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RESEARCH

Mortality and Hospital Stay After Bariatric Surgery in 2,167 Patients: Influence of the Surgeon Expertise

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Abstract
Background Postoperative mortality is a rare event after bariatric surgery. The main goal of this study was to calculate the 30-day mortality rate postbariatric "open" surgery and the length of hospital stay of patients assisted by a health maintenance organization in Brazil. We also investigate their association with sex, age, BMI, preexisting comorbidities, and volume of procedures performed by surgeons.
Methods A total of 2,167 patients who underwent RYGB between 01/2004 and 12/2007 were analyzed. The deaths and hospital stay were identified in the healthcare transactional database and the morbidity data in the preoperative medical audit records. Factors contributing to adverse outcomes were determined by multiple logistic regression analysis.
Results The overall mortality rate was 0.64%, with a decreasing trend over the years. The median hospital stay was 3.1 days. In the multivariate analysis, both mortality and longer hospital stay were positively and significantly associated with age>50 years, BMI>50 kg/m^2, and surgeon volume of less than 20 bariatric surgeries/year. Presence of hypertension also increased the risk of longer hospital stay. Multivariate analysis showed that the 30-day mortality was six times higher in patients operated by professionals who performed less surgeries/year and longer hospital stay, four times more frequent.
Conclusions The 30-day mortality post-RYGB is similar to the rates found in developed countries and much lower than the rates found for patients assisted by the public health system in Brazil. In addition to age and clinical factors, the results suggest that mortality and longer hospital stay are strong and inversely related to surgeon's experience.

Keywords Morbid obesity · Morbidity · Mortality · Private health insurance · Roux-en-Y gastric bypass · Hospital length stay · Surgeon's expertise · 30-Day cause of death

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Introduction

Obesity takes endemic characteristics in many parts of the world, and it is associated to countless comorbidities and to high mortality rates from all causes among men and women at all ages [1, 2]. The sustained weight loss reduces the comorbidities and presents very significant impact on the quality of life of the patients [3, 4].

In Brazil, the prevalence of obesity (BMI>30 kg/m^2) ranges from 4.7% among women aged 20–24 years to 21.8% among those aged 55–64 years. Among men, prevalence varied from 3.1% to 11.9%, respectively [5]. Morbid obesity (BMI> 40 kg/m^2) affects 0.64% of people with 20 or more years of age. Considering only the morbid obesity criteria, more than 600,000 Brazilians were eligible for bariatric surgery in 2003.

The conservative treatment for obesity, which includes diet, exercise, medication, and behavioral therapies, helps patients with mild or moderate obesity [6], but when it comes to morbid obesity, the clinical approach to treatment shows success rates lower than 10% [6, 7]. Bariatric surgery has emerged as an efficient alternative to achieve sustained reduction of body weight and improve associated comorbidities; its indication criteria were established since 1991 by the National Institute of Health [8]. Cohort studies with 11 years of follow-up showed a relative reduction in the risk of death by 29% for the operated patients. [2, 4, 9, 10].

Bariatric surgery is a complex intervention because it is performed in obese patients generally more susceptible to complications during and postsurgery. Pulmonary embolism, anastomotic leak, venous thromboembolism, wound infection, bleeding, incidental splenectomy, incisional and internal hernias, and early small-bowel obstruction are the main causes of morbid-mortality in the peri- or postoperative period [11].

Mortality rates up to 30 days for "open" surgeries, described in the international literature, are between 0.1% and 2.0% [12–30], reaching up to 4.8% in subgroups analysis[12].

In Brazil, bariatric surgery is covered by the Unified Health System (SUS). Besides the universal public system, around 40 million Brazilians have additional coverage from private healthcare insurance systems.

Between January 2001 and December 2007, the SUS performed 12,648 bariatric surgeries in the country. Although this is a significant number, it is well below the number achieved by the private healthcare system. For instance, in the same period, a health maintenance organization (HMO) from Belo Horizonte, fourth largest city in the country, performed 4,674 bariatric surgeries, a number 15 times bigger than the number done by the public system in the same city and period.

In Brazil, there are few studies that assessed the 30-day mortality rate after open bariatric surgery. In the available studies, all involving patients operated on by SUS, the rates range from 3.1% to 4.1% [31–33].

Table 1 shows the mortality rates found in Brazilian and other international studies and the prevalence of some common comorbidities.

The objectives of the present study are to estimate the 30-day mortality associated with open bariatric surgery and the length of hospital stay and to investigate the association of these outcomes to individual characteristics, surgeon's experience, and presurgery morbidity in patients covered by private healthcare insurance.

Methods

The study included all the patients who underwent bariatric surgery between January 2004 and December 2007, covered by the largest HMO in the Brazilian city of Belo Horizonte.

The authorization criteria for the surgery were BMI≥ 40 kg/m^2 or BMI≥35 kg/m^2 associated to significant comorbidities, age between 18 and 65 years old, failure of the conservative treatment, and ability to understand and accept surgical treatment and necessary recommendations for postsurgery follow-up. Information on patients who did not fulfill all these criteria was reviewed by a board of surgeons who discussed the risks and benefits of the intervention.

All applicants for the surgery underwent an audit held by a physician from the HMO, written on a form containing identification, anamnesis and summary clinical examination (with weight and height), assessment of laboratory tests, imaging, digestive endoscopy, polysomnography when necessary, and reports from the patient's physician stating any comorbidity.

The surgery was not authorized for patients having endocrine diseases causing obesity, addiction to alcohol, addiction to other drugs and patients showing serious psychiatric disorders. The surgical technique authorized was open Roux-en-Y gastric bypass exclusively [34].

Death and hospital stay were identified and confirmed in the database of the HMO. Mortality rate was calculated as the number of deaths in the period, divided by the number of individuals included in the study.

As hospital stay does not present normal distribution, the median was used for the analysis of the usage over the years and the 95th percentile as the cutoff point to categorize the variable—above and below the 95th percentile.

The predictive variables were BMI, comorbidities (hypertension, diabetes, arthropathy, and sleep apnea), sex, age, and volume of bariatric surgeries/year performed by the surgeon. Age was tested as both continuous and categorical variable (<50 or ≥50 years old). BMI was used as a continuous variable and afterward categorized as <50 and ≥50 kg/m^2. The surgeons and the hospitals were performed per year, more or less than 20 bariatric surgeries.

Initially, a descriptive analysis and Chi-square tests or Fisher's exact were used to verify the significance of the associations involving categorical variables. Independent variables that were clinically significant and which had a significant relationship with the outcomes (considering $p<0.20$) in the univariate analysis were entered in a model using multiple logistic regression model. Stepwise procedure was adopted to identify the variables significantly associated with the risk of death and of longer hospital stay, using a significance level of 0.05.

Data were entered into Epinfo™ 6.04 and analyzed by the statistical program Stata™ version 9.2. The research project has been approved by the private healthcare organization and by the Research Ethics Committee of the Federal University of Minas Gerais (COEP UFMG 412/07).

Results

A total of 2,167 patients were included in the study, of which 79.9% (1,731) were female. At the time of surgery, the ages ranged from 16 to 70 years, with mean age of 36.5 years (standard deviation of 10.7 years) and median age equals to 34.5 years. Four patients were under 18 years of age, and 11 were above 65 years.

Table 1 Profile of the patients, comorbidities, and mortality rates in published studies in several countries

Author country	Type of population involved, period of data acquisition	Samples	Mortality rate (%)	Mean age (DP) years	Mean BMI (DP) kg/m^2	% superobese	% hyper tense	% diabetic	% sleep apnea
International studies—mortality rate lower than 1.5%									
Christou [9], Montreal, Canada	Retrospective cohort, single center, from 1986 to 2002	1.035	0.4 (intra-hospital)	45.1 (11.6)	50 (8.2)	44			
Zingmond [18], California, USA	Retrospective cohort. Population database. 1995 to 2004	60.092	General 0.33 Medicare 0 Others 0	42.2 (10.4)					
Jones [21], Orlando, USA	Multicentric retrospective series, 2005	25.759	0.25						
Ricciardi [22], USA	Retrospective series, population database, from 2001 to 2002	Only conventional surgery 22,558	0.81 (intra-hospital)	41.5 (11.3)					
Christou [19], Montreal, Canada	Retrospective series with a 10-years follow-up, single center	272	0.36	42 (3.4)	48.1 (1.0)	36.8			
Hutter [23], California, USA	Multicentric prospective cohort, from 2000 to 2003	Only open surgery 955	0.6	43.1	50.5		45	25	
Nguyen [24], American Academy Centers, USA	Multicentric retrospective cohort, only of academic centers, Oct 2003 to Mar 2004	1,144	0.2 (intra-hospital) 0.4 (30 days)	43 (10)	49 (7)		58.7	30.8	31.9
Flancbaum [25]	Retrospective series, single center, single surgeon	1.000	1.2						
Morino [13], Italy	Retrospective cohort. Population database. 1996 to 2006	Only gastric bypass 1.106	0.54 (in 60 days)	41 (12)	48 (6)		39.9	15.7	
Mason [15], USA	Retrospective cohort, population database, from 1986 to 2004	Only gastric bypass <150 cm 18,064	0.22						
Nguyen [26], American Academy Centers, USA	Retrospective cohort, only in academic centers, from 2004 to 2006	Only open surgery 6,065	0.3 (intra-hospital)				57.7	35.0	
Peeters [10], Melbourne, Australia	Case series from 1992 to 1994 with follow-up until 2005, only adjustable gastric band	966	0	47.1 (10.9)	44.9 (9.3)				
Adams [2], Utah, USA	Retrospective cohort, single center, from 1984 to 2002	7.925	0.53 (in the first year)	39.5 (10.5)	45.3 (7.4)				
Sjöström [4], Swedish Obesity Subject Study SOS, Sweden	Cohort population, with 10.9 years of follow-up	Only the surgery group 2,010	0.25 (In 90 days)	47.2 (5.9)	42.4 (4.5)			10.7	25.1
Buchwald [14]	Data meta-analysis published between 1990 and 2006	General 85,048 Superobese 1,808	General 0.28 Superobese 1.25	General 40	General 47.4		General 40.8	General 20.9	General 23.0
Weller [27], USA	Retrospective series. Cross-sectional study population database, 2005	Only conventional surgery 4,883	0.26 (intra-hospital)	42.6			50.5	27.6	
International studies with mortality up to 30 days higher than 1.5%									
MacDonald [28]	Retrospective series of cases, single center, only non-insulin-dependent diabetics, from 1979 to 1994	154	2.6	41.9	50.6		80.5	100	
Flum [16], Washington, USA	Retrospective cohort, population database, from 1987 to 2001	3.328	1.9	43.1 (10.1)				13.1	
Fernandez [29], Virginia, USA	Retrospective series, single center, from 1992 to 2003	Only open surgery. General 1,431	General 1.9	General 40.7 (10.4)	General 53	General 61.8	General 51.3	General 19.5	General 33
		Superobese 884	Superobese 2.9	Superobese 40.4 (10.6)	Superobese 57.8 (9.7)	Superobese 100	Superobese 55.8	Superobese 22.0	Superobese 41.9
Flum [12]	Retrospective cohort, patients covered by Medicare, from 1997 to 2002	16.155	Overall 2.0 >65 years, 4.8 Male 3.7	47.7 (11.3)					

Table 1 (continued)

Author country	Type of population involved, period of data acquisition	Samples	Mortality rate (%)	Mean age (DP) years	Mean BMI (DP) kg/m^2	% superobese	% hyper tense	% diabetic	% sleep apnea
Livingston [30], USA	Retrospective cohort, population database, from 2001 to 2002	25.428	>65 years, 3.2 <65 years c/ Medicare: 0.7 <65 years s/ Medicare, 0.2	41					
Brazilian studies									
Souto [31], Porto Alegre	Case series, single center, only superobese, from 1987 to 2001	49	4.1	42.5 (8.7)	52.8 (10.3)	100	46.9	22.4	
Pajecki [32], São Paulo, Brazil	Case series, single center, from 1995 to 1999	75	3.1		56.7 (10.6)		68	22.6	42.5
Diniz [33], Minas Gerais, Brazil	Case series, single center, from 1998 to 2005	193	4.1	(Mean) 37	52.7 (8.1)	60.6	63.2	23.8	

BMI ranged from 34 to 70 kg/m^2 and the median was 42 kg/m^2. Two patients had BMI of 34 and 35 kg/m^2. Nearly 16% of patients (340) had BMI between 35 and 39 kg/m^2, and 11.3% (244) patients were superobese (BMI≥50 kg/m^2). The surgeries were performed in 16 different hospitals. Five of these hospitals concentrated 83% (1,799) of the interventions. The procedures were performed by 48 surgeons, seven of them concentrated 69% (1,498) of the interventions, and they were the only ones who performed more than 20 surgeries per year.

In 2004, six deaths occurred (1.09%), four in 2005 (0.75%), two in 2006 (0.36%), and two in 2007 (0.38%). The main complications reported were five cases of pulmonary embolism (38.5%) and nine cases of acute abdomen, anastomotic leak, and sepsis (69.2%), with some patients presenting more than one of these complications. There was no information on the type of complication associated with death for two patients.

From 2004 to 2007, the mean length of hospital stay was 4.1 days (SD, 18.7 days) and the median was 3.1 days. All the 14 deaths occurred during hospitalization.

The median and mean length of hospital stays were 3.1 and 5.5 days in 2004, 3.2 and 4.1 days in 2005, 3.1 and 3.6 days in 2006, and 3.0 and 3.6 days in 2007. Six percent (129 patients) stayed above 5 days, the 95th percentile, including the 14 patients who died up to 30th day.

Table 2 compares the characteristics, comorbidities and hospital stay days between survival patients and those who died within 30 days postbariatric surgery. The overall 30-day mortality rate for the cohort was 0.64% (14 deaths). Mortality in the subgroup operated on by surgeons with a volume of more than 20 procedures/year was 0.27%, and in patients operated by surgeons doing less than 20 surgeries/year, the death rate was 1.49% ($p<0.001$). The risk of death associated with lower experience is 5.7 (CI 95% 1.8 to 18.1).

In the multivariate analysis, the initial model included BMI≥50 kg/m^2, age≥50 years old, presence of diabetes, hypertension, number of surgeries done by the surgeon (≥20 or <20 bariatric surgeries/year), and hospital stay with less than 20 bariatric surgeries/year. The variables age, BMI, and surgeon's volume remained statistically associated with mortality (Table 3). The risk of 30-day death is 15.7 times higher in patients will all these characteristics: ≥50 years old, superobese, and operated by a surgeon that performs less than 20 bariatric surgeries/year patients.

In total, 129 (6%) individuals had a hospital stay longer than 5 days. In the univariate analysis, except for sex, arthropathy, and sleep apnea, all the other variables included in the analysis were statistically associated to longer time of hospitalization.

Table 4 presents the variables associated to length of hospital stay above the 95th percentile (equal to 5 days) in the uni- and multivariate analysis. Older age, presence of

Table 2 Characteristics of patients who underwent bariatric surgery from January 2004 to December 2007, according to the outcome of 30-day death after bariatric surgery

	30-day death after bariatric surgery				
	Yes (*n*)	No (*n*)	Total	OR (CI 95%)	*p* value
N (%)	14 (0.6)		2,167 (100)		
BMI (kg/m^2), mean (median)	47.8 (47.0)	43.4 (42.0)		1.75 a 7.01	0.001
Age (years), mean (median)	45.7 (48.2)	36.5 (34.5)		3.61 a 14.88	0.001[a]
Hospital stay (days), mean (median)	13.8 (13)	4.1 (3.1)		5.92 a 13.46	0.000[a]
BMI≥50 kg/m^2	5	239	244 (11.3)	4.36 (1.45 a 13.13)	0.016[a]
Age≥50 years	6	287	293 (13.5)	4.86 (1.68 a 14.12)	0.007[a]
Male	4	432	436 (20.1)	0.63 (0.20 a 2.01)	0.500[a]
Hypertension	10	806	816 (37.7)	3.87 (1.21 a 12.38)	0.014
Diabetes	5	249	254 (11.7)	4.02 (1.34 a 12.10)	0.021[a]
Arthropathy	3	361	364 (16.8)	1.28 (0.36 a 4.61)	0.723 [a]
Sleep apnea	0	108	108 (5.0)	–	–
Others	1	55	56 (2.6)	2.79 (0.36 a 21.72)	0.320[a]
Surgeons with volume less than 20 bariatric surgeries per year	10	659	669 (30.9)	5.67 (1.77 a 18.14)	0.002[a]
Hospital with volume less than 20 bariatric surgeries per year	7	361	368 (17.0)	4.96 (1.73 a 14.24)	0.004[a]

OR Odds Ratio and *CI (95%)* Confidence Interval (95%)

[a] Fisher's exact test

hypertension, superobesity, and being operated by a surgeon with a record of less than 20 bariatric surgeries/year remained statistically associated with longer hospital stay. Longer hospital stay was 11 times more likely in patients presenting all those characteristics.

Discussion

Death shortly after bariatric surgery is not frequent, and its assessment requires large series of patients. Most studies conducted abroad show an overall 30-day mortality rate between 0.1% and 2%. In controlled trials, the 30-day mortality rate for the Roux-en-Y gastric bypass was 1.0% (CI 95% 0.5% to 1.9%) and 0.3% (CI 95% 0.2% to 0.4%) for case series data [20]. The rate found in the current study is closer to the international standards than to the Brazilians ones, which show rates much higher, ranging from 3.1% to 4.1% [31–33].

A difference in access to this procedure is an important aspect to explain mortality rates higher than 1.5%. Longer waiting times explain, for instance, why in the cohorts of Brazilians covered by SUS the operated patients have much higher BMIs and greater prevalence of comorbidities [31–33]. According to Zilberstein [35], the average waiting time for the bariatric surgery at the SUS was 2.9 years, with a mortality rate, while waiting, of 0.6%. For the present cohort, bariatric surgery was approved for all patients who fulfilled the clinical criteria and who did not have contractual restrictions to surgery. In other words, the waiting time between prescription and surgery was very short. This difference in access explains, in part, the lower BMI and better comorbidity profiles of patients in this cohort as compared with those operated on in the public system.

The complications that preceded the deaths were, from a qualitative point of view, those described in the literature. We identified higher frequency of anastomosis leak than did Morino's [13] and Mason's [15] studies, who reported pulmonary thromboembolism as the main cause of death. However, Golfeder in 2006 [36], analyzing data from necropsies of 97 patients who underwent bariatric surgery, showed that the most common cause of death up to 30 days was anastomosis leak in 36% of the cases, followed by pulmonary thromboembolism (12%), which is consistent with the findings of the present study.

Table 3 Multivariate logistic regression for outcome of 30-day death after bariatric surgery

Variable	Odds ratio	CI 95%	*p* value
BMI≥50 kg/m^2	5,038	1.63 a 15.57	0.005
Age≥50 years	4,495	1.53 a 13.22	0.006
Surgeons with volume less than 20 bariatric surgeries per year	6,211	1.90 a 20.26	0.002
Constant	0.001		<0.001

CI (95%) Confidence Interval (95%)

Table 4 Uni- and multivariate analysis for length of hospital stay as a categorical variable (above and below the 95th percentile of stay—5 days)

Variable	Odds ratio	CI 95%	*p* value
Univariate analysis			
Sex	0.81	0.53 a 1.24	0.338
Age≥50 years	3.43	2.32 a 5.08	<0.001
BMI≥50 kg/m^2	2.56	1.65 a 3.98	<0.001
Hypertension	3.38	2.30 a 4.96	<0.001
Diabetes	2.68	1.74 a 4.07	<0.001
Sleep apnea	1.27	0.60 a 2.67	0.530
Arthropathy	0.93	0.57 a 1.51	0.768
Hospital with volume less than 20 bariatric surgeries per year	3.08	2.11 a 4.49	<0.001
Surgeons with volume less than 20 bariatric surgeries per year	3.51	2.44 a 5.04	<0.001
Multivariate logistic analysis			
Age≥50 years	2.46	1.60 a 3.78	<0.001
Hypertension	2.75	1.80 a 4.20	<0.001
BMI≥50 kg/m^2	2.27	1.41 a 3.66	<0.001
Surgeons with records of less than 20 bariatric surgeries per year	3.76	2.54 a 5.56	<0.001

CI (95%) Confidence Interval (95%)

The final logistic regression model for 30-day death shows that age≥50 years, BMI≥50 kg/m^2, and being operated by a surgeon that performs less than 20 bariatric surgeries/year were the only variables, which increased the risk of death at the 0.05 significance level. The cutoff point used for age was 50 years because in Brazil, the surgery is not recommended for patients over 65 years [37].

Despite the difference in the cutoff points, several studies show higher mortality among older patients. Livingston et al. [30], while analyzing patients covered by the American Medicare, found a 30-day mortality postsurgery of 3.2% among those over 65 years old. Flum et al. [12], in a cohort of patients covered by the American Medicare, also found an overall mortality rate of 2.0%, but this rate increased to 4.8% in patients over 65 years old. Older age was more important than the comorbidities present before the surgery.

Our results are consistent with the studies that show higher mortality among superobese (BMI≥50 kg/m^2) [29, 31–33]. This factor seems to explain, in part, the high mortality rate found in Brazilian studies in patients covered by SUS, which have a much higher prevalence of superobesity than in the one seen in our sample [31–33].

Lower mortality rates are reported in studies in which the surgeons had lifetime records of more than 50 and preferably more than 100 surgeries. There is an inverse relationship between surgeon's experience and morbidity or mortality due to surgery complications [2, 38]. Courcoulas et al. [39] in Pennsylvania found a mortality of 5% among surgeons performing fewer than 10 procedures per year, compared to a 0.3% mortality rate for those surgeons with greater volume of surgeries, with a *p* value of 0.06. Adverse events were also less frequent for the second group of surgeons. In the present cohort, we found a highly statistically significant difference in the risk of death among patients operated on by surgeons who had performed more than 20 surgeries/year (0.27%) and those operated by surgeons with lower surgery volume (1.49%). This finding suggests that surgeon's experience is a very relevant factor to explain mortality postbariatric surgery in Brazil. However, the number of surgeries per year for each doctor refers only to those performed under the private healthcare insurance from where this cohort originates. Because this is, by far, the largest private healthcare insurance in the city, even if not exact, the volumes of surgeries are likely to approximate the real ones, and the classification of surgeons into one of the two categories used in the analysis is correct. An interesting finding in the present cohort that supports the importance of surgeons' accumulated experience is the observation, although not statistically significant, of a decreasing trend in deaths rates over the years.

Regarding the influence of comorbidities, hypertension and diabetes were statistically associated with the risk of death in the univariate analysis, but did not remain significant in the final model. This result agrees with those seen in other studies. Fernandez [29] et al., analyzing mortality in bariatric surgery through laparotomy, found a death rate of 1.9% up to 30 days postsurgery in a cohort made of 61.8% superobese, 51.3% hypertensive, and 19.5% diabetic patients. The only risk factor related to early mortality was higher weight. Also, Morino [13] found that hypertension and diabetes was not significantly associated to a higher postsurgery mortality.

A possible limitation that explains our findings might be the fact that hypertension was treated as a dichotomous variable, not categorized by severity. Thus, patients with slightly modified pressure were in the same group of severely hypertensive patients, and this may have diluted the higher risk of death of the latter patients. Similarly, diabetes was categorized only as present or absent, regardless of disease

duration and kind of therapy used, factors that certainly influence the risk of death and postsurgery complications.

A disagreement with many previous studies is the lack of association between 30-day mortality and male gender [12, 14–16, 19]. However, Livingston [40] identified that men had higher risk for morbidity during surgery, but not for mortality. In retrospect, Flum [16] showed that the difference in mortality between the sexes is lower among younger patients, and this is a possible explanation for the lack of association with sex found in our study. The median age of male patients was 33.7 years, which is thus very young, and among women, the median age was 36.7 years. Moreover, the number of deaths among these patients was very small (n=4), limiting the power of the study to identify small differences as statistically significant.

Studies that evaluated hospital stay for Roux-en-Y gastric bypass show that hospital stays tend to fall over the years. Santry [17] showed a decrease in hospital stay from 4.5 days in 1998 to 3.3 days in 2002. In the studied cohort, there was no statistically significant variation for hospital stay over the evaluated years.

The mean length of stay in studies performed after the turn of the millennium varies from 3.4 to 4.8 days [21–24, 26, 27, 30]. In this study, the mean hospital stay was 4.1 days, which is thus in the same range, but for the purpose of defining subgroups, we used the median (equal to 3.1 days), in order to exclude the influence of outliers. Considering this median, the analysis of the patients who remained hospitalized above the 95th percentile (5 days) showed that there was an increased risk for a longer stay in patients ≥50 years old, BMI≥50 kg/m^2, hypertensives, and who had been operated on by less experienced surgeons.

As the hospital stay decreases, many postsurgery complications begin to appear after discharge. Mason [15] reported that half of the deaths in his cohort occurred after hospital discharge. Serious complications from bariatric surgery have a little “time to be treated”. Pulmonary embolism and gastrointestinal leak can rapidly cause death in 2 to 6 days. Therefore, at the time of discharge, patients and relatives must be instructed to immediately return to hospital if warning signs such as fever or persistent tachycardia are noticed.

Based on published literature on this subject, to our best knowledge, this is the first cohort study of postbariatric surgery mortality outside the public health system in Brazil. The observed mortality is much below than that found in most Brazilian studies, and it has been dropping over the years as the experience of the surgeons increase. However, it is still higher than the ones found in major international cohorts. Our study evaluated the 30-day mortality after surgery, which does not reflect the total risk of death associated with this procedure. Analysis of autopsies of patients who underwent bariatric surgery shows that 40% of the postsurgery deaths occur after 30 days [35].

The long follow-up of cohorts of morbidly obese patients exposed and not exposed to bariatric surgery show clear differences in survival in favor of those who underwent surgery [2, 4, 19]. Considering that older age, higher BMI, and experience of the surgeon are all related to risk of death postsurgery, it is important to evaluate carefully whether to indicate the operation to older patients and patients with higher BMI or to insist with conservative attempts to approach the problem.

Up to now, the very-long-term results of bariatric surgery have not been evaluated. The improvement in survival for patients who underwent the surgery is established in the literature, but little can be said about the restrictive and disabortive effects, especially for young people who undergo the procedure, with life expectancies of many decades with nutritional limitations. Younger patients and those with lower body mass index are not the only ones that get better results from surgery but also those who will survive longer with restrictions imposed by the surgery. It ought to be at least an ethical obligation to advise the patients against the known risks in order to give them subsidies for their decision regarding the surgery.

Conclusion

Bariatric surgery, in general, is relatively safe and has very favorable impacts. However, it is worth noting the fact that morbidly obese patients who desires to undergo the surgery are predominantly young, at working ages, without other limitations than the excessive weight, and highly motivated to improve their health. They are patients with no imminent risk of death. For these reasons, bariatric surgery, more than other surgeries which deal with risk afflictions in a short term, must evolve to the minimum possible risk. The risk of death of patients operated on in the private healthcare insurance, though much lower than the risk of patients operated on in the public health system of Brazil, must be further reduced, as excellence is a dynamic goal only accomplished when deaths from surgery are no longer reported.

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Conflict of interest The authors have nothing to disclose regarding any commercial interest in the subject of study.

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