Hospitalization Before and After Gastric Bypass Surgery

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Context The use of Roux-en-Y gastric bypass (RYGB) has been reported to be effective in the treatment of obesity and its related comorbidities. Utilization of inpatient services after RYGB is less well understood.

Objective To determine the rates and indications for inpatient hospital use before and after RYGB.

Design, Setting, and Participants Retrospective study of Californians receiving RYGB in California hospitals from 1995 to 2004.

Main Outcome Measure Hospitalization in the 1 to 3 years after RYGB.

Results In California from 1995 to 2004, 60 077 patients underwent RYGB—11 659 in 2004 alone. The rate of hospitalization in the year following RYGB was more than double the rate in the year preceding RYGB (19.3% vs 7.9%, $P<.001$). Furthermore, in the subset of patients (n = 24 678) with full 3-year follow-up, a mean of 8.4% were admitted a year before RYGB while 20.2% were readmitted in the year after RYGB, 18.4% in the second year after RYGB, and 14.9% in the third year after RYGB. The most common reasons for admission prior to RYGB were obesity-related problems (eg, osteoarthritis, lower extremity cellulitis), and elective operation (eg, hysterectomy), while the most common reasons for admission after RYGB were complications often thought to be procedure related, such as ventral hernia repair and gastric revision. In multivariate logistic regression models predicting 1-year readmission after RYGB, increasing Charlson Comorbidity Index score, and hospitalization in the 3-year period prior to RYGB were significantly associated with readmission within a year.

Conclusions Increases in hospital use after surgery appear to be related to RYGB. Payers, clinicians, and patients must consider the not-inconsequential rate of rehospitalization after this type of surgery.

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BARIATRIC SURGICAL PROCEDURES are an increasingly common treatment for morbid obesity. More than 100 000 Roux-en-Y gastric bypasses (RYGBs)—the primary bariatric procedure now done—are performed annually in the United States.[1,2] Weight loss after RYGB is reportedly both significant and sustained—many individuals lose more than 40 kg in the initial period after the procedure without significant rebound in weight after this period.[3] A recent systematic review and meta-analysis of bariatric procedures determined that the mean percentage of excess weight loss after operation was 61%, with rates of resolution or improvement for the following comorbidities: diabetes 86%, hyperlipidemia 70%, hypertension 79%, and obstructive sleep apnea 84%.[4] In the Swedish Obese Subjects (SOS) cohort study, 10-year follow-up after bariatric procedure showed increased weight loss, improved lifestyle, and amelioration of risk factors (eg, diabetes, hypertriglyceridemia, and hyperuricemia) compared with conventional treatment for obesity.[5]

Medical interventions for weight loss do not have such dramatic and persistent weight loss associated with them, making surgical intervention attractive to individuals who have been unable to successfully lose weight.[6] Based on a review of the current data, the American College of Physicians recommends operation as a treatment option for patients with a body mass index greater than 40; obesity-related comorbid conditions; and inability to lose weight with a combination of a diet, exercise, or drug therapy program.[7,8] Body mass index is calculated as weight in kilograms divided by the square of height in meters.

Previous research has addressed some of the economic issues related to bariatric procedures. In a Canadian cohort, overall costs at 5 years appear lower among those receiving a bariatric operation.[9,10] In contrast, patients in the SOS study undergoing an operation were more likely than those not undergoing an operation to be hospitalized in the 6 years after operation and medication costs did not differ between the groups.[11,12] Procedure costs are in excess of $10 000 per person with an unknown cost for postoperative

See also pp 1903, 1909, 1957, and 1960 and Patient Page.

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complications.[3] It remains unclear from this literature whether after bariatric operation, the use of inpatient services, which routinely makes up a large proportion of direct costs in the general population,[13] is less than before a bariatric operation.

In the current research, we assessed the impact of RYGB on use of inpatient care. We examined rates of inpatient hospitalization before and after RYGB performed in California from 1995 to 2004. In this study, we addressed the following 3 questions: (1) does utilization of inpatient hospitalization decrease after RYGB; (2) are the reasons for inpatient hospitalization before and after RYGB different; and (3) does the level of patient comorbidity and prior hospitalization predict postoperative utilization of inpatient care?

METHODS

Data Sources

Roux-en-Y gastric bypass cases in California from 1995 to 2004 were identified using the annual hospital Patient Discharge Database, maintained by the California Office of Statewide Health Planning and Development. The database contains discharge abstracts for hospitalizations at all acute care hospitals in California. Each discharge record abstract reports a unique record linkage number (encrypted Social Security number), sex, age, race and ethnicity categories (white, black, Asian, Native American, other, and unknown) expected source of payment, ZIP code of residence, unique hospital identifier, diagnosis related group, primary and secondary (up to 24) diagnoses, primary and secondary (up to 20) procedures, dates of admission and discharge, total charges, and patient disposition at discharge. All diagnoses and procedures were coded using the *International Classification of Diseases, 9th Revision, Clinical Modification* (*ICD-9-CM*).

Admissions for patients before and after RYGB were identified through the record linkage number. Data on out-of-hospital deaths were identified via linkage of Patient Discharge Database records with the most up-to-date death records available (1995-2003) reported in the California Death Statistical Master File. Thus, the most recent year of data with 365-day mortality is 2002 while the most recent data with 30-day mortality is through December 1, 2003. A description of the linkage methodology and its validation are described elsewhere.[14] Patient income was represented by a proxy measure created by linking reported patient ZIP code of residence to the 2000 US Census. Data on characteristics of individual hospitals were obtained from Office of Statewide Health Planning and Development annual hospital financial reports.

Case Definition

We identified cases of RYGB by selecting all records with diagnosis related group equal to 288 (operating room procedure for obesity) and procedure identifiable as being for gastric bypass—*ICD-9-CM* codes 44.31 and 44.39. Unique codes for laparoscopic RYGB do not exist and alternative codes for laparoscopic procedures (eg, secondary procedure codes for laparoscopy [54.21], laparoscopic cholecystectomy [51.23], or laparoscopic appendectomy [47.01 or 47.11] appear to dramatically under code for laparoscopic RYGB (only 39% were coded at our own institution) and thus a comparison of laparoscopic and open cases was not performed. For each patient, the index RYGB was the first operation reported between 1995 and 2004. Non-Californians represented 6.1% of cases and were excluded from outcome analyses because out-of-state readmission and mortality cannot be identified for these patients.

Utilization Measures

The occurrence and type of admissions for a year before and after the index RYGB were characterized for all patients undergoing RYGB from 1995-2003. Admission rates excluding pregnancy-related admissions were calculated for each year before and after the index admission. The RYGB admission was not included in the calculation of these measures. Using primary diagnosis and procedure codes, we identified the prevalent reported reasons for hospitalization. Three-year follow-up was available for individuals receiving RYGB through 2001, and these results are presented as a subgroup analysis. A cumulative 3-year admission rate was calculated and defined as any patient in the 1995-2001 subgroup with an admission in the 3 years before or after RYGB. We also calculated total reported charges for admissions before and after RYGB.

Independent Variables

Patient characteristics studied include sex; age category; combined race and ethnicity categories (non-Latino black, non-Latino white, Latino, Asian, other); insurance status, estimated median income (based on residence ZIP code); Charlson Comorbidity Index;[15] and annual admission history in the 1, 2, and 3 years preceding RYGB. Race and ethnicity was studied given the diverse nature of the California population and the high prevalence of obesity in minority populations. Hospital characteristics included hospital ownership, hospital size, academic medical center, and hospital RYGB volume.

Analysis

Analyses were constructed to answer the 3 research questions. First, to determine whether the utilization of inpatient services decreased following RYGB, we compared 1-year admission rates before and after RYGB for the cohort undergoing RYGB between 1995 and 2003. In addition, 3-year admission rates before and after RYGB were compared for the cohort with available 3-year follow-up data (1995-2001).

Second, we identified the reasons for inpatient hospitalization before and after RYGB by comprehensive review of primary diagnosis and procedure *ICD-9-CM* codes for all admissions occurring before and after RYGB. Diagnosis codes and procedure codes were grouped into 5 major categories: (1) admission for a gastrointestinal tract procedure or gastric bypass–related com-

Table 1. Characteristics of California Residents Having Roux-en-Y Gastric Bypass, 1995-2004*

	No. (%) (n = 60 092)
Women	50 438 (83.9)
Age, mean (SD), y	42.2 (10.4)
Age, y	
<30	7353 (12.3)
30-39	17 448 (29.0)
40-49	19 537 (32.5)
50-64	15 159 (25.2)
≥65	595 (1.0)
Race	
White	45 246 (75.3)
Black	4663 (7.7)
Latino	7816 (13.0)
Asian	340 (0.6)
Other	2027 (3.4)
Insurance	
Medicare†	3143 (5.2)
Medicaid	2699 (4.5)
Private insurance	49 680 (82.7)
Other indigent insurance	1580 (2.6)
Self-pay or other	2990 (5.0)
Income, mean (SD), $	35 810 (11 400)
Charlson Comorbidity Index	
0	33 909 (56.4)
1	18 528 (30.8)
2	5520 (9.2)
≥3	2135 (3.6)
Admission before surgery, y	
1	4752 (7.9)
2	4986 (8.3)
3	4672 (7.8)
Cumulative 3 y before surgery	11 664 (19.4)
Hospital characteristics	
Ownership	
Nonprofit	40 869 (68.0)
District	2039 (3.4)
County	190 (0.4)
For-profit	16 994 (28.2)
Size, beds	
<100	4736 (7.9)
100-199	15 131 (25.2)
200-299	11 556 (19.2)
≥300	28 669 (47.7)
Academic medical center	16 220 (27.0)
Volume	
High (top 20% hospitals)	47 398 (78.9)
Medium (middle 40% hospitals)	11 536 (19.2)
Low (bottom 40% hospitals)	1158 (1.9)
Outcomes	
Length of stay, mean (SD), d	3.54 (3.20)
Mortality	
Hospital	107 (0.18)
30-day‡	180 (0.33)
1-year§	318 (0.91)
Readmission	
Within 1 y after surgery‖	9363 (19.3)
Within 3 y after surgery¶	9974 (40.4)

*Excludes out-of-state residents.
†Mean Medicare beneficiary age, 49.2 years.
‡Operations through December 1, 2003 (n = 47 232).
§Operations through December 31, 2002 (n = 34 796).
‖Operations through December 31, 2003 (n = 48 433).
¶Operations through December 31, 2001 (n = 24 678).

plication (eg, ventral hernia repair, gastric revision, endoscopy); (2) elective admission unrelated to RYGB (eg, hysterectomy, plastic surgery, knee surgery); (3) obesity-related admission (eg, osteoarthritis, lower extremity cellulitis); (4) cardiac admission (eg, cardiac catheterization, cardiac angioplasty, chest pain); and (5) other admission.

Reasons for admissions were attributed first to the major procedure categories and then to the major diagnosis categories. Hierarchical assignments were given to the procedure groupings because these tend to be more specific and sensitive than corresponding diagnostic codes. Varying the order of assignment did not significantly change the final classification results.

Finally, we performed staged multivariate logistic regression analyses to identify factors associated with 1-year readmission following RYGB. We specifically focused on the effect of the Charlson Comorbidity Index and prior hospitalization within the 3 years preceding RYGB on the outcome of hospital utilization a year after surgery for individuals having RYGB through 2001. The model was controlled for patient case-mix (sex, age category, race, insurance status, estimated median income), and hospital characteristics (hospital volume and academic medical center). A clustering correction on hospital of surgery was used to account for within-hospital clustering of cases and to improve standard error estimates. A log likelihood test was performed to calculate whether the Charlson Comorbidity Index score, prior hospitalization, or both were significant predictors in the model. Because of multiple comparisons, we chose a conservative threshold for statistical significance ($P<.01$).

All analyses were performed using Intercooled Stata 7.0 SE (College Station, Tex). The study protocol was reviewed and approved by the internal review board at the University of California Los Angeles. Due to the nature of these secondary data analyses, waiver of patient consent was granted.

RESULTS

In California from 1995 to 2004, a total of 60 077 California residents underwent RYGB for obesity. The number of procedures increased from 887 performed in 1995 to 13 637 in 2003. In 2004, the number decreased to 11 659. The 3694 non-California residents excluded from these analyses were similar to California residents with respect to age, sex, and Charlson Comorbidity Index but were more likely to be white, have self-pay insurance, and undergo RYGB at for-profit, nonacademic, and high-volume hospitals. TABLE 1 provides demographics of the overall cohort of California residents who underwent RYGB from 1995 to 2004. The average age was 42.2 years, 83.9% of patients were women, and 88% were privately insured or self-pay. The mean Charlson Comorbidity Index score was 0.62, with 43.6% of patients having a score greater than 0.

Outcomes are also shown in Table 1. Average length of stay was 3.5 days. Overall in-hospital mortality was 0.18%, 30-day mortality was 0.33%, and 1-year mortality was 0.91%. The in-hospital mortality for Medicare beneficiaries (not shown in the table) was 0.64% and higher than for the rest of the cohort ($P<.001$). For patients with a year of follow-up (1995-2003), 19.3% were readmitted within the first year compared with 7.9% being admitted in the year before surgery.

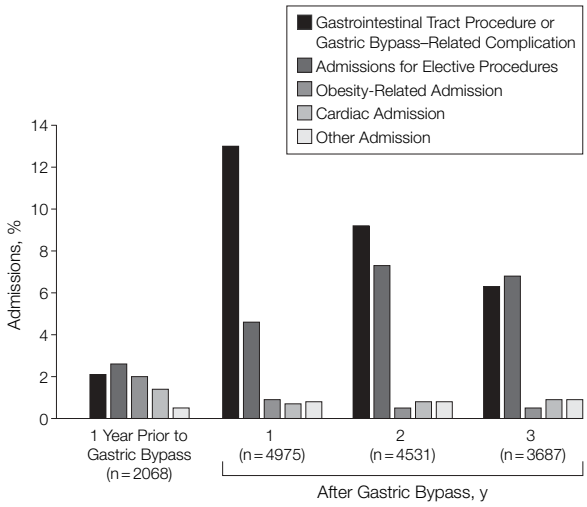
In a subset analysis of all patients who underwent RYGB with complete 3-year follow-up, we also examined the rate of hospitalization in the 3 years before and after RYGB. Of these 24 678 patients, the mean percentage of patients admitted in the year prior to RYGB was 8.4%. In each of the 3 years following RYGB, the rates of hospitalization remained increased, with 20.2% of patients readmitted in the first year after RYGB, 18.4% in the second year after, and 14.9% in the third year after. The cumulative admission rate for the 3-year period prior to RYGB was 20.2% compared with the cumulative 3-year admission rate after RYGB of 40.4%. For persons with 3 years of fol-

low-up, mean hospital charges were $33 672 for RYGB, $4970 for hospitalizations in the 3 years before RYGB, and $20 651 for hospitalizations in the 3 years after RYGB. Finally, in the subset of patients with a full 5 years of follow-up (1995-1999), postoperative admission rates remained elevated (mean [SD], 13.3% [–0.3%]) in the fifth year after operation.

The hierarchically assigned rates and indications for hospitalization for the year before and the 3 years after RYGB performed through 2001 are shown in the FIGURE. Details of all indications for admission are presented in TABLE 2. Prior to RYGB, the 2 most common reasons for admission were elective operation (eg, hysterectomy and cholecystectomy) and obesity-related admission (eg, osteoarthritis and lower extremity cellulitis). In contrast, the 2 most common reasons for admission in the 1 to 3 years following RYGB were a gastrointestinal (GI) tract or complication-related procedure or diagnosis (eg, gastric revision, ventral hernia repair, wound infection, small bowel obstruction, and hypovolemia) and elective surgery (eg, knee arthroplasty, plastic surgery). The 2 indications for admission demonstrated differing trends. In the first year after RYGB, the percentage of admissions for GI tract or complication-related reasons was significantly greater than elective surgery. In the second year after RYGB the percentage of admissions for GI tract or complication-related reasons remains slightly greater than elective surgery, while in the third year after RYGB, there were more admissions for elective procedures than for GI tract or complication-related reasons.

Finally, we performed staged multivariate logistic regression models predicting readmission in the year following RYGB (TABLE 3). A log-likelihood test for the addition of Charlson Comorbidity Index ($P<.001$) and prior hospitalization ($P<.001$) to the baseline model (other patient-level and hospital covariates) were both significant. After controlling for patient demographics and hospital characteristics, patients who had a greater Charlson Comorbidity Index score or were admitted in the 3 years before RYGB had greater odds of 1-year readmission. Among the other covariates, being a woman was associated with lower odds of readmission; and having Medicare or Medicaid insurance or receiving RYGB at lower-volume hospitals was associated with higher odds of readmission.

Figure. Rates and Indications for Hospital Admission Before and After Roux-en-Y Gastric Bypass, 1995-2001



COMMENT

The number of gastric bypass operations performed in California increased over 10-fold between 1995 and 2004 and will likely remain high due to the epidemic problem of obesity and the lack of other efficacious long-term interventions. An important factor supporting RYGB for the treatment of obesity is the resolution of comorbid disease after RYGB, such as diabetes, sleep apnea, and hypertension.[4]

Our results also show that relative to utilization, mortality appears to be a rare occurrence. While mortality is not a primary focus of our study, we note that overall mortality rates within the hospital, at 30 days, and at 1 year are low but are consistent with most other reports in the literature.[4,16-18] Although there is at least 1 population-based study that had rates as high as 1.7% at 1 year,[17] the large number of cases and the accuracy of the California death linkage[14] give confidence to these findings. Relatively low mortality rates for RYGB in this cohort likely reflect improving surgical skill (including the use of laparoscopic approaches) in recent years, improved patient selection, and the concentration of operations at high-volume referral centers in California.

A working hypothesis in our study was that use of health care services should likewise improve, namely that inpatient care should decrease after RYGB. However, we found significant and sustained increases in the rates of hospital admission for morbidly obese patients after RYGB. Annual rates of hospital admission after RYGB are double that prior to operation and are sustained beyond a year in this population-based study. Most published studies in this regard have been performed outside the United States but are inconclusive about inpatient utilization after RYGB.[9,10,12,19] For example, in an observational cohort at a medical center in Canada, Christou et al[10] demonstrated that RYGB patients had a lower number of hospitalizations, hospital days, physician visits, and total direct costs over a 5-year period after operation vs age- and sex-matched obese controls. In contrast, findings from the SOS study support the con-

tention that inpatient costs are higher in surgical patients postoperatively and that these costs are directly related to RYGB.[11] The challenge to reconcile these differences underlies the importance of studying inpatient utilization after RYGB in a population-based US sample. The current study includes bariatric procedures performed at over 100 hospitals across all of California, including a range of hospital types. The increase in utilization after RYGB reflects the "real world" experience of these procedures across surgical centers.

Table 2. Prevalent Procedures and Diagnoses for Admissions Before and After Roux-en-Y Gastric Bypass, 1995-2003*

	One-Year Follow-up, %†		Three-Year Follow-up, %‡	
	Before	After	Before	After
Admissions, No.	3840	9359	6279	13 192
GI tract procedure or gastric bypass–related complication				
Procedures				
Upper GI tract endoscopy	3	16	2	10
Ventral hernia repair	1	8	1	15
Exploratory laparatomy	1	7	1	5
Wound incision, drainage, or revision	3	5	3	5
Lysis of adhesions	0	5	0	4
Gastric revision	0	4	0	3
Diagnoses				
Complication of surgery, GI tract§	0	14	0	7
Obstruction	1	8	1	6
Wound infection	1	7	1	4
Hypovolemia	1	6	1	4
Hernia without complication	1	6	1	13
Wound complication	1	6	1	4
Abdominal pain	2	6	2	4
Ulcer disease	0	6	0	4
Nausea and vomiting	0	5	0	3
Postoperative GI tract symptoms	0	4	0	2
Hernia with complication	1	3	1	4
Elective admission				
Procedures				
Other general surgery procedure‖	4	8	5	7
Cholecystectomy	5	5	6	4
All orthopedic procedures	8	4	10	6
Hysterectomy	6	3	9	5
Plastic procedures	1	2	1	11
Diagnoses				
Gallbladder disease	5	5	6	5
Local adiposity	0	2	0	8
Cardiac admission				
Procedures				
Cardiac catheterization or angioplasty	7	7	7	7
Diagnoses				
Chest pain or angina	11	11	11	11
Coronary artery disease	4	1	3	1
Congestive heart disease	4	0	4	1
Obesity-related admission (diagnoses)				
Osteoarthritis	3	2	3	3
Cellulitis	7	2	6	2
Obstructive lung disease	7	1	8	1
Other admission (diagnoses)				
Bacterial pneumonia	4	3	4	2

Abbreviation: GI, gastrointenstinal.
*Includes all diagnostic groupings (prior to hierachical assignment) that occurred in at least 3% of admissions in any year before or after Roux-en-Y gastric bypass. Excludes out-of-state residents.
†Admissions from 1995 to 2003.
‡Admissions from 1995 to 2001.
§Category includes only *International Classification of Diseases, 9th Revision, Clinical Modification* code 997.4: "complication after gastrointestinal surgery."
‖General surgery procedure (other) includes procedures such as lymph node biopsy.

Our examination of the indications for admission shows that the reasons for admission differ in the preoperative and postoperative periods. When classified, diagnoses are much more likely to be obesity related (eg, osteoarthritis, lower extremity cellulitis) or elective admissions (eg, hysterectomy and other general surgery procedures such as cholecystectomy) in the years before RYGB while following RYGB, particularly in the first year, the majority of admissions appear to be procedure-related complications. In the third year following RYGB, there was an encouraging reversal in that there were more admissions for elective procedures than operation-related complications. Regarding elective operations, it seems that after RYGB and successful weight loss, individuals undergo plastic procedures, such as panniculectomy. Additionally, there is probably a delayed demand for other interventions—elective procedures postponed because of a patient's obesity (eg, total knee arthroplasty, disk procedures).

The reasons for admission before RYGB differ from the chronic conditions commonly highlighted as improving after RYGB. The recent meta-analysis and systematic review of RYGB by Buchwald et al[4] evaluated the improvement or resolution of 4 obesity-related complications: diabetes, hypertension, sleep apnea, and osteoarthritis, but none of these are highly prevalent reasons for admission prior to RYGB in the current study. These chronic conditions are much less likely to be considered as a primary reason for admission, but rather as comorbid illnesses. In contrast, common reasons for admission prior to RYGB are acute illnesses often asso-

ciated with obesity—Pickwickian Syndrome manifestations (chest pain, congestive heart failure, coronary artery disease, and obstructive lung disease), lower extremity cellulitis, and cholelithiasis.

Our findings may have implications for payers and purchasers of health care. Rather than expecting a decrease in inpatient health care utilization after RYGB, the costs associated with inpatient hospitalization may remain elevated for as many as 5 years following RYGB. Analysis of 3-year charges before and after RYGB suggest that costs of post-RYGB–related procedures and complications may be 40% to 60% of the costs of RYGB itself.

Limitations

The research reported herein has a number of limitations. The study is retrospective in nature and causality cannot be confirmed. Administrative data may not accurately report all diagnoses and procedures. The California Patient Discharge Database does not include the patient's weight or body mass index, which may be highly predictive of hospitalization both before and after RYGB. We were only able to evaluate utilization of inpatient services (vs outpatient visits or medication use) although these findings will likely affect the overall costs of RYGB since inpatient hospitalization costs represent the largest percentage (31%) of the US national health care expenditures.[13] We were unable to reliably study laparoscopic vs open RYGB procedures. Finally, analyses are for RYGB performed only in California and may not be generalizable to other regions of the country or other periods. Despite these limitations, the study presents the first comparison of hospitalization rates for a 3-year period before and after RYGB with trends over time. The current study demonstrates that there is not only an increase in hospitalization rates after RYGB, but the reasons for admission are different after RYGB, and this increase is apparent for at least 3 to 5 years after the procedure. Lastly, this study demonstrates one of the limitations of using administrative data for the purposes of comparing different types of procedures. We were unable to distinguish laparoscopic and open procedures because we found that the available coding scheme captured only 39% of cases performed laparoscopically at our institution. As a result, differences in health care utilization found between open and laparoscopic cases cannot be reliably detected.

Table 3. Predictors of 1-Year Readmission After Roux-en-Y Gastric Bypass, 1995-2003*

	Unadjusted Results		Multivariate Regression Results	
	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
Women	0.84 (0.78-0.90)	<.001	0.89 (0.84-0.94)	<.001
Age, y				
<30	0.88 (0.83-0.94)	<.001	1.01 (0.94-1.09)	.78
30-39	0.88 (0.84-0.93)	<.001	0.97 (0.92-1.03)	.35
40-49	1.00		1.00	
50-64	1.16 (1.10-1.21)	<.001	1.03 (0.97-1.08)	.37
≥65	1.73 (1.44-2.08)	<.001	0.95 (0.78-1.15)	.59
Race				
White	1.00		1.00	
Black	1.14 (1.02-1.26)	.02	1.08 (1.00-1.17)	.04
Latino	0.92 (0.85-0.99)	.03	0.90 (0.84-0.96)	.002
Asian	1.39 (1.02-1.89)	.04	1.34 (1.03-1.73)	.03
Other	0.73 (0.60-0.90)	.002	0.81 (0.71-0.91)	.001
Insurance				
Medicare	2.46 (2.23-2.71)	<.001	1.87 (1.72-2.04)	<.001
Medicaid	1.53 (1.29-1.81)	<.001	1.37 (1.24-1.50)	<.001
Private	1.00		1.00	
Other insurance	1.03 (0.81-1.31)	.80	1.10 (0.96-1.25)	.18
Self-pay or indigent	0.82 (0.68-0.99)	.04	0.86 (0.78-0.96)	.006
Income	1.00 (1.00-1.00)	.74	1.00 (0.99-1.00)	.32
Charlson Comorbidity Index				
0	1.00		1.00	
1	1.20 (1.13-1.28)	<.001	1.09 (1.04-1.15)	<.001
2	1.58 (1.46-1.72)	<.001	1.28 (1.19-1.38)	<.001
≥3	2.01 (1.81-2.23)	<.001	1.47 (1.32-1.63)	<.001
Hospitalization within 3 y of RYGB	2.09 (1.96-2.21)	<.001	1.80 (1.71-1.89)	<.001
Hospital volume†				
High	1.00		1.00	
Medium	1.33 (1.17-1.50)	<.001	1.17 (1.11-1.23)	<.001
Low	1.54 (1.24-1.92)	<.001	1.37 (1.19-1.58)	<.001
Academic medical center	1.04 (0.86-1.26)	.69	1.01 (0.97-1.06)	.60

Abbreviations: CI, confidence interval; OR, odds ratio; RYGB, Roux-en-Y gastric bypass.
*Cohort includes persons receiving gastric bypass in California, 1995-2003. Excludes out-of-state residents. Multivariate logistic regression model was used with clustering correction for hospital while adjusting for age, sex, race or ethnicity, insurance, income, hospital volume, and academic medical center.
†For a definition of hospital volume designations, see Table 1.

Conclusion

The potential of RYGB for yielding long-term weight reduction and alleviation of obesity-related comorbid illnesses has significantly increased the rates of RYGB over the past decade. Despite these potential benefits, the current study demonstrates that the rates of hospitalization double in the years after operation and that many of these admissions are directly attributable to this procedure.

Author Contributions: Dr Zingmond had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Zingmond, Ko.
Acquisition of data: Zingmond, Ko.
Analysis and interpretation of data: Zingmond, McGory, Ko.
Drafting of the manuscript: Zingmond.
Critical revision of the manuscript for important intellectual content: Zingmond, McGory, Ko.
Statistical analysis: Zingmond, McGory.

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The true men of action in our time, those who transform the world, are not the politicians and statesmen, but the scientists. Unfortunately poetry cannot celebrate them, because their deeds are concerned with things, not persons, and are, therefore, speechless. When I find myself in the company of scientists, I feel like a shabby curate who has strayed by mistake into a drawing room full of dukes.

—W. H. Auden (1907-1973)

