ELSEVIER

Surgery for Obesity and Related Diseases 000 (2018) 1–9

SURGERY FOR OBESITY AND RELATED DISEASES

Original article

Outcome of bariatric surgery in older patients

Sergio Susmallian, M.D.[a,*], Royi Barnea, Ph.D.[b], Yossi Weiss, M.P.H., Ph.D.[b,c], Asnat Raziel, M.D.[d]

[a] Department of Surgery, Assuta Medical Center, Tel-Aviv, Israel
[b] Assuta Health Services Research Institute, Assuta Medical Center, Tel-Aviv, Israel
[c] Ariel University, Israel
[d] Assia Medical Group, Assuta Medical Center, Tel-Aviv, Israel

Received 24 April 2018; received in revised form 1 August 2018; accepted 4 August 2018; Available online xxx

Abstract

Background: People are living longer than they were expected to 2 decades ago. Increased life expectancy and reduced mortality encompasses a simultaneous increase in the number of older adults with obesity that entails an increase of co-morbidities, such as diabetes, hypertension, cancer, and many other diseases. The aim of our study was to compare the outcomes of bariatric surgery in patients age ≥65 in comparison with younger patients.

Methods: This retrospective study compares bariatric surgeries performed in a private institution between the years 2013 and 2015. The study included 9044 patients divided into an older group (451 patients) and the younger group (8593 patients).

Results: In the younger group, bariatric surgery is distributed as follows: 77.68% sleeve gastrectomy, 12.72% gastric banding, 9.27% gastric bypass, and .33% duodenal switch or biliopancreatic diversion; in the older group: 70.51% sleeve gastrectomy, 15.08% gastric bypass, 13.97% gastric band, and .44% biliopancreatic diversion. In the control group 550 cases (6.4%) underwent revisional surgery; 64 cases (14.10%) underwent revision in the older group. Older patients lost less excess weight than younger patients (72.44% versus 86.11%, respectively). Older patients presented higher rates of complications (8.42% versus 5.59%), co-morbidities (77.60% versus 55.45%), and revisions (1.33% versus .77%). There was no statistical difference in hospital stay between older group and control group (2.27 versus 2.23, respectively). When performing a Clavien-Dindo classification, we demonstrated significant differences in class 3B and 4A and no differences in other classes. Two deaths occurred in the control group. Diabetes, fatty liver, and sleep apnea have been improved or remitted in >90% of patients in both groups, hypertension and hyperlipidemia by >80%, and hyperuricemia and ischemic heart disease were improved or resolved in >70% of the patients

Conclusions: Bariatric surgery in the elderly has more complications, but it can still be considered safe. (Surg Obes Relat Dis 2018;000:1–9.) © 2018 American Society for Bariatric Surgery. Published by Elsevier Inc. All rights reserved.

Keywords: Elderly; Bariatric surgery; Complications; Co-morbidities; Body mass index

Introduction

Together with the overall population increase and the rise proportion of seniors, the percentage of people that suffer from obesity and being overweight increases accordingly. People >60 years currently represent 14% of the global population, and the 2050 forecast claims that the proportion of the world's population >60 years will nearly double to 22%, based on the declining rates of children and youth [1].

*Correspondence: Sergio Susmallian M.D., Department of Surgery, Assuta Medical Center, 20 Habarzel Street, Tel Aviv, 69710, Israel.
E-mail address: sergios@assuta.co.il (S. Susmallian).

https://doi.org/10.1016/j.soard.2018.08.007

Global obesity is a disease with no Cure that must be prevented and addressed in the fields of health, economics, and governmental policy by proposing efficient measures, as the number of overweight individuals in the world is currently estimated at 1.7 billion [2]. The disease was declared by the World Health Organization as an epidemic in 1990 [3]. Obesity is accompanied by increasing risks of cardiovascular disease, type 2 diabetes, musculoskeletal disorders, some cancers (endometrial, breast, and colon), and many other diseases [4]. Over the last decade, the prevalence of obesity in Western and Westernizing countries has more than doubled [5]. However, an exception was found in the study published by Ogden et al. [6] reporting that the prevalence of overweight among children and adolescents and obesity among men increased significantly, while among women no overall increase in the prevalence of obesity was observed.

Obesity is a complex disease, the origin of which, so far, is not well elucidated because it is influenced by multiple factors. The scientific community must demand higher standards in efforts to understand obesity's causes and potential solutions [7]. Promotion of healthy eating habits, an increase in physical activity, improvement laws for food manufacturing, and endorsement measures to regulate caloric imbalance should be conducted with urgency [8,9].

While diets, physical activity, drugs, and behavioral changes, alone or in combination, have failed to solve the problem of obesity [10–12], bariatric surgery is the most well-known effective treatment for obesity. In 1991, the National Institutes of Health Consensus Development Conference on Gastrointestinal Surgery for Severe Obesity accepted the age range of 18 to 60 as recommended for performing bariatric surgery [13]. Obviously, it is worth asking whether the current reality justifies strict age limits to perform bariatric surgery.

Initially, this age range was widely respected; however, after the year of 2000, the number of patients ≥65-years old who requested bariatric surgery increased considerably. The increased demand may be a result of the fact that family physicians recommend bariatric surgery as a remedy for improving co morbidity of the metabolic origin. Surgery is more frequent in older adults [14]. Surgical rates are 55% higher in persons over the age of 65 (215 operations/1000) than in persons below the age of 65 (120 operations /1000) [14]. Elderly patients had a higher rate of major perioperative complications and mortality after noncardiac surgery [15]. Although, the laparoscopic approach for bariatric procedures assisted to significantly improve surgical outcomes.

Laparoscopic bariatric surgery has been reported to be performed in patients >55 to 60 years [16,17]. Recent data showed that teenagers and patients >70 years can benefit from bariatric surgery with little or no increased risk [18].

Definitively, comprehensive geriatric assessment is essential as it reduces mortality and improves the physical wellbeing of older people [19].

In Israel, the Ministry of Health has set the age restriction for bariatric surgery to 18 to 65. The bariatric committee is responsible to approve all patients' aptness for bariatric surgery. Thus, all patients ≥65-years old are considered exceptional cases and are approved as such.

The aim of this study was to compare the surgical outcome of bariatric surgery in patients age ≥65 (elderly group) compared with patients <65-years old (control group).

Methods

We performed a retrospective analysis of all bariatric surgeries performed in our private institution between the years 2013 and 2015, comparing the outcomes in patients aged <65 with the outcomes of patients aged ≥65. 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.

Thirty-nine experienced bariatric surgeons performed all surgical procedures. The surgical techniques included sleeve gastrectomy, gastric banding, gastric bypass, and biliopancreatic diversion, carried out laparoscopically.

Patient data were obtained from our medical records and divided according to the age group criteria. The follow-up included 3-, 6-, 9-, and 12-months follow-up using a telephonic programmed survey or records of visits to the outpatient clinic. The study exposes the analysis of operative complications, hospital stay, weight loss, co-morbidities, and their evolution compared between the 2 groups of patients.

Statistical analysis

Statistical analyses were performed using IBM SPSS statistic software, version 23 (Armonk, NY, USA). Continuous variables are presented as means ± standard deviation, and dichotomous/categoric variables are presented as proportions. The normality of the distribution of continuous variables was tested by the Kolmogorov-Smirnov test, and the χ^2 test was used to evaluate and examine proportions. $P < .05$ was considered as statistical significance. Relative risk calculation, according to Altman, 1991, was performed to evaluate the complications risk.

Results

Basic demographic parameters

The study population included 9044 patients that underwent bariatric surgery in a private medical center from January 2013 to August 2015.

Please cite this article as: Sergio Susmallian et al., Outcome of bariatric surgery in older patients, Surgery for Obesity and Related Diseases (2018), https://doi.org/10.1016/j.soard.2018.08.007

Table 1
Demographic characteristics

	AGE		
	Age <65	Age ≥65	*P* value
Patients	8593	451	
Mean age	42.92	67.92	<.001*
Mean BMI	42.54	40.32	.47
Male/female index	1:2.02	1:1.49	.002*
1st bariatric procedure	8043 (93.6%)	387 (86%	<.001*
Revisional procedure	550 (6.4%)	64 (14%)	<.001*
With co-morbidities	4764 (55.45%)	349 (77.60%)	<.001*
Without co-morbidities	3829 (44.55%)	102 (22.40%)	<.001*
Metabolic syndrome	4.67%	20.84	<.001*

*statistically significant differences.
BMI = body mass index.

Table 2
Co-morbidities in both groups

Disease	Age <65		Age ≥65		*P* value
	Number	Percent	Number	Percent	
Diabetes	2327	27.08	285	63	< .001**
Hypertension	2594	30.18	328	73	< .001**
Hyperlipidemia	2767	32.20	323	72	< .001**
Fatt liver	1363	15.86	91	20	0 .013**
Sleep apnea	320	3.72	37	8.20	< .001**
Osteoarthitis	1242	14.45	100	22.17	< .001**
Ischemic heart disease	182	2.11	73	16.18	< .001**
Urinary incontinence	7	.08	5	9.8	< .001**
Vitamin D deficiency	522	6.07	21	4.6%	.24
Gout	166	1.93	19	4.21	< .001**

**statistically significant differences.

Of patients, 6032 (66.7%) were female and 3012 (33.3%) were male. The mean body mass index (BMI) of the study population was 42.43 kg/m^2 ± 5.15.

The study population was divided into the following 2 groups according to age: patients age <65-years old (8593 patients, 95.01%, controls) and age ≥65 (451 patients, 4.99%). The mean age for the control group was 42.92 years (range, 15–64) and for the elderly group was 67.92 years (range, 65–84). The corresponding mean BMI was 42.54 (±5.12) and 40.32 kg/m^2 (±5.32), respectively ($P = .47$). Six patients with low BMI who did not meet the criteria for surgery were also considered; those cases underwent revisional surgery due to gastric banding slippage in 4 patients and band erosion in 2 patients. In the elderly group, we found a greater number of patients with co-morbidities, metabolic syndrome, and more need for revisional surgery. Data regarding the basic demographic parameters are presented in Table 1.

Bariatric procedure distribution

All 9044 procedures were performed laparoscopically, with no conversions to open surgery.

For the control group, procedure distribution was as follows: in 6675 cases sleeve gastrectomy (77.68%), in 1093 cases gastric banding 12.72%, in 797 cases gastric bypass (9.27%), and in 28 cases (.33%) duodenal switch or biliopancreatic diversion.

Among the elderly group the procedure distribution was in 318 cases (70.51%) sleeve gastrectomy, in 68 cases (15.08%) gastric bypass, in 63 cases (13.97%) gastric banding, and in 2 cases (.44%) duodenal switch or biliopancreatic diversion (Fig. 1).

For most patients in the study the procedure was their first bariatric procedure, 8043 (93.60%) in the younger group and 387 (85.80) in the older group ($P < .001$). In the elderly group, 64 (14.10%) patients underwent revisional bariatric surgery; whereas, in the control group, only 550 (6.4%) had revisional surgery ($P < .001$ between groups).

Most revisional surgeries were performed after gastric band; the distribution of previous surgery in the control group was: 74.9% after gastric banding, 4.5% after silastic ring vertical gastroplasty, 9.8% after gastric bypass, and 10.8% after sleeve gastrectomy; 25.5% in this group underwent ≥2 previous bariatric surgeries. In those cases, previous surgeries were converted to sleeve gastrectomy in 48.8%, gastric bypass in 19.3%, biliopancreatic diversion in 1.7%, and gastric band in 30.2%. The distribution of previous surgery in the older group was: 78.9 % after gastric band, 5.3% after silastic ring vertical gastroplasty, and 15.8% after gastric bypass; 26.3% underwent ≥2 previous bariatric surgeries. Most conversional surgery in older patients was gastric banding in 44.4%, biliopancreatic diversion in 11.1%, gastric bypass in 16.6%, and sleeve gastrectomy in 27.8%.

Co-morbidities

The elderly group, as expected, presented with a higher rate of co-morbidities, 77.60% versus 55.45% ($P = .0001$).

Further evaluation of the co-morbidities and the incidence of metabolic syndrome were measured by calculating the number of patients presenting central obesity, diabetes, hyperlipidemia, and hypertension. The results demonstrated higher incidence for metabolic syndrome among the older group than in the younger— 94 patients (20.84%) and 402 (4.67%), respectively ($P < .0001$). The following co-morbidities were significantly more common in the older group: diabetes, hypertension, hyperlipidemia, fatty liver, sleep apnea, osteoarthritis, ischemic heart disease, urinary incontinence, and gout, with the exception of vitamin D deficiency that was most prevalent in the control group. Table 2 presents data regarding the incidence of co-morbidities in the different age groups.

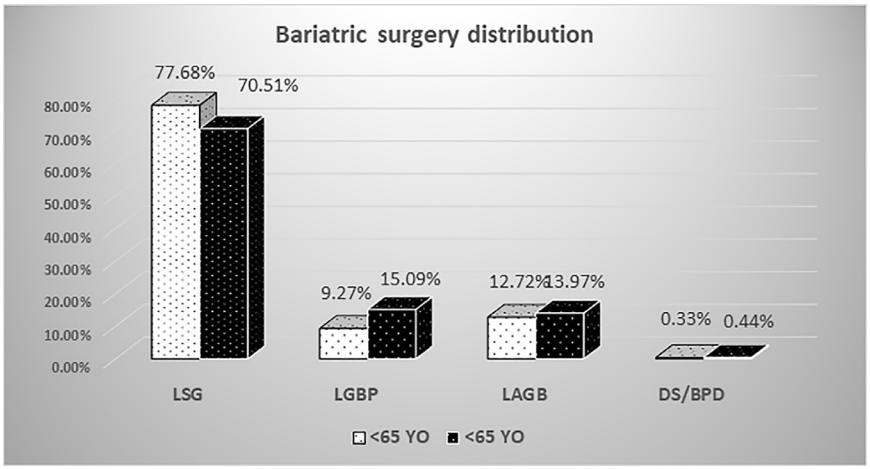

Fig. 1. Distribution of bariatric surgeries according to the surgery type in different age groups. Data are presented as percent of surgeries.

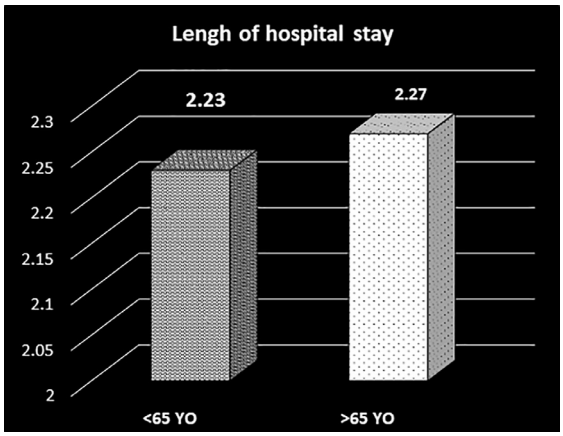

Fig. 2. The average of hospitalization days after surgery in the different age groups.

Length of hospital stay

Average hospital stay after surgery was similar between the 2 groups, 2.23 days in the younger group versus 2.27 days in the elderly group, respectively ($P = .88$; Fig. 2).

Complications

The number of complications that occurred during bariatric procedures was analyzed. A significantly increased rate of complications was observed among elderly patients. In the group <65 years, 438 patients (5.09%) experienced complications, and in the older group, 40 patients (8.86%) experienced complications ($P = .03$, Table 4).

When classifying the complications, we considered 3 different groups: need for reoperation, surgery-related complications treated conservatively (such as drains secreting blood or gastric content, drains introduced percutaneously, stenting or endoscopic clips application without the need for reoperation), co-morbidity-related complications (e.g., uncontrolled diabetes, diabetic ketoacidosis, hypertensive crisis, chronic lung disease exacerbation, acute gout attack, etc.), and readmissions (due to inability to drink, fever, surgical site infection, etc.). The rate of each type of complication was calculated as their percentage of the entire group size.

There was a significantly higher incidence of conservatively treated complications in elderly patients than in the control group (5.32% versus 2.4%, respectively; $P = .002$). No significant differences were found between groups in regard to co-morbidity-related complications ($P = .78$). There was 1 death perioperatively (.01%) in the control group due to massive bleeding, with no perioperative mortality in the older group. One patient in the control group died after 45 days (mortality .02% during the first year after surgery) due to myocardial infarction, with a large history of ischemic events; there were no mortality in the older group ($P < .001$)

In a Clavien-Dindo classification (severity grading system of surgical complications) of the complications performed, we demonstrated significant differences between the older group and the control in 2 classes of the classification (Table 5). In the scale IIIB there were more complications in the older group, 1.46% versus 0.36% ($P < .001$) and also in the scale IVA, 0.97% versus 0.19% ($P = .001$).

The number of revisions was significantly higher among the elderly patients group (67 cases, .77%, versus 6 cases, 1.33%, respectively; $P = .03$; Table 7). The reasons that motivated the need for reoperation are distributed in bleeding, uncontrolled leak, obstruction, foreign body (Gossypiboma), pancreatitis, and negative explorations; there were no significant statistical differences comparing these reasons in both groups (Table 7).

Please cite this article as: Sergio Susmallian et al., Outcome of bariatric surgery in older patients, Surgery for Obesity and Related Diseases (2018), https://doi.org/10.1016/j.soard.2018.08.007

Re-hospitalizations analysis revealed a nonsignificant difference toward higher incidence in the elderly group (1.35% versus 1.99%, respectively; $P = .08$).

Surgical complications in the control group occurred in 34 (6.18%) patients in revisional surgery, while in the group of older patients there were complications in 7 (10.93%), without significant difference ($P = .15$). In the control group, 8 patients required reoperation (7 due to leakage and 1 due to bleeding) while 26 were conservatively treated (21 due to leakage and 5 due to bleeding). In the elderly group, 2 patients required reoperation due to leakage and 5 were treated conservatively (4 due to leak and 1 due to bleeding).

We found a greater percentage of complications in revisional surgery than in primary surgery in both groups: in the control group 6.18% and 5.02%, respectively ($P = .232$) and in the elderly group 10.93% and 8.52%, respectively ($P = .530$). No deaths were recorded in revisional surgery patients of both groups. Comparing the results of primary surgery in the elderly group and control group, the difference is significant ($P = .002$), while comparing the results of revisional surgery in both groups, the difference is not statistically significant ($P = .147$).

The calculated probability of complication for control group is 5.2% and in >65 years is 8.9% with statistical significance ($P = .001$), as shown in Table 6. Furthermore, relative risk calculation resulted in an increased risk for complication among the elderly compared with the control group (relative risk = 1.77, 95% confidence interval = 1.2767–2.3714, $P = .0005$).

Weight loss

The weight loss in our patients has been completed in 99.98% (there were 2 fatalities), thanks to a service implemented by our hospital for up to 1 year of active follow-up collecting the weight measured by family physician office visits, a telephonic survey was completed in all patients, and outpatient clinic visits were completed in 28% of the patients.

The postoperative results of the bariatric surgery demonstrated that older patients had a lower percentage of excess weight loss; the older group lost 72.44% of excess weight versus 86.11% in the control group ($P < .05$; Fig. 3).

Co-morbidities improvement

The outcomes in terms of co-morbidities were classified after 1 year as "no-change" when the patient continues with the same medication and without changes in laboratory measurements, "improvement" in those cases of drug reduction and/or reduction of parameters of laboratory, and "remission" in those patients who do not receive medication and laboratory levels are normal.

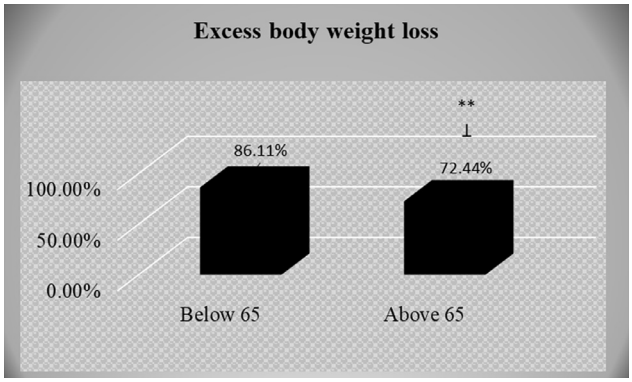

Fig. 3. Changes in excess weight loss between the 2 age groups. Young patients demonstrated a significantly higher reduction in their excess weight 1 year after surgery compared with older patients ($P < .05$).

Notably, in both groups, there were markedly high improvements in diseases with significant statistical differences in diabetes and hypertension; the elderly demonstrated better improvement or cure than the younger group. However, regarding hyperlipidemia, sleep apnea, ischemic heart disease, fatty liver, and gout there were no statistical significance despite the high percent of improvement or cure.

Diabetes, fatty liver, and sleep apnea have been improved or remitted in >90% of patients in both groups; hypertension and hyperlipidemia were improved by >80%, and hyperuricemia/gout and ischemic heart disease were improved or resolved in >70% of the patients, Table 3.

Discussion

Obesity has accelerated in the elderly population worldwide and is expected to continue rising. [20,21]. In Spain, the beginning of the 21st century was characterized in increased obesity both in the elderly and general population [22]. Obesity appears to lessen life expectancy markedly, especially among younger adults [23]. In 1992, Sjöström et al. [21] reported that total mortality ratio for severe obesity decreased from 55 years of age and is not detectable >80 years.

In our practice, in the last 10 years there was an increase in the number of patients ≥65 years asking for bariatric surgery, both in quantity and in patient's age. We believe that it is due to 2 main reasons, namely an increase in an otherwise healthy elderly population seeking improved life quality, and second the acceptance of bariatric surgery as a safe procedure with minimal side effects.

Obesity has been recognized to be associated with several disorders with ensuing morbidity and even increased mortality [24]. Health risks in elderly people cannot be evaluated simply in conventional terms of body fatness or fat distribution, skeletal muscle atrophy, or sarcopenia, is highly prevalent in the elderly population, increases with

Please cite this article as: Sergio Susmallian et al., Outcome of bariatric surgery in older patients, Surgery for Obesity and Related Diseases (2018), https://doi.org/10.1016/j.soard.2018.08.007

Table 3
Variation in co-morbidities after bariatric surgery in both groups

	Age <65						Age ≥65						
	NCH		IMP		REM		NCH		IMP		REM		*P* value
Disease	N	%	N	%	N	%	N	%	N	%	N	%	
Diabetes	203	8.72	875	37.61	1249	53.67	10	3.51	159	55.79	116	40.70	.003*
Hypertension	461	18.97	1090	42.02	1012	39.01	40	12.19	98	29.88	190	57.93	.005*
Hyperlipidemia	325	11.75	1694	61.22	748	27.03	51	15.79	177	54.80	95	29.41	.053
Sleep apnea	18	5.63	161	50.31	141	44.06	2	5.41	22	59.45	13	35.14	.957
Ischemic heart	47	25.82	83	45.61	52	28.57	15	20.55	45	61.64	13	17.81	.434
Fatty liver	23	1.70	495	36.32	845	62.0	4	4.40	40	43.95	47	51.65	.068
Gout	56	33.73	74	44.58	36	21.69	5	26.32	7	36.84	7	36.84	.579

*statistically significant differences.
NCH = no changes, IMP = improvement, REM = remission.

Table 4
Complications

	Age <65		Age ≥65		*P* value
	Number	Percent	Number	Percent	
Re-operation	67	.78	6	1.33	.61
Conservative treatment	207	2.40	24	5.32	.002*
Co-morbidities related complication	164	1.91	10	2.21	.78
Total	438	5.09	40	8.86	.03*

*statistically significant differences.

Table 5
Complication classified according to Clavien–Dindo System

Grade	Age <65		Age ≥65		*P* Value
	Number	Percent	Number	Percent	
I	204	2.37	15	3.65	.100
II	147	1.71	12	2.92	.069
III A	33	.38	2	.49	.725
III B	32	.36	6	1.46	<.001*
IV A	16	.19	4	.97	.001*
IV B	6	.07	1	.24	.227
V	1	.01	0	0	.99

*statistically significant differences.

Table 6
Probability of complications calculated

Probability of complications			
Outcome	Age <65	Age ≥65	*P* value
Negative	94.8%	91.10%	.001*
Positive	5.2%	8.9%	.001*

*statistically significant differences.

Table 7
Reoperation rates and causes

	Age <65		Age ≥65		*P* value
	N	%	N	%	
Reoperation	67		6		.03*
Bleeding	30	44.8	1	16.7	N/S
Leak	22	32.8	4	66.6	N/S
Obstruction	10	14.9	1	16.7	N/S
Foreign Body	1	1.5	0	0	N/S
Pancreatitis	1	1.5	0	0	N/S
Negative exploration	3	4.5	0	0	N/S

*statistically significant differences.
N/S: no statistically differences.

age and is strongly associated with disability, independent of morbidity [25]. In addition, serum leptin levels, affecting energy balance and increased appetite gradually declined during aging independent of BMI, as well as with the development of leptin resistance [26]. Another important common feature of obesity and aging is the development of resistance to certain hormones, such as insulin and leptin, which triggers metabolic dysregulations, such as type 2 diabetes, and failure to regulate food intake as well as fat distribution [27].

Several studies have explored the safety and efficacy of bariatric surgeries in elderly patients [28–31], whereas controversial findings are reported that indicate an increase in short-term mortality in the elderly after a bariatric surgery [32]. These studies evaluated the mortality, morbidity and effectiveness of bariatric surgeries in elderly patients. Flum et al. [32] found a perioperative mortality higher in >65-years old (4.8% versus 1.7%) and were 5-fold greater for older Medicare beneficiaries within 90 days postoperative in ≥75-years old. Sugerman et al. [28] reported a low mortality and morbidity rate in 80 cases of bariatric surgery in elderly. Varela et al. [29] concluded that morbidity and mortality is higher in the elderly, but bariatric surgery in the elderly is considered as safe as other gastrointestinal procedures because the observed mortality (.9%) is better than the expected (risk-adjusted) mortality. Although all these studies coincide with our results in the elderly being more ill and with a high-operative risk, bariatric surgery is considered safe both in the general population and in the elderly population as well. Our study presents the data and results of a large number of patients with a low-mortality rate, which confirms the safety of bariatric

surgery in patients with morbid obesity; the higher rate of complications in the older group can be influenced by a significant high percentage of revisional surgeries, >14% of the older patients with a complication rate of 10.93%, and by their health deterioration. Furthermore, the frailty of elderly patients was associated with postoperative complications, increased length of hospitalization, and mortality [33].

Mognol et al. [34] showed that complication rate is higher in revisional surgeries. Revisional surgery is an independent risk factor for the development of severe complications [35]. Compared with primary bariatric surgery, revisional bariatric surgery has a higher complication rate, ranging between 0% and 46.3% [36]. Our results demonstrate an increased number of complications in revisional surgery in both groups.

On the other hand, consideration of co-morbidities in older adults should be evaluated in comparison to prevalence of similar co-morbidities in the general population. Wolff et al. [37] have found that 82% of aged Medicare patients had at least 1 chronic disease and 65% had multiple diseases. The number of hospitalizations increased in accordance with the number of chronic diseases, with almost 100% higher incidence of hospitalization in elderly patients with >4 chronic diseases [37]. In the cohort study, the older group demonstrated a significant resolution or improvement of diabetes while the control group demonstrated a significant response of hypertension. Other co-morbidities showed excellent outcomes in relation to bariatric surgery without significant differences between both groups.

It is worth stating that there is a controversial debate regarding the success rate of bariatric surgery outcomes in elderly patients. Regarding the outcome of bariatric surgery in relation to weight loss, on the one hand, we find reports that elderly people lose little weight [28] and, on the other hand, that excess weight lost is comparable to young people [38,39]. In our study, despite losing less weight among older patients compared with younger patients, there were significant improvements regarding the co-morbidities, making this the key point of effective bariatric operation outcomes in the elderly.

Another controversial topic is the effect of bariatric surgeries on the mortality and life expectancy of elderly patients. Livingston et al. [39] reported that older patients had the same complication rate but a 3-fold higher mortality, suggesting that they lacked the ability to recover from complications when they occurred. Bariatric surgery in older adults should be considered when patients require improvement of quality of life and stabilization or improvement of their co-morbidities [40,41]. A study conducted by Maciejewski et al. [42] reported that, compared with conservative treatment, the mortality of elderly patients who underwent bariatric surgery was not significantly different during a mean 6.7 years of follow-up.

The effect of bariatric surgery on weight reduction leads to remission or improvement of associated diseases in a high percentage. These explain why bariatric surgery should be recommended to any patient that suffers from obesity and thus benefits from improved health status [43–45]. We disagree with Scozzari et al. [46] who affirm that advanced age represents a risk factor for complications and mortality, and given that bariatric surgery may not be as effective in older patients compared with younger patients, surgical indications in patients >50 years should be carefully considered. We accept that meticulous selection of older patient candidates for bariatric surgery can improve outcomes.

The risk of complications and mortality is increased by age as demonstrated by Polanczyk et al. [15] but the benefit of improving health status and quality of life justifies carrying out bariatric surgery [47]. This analysis is a large-scale study that might shed light on the complicated topic of bariatric surgeries in older patients. Bariatric surgery in selected patients aged ≥75 years would be safe and effective despite being higher risk [48]. Age alone should not be the limiting factor for selecting patients for bariatric surgery.

The limitation of our study is the low number of patients intervened at older ages either >70 or 80 years of age, which could help to elucidate more clearly what are the acceptable limits to carry out bariatric surgery in elderly.

We consider that the meticulous preparation of the patients before surgery and the importance of carrying out the operations by laparoscopic approach [49] help to achieve results as those shown in our study. However, another aspect to clarify is the limit to perform bariatric surgery because age does not play a preponderant role. Calculation of the expected remaining years of functional well-being using life-table techniques as proposed by Katz et al. [50] can be useful to determine who may undergo a bariatric surgery.

In our opinion, the international consensus on the age limit (18–65 yr) for performing bariatric surgery should be reviewed and revised, as previously suggested [13].

Therefore, based in the literature and our results, it is unfair to consider the age of 65 years as a limit to perform bariatric surgery considering that it prolongs years of life, improves health status, and above all improves the quality of life [51,52]. Although our study demonstrates an increased risk for complications in elderly, with no mortality, we consider that metabolic surgeries are safe and effective if we compare with other abdominal procedures, such as cholecystectomy, appendectomy, or cone resection [53].

Conclusions

Bariatric surgery in the elderly has more complications and no differences in mortality rate. Considering the posi-

Please cite this article as: Sergio Susmallian et al., Outcome of bariatric surgery in older patients, Surgery for Obesity and Related Diseases (2018), https://doi.org/10.1016/j.soard.2018.08.007

tive impact of bariatric surgery in the improvement of comorbidities and the probability of complications in both groups, bariatric surgery can be offered to patients aged ≥65, taking into account the meticulous preoperative selection, preparation, and avoiding preventable complications.

Disclosures

The authors have no commercial associations that might be a conflict of interest in relation to this article.

References

[1] Ageing and health [homepage on the Internet]. Geneva: World Health Organization; c2018 [updated 2018 Feb 5]. Available from: http://www.who.int/news-room/fact-sheets/detail/ageing-and-health.
[2] Denney-Wilson E, Baur LA. Adolescent obesity: making a difference to the epidemic. Int J Adolesc Med Health 2007;19(3):235–43.
[3] World Health Organization. Global estimates for health situation assessment and projections, 1990. No. WHO/HST/90.2. Unpublished. Geneva: World Health Organization, 1990.
[4] Haslam DW, James WPT. Obesity. Lancet 2005;366(9492):1197–209.
[5] James PT. Obesity: the worldwide epidemic. Clin Dermatol 2004;22(4):276–80.
[6] Ogden CL, Carroll MD, Curtin LR, et al. Prevalence of overweight and obesity in the United States, 1999-2004. JAMA 2006;295(13):1549–55.
[7] Hebert JR, Allison DB, Archer E, Lavie CJ, Blair SN. Scientific decision making, policy decisions, and the obesity pandemic. Mayo Clin Proc 2013;88(6):593–604.
[8] Story M, Kaphingst KM, French S. The role of schools in obesity prevention. Future Child 2006;16:109–42 10.
[9] Hill JO. Understanding and addressing the epidemic of obesity: an energy balance perspective. Endocr Rev 2006;27(7):750–61.
[10] Mun EC, Blackburn GL, Matthews JB. Current status of medical and surgical therapy for obesity. Gastroenterology 2001;120(3):669–81 10.
[11] Wadden TA, Butryn ML, Hong PS, Tsai AG. Behavioral treatment of obesity in patients encountered in primary care settings: a systematic review. JAMA 2014;312(17):1779–91.
[12] Atkinson RL. Current status of the field of obesity. Trends Endocr Metab 2014;25(6):283–4.
[13] NIH conference Gastrointestinal surgery for severe obesity. Consensus Development Conference Panel. Ann Intern Med 1991;115(12):956–61.
[14] Thomas DR, Ritchie CS. Preoperative assessment of older adults. J Am Geriatr Soc 1995;43(7):811–21.
[15] Polanczyk CA, Marcantonio E, Goldman L, et al. Impact of age on perioperative complications and length of stay in patients undergoing noncardiac surgery. Ann Intern Med 2001;134(8):637–43.
[16] Hazzan D, Chin EH, Steinhagen E, et al. Laparoscopic bariatric surgery can be safe for treatment of morbid obesity in patients older than 60 years. Surg Obes Relat Dis 2006;2(6):613–16.
[17] Pories WJ. Bariatric surgery: risks and rewards. J Clin Endocrinol Metab 2008;93(11 Suppl 1):S89–96.
[18] Salihu HM, Bonnema SM, Alio AP. Obesity: what is an elderly population growing into? Maturitas 2009;63(1):7–12.
[19] Partridge JSL, Harari D, Martin FC, Dhesi JK. The impact of pre–operative comprehensive geriatric assessment on postoperative outcomes in older patients undergoing scheduled surgery: a systematic review. Anaesthesia 2014;69(Suppl 1):8–16.
[20] Arterburn DE, Crane PK, Sullivan SD. The coming epidemic of obesity in elderly Americans. J Am Geriatr Soc 2004;52(11):1907–12.
[21] Sjostrom LV. Mortality of severely obese subjects. Am J Clin Nutr 1992;55(2 Suppl):516S–523S.
[22] Gutierrez-Fisac JL, Lopez E, Banegas JR, Graciani A, Rodriguez-Artalejo F. Prevalence of overweight and obesity in elderly people in Spain. Obes Res 2004;12(4):710–15.
[23] Fontaine KR, Redden DT, Wang C, Westfall AO, Allison DB. Years of life lost due to obesity. JAMA 2003;289(2):187–93.
[24] Pi-Sunyer FX. Medical hazards of obesity. Ann Intern Med 1993;119(7 Pt 2):655–60.
[25] Baumgartner RN. Body composition in healthy aging. Ann N Y Acad Sci 2000;904:437–48.
[26] Holden KF, Lindquist K, Tylavsky FA, Rosano C, Harris TB, Yaffe K. Serum leptin level and cognition in the elderly: findings from the Health ABC Study. Neurobiol Aging 2009;30(9):1483–9.
[27] Ma XH, Muzumdar R, Yang XM, Gabriely I, Berger R, Barzilai N. Aging is associated with resistance to effects of leptin on fat distribution and insulin action. J Gerontol A Biol Sci Med Sci 2002;57(6):B225–31.
[28] Sugerman HJ, DeMaria EJ, Kellum JM, Sugerman EL, Meador JG, Wolfe LG. Effects of bariatric surgery in older patients. Ann Surg 2004;240(2):243–7.
[29] Varela JE, Wilson SE, Nguyen NT. Outcomes of bariatric surgery in the elderly. Am Surg 2006;72(10):865–9.
[30] Gerber P, Anderin C, Szabo E, Näslund I, Thorell A. Impact of age on risk of complications after gastric bypass: a cohort study from the Scandinavian Obesity Surgery Registry (SOReg). Surg Obes Relat Dis 2018;14(4):437–42.
[31] Hassinger TE, Mehaffey JH, Johnston LE, Hawkins RB, Schirmer BD, Hallowell PT. Roux-en-Y gastric bypass is safe in elderly patients: a propensity-score matched analysis. Surg Obes Relat Dis. Epub 2018 Apr 17.
[32] Flum DR, Salem L, Elrod JA, Dellinger EP, Cheadle A, Chan L. Early mortality among Medicare beneficiaries undergoing bariatric surgical procedures. JAMA 2005;294(15):1903–8.
[33] Partridg JS, Harari D, Dhesi JK. Frailty in the older surgical patient: a review. Age Ageing 2012;41(2):142–7.
[34] Mognol P, Chosidow D, Marmuse JP. Laparoscopic conversion of laparoscopic gastric banding to Roux-en-Y gastric bypass: a review of 70 patients. Obes Surg 2004;14(10):1349–53.
[35] Coblijn UK, Lagarde SM, de Raaff CA, et al. Evaluation of the obesity surgery mortality risk score for the prediction of postoperative complications after primary and revisional laparoscopic Roux-en-Y gastric bypass. Surg Obes Relat Dis 2016;12(8):1504–12.
[36] Cheung D, Switzer NJ, Gill RS, Shi X, Karmali S. Revisional bariatric surgery following failed primary laparoscopic sleeve gastrectomy: a systematic review. Obes Surg 2014;24(10):1757–63.
[37] Wolff JL, Starfield B, Anderson G. Prevalence, expenditures, and complications of multiple chronic conditions in the elderly. Arch Intern Med 2002;162(20):2269–76.
[38] Dunkle-Blatter SE, Jean MR, Whitehead C, et al. Outcomes among elderly bariatric patients at a high-volume center. Surg Obes Relat Dis 2007;3(2):163–9.
[39] Pajecki D, Santo MA, Joaquim HD, Morita F, Riccioppo D, de Cleva R, et al. Bariatric surgery in the elderly: results of a mean follow-up of five years. Arq Bras Cir Dig 2015;28(Suppl 1):15–18.
[40] O'Keefe KL, Kemmeter PR, Kemmeter KD. Bariatric surgery outcomes in patients aged 65 years and older at an American Society for Metabolic and Bariatric Surgery Center of Excellence. Obes Surg 2010;20(9):1199–205.
[41] Gulliford MC, Charlton J, Booth HP, et al. Costs and outcomes of increasing access to bariatric surgery for obesity: cohort study and cost-effectiveness analysis using electronic health records. Health Services and Delivery Research 2016.

Please cite this article as: Sergio Susmallian et al., Outcome of bariatric surgery in older patients, Surgery for Obesity and Related Diseases (2018), https://doi.org/10.1016/j.soard.2018.08.007

[42] Maciejewski ML, Livingston EH, Smith VA, et al. Survival among high-risk patients after bariatric surgery. JAMA 2011;305(23):2419–26.
[43] Dhabuwala A, Cannan RJ, Stubbs RS. Improvement in co-morbidities following weight loss from gastric bypass surgery. Obes Surg 2000;10(5):428–35.
[44] Luppi CR, Balagué C, Targarona EM, et al. Laparoscopic sleeve gastrectomy in patients over 60 years: impact of age on weight loss and co-morbidity improvement. Surg Obes Relat Dis 2015;11(2):296–301.
[45] Aftab H, Risstad H, Søvik TT, et al. Five-year outcome after gastric bypass for morbid obesity in a Norwegian cohort. Surg Obes Relat Dis 2014;10(1):71–8.
[46] Scozzari G, Passera R, Benvenga R, Toppino M, Morino M. Age as a long-term prognostic factor in bariatric surgery. Ann Surg 2012;256(1):724–9.
[47] Frutos MD, Luján J, Hernández Q, Valero G, Parrilla P. Results of laparoscopic gastric bypass in patients ≥ 55 years old. Obes Surg 200;16(4):461–4.
[48] Nor Hanipah Z, Punchai S, Karas LA, et al. The outcome of bariatric surgery in patients aged 75 years and older. Obes Surg 2018;28(6):1498–503.
[49] Gonzalez R, Lin E, Mattar SG, Venkatesh KR. Gastric bypass for morbid obesity in patients 50 years or older: is laparoscopic technique safer? Am Surg 2003;69(7):547.
[50] Katz S, Branch LG, Branson MH, Papsidero JA, Beck JC, Greer DS. Active life expectancy. N Engl J Med 198;309(20):1218–24.
[51] Schauer DP, Arterburn DE, Livingston EH, et al. Impact of bariatric surgery on life expectancy in severely obese patients with diabetes: a decision analysis. Ann Surg 2015;261(5):914–19.
[52] Sjöström L, Narbro K, Sjöström CD, et al. Effects of bariatric surgery on mortality in Swedish obese subjects. N Engl J Med 2007;357(8):741–52.
[53] Weiss A, Anderson JE, Chang DC. Comparing the National Surgical Quality Improvement Program with the Nationwide Inpatient Sample Database. JAMA Surg 2015;150(8):815–16.

Please cite this article as: Sergio Susmallian et al., Outcome of bariatric surgery in older patients, Surgery for Obesity and Related Diseases (2018), https://doi.org/10.1016/j.soard.2018.08.007