SURGERY FOR OBESITY AND RELATED DISEASES

Surgery for Obesity and Related Diseases 3 (2007) 73–77

Original article

Natural history of morbid obesity without surgical intervention

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Received May 16, 2006; revised September 30, 2006; accepted October 29, 2006

Abstract

Background: To study the mortality among morbidly obese patients qualifying for bariatric surgery. Mortality from bariatric surgery for morbid obesity has been widely reported; however, little is known about the mortality in morbidly obese patients who defer surgery.

Methods: Consecutive patients evaluated for bariatric surgery with an initial encounter between 1997 and 2004 were identified. The Social Security Death Index and office records were used to identify mortality through 2006. We conducted telephone interviews to determine whether the 305 patients who did not undergo bariatric surgery at our institution had undergone the surgery elsewhere. Using Cox proportional hazards models, we compared the mortality in patients undergoing surgery with that of those who did not. To evaluate bias resulting from missing data, we conducted analyses assuming that all patients with missing data had (1) undergone surgery and (2) not undergone surgery.

Results: A total of 908 patients underwent bariatric surgery (880 patients at our institution and 28 patients elsewhere). A total of 112 patients did not undergo surgery. Data regarding surgery on 165 patients could not be obtained. The mortality in those patients who did not undergo surgery was 14.3% compared with 2.9% for those who did undergo surgery. Adjusting for age, gender, and body mass index, patients who had undergone surgery had an 82% reduction in mortality (hazard ratio 0.18, 95% confidence interval 0.09–0.35, $P < .0001$). Sensitivity analysis, assuming that all patients with missing data received surgery resulted in an 85% mortality reduction ($P < .001$) and assuming that patients did not receive surgery resulted in a 50% mortality reduction ($P = .04$).

Conclusions: Mortality among morbidly obese patients without surgery was 14.3% during the study period. Surgical intervention offered a 50%–85% mortality reduction benefit. (Surg Obes Relat Dis 2007;3:73–77.)

Keywords: Morbid obesity; Mortality; Surgery

Morbid obesity is a significant and rapidly growing problem in the United States. According to the Centers for Disease Control and Prevention, in 1991, no state had an obesity (body mass index [BMI] >30 kg/m^2) prevalence rate of $\geq$20%. By 2004, 33 states had an obesity prevalence rate of 20–24%; and 9 states had a rate of $>$25% [1]. Arterburn et al. [2] showed that, in 2000, the U.S. healthcare expenditures for morbidly obese adults were 81% greater than those for normal weight adults and that the healthcare expenditures associated with excess body weight among these patients were >$11 billion. The comorbidities associated with morbid obesity such as diabetes, hypertension, sleep apnea, and heart disease have been widely documented [3,4].

Bariatric surgery has proved to be the most reliable method of obtaining and sustaining significant weight loss among morbidly obese individuals. Nguyen et al. [5]

Presented at the 23rd Annual Meeting of the American Society for Bariatric Surgery, June 26, 2006, San Francisco, CA.

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1550-7289/07/$ – see front matter
doi:10.1016/j.soard.2006.10.017

showed that 6 months after gastric bypass surgery, the Medical Outcomes Study Short Form 36-item Health Survey quality-of-life scores on all patients had improved and were comparable with U.S. norms [5]. The reduction in comorbidities as a result of bariatric surgery has also been well documented [4,6]. Bariatric surgery carries risks in terms morbidity and mortality [7–9]. Few studies have considered the effect of morbid obesity itself on mortality [10–12]. We studied the mortality among a cohort of morbidly obese patients who did not undergo bariatric surgery after having met the National Institutes of Health criteria.

Methods

We reviewed the master bariatric database of consecutive patients seen for initial office visits at the Hospital of Saint Raphael from January 1997 to December 2004. We identified the patients who met the 1991 National Institutes of Health consensus guidelines for bariatric surgery (BMI ≥40 kg/m^2 or BMI >35 kg/m^2 with comorbidity) and underwent surgery and a cohort of patients who also met the criteria but did not undergo surgery. Information on patient age, weight, height, and BMI at the initial visit was obtained from the database. Patients presenting for revision of previous bariatric surgery and those disqualified after psychiatric evaluation were excluded from the study.

The operations were performed by 5 surgeons at our institution. The procedure was Roux-en-Y gastric bypass, except in 7 cases where the adjustable gastric band was placed by one surgeon. A single, experienced surgeon performed 76% of the cases using an open approach.

Identification of outcome (mortality) events

Using the on-line Social Security Death Index (http://ssdi.rootsweb.com) and office records, we identified all deaths that occurred in the study population from the initial office visit to March 27, 2006.

Table 1
Characteristics of study population

Variable	No surgery (n = 112)	Surgery (n = 908)	*P* value
Gender (% female)	70.5	73.46	NS
Age (yr)			<.0001
<35	12.5	26.7	
36–45	27.7	29.1	
46–55	34.8	31.4	
56–65	17.9	12.1	
>65	7.1	.7	
Mean	47.9 ± 12.1	43.2 ± 10.3	
BMI (kg/m^2)			.007
35–40	7.1	2.1	
41–50	45.5	35.2	
51–60	32.2	37.6	
>60	15.2	25.1	
Mean	51	54	
Mean follow-up (d)	1334	1624	.0003

BMI = body mass index.

Table 2
Mortality by gender, age, and BMI category

Variable	No surgery		Surgery		*P* value
	Mortality rate (%)	Patients at risk (n)	Mortality rate (%)	Patients at risk (n)	
Age (yr)					
<35	14.3	14	2.5	243	.0039
36–45	9.7	31	3.8	264	.0382
46–55	10.3	39	1.4	285	.0004
56–65	15	20	5.4	110	.1005
>65	50	8	.0	6	.1122
BMI (kg/m^2)					
35–40	.0	8	6.1	33	.48
41–50	9.8	51	1.4	361	<.0001
51–60	13.9	36	2.2	319	<.0001
>60	35.3	17	6.2	195	<.0001
<60	10.5	95	2.0	713	<.0001

BMI = body mass index.

Identification of surgery performed elsewhere and follow-up of comorbidity

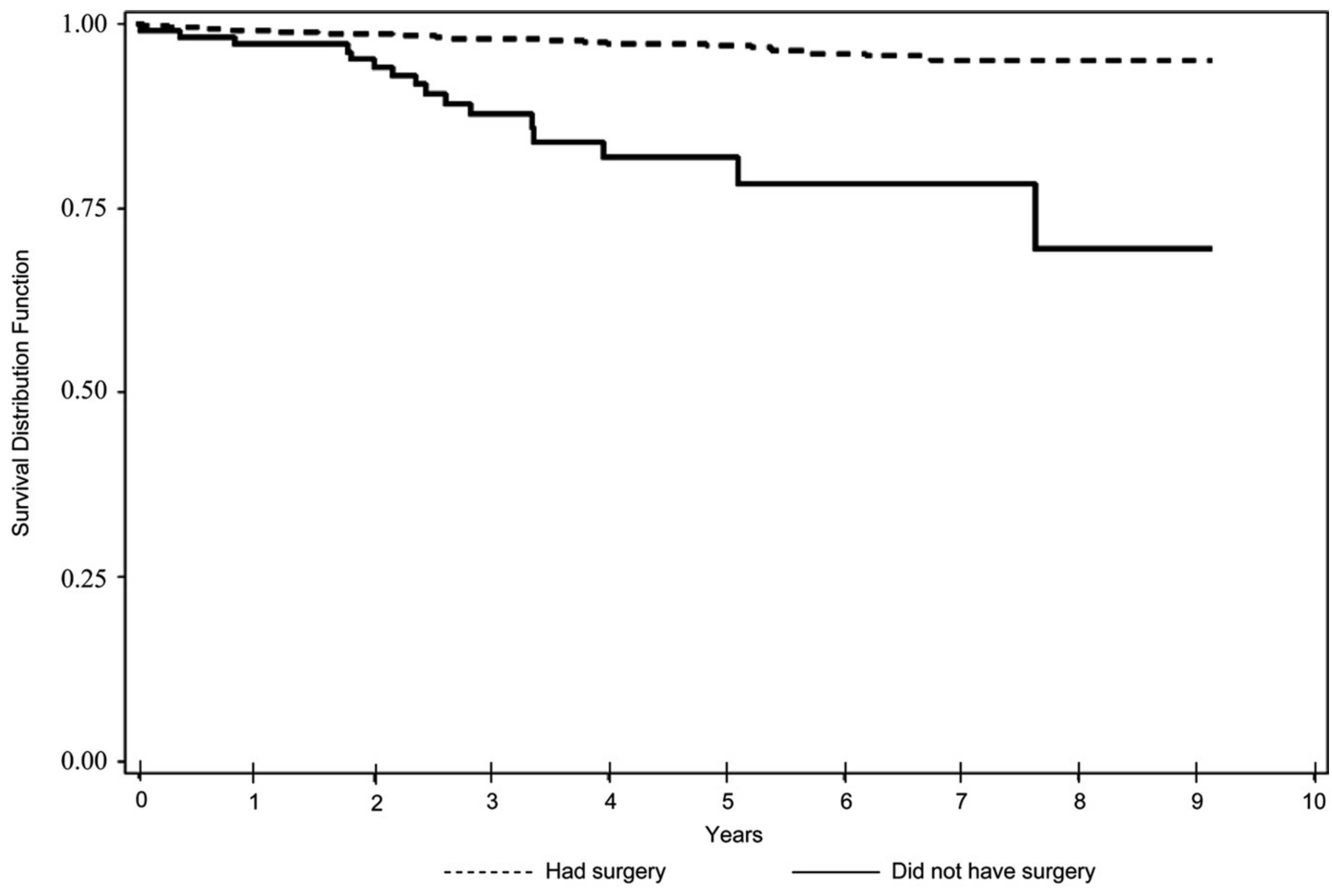
Telephone interviews were conducted with patients who did not undergo surgery at our institution to determine whether they had undergone bariatric surgery elsewhere. During the interview, we also asked the patients the reason they did not return for surgery. A minimum of 3 telephone calls were made at different times in an attempt to reach every patient. Patients who had died were followed through their primary/referring physicians and their hospital records to determine whether bariatric surgery had been performed outside our institution. All patients identified to have undergone surgery outside of our institution were included in the surgery group.

Statistical analysis

We tabulated data on patient characteristics at the initial visit and compared the proportions using *P* values derived from the chi-square statistic and compared means using *P* values derived from the *t* test. To examine the time until death, we fit Kaplan-Meier survival curves to graphically represent the proportion of patients who died during the follow-up period. We fit Cox proportional hazards models to estimate the hazard ratio for the association between surgery and death, adjusting for baseline covariates and censoring patients who had not died at the end of the study period. The hazard ratio compares the hazard (i.e., rate) of death between the 2 groups (surgery versus no surgery).

Results

Overall, data from 1185 patients were reviewed from our database; 880 had undergone surgery at our institution. Of



Number of patients:

Had surgery	908	900	782	621	475	347	241	142	83	11
Did not have surgery	112	109	89	56	38	23	17	10	7	2

Fig. 1. Kaplan-Meier plot of mortality over time.

the 305 remaining patients, we were able to interview 140 for follow-up; 165 patients could not be interviewed (127 of the telephone numbers were wrong, had changed, or were not in service). Of the 140 patients interviewed, 28 reported that they had undergone surgery elsewhere and were included in the surgery group, for a total of 908 patients who had undergone surgery and 112 who had not.

The demographics of the study population are shown in Table 1. Both groups were comparable in terms of gender distribution, but were significantly different in terms of age, BMI, and mean follow-up time. The mean age was older in the group that did not undergo surgery (47.9 years versus 43.2 years, $P < .0001$). The mean BMI was lower in those who did not undergo surgery (51 kg/m^2 versus 54 kg/m^2, $P < .0001$). The BMI range for patients who did not undergo surgery was 35–83 kg/m^2 and was 35–122 kg/m^2 for those who did undergo surgery. The largest proportion of patients who did not undergo surgery had a BMI of 41–50 kg/m^2. In contrast, of those who underwent surgery, the largest proportion were the super obese (BMI >51 kg/m^2).

Mortality in every age category was greater for those who did not undergo surgery (Table 2). Of those in the surgery group who were >65 years, 0 of 6 patients died compared with 4 of 8 patients who did not undergo surgery. The mortality among patients with a BMI of ≥60 kg/m^2 who underwent surgery was significantly lower than that for those who did not undergo surgery. This was despite the known greater surgical risk for this patient group.

As shown in Fig. 1, the mortality at 9 years of follow-up was significantly greater for patients who did not undergo surgery compared with those who did undergo surgery (14.3% versus 2.9%, $P < .0001$). Adjusting for age, gender, BMI, and follow-up time, the hazard ratio comparing the mortality for patients who had undergone surgery with that for those who had not undergone surgery was 0.18% (95% confidence interval 0.09–0.35%, $P < .00010$), resulting in a mortality reduction of 82% for those receiving surgery. In addition, male gender, age >65 years, and increasing BMI were associated with an increased risk of death (Table 3).

Table 3
Cox proportional hazards with 95% confidence intervals and P values

Variable	Crude HR (95% CI)	P value	Adjusted HR (95% CI)	P value
Surgery				
Yes	.16 (.09–.31)	<.0001	.18 (.09–.35)	<.0001
No	1.0		1.0	
Gender				
Male	2.04 (1.11–3.76)	.02	2.05 (1.08–3.90)	.03
Female	1.0		1.0	
Age (yr)				
<35	1.0		1.0	
36–45	1.40 (.58–3.39)	.45	1.14 (.47–2.77)	.77
46–55	.87 (.33–2.31)	.77	.71 (.27–1.91)	.50
56–65	2.79 (1.08–7.24)	.04	2.20 (.83–5.82)	.11
>65	8.29 (2.50–27.55)	.0006	5.28 (1.42–19.69)	.01
BMI (kg/m^2)		.003		.004
35–40	1.0		1.0	
41–50	1.73 (1.20–2.49)		1.78 (1.20–2.64)	
51–60	2.98 (1.43–6.18)		3.17 (1.44–6.96)	
≥61	5.13 (1.72–15.35)		5.63 (1.73–18.38)	

HR = hazard ratio; CI = confidence interval; BMI = body mass index.

After 1 year, the difference in survival was 2%, with a 10% difference at 3 years and a 19% difference at 5 years. As seen in Fig. 1, the differences in survival continued to increase with time. Because we could not interview 165 patients, we were unable to determine whether they had undergone surgery outside our institution. To evaluate any bias that the missing data might have had on our results, we performed a sensitivity analysis in which we assumed 2 extreme possibilities: (1) all 165 patients had undergone surgery; and (2) all 165 patients had not undergone surgery. Under the scenario that all missing patients had undergone surgery, the adjusted hazard ratio was 0.15, indicating an 85% mortality reduction (P <.0001). Assuming that all patients with missing data had not undergone surgery, the adjusted hazard ratio was 0.50, indicating a 50% adjusted mortality reduction (P = .04). Therefore, the age-, gender-, BMI-, and follow-up–adjusted mortality reduction by undergoing surgery was significant at 50–85%.

Discussion

Bariatric surgery has proved to be effective in achieving sustainable weight loss in morbidly obese patients and reducing or eliminating the associated comorbidities [4]. A multitude of studies have examined the risks and outcomes of having surgery for morbid obesity [5–9]. However, concern remains about some aspects of bariatric surgery. Mehrotra et al. [13] was critical of the increased rate and costs of bariatric surgery in the wake of the obesity epidemic in the United States. In contrast, Arterburn et al. [2] showed that the healthcare expenditures for morbidly obese adults were 81% greater than for normal weight adults. Flum and Dellinger [14] reported on Medicare patients aged >65 years with a high mortality rate of 11% at 1 year. In our institution, the general policy is not to operate on patients aged >65 years unless they have a very good performance status. This is reflected in the 0% (0 of 6 patients) surgical patient mortality rate in this group of our study. However, the mortality rate for the nonoperative group was 50% (4 of 8).

The results of this study have demonstrated that surgery in a group of patients with a mean BMI in the super-obese range can be undertaken with an acceptable mortality rate. Our adjusted mortality reduction resulting from surgery of 82% is comparable to that reported by Christou et al. [10], 89%, in a population-based study. Another population-based analysis by Flum and Dellinger [14] showed significant survival benefit for surgical patients at 15 years of follow-up starting from the first year postoperatively (hazard ratio 0.67, 95% confidence interval 0.54–0.85). MacDonald et al. [12], in 1997, reported a 28% mortality rate in a group of morbidly obese patients who did not undergo surgery compared with a 9% mortality rate among patients who had undergone surgery after 9 years of follow-up. The other significant benefits of bariatric surgery, that cannot be overemphasized, include the improvements in comorbidities and quality of life [4–6,12,15].

According to our study, the benefit of surgery was greatest among patients <55 years and with a BMI in the super-obese range and greater. Surgery in patients >65 years should be selective and based on performance status and physiologic reserve. Using telephone interviews, we interviewed 112 patients who did not undergo surgery to determine the reason for the lack of surgical follow-up. Among the respondents, 27% cited fear as the reason, 20% said insurance problems were responsible, 30% gave various other personal reasons such as spouse refusal, unwillingness to change lifestyle, not liking the surgeon or other office staff members, or inconvenience. The remaining patients did not give an answer or were still considering surgery.

This study had several limitations. It was a study of a difficult follow-up population, as shown by the number of missing patients. Despite this limitation, we were able to derive a mortality reduction with precision using the Social Security Death Index. We could not adjust our outcomes for difference in comorbidities, race, socioeconomic status, or insurance status, because we did not have complete data.

Conclusion

The mortality associated with untreated morbid obesity is significant, many-fold that of the normal population and exceeds the risk of surgical intervention. The reduced mortality after surgical intervention needs to highlighted, considering the epidemic proportions of morbid obesity in the United States.

Disclosures

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

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Editorial comment

The authors should be congratulated for providing this interesting and timely analysis. Although the benefits of bariatric surgery regarding obesity-related disease and quality of life are readily observable, the mortality advantage for those treated with surgery has not to date been well documented.

This study considers the mortality in a consecutive group of patients who presented for an initial office visit regarding bariatric surgery. The patients were included if they fulfilled the 1991 National Institutes of Health criteria for bariatric surgery. The key study outcome was a marked reduction in mortality (hazard ratio 0.18, 95% confidence interval .09–.35, P <0.001) for the 908 who underwent surgery compared with 112 who did not undergo surgery.

However, the study had major shortcomings:

We are not told the reason for the relatively small group not receiving surgery. This is a major oversight and might reflect selection bias. The characteristics of the case and control cohorts were signficantly different. Also, many of these subjects could not be contacted for follow-up.

The degree to which vital status was known on March 27, 2006 is critical to the analysis. Just how reliable were the Social Security Death Index and office records. Vital status is of value when you know the person is alive, but a negative search through death registries can be problematic.

Of the group of just 112 patients who did not undergo surgery, 16 patients died, yet a subanalysis was performed dividing this small group in to 5 categories for age and BMI. This is clearly a tenuous analysis when just 1 death could change the nature of the subanalysis substantially.

This study shares many of the concerns regarding the "control groups" that have plagued all the published analyses to date, and these have been referenced in the discussion within the current report. All have been justly criticized for not having matched community controls, and the risk of bias has been high.

This study adds to a growing body of evidence that intentional weight loss through bariatric surgery saves lives.

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

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