

# Bariatric surgery in older adults

## Should there be an age limit?

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### Abstract

Obesity has become one of the most significant health problems worldwide, affecting more than one-third of the global population. The elderly population is not immune to this proportional increase in obesity. To date, there is no cure for obesity, but surgery is the most effective treatment available today.

We analyzed the results of bariatric surgery in elderly patients for a period of 3 years. Patients 65 years old and older were included in the study, 451 older adults were included. The mean age of the study group was 67.92 years old (min. 65, max. 84). The mean body mass index (BMI) was 40.32 Kg/m<sup>2</sup> (min. 34 and max. 59). Sleeve gastrectomy (SG) was the most common procedures, and were conducted in 346 (76.72%) patients, gastric bypasses (GBPs) in 53 (11.75%) of which 33 were roux en y GBP (7.32%) and 20 mini GBPs (4.43%), gastric banding in 48 (10.64%), and duodenal switching in 4 (0.89%) cases.

There were 40 (8.86%) patients with perioperative complications, 6 (1.33%) required re-operations, 12 (2.66) patients with operative complications were treated conservatively, 8 (1.77%) re-admission 5 of them with intrabdominal abscess, and 14 (3.10%) with co-morbidities complications. More than 76% of the patients had co-morbidities, 1 year after surgery the average remission of diseases was 34.74%, the improvement was 49.67% and no changes in the co-morbidities was 15.59%. There were no deaths reported in this cohort.

The mean excess body weight (EBW) loss among the patients was 70.76% (from 32% to 92%). No failure of weight loss (less than 25% of EBW loss) was observed after the first postoperative year.

Bariatric surgery offers obese elderly patients an acceptable result, and it can be offered to improve the quality of life of these patients. A new consensus conference panel is needed to set appropriate recommendations regarding criteria that limit bariatric surgery in older adults.

**Abbreviations:** EBW = excess body weight, GB = gastric banding, GBP = gastric bypass, SG = sleeve gastrectomy.

**Keywords:** comorbidities, elderly, obesity

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SS conceived of the presented idea, performed the analytic calculations, wrote the manuscript with the supervision of the others authors.

AR conceived of the presented idea and data collection.

RB developed the theory and performed the computations, performed the analytic calculations, Chart and Tables.

HP supervised the findings of this work and supervised the project.

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## 1. Introduction

Who is old? Those people who no longer work and are retired? Or people who cannot perform their tasks themselves, or, when they become grandparents? It seems that human evolution is progressing faster than we update the concepts of old age. Today it is accepted to define as an elder a person over 65 years old.<sup>[1]</sup>

The life expectancy has improved and the percentage of the population has decreased, due to declining fertility, which causes an increase in the percentage of the elderly population.<sup>[2,3]</sup> It has been estimated that the elderly population will grow by 1% every year until 2040.<sup>[4]</sup> The proportion of obese people in older adults has increased as it happens in all ages. Moreover, physical inactivity and high caloric intake have caused an increase in obesity in a way that is considered to be a global epidemic.<sup>[5]</sup> In our environment, elderly patients request bariatric surgery more frequently.

In the literature, there are no contraindications, per se for major surgery in elderly patients,<sup>[6]</sup> and there is no doubt that mortality and morbidity in elderly patients are related to age and coexisting diseases.<sup>[7]</sup>

Consequently, uncontrolled increasing weight leads to increase of diabetic patients, hypertensive, atherosclerosis, heart disease, cancer besides a large number of different obesity-induced diseases.<sup>[8–10]</sup> Obesity also exacerbates the age-related decline in physical function and causes frailty in older adults.<sup>[11]</sup>

Conservative treatments for obesity, such as medicines and behavioral and physical activities, have failed to stop the increase

in obesity;<sup>[12]</sup> therefore, surgical options appear to be best treatment for obesity and its related diseases.<sup>[13]</sup>

Because of the decreased physiological reserve and tissue frailty in the geriatric patients, it would be rational to expect higher rate of morbidity and mortality in elderly patients that received surgery.<sup>[14]</sup> A logical question to ask is whether the age of patients wishing to undergo a bariatric operation should be limited?

Patients 80 and older have a higher risk of perioperative mortality of 2% and a risk of complications of 20% following common non-cardiac operations.<sup>[15]</sup> Bariatric surgery currently, has a low risk of complication and mortality, less than colonic surgery, cholecystectomy and appendectomy.<sup>[16]</sup>

Despite the operative risk that exists, old people seek to perform bariatric surgeries from the point of view of improving their health condition by means of the resolution of concomitant diseases or improving the quality of life.

In 1991, the National Institutes of Health Consensus Development Conference on Gastrointestinal Surgery for Severe Obesity accepted that the age ranges from 18 to 60 years old was ideal for performing bariatric surgery.<sup>[17]</sup> All of this information leads to a logical, reasonable question: "Is it acceptable to set the age limit to 65 years old for bariatric surgery in obese patients?"

Therefore, the aim of the study was to corroborate the results of bariatric surgery in elderly patients.

## 2. Materials and methods

A retrospective analysis of elderly patients that underwent bariatric procedures was performed in a private medical center (Assuta Medical Center) between January 2013 and December 2015. The study group included 451 elderly patients, which represented 4.98% bariatric surgeries performed in the institution; 284 of them were female (63%) and 167 were male (37%). All of the procedures were performed laparoscopically by a total of 39 expert surgeons (there were no conversions to open surgery). The mean age of the study group was 67.92 years old (min. 65, max. 84). Of these patients, 360 (79.82%) were 65 to 69 years old, and 91 (20.18%) were 70 years old and older. The mean body mass index (BMI) was 40.32 Kg/m<sup>2</sup> (min. 34 and max. 59).

Primary surgery was performed in 410 (90.1%) patients and 41 (9.9%) revisional surgeries.

Chronic simple or multiple diseases affected 349 (77.6%) patients while 102 (22.4%) patients did not suffer from co-morbidities. Three hundred twenty-eight patients had hypertension, 323 patients had hyperlipidemia and 285 suffer from diabetes. All the demographics data are shown in Table 1.

Follow-ups were conducted on all of the patients and ranged from 9 to 45 months. These were performed in outpatient clinics (70%) or in routine phone questionnaires (30%) carried out by the institution every 3 months for one year.

The study was approved by the Institutional Ethics Committee (Helsinki board: 2015073) and registered in the National Institutes of Health web site (ClinicalTrials.gov) with the study identifier NCT02817295.

### 2.1. Statistical analysis

Statistical analyses were performed using IBM SPSS statistic software, version 23. Continuous variables are presented as means  $\pm$  SD, and dichotomous/categorical variables are presented as proportions. The normality of the distribution of continuous variables was tested by the Kolmogorov–Smirnov test, and the Chi-square test was used in order to evaluate and examine proportions.  $P < .05$  was considered as statistical significance.

**Table 1**

#### Demographics characteristics.

Variable	Mean/percent
Mean Age	67.92
Mean BMI	40.32
Male/ female index	1/1.7
<b>N/percent</b>	
First bariatric procedures	387 (86%)
Revisional procedures	64 (14%)
With co-morbidities	349 (77.60%)
Without co-morbidities	102 (22.40%)
Metabolic syndrome	20.84%
Diabetes	285 (63.19%)
Hypertension	328 (72.73%)
Hyperlipidemia	323 (71.62%)
Fatty liver	91 (20.18%)
Ischemic Heart dis	73 (16.19%)
Osteoarthritis	99 (21.95%)
Reflux disease	54 (11.97%)
Sleep apnea/snoring	73 (16.19%)
Urinary incontinence	36 (7.98%)
Depression	19 (4.21%)
Chronic renal failure	14 (3.10%)
Hypothyroidism	23 (5.10%)
Vitamin D Deficiency	23 (5.10%)
Gout	19 (4.21%)
Asthma	27 (5.99%)
Chronic lung disease	19 (4.21%)
Osteoporosis	14 (3.1%)
Gallstones	9 (2%)

BMI = body mass index.

Simple Linear regression analysis was conducted to predict the relation between 2 variables using Microsoft Excel software (2016).

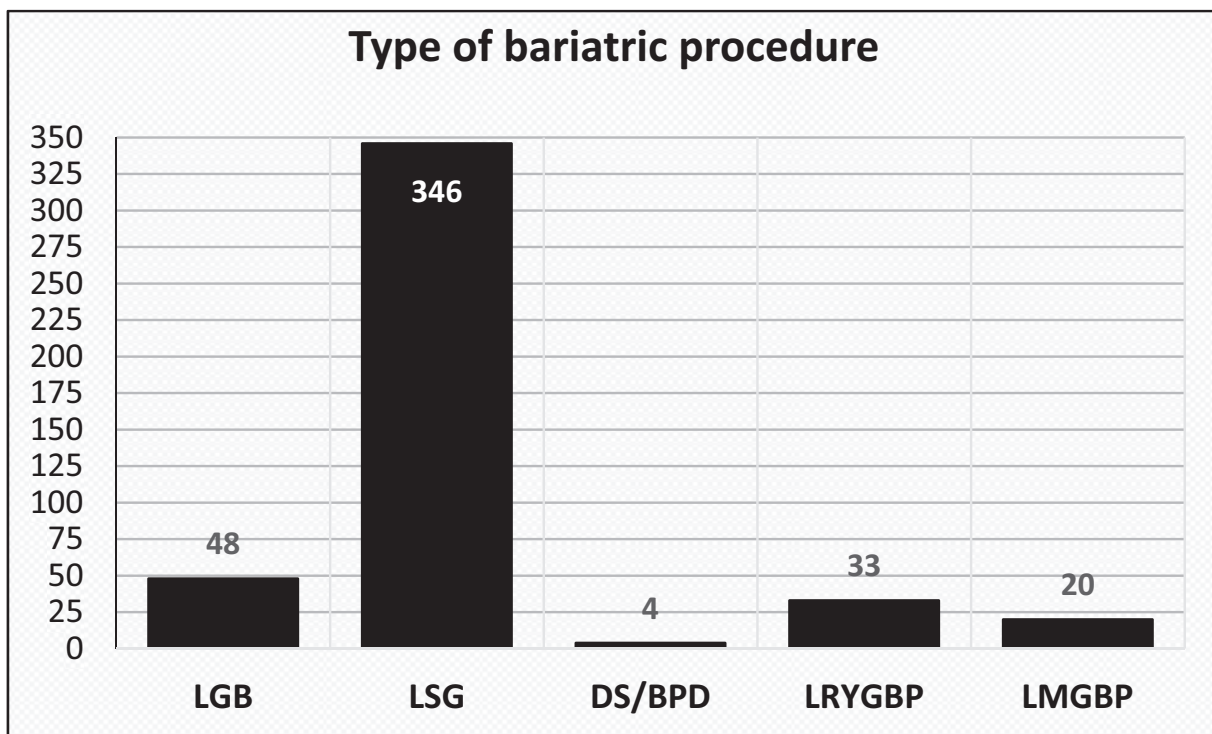
## 3. Results

Overall, the results of the statistical analysis are presented as means, with ranges and percentages where relevant.

The procedures performed were distributed as follows: sleeve gastrectomy (SG) in 346 patients (76.72%), gastric bypasses (GBPs) in 53 (11.75%) of which 33 were roux en y GBP (7.32%) and 20 mini GBPs (4.43%), gastric banding (GB) in 48 (10.64%) and duodenal switching in 4 (0.89%) cases (Fig. 1).

In 316 (70.1%) of the patients, this was the first bariatric procedure, while in 135 (29.9%) patients underwent a revision from one to another type of bariatric surgery. The mean excess body weight (EBW) loss among the patients was 70.76% (from 32% to 92%). No failure of weight loss (less than 25% of EBW loss) was observed after the first postoperative year.

There were 101 patients (22.4%) without comorbidities and 350 (77.6%) with obesity related co-morbidities. However, about 70% of these elderly patients suffered from diabetes, hyperlipidemia, and hypertension simultaneously. Of the 285 diabetic patients, 69 (24%) were diagnosed with type I diabetes mellitus. Overall, co-morbidities resolved in 34.74%, improved in 49.67% and unchangeable in 15.59% during the follow up time. The resolution of type II diabetes was 88% without medications and 12% improvement with decreased medical treatment. In the type I diabetes patients, the use of insulin was decreased by 35%. In addition, the hypertensive patients



**Figure 1.** The distribution of procedures per type in numbers. DS/BPD= duodenal switch/biliopancreatic diversion, GB =gastric banding, GBP=gastric bypass, SG= sleeve gastrectomy.

demonstrated a resolution of 57.93% and improvement of 29.88%, while the hyperlipidemic patients had a resolution of 29.41% and improvement of 54.8%. Finally, there was a resolution in sleep apnea of 89.04%, and improvement in 6.85% of the patients. Therefore, bariatric surgery improved or resolved 84.41% of the co-morbidities, the average remission of diseases was 34.74%, the improvement was 49.67% and no changes in the co-morbidities was 15.59%. (Table 2).

A sub-comparison between patients between the ages of 65 to 69 and patients above 70 years old did not reveal any significant

effect as both groups presented similar outcomes in the rates of complications, revisions, co-morbidities and BMI.

There were 40 patients (8.86%) with perioperative complications, 6 patients (1.33%) required reoperations: 4 for leak control, 1 due to bleeding, and 1 for obstruction.

Eight of the patients were readmitted: 5 patients needed interventional radiology for intra-abdominal abscess drainage, 1 with a portal thrombosis that was treated conservatively with anticoagulation drugs, 1 had dehydration, and 1 had type 1 diabetics ketoacidosis.

In 14 patients there were complications related to their co-morbidities, 6 patients had uncontrolled hypertension, 2 patients had hyperglycemia nonketotic syndrome, 2 patients suffered exacerbation of chronic lung disease (CLD), 2 patients with deterioration of chronic renal failure (CRF) it was necessary to correct, in 1 patient has asthma attack, and 1 patient with acute gout arthritis.

In 12 patients there were complications treated conservatively, 6 had contained leak controlled by drainage put during operation by the surgeon without need for reoperations, 2 had intraluminal bleeding treated endoscopically with clip application and in 2 cases the bleeding was treated conservatively (Table 3). Overall, there were no deaths reported in this cohort of patients. Complication of patients under 70 years old occurs in 32 cases (8.88%) and in older than 70 years old in 8 (8.79%) cases ( $P=.978$ ).

The average hospital stay was 2.29 days (min 0, max 10), while those patients with complications stayed for an average of 4.35 days under 70 years old and 3.33 days over 70 years old ( $P=.162$ ).

The average weight loss was 72.44% of the EBW. Weight loss varies depending on the type of bariatric surgery carried out: Gastric band 38.16% average loss of EBW, SG 57.13%,

Effect of bariatric surgery in co-morbidities				
Disease	Number	Remission	Improve	No changes
Diabetes	285	40.7%	55.79%	3.51%
Hypertension	328	57.93%	29.88%	12.19%
Hyperlipidemia	323	29.41%	54.8%	15.79%
Fatty Liver	91	51.65%	43.95%	4.4%
IHD	73	17.81%	61.64%	20.55%
Osteoarthritis	99	9.9%	74.25%	15.85%
GERD	54	42.59%	51.86%	5.55%
OSA/Snoring	73	89.04%	6.85%	4.11%
Urinary distress	36	77.77%	19.44%	2.79%
Depression	19	21.06%	52.63%	26.31%
CRF	14	0%	57.14%	42.86%
Hypothyroidism	23	26.09%	47.82%	26.09%
Vit. D Def.	23	21.74%	65.22%	13.04%
Gout	19	36.84%	36.84%	26.32%
Asthma	27	33.33%	62.97%	3.7%
CLF	19	0%	73.69%	26.31%

CLF= chronic lung disease, CRF= chronic renal failure, GERD= gastroesophageal reflux disease, IHD= ischemic heart disease, OSA= obstructive sleep apnea.

**Table 3**  
**Complications description in elderly patients after bariatric surgery.**

Complication	Number	Percent	Sub group	Number
Reoperation	6	1.33%	Leak	4
			Bleeding	1
			Obstruction	1
			Uncontrolled BP	6
Co-morbidities related complications	14	3.10%	Hyperglycemia	2
			CLD exacerbation	2
			CRF exacerbation	2
			Asthma attack	1
Re-admission	8	1.77%	Acute gout arthritis	1
			Abdominal abscess	5
			Portal vein thrombosis	1
			DKA	1
Conservatively treated complications	12	2.66%	Vomiting	1
			Unable to drink	4
			Controlled leak	6
Total	40	8.86%	Bleeding	2

BP=blood pressure, CLD=chronic lung disease, CRF=chronic renal failure, DKA=diabetic ketoacidosis.

Duodenal switch or Biliopancreatic Diversion 59.03%, Roux en Y GBP 67.93% and Mini-GBP 87.3%. The comparison of the results regarding the types of bariatric surgery result in differences with statistical significance ( $P < .001$ ) and the R2 coefficient of determination is 93.24% (Fig. 2).

In relation to gender, male lost 58.11% of EBW and Female 55.56%, differences do not show significant differences ( $P = .254$ ) and R2 coefficient of determination is 100% (Fig. 3). Separating the patients into subgroups by age we see that the more elderly loses less weight after bariatric surgery, therefore the 65 to 69-year

group lost 62.57% EBW, 70 to 74 year lost 37.8% EBW, 75 to 79 years under 24.95% EBW and more than 80 lost 18.74% of EBW. The differences are statistically significant ( $P < .001$ ) and the R2 coefficient of determination is 92.25% (Fig. 4)

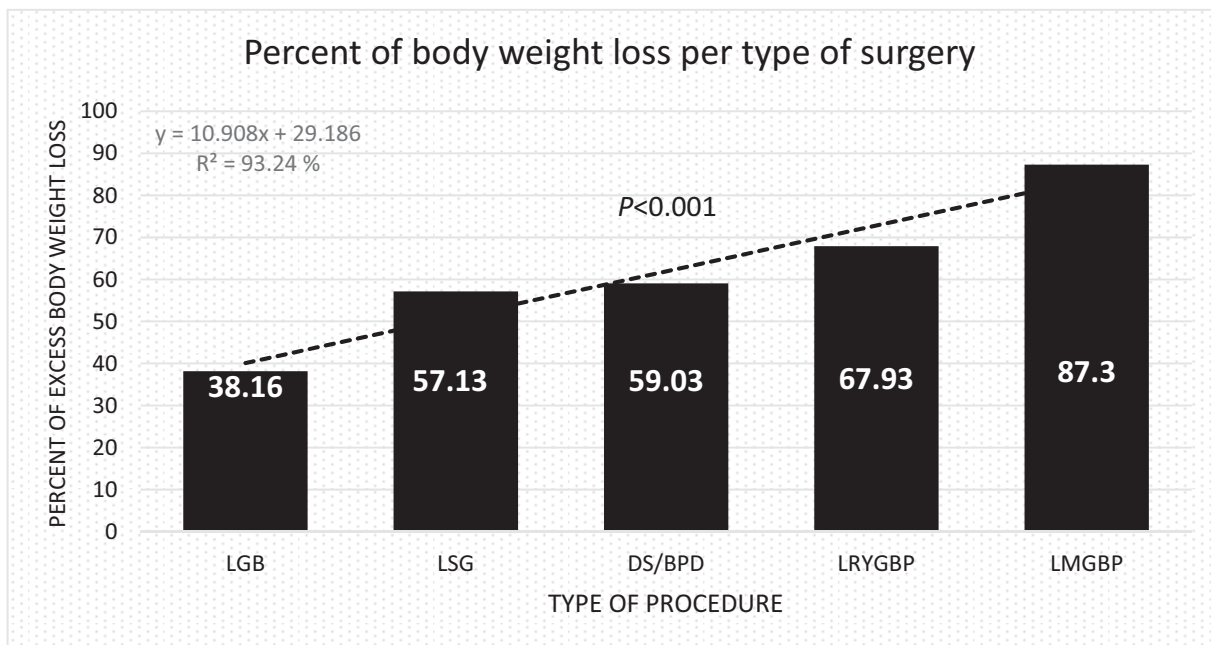
The weight loss changes of those 64 patients (14%) that underwent a second bariatric operation lost 5% to 15% less of their EBW ( $P = .005$ ) when compared to their first bariatric operation (Fig. 5).

**4. Discussion**

To begin with, we must accept the correct definition of “elderly.” Conventionally, elderly has been defined as a chronological age of 65 years old or older.<sup>[18]</sup> Several risk factors for postoperative morbidity and mortality increase with age, and increasing age itself remains an important risk factor for postoperative morbidity and mortality.<sup>[19]</sup>

In our group, we saw that more than 77% of the patients suffered from comorbidities, more than 66% were diabetic and more than 70% had hypertension and hyperlipidemia. A laparoscopic approach to surgery can be used safely in an elderly population in daily practice for miscellaneous conditions, whether they are elective or emergency operations.<sup>[20]</sup> We agree with the research of Ceulemans et al, who suggested that the most adequate approach for elderly patients is laparoscopy.<sup>[20]</sup> Today, all types of bariatric procedures are performed laparoscopically. The benefits of a laparoscopic approach are well-known, and the large list of improvements is important to emphasize: less pain, reduced blood loss, shorter time to the resumption of oral intake and earlier discharge from the hospital,<sup>[21]</sup> all of our patients underwent their surgery laparoscopically without conversion to open performed by surgeons with extensive experience.

The account of complications was higher than that for the general population (8.42%), but 35% of the complications were related to comorbidities and not to the surgical procedure in a cohort of illness patients.



**Figure 2.** Percent of Excess body weight loss after Bariatric Surgery.

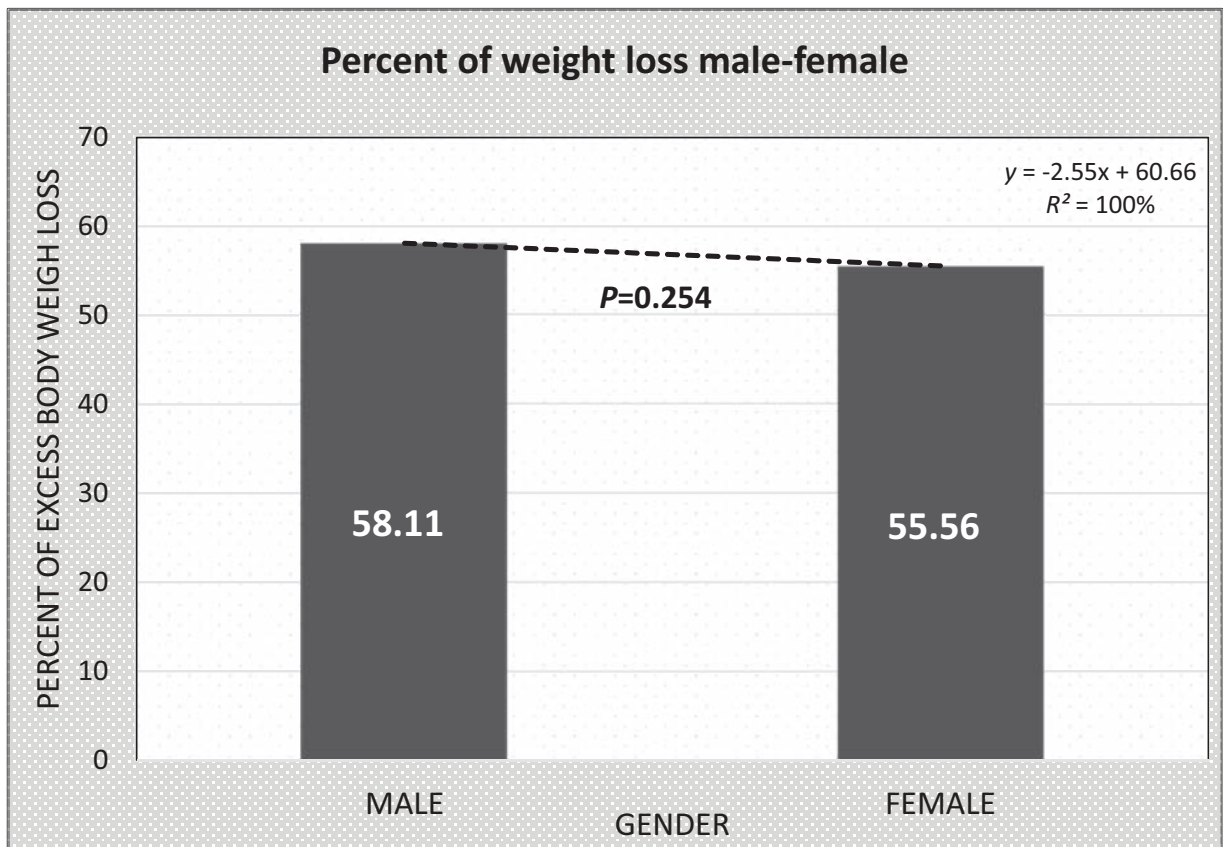


Figure 3. Percent of excess body weight loss per gender.

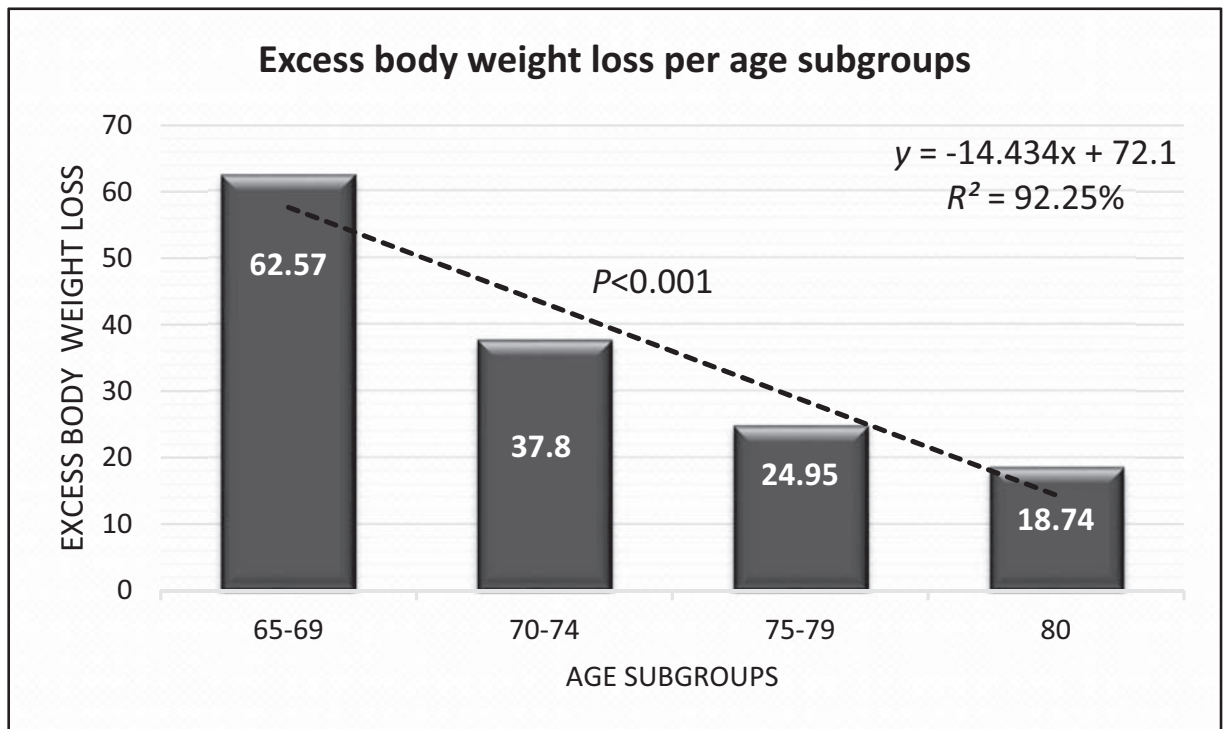


Figure 4. Percent of excess body weight loss per age subgroups.

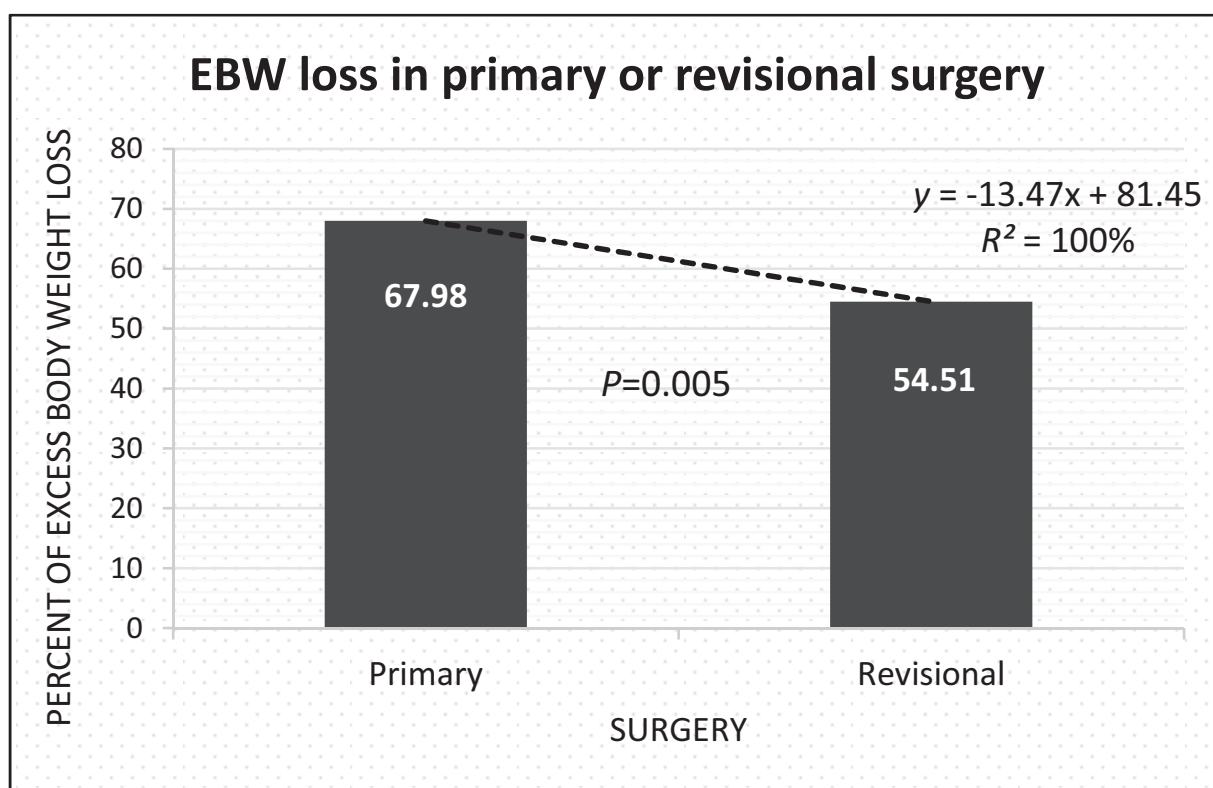


Figure 5. Comparison of EBW loss in primary bariatric surgery and in revisional surgery. EBW=excess body weight.

In our cohort, we found that the number of complications related to the operative procedure was similar to those in general bariatric operations. Controversial reports have been found in the literature regarding complications in bariatric surgery, although the morbidity and mortality are higher in the elderly, bariatric surgery is considered to be as safe as other gastrointestinal procedures.<sup>[22,23]</sup> In our study group we found that the total number of complications is 8.86% considering that 5.76% of these complications are due to operative complications and 3.10% in relation to aggravation of previous diseases, these results are below what was expressed by Nguyen et al, with a readmission of 6.6% when in our group it was less than 2%, and with reoperation rate 4% compared to 1.33 in our study group.<sup>[24]</sup> Furthermore, patients above 70 years old have less complication than patients under 70 without statistical significance. Successively, 14% of our study group underwent revisional surgery after a previous (different) bariatric procedure. A study by Victorzon concluded that revisional bariatric surgery can be performed with an increased, but acceptable risk, with at least short-term weight loss comparable to primary operations.<sup>[25]</sup> In addition, Sugerman et al reported that bariatric surgery was effective for older patients, with low morbidity and mortality.<sup>[26]</sup> There is no doubt that the progress made in terms of anesthesia and post-operative management offers a great possibility to elderly patients as candidates for bariatric surgery, with an acceptable risk.

Weight loss decrease with age, as previously reported by Contreras,<sup>[27]</sup> but in old adults, the weight loss is enough to satisfactorily correct co morbidities. In our group of patients, the results of biliopancreatic diversion do not correlate with the literature since they are patients with 2 or more previous bariatric surgery.<sup>[28]</sup>

The committee that analyzes the indications and contraindications to perform bariatric surgery should carefully consider the risks of surgery versus the benefits in improving comorbidities and quality of life; in our institution, 10% of the candidates for bariatric surgery are rejected due to any type of contraindication or poor health condition.<sup>[16]</sup> In our study, we did a comparison of the results in the population under 70 years of age and over with no significant differences. We agree with Zavery that each bariatric procedure can be performed on patients older than 70 with low morbidity rate.<sup>[29]</sup> Actually, the complication rate does not differ significantly from the overall benchmark,<sup>[30]</sup> and the death rate is low. In the paper published by Flanagan, access to bariatric surgical care was impeded by the insurance certification processes in 22% of the medically acceptable candidates. Those processes that delay or restrict efficient access to bariatric surgery are associated with a 3-fold increase in mortality.<sup>[31]</sup> Short-term risks should be considered in the context of the long-term health effects of surgically induced weight loss on coexisting health conditions.<sup>[32]</sup> For example, elderly patients report a high rate of improvement in comorbidities, as demonstrated in our study, and extreme improvement in the quality of life, as reported previously in the literature.<sup>[33]</sup>

Angrisani reports that the most common bariatric procedure in Israel is the SG performed in more than 70% of the patients as primary surgery.<sup>[34]</sup> This finding correlates with our results, which indicated that 70% of the patients underwent sleeve gastrectomies and 14.6% underwent GBPs. Globally, the distribution of bariatric procedures differs from that in Israel; the most commonly performed procedure worldwide was the Roux-en-Y GBP (45%), followed by the SG (37%) and adjustable GB (10%).<sup>[35]</sup> In many countries, the SG has increased

in popularity for many reasons; for example, the patients seem to be highly motivated to request this procedure, and it is technically easier for the surgeon to perform. Overall, our patients reported great satisfaction with the SG operation. Furthermore, we found a broad support in the medical literature to perform SG as a stand-alone procedure.<sup>[36–38]</sup>

Furthermore, if we compare elderly patients in different age groups there were no differences in the outcome, weight loss and resolution rate of complications. Our study is limited by the number of patients over 70 years of age operated, studies that include bariatric surgeries in patients older than 70 years may confirm or not our hypothesis. We believe that setting as maximum age of 65 years for bariatric surgery is unacceptable at present, we advise to review and modify the indications related to age to perform bariatric surgery. We agree with Orimo, who proposes to divide the age of the elderly into 2 groups, between 65 and 74 years of age “Early elders” and more than 75 “late elders”.<sup>[38]</sup> In addition, other variables to consider would include demographics, specific comorbidities, specific procedural data, and outcomes such as morbidity, mortality, discharge destination, quality of life, and functional status.<sup>[39]</sup>

This study was conducted with a number of 360 participants from 65 to 69 years old, 90 patients from 70 to 80 years and only 1 patient over 80 years old, future studies should be carried out to know the results of bariatric surgery in people over 70 and 80 years old to know what is the age limit to perform bariatric surgery.

## 5. Conclusion

Bariatric surgery offers an acceptable outcome to elderly patients since the higher complication rates in elderly patients are attributable to the comorbidities. Bariatric surgery should be provided to elderly patients to improve their health conditions and quality of life. Therefore, it is imperative to create a new consensus conference panel to determine the indications for increasing the age for bariatric surgery, thereby including elderly patients.

## Author contributions

**Conceptualization:** Sergio Susmallian.

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**Validation:** Sergio Susmallian, Asnat Raziel, Royi Barnea, Haim Paran.

**Visualization:** Sergio Susmallian, Royi Barnea.

**Writing – original draft:** Sergio Susmallian, Asnat Raziel.

**Writing – review & editing:** Sergio Susmallian, Haim Paran.

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