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Is bariatric surgery safe in the elderly population?

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Abstract
Background Bariatric surgery has proven to be the most effective treatment for morbid obesity in all age groups and is considered superior to medical treatment. The aim of our study was to report the outcomes of bariatric surgery in patients over 65 years of age at our institution.
Methods A retrospective review of a prospectively collected database was conducted of all patients $\geq$ 65 years who underwent a bariatric procedure between 2005 and 2015 at our institution. We compared this group to a control group of patients < 65 years of age who were operated on during the last 5 years, from 2011 to 2015. Data analyzed included age, preoperative BMI, postoperative complications, and comorbidities.
Results Of 1613 patients studied, 1220 patients were under 65 years of age, and in Group B, 393 were $\geq$65 years of age at time of surgery. There was a significant difference in proportion of male patients among groups; 42 % in Group B were male compared to 30 % in Group A ($p < 0.001$). Caucasians represented the majority in both groups. Both groups had comparable preoperative BMI 42.27 kg/m^2 for the younger Group A population versus 41.64 kg/m^2 for Group B ($p = 0.074$). Group B had more comorbidities than Group A: hypertension ($p < 0.001$), sleep apnea ($p < 0.001$), and hypercholesterolemia ($p < 0.001$). No difference was found between groups in history of depression ($p = 0.409$) or type II diabetes ($p = 0.961$). Distribution of procedures was significantly different between groups, with more LSG in Group A ($p < 0.001$). Elderly patients had longer length of stay (LOS) by one day on average (LOS = 3 days, $p < 0.001$), but a lower readmission rate (10 % vs. 7 %) ($p = 0.023$). Complication rates were comparable in both groups, except for incidence of de novo GERD, which was higher in Group B (5 % vs. 8 %) ($p = 0.005$).
Conclusions Elderly patients are usually sicker in terms of comorbidities than the younger population. However, age does not seem to represent a risk of surgical complications after bariatric surgery.

Keywords Bariatric Surgery · Elderly · Complications · Gastric bypass · Laparoscopic sleeve gastrectomy

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The prevalence of obesity in the USA is high, with one-third of adults and 17 % of children being obese [1]. The incidence of obesity in the elderly population has also been increasing in the past 10 years. In the USA, 70.9 % of men and 61.9 % of women are overweight or obese, compared to 38 % of men

and 36.9 % of women worldwide [2]. Bariatric surgery has been the most effective treatment for morbid obesity in all age groups and is considered to be superior to the medical treatment in terms of weight loss and amelioration of comorbidities [3]. However, between the different age groups, elderly patients lose less weight and experience less resolution of comorbidities than younger patients [4, 5]. But controversy exists regarding the indications and safety of bariatric surgery in elderly patients. So far, there are no clearly defined guidelines concerning the indications of bariatric surgeries in the elderly age group. The primary concern in elderly age group is the increased risk of perioperative morbidity and mortality [4].

Most studies focus on individual bariatric procedures and their outcomes in terms of weight loss and resolution of comorbidities [6]. However, there is very limited literature comparing all of these procedures, including revisional surgery, with respect to the patients' age. The safety of bariatric procedures in the elderly age group has not been widely studied. The aim of our study is to report the outcomes and safety of bariatric surgery in patients over 65 years of age at our institution.

Materials and methods

After institutional review board (IRB) approval and following the Health Insurance Portability and Accountability Act (HIPAA) guidelines, we conducted a retrospective review of a prospectively collected database of all the patients of 65 years of age or older (Group B) who underwent a bariatric procedure during the 11-year period between 2005 and 2015 at Cleveland Clinic Florida Bariatric and Metabolic Institute. We compared this group to a control group (Group A) of patients less than 65 years of age operated on during the last 5 years, from 2011 to 2015.

Procedures were divided into 4 groups: laparoscopic gastric banding (LAGB), laparoscopic sleeve gastrectomy (LSG), laparoscopic Roux-en-Y gastric bypass (LRYGB), and laparoscopic revisions (LREV).

The data analyzed included demographics, comorbidities, procedure type, preoperative body mass index (BMI), postsurgical complications, and readmissions after bariatric surgery.

The data were collected from patients' chart reviews and imported into JMP software (SAS Institute Inc, NC, USA), which was then used to apply variable formatting and change variable names to conform to the conventions needed for R software (R version 3.2.1 (2015-06-18), Vienna, Austria). Continuous variables were described by their quartiles, and categorical variables were described by counts and percentages.

Comparisons of categorical variables between groups were done using the Pearson χ^2 test for nominal variables and the proportional odds likelihood ratio test for ordinal variables. Comparisons of continuous variables between groups were done using the Wilcoxon rank-sum test. All analyses and summaries use complete cases only and were created using R software (R version 3.2.1 (2015-06-18), Vienna, Austria). A significance level of 5 % was used for all testing.

Results

We studied a population of 1613 patients; in the younger group, Group A, 1220 patients were under 65 years of age, and in Group B, 393 were 65 of age years or older at the time of the surgery.

Eight hundred ninety (55.2 %) patients underwent laparoscopic sleeve gastrectomy, 382 (23.7 %) laparoscopic gastric bypass, 264 (16.4 %) laparoscopic revisional procedures, and 77 (4.7 %) laparoscopic gastric banding. The distribution of procedures among groups [Table 1] was significantly different.

Table 2 presents comparisons of demographics between the two groups. Significant difference was found for the patient's gender ratio ($p < 0.001$) and race ($p < 0.001$). Preoperative BMI was comparable in both groups ($p = 0.074$).

When comparing certain comorbidities, older patients presented higher rates of sleep apnea, hypertension, and hypercholesterolemia ($p < 0.001$). GERD was more prevalent in the younger group ($p < 0.001$). However, both age groups had comparable rates of diabetes ($p = 0.961$) and prior history of depression ($p = 0.409$). [Table 3].

Length of stay was longer in the Group B (median of 2 days in Group A vs. 3 days in Group B, $p < 0.001$). We

Table 1 Population distribution by procedure type

	n	LAGB $n = 77$	LSG $n = 890$	LRYGB $n = 382$	REV $n = 264$	Test statistic
Group A (<65)	1220	3 % (34)	60 % (726)	20 % (252)	17 % (208)	$X_3^2 = 79.23$, $p < 0.001$
Group B (≥65)	393	11 % (43)	42 % (164)	33 % (130)	14 % (56)	

Numbers after percents are frequencies

Test used Pearson test

Table 2 Comparisons between age groups and presurgical demographics

	n	Group A (<65) $n = 1220$	Group B (≥65) $n = 393$	Test statistic
Preoperative BMI	1613	37.8^a–42.2^b–47.6^c	37.8^a–41.6^b–46.1^c	$F_{1,1611} = 3.21$, $p = 0.074$[1]
Sex male	1613	30 % (372)	42 % (164)	$X_8^2 = 16.92$, $p < 0.001$[2]
Race	1613			$X_8^2 = 126.86$, $p < 0.001$[2]
African-American		21 % (257)	5 % (19)	
Caucasian		51 % (624)	83 % (326)	
Hispanic		26 % (1318)	11 % (45)	
Other		2 % (21)	1 % (3)	

Test used [1] Kruskal–Wallis test; [2] Pearson test

a, b, and c represent the lower quartile a, the median b, and the upper quartile c for continuous variables. Numbers after percents are frequencies

Table 3 Comparisons between groups by presurgical comorbidities

	n	Group A (<65) $n = 1220$	Group B (>65) $n = 393$	Test statistic
Diabetes II	1613	59 % (725)	59 % (233)	$X_1^2 = 0$, $p = 0.961$
GERD	1613	52 % (632)	42 % (164)	$X_1^2 = 12.07$, $p < 0.001$
Sleep Apnea	1613	43 % (522)	56 % (219)	$X_1^2 = 20.04$, $p < 0.001$
Hypertension	1613	59 % (699)	85 % (334)	$X_1^2 = 100.4$, $p < 0.001$
History of depression	1613	14 % (166)	15 % (60)	$X_1^2 = 0.68$, $p = 0.409$
Hypercholesterolemia	1613	33 % (400)	44 % (174)	$X_4^2 = 17.11$, $p = 0.001$

Numbers after percents are frequencies

Test used Pearson test

defined readmission as any visit to our hospital emergency room within 30 days after surgery regardless of patient disposition at the visit. Readmission rate was lower in older patients at 7 % ($n = 26$), while Group A had a readmission rate of 10 % ($n = 128$). This proved to be statistically significant ($p = 0.023$).

Twenty different complications any time after the surgery were recorded. The rate of all complications was comparable in both groups, except for the symptoms of GERD after the surgery, which was higher in the Group B ($p = 0.005$) (Table 4).

Discussion

With the increase in prevalence of obesity in the USA and longer life expectancy, there are an expected increased number of candidates who will qualify for a bariatric procedure in the elderly population [7]. The efficacy of bariatric surgery in elderly patients may be less than that of younger patients [8, 9]; however, the overall resolution rate of comorbidities is still superior to that of medical treatment.

There have been many publications that looked at the safety of bariatric surgery for the geriatric population, but data are still scarce [6]. In the past, surgeons would use the age as a contraindication for bariatric surgery for an elderly patient [9]; however, as more bariatric surgeries are performed domestically and internationally, more surgeons have expanded the inclusion criteria to accommodate elderly patients. This may be possible because of the improvement in surgical techniques, safety of the procedures, and perioperative care [10, 11].

These data provide great insight on a specific group of bariatric patients who are older than 65 years of age, and it aims to compare the surgical safety and outcomes to a younger population who were operated on following the same protocols at our institution. To our knowledge, 393 consecutive cases have been the largest number of patients reviewed for this particular group in a single institution to date.

There were several differences between the two groups, including the gender, race, and procedural distribution. Our gender distribution overall is similar to what has been reported in the literature [12, 13]. We noticed that there are a significant increased number of male patients in the Group B elderly population than the younger Group A. The cause of this phenomenon is uncertain, but we can speculate that females may seek bariatric surgical service earlier on in order to improve their body image in addition to the health benefits, and this increases the female–male ratio in our younger group. Also, it could be that the elderly male

Table 4 Comparisons between groups by postsurgical complications

Total $n = 1613$	Group A (<65) $n = 1220$	Group B (≥65) $n = 393$	Test statistic
Wound infection	2 % (22)	2 % (9)	$X_1^2 = 0.37$, $p = 0.541$
Early wound infection (30 day)	1 % (9)	1 % (3)	
Obstruction	2 % (20)	3 % (10)	$X_1^2 = 1.33$, $p = 0.248$
Early obstruction (30 day)	1 % (16)	1 % (2)	
Stricture	1 % (12)	1 % (4)	
Leak	1 % (8)	1 % (1)	
Bleed	1 % (7)	1 % (5)	
Fistula	1 % (17)	2 % (7)	$X_1^2 = 0.3$, $p = 0.581$
Jejunal ulcer	2 % (19)	2 % (9)	$X_1^2 = 0.94$, $p = 0.333$
Nausea	13 % (157)	11 % (43)	$X_1^2 = 1.02$, $p = 0.313$
Vomiting	10 % (120)	9 % (36)	$X_1^2 = 0.16$, $p = 0.693$
Diarrhea	4 % (49)	5 % (21)	$X_1^2 = 0.16$, $p = 0.261$
Abscess	3 % (32)	2 % (7)	$X_1^2 = 0.89$, $p = 0.345$
De novo GERD	5 % (57)	8 % (33)	$X_1^2 = 7.83$, $p = 0.005$
Pneumonia	3 % (32)	2 % (6)	$X_1^2 = 1.55$, $p = 0.213$
Dehydration	5 % (58)	4 % (16)	$X_1^2 = 0.32$, $p = 0.574$
Deep venous thrombosis	1 % (6)	1 % (4)	
Pulmonary embolism	1 % (7)	1 % (2)	
Incisional hernia w/obstruction	2 % (24)	2 % (6)	
Incisional hernia w/o obstruction	2 % (24)	2 % (7)	$X_1^2 = 0.05$, $p = 0.815$
Diaphragmatic hernia	2 % (29)	1 % (4)	$X_1^2 = 2.74$, $p = 0.098$

Numbers after percents are frequencies

Test used Pearson test

patients have less reservation about major surgical procedures than the elderly female patients.

The race distribution was significantly different between the two groups as well. The vast majority of elderly patients who underwent a bariatric surgery was Caucasian; other racial groups, including African-American, Hispanic/Latino, and others, added to only 27 % of Group B. Perception of obesity plays an important role among African-American culture [14], so this particular distribution pattern may reflect the cultural background, geographic influences, and socioeconomic differences.

Preoperative BMI was comparable in both groups at around 42 kg/m2 ($p = 0.074$). This is in the same rate as other reports [15, 16].

Of these demographic differences, only male gender has been reported previously in the literature as a predictor of increased risk of postoperative complications [17]. This may influence our results as it could potentially put our older group at a higher risk.

We also noted that the distribution of procedures was significantly different between the two age groups. The older patients tend to have more gastric bands as their primary bariatric surgery than the younger group. This may be secondary to the fact that elderly patients in the study were included from 2005 to 2015, while the younger control group includes patients from 2011 to 2015. At our institution, we used the age to guide our decision to determine what procedure the patients would benefit from most. In this regard, the gastric band was performed more commonly on the elderly patients because of the simplicity of the procedure, shorter LOS, and low complication rate at the time [18]. Also, we observe that more patients from the younger Group A had undergone revision surgeries; however, this may be because of shorter and more recent inclusion period for the group. Because we are comparing the recent younger group from 2011–2015 to the older group from a longer time period of 2005–2015, it is expected that the revision surgery would generally be more prevalent in recent years than 2005–2015. Considering that sleeve gastrectomy has been emerging as a stand-alone bariatric procedure of choice in the past few years [19, 20], it is not strange to observe only 42 % of elderly patients underwent sleeve gastrectomy.

Elderly patients in our study had more comorbidities than the younger patients as expected. Patients had significantly more hypertension, sleep apnea, and dyslipidemia. This is concordance with previous reports in the literature [8, 21]. It has been well studied that elderly

patients have more chronic conditions and comorbidities, and more frail elderly patients have higher postoperative complications [17].

We observed that the elderly patients in Group B had a longer LOS by 1 day, but the same group had a lower early readmission rate. The readmission rates were 10 and 7 % in Groups A and B, respectively, which may be higher than what has been reported in the literature [22]. This may be because the parameter included all patients who had any emergency room (ER) visit within 30 days after the discharge, even if the patient's disposition at the time of subsequent ER visit was not to be admitted to the hospital. It is still unclear as to why the readmission rate is lower in the elderly group compared to the younger group. The extra LOS may have made the difference in the immediate readmission rate during the first 30 day postoperative period, but further investigation is necessary to verify such a hypothesis. Certainly in our institution, we tend to be more conservative with our discharges for the elderly patients, as is reflected in the analysis.

However, our results show that the outcomes are comparable between the two groups in terms of surgical safety. Besides the new-onset GERD, all the other analyzed complication parameters, including but not limited to wound infection, obstruction, stricture, leak, hemorrhage, nausea, vomiting, DVT, PE, or hernia, failed to show any significant differences between the younger and older patients. The new-onset reflux can be explained by the higher percentage of gastric band patients in Group B since severe reflux is a well-documented complication after gastric band placement [23]. The higher incidence of new-onset GERD in this group needs further investigation because the rate only reflects a patient's subjective complaints postoperatively rather than based on objective measurements or findings. In any case, these symptoms were treated satisfactorily with proton-pump inhibitors or h2 antagonist medications.

The limitations of this study include the heterogeneity of the timeframe analyzed for the two populations. However, this is a large population of patients 65 years of age and older from a single institution, which adds strength to the data.

Conclusion

This analysis of patients who are 65 years of age and older supports that bariatric surgery can be safely performed without additional short-term postoperative complications when compared to younger patients, even though the older group was proven to be more ill. Older patients should be well informed prior to the surgery of increased length of stay and incidence of reflux. Overall, as our data suggest, age greater than 65 should not be used as a contraindication to bariatric surgery.

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Compliance with ethical standards

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