	p-value
	n=107	n=2199	
Age (years)	62.0 (60.0-64.0)	41.0 (35.0-50.0)	<0.001
BMI (kg/m ²)	47.0 (43.0-52.8)	49.9 (44.0-56.0)	0.007
White	105 (98.1%)	1929 (87.7%)	0.001
Female	86 (80.4%)	1661 (75.5%)	0.25
OSA	50 (46.7%)	485 (22.1%)	<0.001
Osteoarthritis	67 (62.6%)	783 (35.6%)	<0.001
COPD	25 (23.4%)	79 (3.6%)	<0.001
DM Type II	63 (58.9%)	600 (27.3%)	<0.001
GERD	56 (52.3%)	642 (29.2%)	<0.001
CHF	27 (25.2%)	125 (5.7%)	<0.001
Hypertension	84 (78.5%)	1056 (48.0%)	<0.001
History of tobacco use	25 (23.4%)	46 (2.1%)	<0.001

Categorical variables listed as N (%) and continuous variables listed as median (IQR).

BMI = Body mass index; OSA = Obstructive sleep apnea; COPD = Chronic obstructive pulmonary disease;

DM Type II = Diabetes mellitus type II; GERD = Gastroesophageal reflux disease; CHF = Congestive heart failure

Table 2

Operative and Mid-term Outcomes Between Elderly and Non-elderly Surgical Patients.

	Elderly Patients	Non-elderly Patients	p-value
	n = 107	n = 2199	
Laparoscopic	95 (88.8%)	1646 (74.9%)	0.001
Procedure duration (minutes)	185.0 (150.0-241.0)	180.0 (147.5-236.0)	0.32
Conversion to open	8 (7.5%)	103 (4.7%)	0.19
Postoperative bleeding	2 (1.9%)	45 (2.1%)	0.90
Surgical site infection	1 (0.9%)	70 (3.2%)	0.19
Anastomotic/staple line leak	2 (1.9%)	32 (1.5%)	0.73
Intestinal ischemia	0 (0.0%)	5 (0.2%)	0.62
Respiratory complication	1 (0.9%)	34 (1.6%)	0.61
Pulmonary embolism	0 (0.0%)	8 (0.4%)	0.53
%REBMI	83.8 (62.9-102.1)	61.1 (33.6-83.3)	<0.001
Time of follow up (months)	43.3 (22.8-77.7)	88.3 (36.9-147.2)	<0.001

Categorical variables listed as N (%) and continuous variables listed as median (IQR).

Postoperative bleeding includes postoperative blood transfusion and reoperation.

%REBMI = Percent reduction in excess body mass index

Table 3

Baseline Characteristics Between Propensity-matched Elderly Groups.

	Surgery	No Surgery	p-value
	n=107	n=428	
Age (years)	62.0 (60.0-64.0)	61.0 (61.0-63.0)	0.11
Female	84 (78.5%)	341 (79.7%)	0.79
White	103 (96.3%)	420 (98.1%)	0.24
BMI (kg/m ²)	47.0 (43.0-52.8)	46.7 (41.1-54.6)	0.38
OSA	50 (46.7%)	194 (45.3%)	0.79
Osteoarthritis	67 (62.6%)	276 (64.5%)	0.72
COPD	26 (24.3%)	101 (23.6%)	0.88
DM Type II	64 (59.8%)	245 (57.2%)	0.63
GERD	56 (52.3%)	226 (52.8%)	0.93
CHF	8 (7.5%)	36 (8.4%)	0.75
Hypertension	85 (79.4%)	338 (79.0%)	0.92
Steroid use	2 (1.9%)	8 (1.9%)	1.00
History of tobacco use	26 (24.3%)	99 (23.1%)	0.80

Categorical variables listed as N (%) and continuous variables listed as median (IQR).

BMI = Body mass index; OSA = Obstructive sleep apnea; COPD = Chronic obstructive pulmonary disease;

DM Type II = Diabetes mellitus type II; GERD = Gastroesophageal reflux disease; CHF = Congestive heart failure

Table 4

Mid-term Outcomes Between Propensity-matched Elderly Groups.

	Surgery	No Surgery	p-value
	n=107	n=428	
Time of follow up (months)	43.3 (23.2-77.7)	31.5 (18.2-47.8)	<0.001
Alive at follow up	97 (90.7%)	400 (93.5%)	0.31
%REBMI	83.8 (62.9-102.1)	4.9 (-4.2-24.8)	<0.001

Categorical variables listed as N (%) and continuous variables listed as median (IQR).

%REBMI = Percent reduction in excess body mass index