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Roux-en-Y Gastric Bypass vs Gastric Banding for Morbid Obesity

A Case-Matched Study of 442 Patients

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Hypothesis: Gastric banding (GB) and Roux-en-Y gastric bypass (RYGBP) are used in the treatment of morbidly obese patients. We hypothesized that RYGBP provides superior results.

Design: Matched-pair study in patients with a body mass index (BMI) less than 50.

Setting: University hospital and regional community hospital with a common bariatric surgeon.

Patients: Four hundred forty-two patients were matched according to sex, age, and BMI.

Interventions: Laparoscopic GB or RYGBP.

Main Outcome Measures: Operative morbidity, weight loss, residual BMI, quality of life, food tolerance, lipid profile, and long-term morbidity.

Results: Follow-up was 92.3% at the end of the study period (6 years postoperatively). Early morbidity was higher after RYGBP than after GB (17.2% vs 5.4%; $P<.001$), but major morbidity was similar. Weight loss was quicker, maximal weight loss was greater, and weight loss remained significantly better after RYGBP until the sixth postoperative year. At 6 years, there were more failures (BMI > 35 or reversal of the procedure/conversion) after GB (48.3% vs 12.3%; $P<.001$). There were more long-term complications (41.6% vs 19%; $P<.001$) and more reoperations (26.7% vs 12.7%; $P<.001$) after GB. Comorbidities improved more after RYGBP.

Conclusions: Roux-en-Y gastric bypass is associated with better weight loss, resulting in a better correction of some comorbidities than GB, at the price of a higher early complication rate. This difference, however, is largely compensated by the much higher long-term complication and reoperation rates seen after GB.

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THE PREVALENCE OF MORBID obesity has been growing exponentially over the past 20 years. A recent survey showed that bariatric procedures have more than doubled between 2003 and 2008.[1] In the United States, the increase was much greater for gastric banding (GB) than for gastric bypass (RYGBP).

See Invited Critique at end of article

This is probably because GB is perceived both by doctors and patients as a simple, safe, and reversible operation but also because of a huge industry-driven marketing campaign. Because GB was approved by the Food and Drug Administration only in 2001, the evolution in the United States is similar to that observed in Europe and Australia a decade before. In Europe, an opposite trend has recently been noted.[1]

Controversy about bariatric procedures has been ongoing. For patients with body mass index (BMI) less than 50 (calculated as weight in kilograms divided by height in meters squared), it lies mostly between purely restrictive operations (GB and vertical banded gastroplasty) and restrictive/malabsorptive procedures (RYGBP) also acting by hormone-mediated mechanisms influencing hunger and satiety.[2-4] Several trials have demonstrated the superiority of RYGBP over vertical banded gastroplasty regarding weight loss and long-term complications, resulting in the progressive abandonment of the latter.[5-10] Until now, 17 studies comparing GB with RYGBP have been published,[11-27] including 2 randomized trials,[11,12] 3 case-matched studies,[11,12,27] and many with important methodological flaws (eg, small numbers and different patient groups) and/or very limited follow-up. Tice et al[28] reviewed those available in 2008. General conclusions were that RYGBP pro-

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vided better weight loss and comorbidity improvements. Because of the aforementioned drawbacks, however, conclusions from the existing studies should be interpreted with caution. In the present study, we compared GB and RYGBP in matched pairs of patients treated during the same time frame by the same team.

METHODS

Bariatric surgery was offered to patients with a BMI more than 40, or more than 35 with at least 1 severe comorbidity, after failed conservative therapy and complete evaluation by a multidisciplinary team. Until December 2000, information and preoperative education was provided individually, whereas patients attended a 3-session preoperative course as of 2001.[29] All patients were informed about the importance of major/permanent changes in eating behavior, increase in physical activities, and intense follow-up.

Only patients with a BMI less than 50 who underwent a laparoscopic primary bariatric procedure before June 2005 were included in this study so that follow-up would be at least 6 years for everyone. Patients operated on early on with either technique were excluded to limit the effects of the learning curve, leaving 253 and 310 eligible patients in the GB and RYGBP groups, respectively. All data were retrieved retrospectively from our prospectively established database.

Patients who underwent GB were matched to RYGBP patients according to sex, age, and BMI. The GB patients with no match were excluded. All patients were operated on between March 1998 and May 2005.

Gastric banding was performed using either the LAP-BAND (BioEnterics) or the Swedish Adjustable Gastric Band (SAGB) (Obtech Medical for Ethicon Endo-Surgery). The original technique for implantation of either band was used (perigastric for the LAP-BAND and pars flaccida for the SAGB).[30,31] Both techniques were still widely used during the study period. In a randomized trial comparing these 2 devices, we showed the midterm complication rates to be similar.[30] A recent update of this study (unpublished data) confirmed that the long-term major complication rates remained similar after 10 years.

Roux-en-Y gastric bypass was performed in a retrocolic/retrogastric fashion with a small 10- to 15-mL gastric pouch, a short biliopancreatic limb, and a 100-cm Roux limb.[32]

Follow-up for GB patients was performed at monthly intervals for 6 months, every 2 months for the next semester, quarterly during the second year, and at least biannually thereafter. The first band adjustment was performed after 1 month after a barium study proving the band to be in the correct position. Further adjustments were based on food tolerance, satiety, and weight loss. The RYGBP patients were followed up after 1 month, quarterly during the first year, and biannually thereafter. After GB, barium swallows were performed every 18 to 24 months to ensure the absence of complication. A complete laboratory workup was performed at least annually. Follow-up data included early complications, percentage of excess weight loss (EWL), BMI, quality of life improvement (Moorehead-Ardelt questionnaire[33]), late complications, and reoperations. Food tolerance was assessed with a questionnaire, in which a general score (range, 0-27, with 27 being the best) compounds overall patient satisfaction with food tolerance, frequency of vomiting/regurgitating, and ease/difficulty of eating different types of food.[34] Ideal weight was defined by the median value in the World Health Organization table by Jelliffe[35] and ideal BMI was defined as 25, the upper limit of the normal range.[36] Early complications arose within the first month or during the same hospital stay if it was prolonged. Major early complications were life threatening and/or required reoperation. Weight loss was considered excellent with a residual BMI less than 30 and acceptable with a residual BMI less than 35. Weight loss failure was either EWL less than 25% or residual BMI more than 35. Complications after GB, except for band erosion, were always treated first conservatively with band deflation. With a few exceptions, this policy led to weight regain in most cases, despite dietary and sometimes psychological counseling. Eventually, a decision had to be made between keeping the band with severe adverse effects and/or poor weight loss and removing the band with or without conversion to another procedure, according to the patient's wishes, to achieve acceptable weight loss and quality of life. Complications severely impairing quality of life were not seen after RYGBP. Poor weight loss or weight regain alone was never an indication for conversion. The need for reversal of the procedure/conversion was considered a failure. Patients who underwent reversal/conversion were excluded from further analysis as of reoperation.

Statistical analysis was performed using Systat 8.0 (IBM SPSS Inc). The *t* test for paired groups was used for numerical variables, and the McNemar test was used for categorical variables, as appropriate. The Fisher exact test was used for comparisons within groups. A P value $<.05$ was considered significant.

RESULTS

Of 253 eligible GB patients, 221 (87.3%) found a suitable match in the RYGBP group so that a total of 442 patients were included. As a result of matching, sex ratio, age, and initial BMI were similar between groups. The follow-up rates at 6 years were 92.8% and 91.9%, respectively, after GB and RYGBP.

EARLY COMPLICATIONS

There were significantly more early complications after RYGBP than after GB (17.2% vs 5.4%; $P<.001$). Most complications were not life threatening and were treated conservatively. Major morbidity included only technical complications and was higher in the RYGBP group, but the difference was not statistically significant (3.6% vs 2.2%; $P=.54$).

WEIGHT LOSS

Maximal weight loss was achieved after a mean of 36 months after GB vs 18 months after RYGBP ($P<.01$). Maximal EWL after RYGBP was significantly higher (78.5% vs 64.8%; $P<.001$), and the mean nadir BMI was lower (26.7 vs 29.4; $P<.001$) (**Figure 1** and **Figure 2**). Although patients who required reversal/conversion were progressively excluded from analysis, weight loss was better with RYGBP, resulting in significantly more patients with an excellent or acceptable result at all intervals.

At 3 years, 42 (22.3%) of the available patients after GB had a BMI more than 35 (mean BMI, 40.1) compared with 15 (6.9%; mean BMI, 36.1) after RYGBP ($P<.001$). The 6-year figures were 51 (33.5%) and 25 (12.3%) ($P<.001$), respectively. Similarly, after 3 years, 10 (5.3%) of the GB patients had a BMI more than 40 compared with 3 (1.3%) after RYGBP ($P=.02$). After 6 years, the corresponding figures were 21 (13.8%) and 5 (2.4%) ($P=.003$). The distribution of EWL differed between the 2 groups, with a larger standard deviation after GB (27.1% vs 18.5% for EWL after 5 years).

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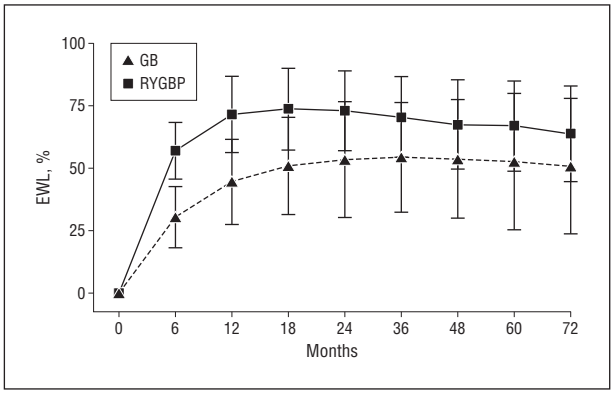

Figure 1. Evolution of excess weight loss (EWL) after gastric banding (GB) and Roux-en-Y gastric bypass (RYGBP). Error bars represent standard deviation. Patients in whom the band had to be removed, with or without conversion to another bariatric procedure, are excluded. There is a significant difference between the 2 groups, with $P<.001$ at all intervals.

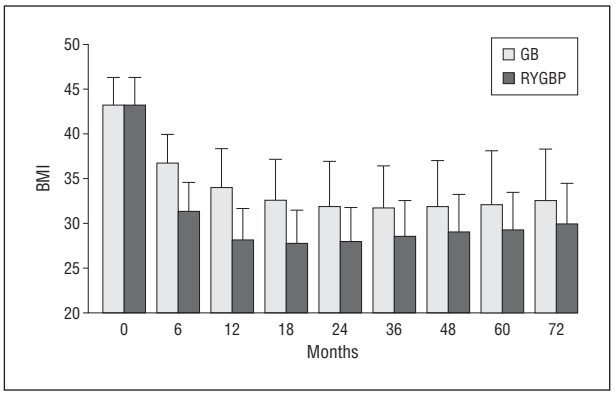

Figure 2. Evolution of the mean body mass index (BMI) (calculated as weight in kilograms divided by height in meters squared) after gastric banding (GB) and Roux-en-Y gastric bypass (RYGBP). Error bars represent standard deviation. Patients in whom the band had to be removed, with or without conversion to another bariatric procedure, are excluded. There is a significant difference between the 2 groups, with $P<.001$ at all intervals as of postoperative year 1.

LONG-TERM COMPLICATIONS

The 6-year long-term complication rate was significantly higher after GB (41.6% vs 19%; $P<.001$) (**Table 1**), resulting in more reoperations (**Table 2**) (26.7% vs 12.7%; $P<.001$). After GB, functional problems like esophageal dilatation (10.4%), impairing reflux requiring (or resistant to) daily high-dose proton-pump inhibitor therapy (6.8%), or severe food intolerance (6.3%) accounted for the majority of long-term complications, together with band erosions (7.7%). Overall, band removal was necessary in 47 patients (21.3%), of whom 29 (13.1%) were converted to another procedure. The majority of long-term complications after RYGBP were related to internal hernia, and no reversal was necessary. No patient died during follow-up.

SUCCESS OR FAILURE

At 3 years, there were 39 failures (EWL < 25%) or the need for reversal/conversion after GB compared with zero after RYGBP (18.2% vs 0%; $P<.001$). For BMI more than 35 or the need for reversal/conversion, we had 68 and 15 failures, respectively (31.7% vs 6.9%; $P<.001$). After 6 years, for band removal/conversion or EWL less than 25%, there were 79 failures after GB and 5 after RYGBP (38.9% vs 2.5%; $P<.001$). If BMI more than 35 was considered, the figures were 99 after GB and 25 after RYGBP (48.3% vs 12.3%; $P<.001$). **Figure 3** shows the progression of the failure rates.

QUALITY OF LIFE AND FOOD TOLERANCE

Quality of life improved in both groups. Improvement was quicker after RYGBP and a significant difference remained between both groups up to 4 years (**Figure 4**). Food tolerance was much better and remained unchanged after RYGBP, whereas there was a tendency for worsening over time after GB (**Figure 5**).

COMORBIDITIES

The initial lipid profile was similar between groups. Improvement after 5 years was significantly better after RYGBP (**Figure 6**). Total cholesterol level remained unchanged after GB but significantly decreased after RYGBP. The high-density lipoprotein level improved in both groups, resulting in a significantly better total to high-density lipoprotein cholesterol ratio after RYGBP. The low-density lipoprotein level remained unchanged after GB but decreased significantly after RYGBP. Triglyceride levels improved similarly. The mean fasting glucose level had a tendency to be lower after RYGBP after 3 (89.55 vs 92.79 mg/dL [to convert to millimoles per liter, multiply by 0.0555; $P=.07$) and 5 (91.17 vs 95.32 mg/dL; $P=.11$) years.

COMMENT

Gastric banding and RYGBP are the most popular procedures worldwide,[1] and the debate about which is the best has been ongoing for years. Among factors influencing this controversy, the way procedures are evaluated plays a role, with some focusing on results and others, on risks. Well-designed, large prospective randomized trials would be ideal to compare procedures. Such studies, however, are difficult to set up, with only about one-fifth of the patients accepting randomization.[11,37]

In their review of 14 of the 17 currently published studies[11-27] comparing GB and RYGBP, Tice et al[28] concluded that RYGBP was superior regarding weight loss and comorbidities. They underlined, however, the poor overall quality of the included studies. In the largest randomized trial published to date,[11] significant differences in preoperative data (age and BMI) indicate a likely bias in patient selection/acceptance.

Matched-pair studies are the second best way to make comparisons.[26] The present study includes a homogeneous population and is the largest of this type. All the patients have reached the 6-year point, with follow-up exceeding 90%, allowing for 3 major conclusions: (1) Early morbidity is significantly lower with GB. (2) Roux-en-Y gastric bypass provides more weight loss. (3) Long-term complications and reoperations are more common after GB.

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Table 1. Late Complications

GB	No. (%)	RYGBP	No. (%)	*P* Value
Port/catheter leak	15 (6.8)	Anastomotic stricture	14 (6.3)	
Psychological intolerance	2 (0.9)	Marginal ulcer	2 (0.9)	
Port infection	2 (0.9)	Small-bowel obstruction (adhesions)	2 (0.9)	
Band infection	1 (0.4)	Small-bowel obstruction (internal hernia)	2 (0.9)	
Pouch dilatation ± slippage	10 (4.5)	Symptomatic internal hernia	22 (9.9)	
Esophageal dilatation	23 (10.4)	Incisional hernia	2 (0.9)	
Band erosion	17 (7.7)			
Band leak	2 (0.9)			
Late food intolerance	14 (6.3)			
Gastroesophageal reflux	15 (6.8)			
Total patients with complication(s)	92 (41.6)		42 (19)	<.001
Total patients with major complication(s)	47 (21.3)		0	<.001

Abbreviations: GB, gastric banding; RYGBP, Roux-en-Y gastric bypass.

Table 2. Long-term Reoperations

GB Reoperation	No. (%)	RYGBP Reoperation	No. (%)	*P* Value
Intervention on port/catheter	19 (4.5)	Endoscopic dilatation	14 (6.3)	
Band change	1 (0.4)	Laparoscopy for internal hernia/adhesions	21 (9.5)	
Band repositioning	2 (0.9)	Laparotomy for internal hernia/adhesions	4 (1.8)	
Band removal alone	15 (6.8)	Small-bowel resection	1 (0.4)	
Band removal and conversion to RYGBP	28 (12.7)	Incisional hernia repair	2 (0.9)	
Band removal and conversion to biliopancreatic diversion	1 (0.4)			
Total patients with reoperation(s)	59 (26.7)	Total (excluding anastomotic dilatation)	28 (12.7)	<.001
Total patients with reversal	47 (21.3)		0	<.001

Abbreviations: GB, gastric banding; RYGBP, Roux-en-Y gastric bypass.

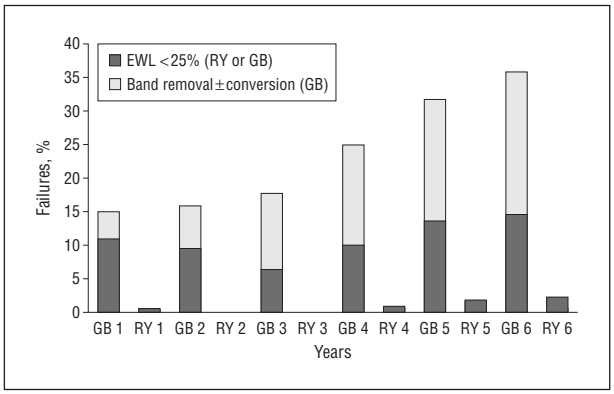

Figure 3. Evolution of the failure rate according to time. Failure is defined by an excess weight loss (EWL) less than 25% or reversal of the procedure (band removal with or without conversion to another bariatric operation). GB indicates gastric banding and RY, Roux-en-Y gastric bypass. $P < .001$ at all intervals.

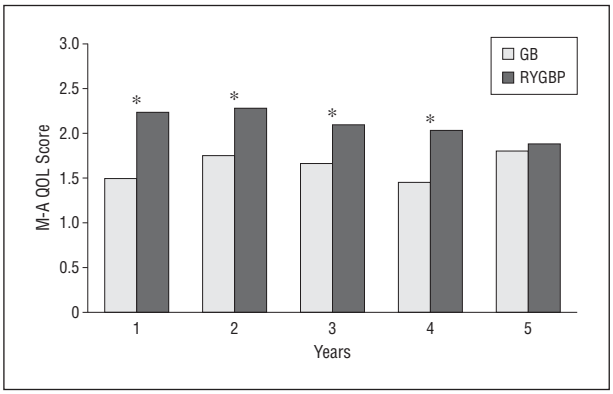

Figure 4. Evolution of quality of life according to the Moorehead-Ardelt quality of life (M-A QOL) score. $*P < .01$. GB indicates gastric banding and RYGBP, Roux-en-Y gastric bypass.

We show superior weight loss after RYGBP throughout the study period. The difference would be larger had patients who lost their band owing to complications not been excluded, because these patients are prone to weight regain unless they are converted to another bariatric procedure. This confirms the results of the 2 available randomized trials including 51 and 197 patients, respectively.[11,12] Cottam et al,[13] in their matched-pair study, found a similar difference. In all 4 studies with 4- or 5-year results,[11,12,26] including the present one, a significant difference remains favoring RYGBP. Some argue that intense follow-up including several yearly visits and band adjustments is necessary to achieve optimal results. Our biannual plan after the second postoperative year may be insufficient, but it represents a minimum. We regularly intensify follow-up, multiply band adjustments, and repeat dietary counseling for patients with insufficient weight loss.

In the present study, early morbidity was higher after RYGBP, without a significant difference for major complications, confirming results reported by others.[11,12,26,28] Being a more complex operation than GB, with a longer operative time and hospital stay, it is not surprising that the morbidity for RYGBP is higher.[28] Gastric banding, how-

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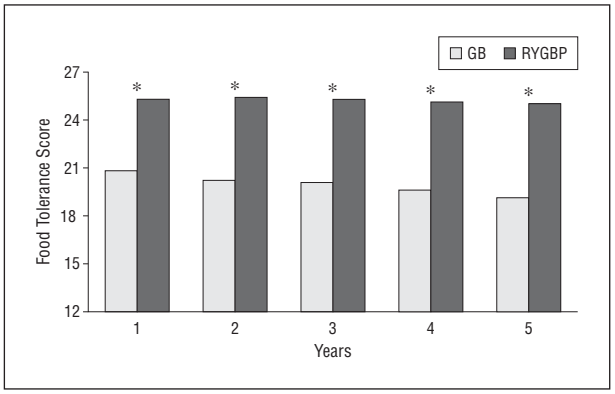

Figure 5. Evolution of food tolerance after gastric banding (GB) and Roux-en-Y gastric bypass (RYGBP) over the first 5 years (the maximum score is 27). *$P<.001$.

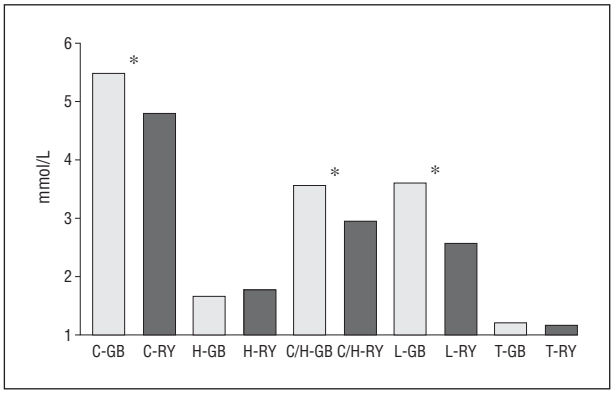

Figure 6. Lipid profile results 5 years after surgery. C indicates total cholesterol level; C/H, total to high-density lipoprotein cholesterol ratio; GB, gastric banding; H, high-density lipoprotein cholesterol level; L, low-density lipoprotein cholesterol level; RY, Roux-en-Y gastric bypass; and T, triglyceride level. *$P<.01$ between GB and RY at 5 years. SI conversion factors: to convert total cholesterol, high-density lipoprotein cholesterol, and low-density lipoprotein cholesterol to milligrams per deciliter, divide by 0.0259; triglycerides to milligrams per deciliter, divide by 1.8.

ever, is not devoid of problems. In recent studies, its early morbidity ranged from 1% to 3%,[38-40] and the Longitudinal Assessment of Bariatric Surgery consortium reported a 1% incidence of "major events" compared with 4.8% after RYGBP.[41] In our own experience with RYGBP, we have noticed a marked decrease in early morbidity (4.7% overall) and a 1% major complication rate among 670 patients operated on since 2006.

There were significantly more long-term complications after GB. Results in the literature are variable, depending on the duration and quality of follow-up. Nguyen et al[11] found more late complications after RYGBP, but most were anastomotic strictures treated endoscopically. The reoperation rates did not differ, but there was a tendency for more reversals (5.8% vs 0.9%; $P=.08$) after GB. Angrisani et al[12] did not report any difference. Weber et al[14] and Cottam et al[13] both reported higher complication and reoperation rates after GB. A high long-term morbidity after GB is common in series with long-term results,[42,43] and our results lie well within the reported figures. Many long-term complications of GB appear late in the course of follow-up, and their incidence is likely to increase over time. Long-term complications after RYGBP are essentially limited to anastomotic strictures and bowel obstructions and symptomatic internal hernia. We are convinced that the surgical technique is important in these complications. We report a quite acceptable 2.3% stricture rate, but we recently showed that a rate less than 1% was achievable using a modified surgical technique.[44] Most strictures are treated by endoscopic dilatation and are not major complications. On the contrary, bowel obstructions are potentially dangerous or even life threatening and can lead to extended bowel necrosis if not recognized and treated promptly. In most cases, they do not, however, jeopardize the effectiveness of RYGBP or mandate reversal. Careful closure of all mesenteric defects with running nonabsorbable sutures considerably reduces the internal hernia rate.[45]

Quality of life improved similarly after both procedures, as reported by Nguyen et al,[11] despite poorer food tolerance after GB. The importance of weight loss after bariatric surgery may not play as important a role in quality of life as has been suggested. Also, limited food tolerance and more frequent vomiting/regurgitation after GB may not impact overall quality of life so much. Specific gastrointestinal quality of life questionnaires should be used to confirm this impression.

A large meta-analysis concluded that the remission rates of several major comorbidities were significantly higher after RYGBP than after GB.[44] In the matched-case study by Weber et al,[14] the results strongly favored RYGBP regarding diabetes mellitus and dyslipidemia. Bowne et al,[20] Campos et al,[26] and Boza et al[27] reported similar findings, while others found no difference in the short-term.[21,22] Comorbidities evaluated in this study showed greater improvement after RYGBP. In their review, Tice et al[28] concluded that more patients would be cured of diabetes, sleep apnea, hypertension, and other obesity-related comorbidities if treated with RYGBP rather than GB.

This study has limitations. Eighty GB patients were operated on using the perigastric technique. Although this is nowadays considered obsolete, it was the original technique described for the LAP-BAND. There was no strong evidence 10 to 12 years ago that it should not be used anymore, and we had a randomized study comparing the 2 devices using the 2 techniques. Nine patients with the perigastric LAP-BAND technique developed pouch-related complications, compared with only 1 in the pars flaccida SAGB group (11.2% vs 0.7%; $P<.001$, Fisher exact test). Although the major long-term complication rates did not differ significantly between these 2 groups (20% vs 22%; $P=.86$, Fisher exact test), using the pars flaccida technique may have resulted in fewer long-term complications. Our overall 4.5% rate of pouch dilatation/slippage, however, is very similar to that recently reported by Brown et al[46] with the pars flaccida technique (4.4%), and the differences in long-term major complication rates remain significant between RYGBP and GB even if pouch complications are discarded. Another limitation could be that medications taken by the patients were not evaluated together with their lipid profile results. A major difference in the prescription habits, however, is unlikely in 2 patient populations treated by the same team in the same area.

Strengths of our study are the large sample size and the homogeneity of the study population, the long follow-up, and the high follow-up rates. It is accepted that pa-

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tients lost from follow-up tend to have worse results than patients attending regular visits, and this has recently been shown by te Riele et al[47] after GB.

CONCLUSIONS

On the basis of our results and analysis of the literature, we conclude that RYGBP provides better, more rapid, and more sustained weight loss, resulting in better correction of comorbidities than GB. The cost is higher early morbidity. With increasing experience, however, and the development of centers of excellence, early morbidity after laparoscopic gastric bypass is declining. Even if early morbidity after RYGBP remains somewhat higher than after GB, this difference is largely compensated for by the much higher long-term major morbidity seen after GB, leading to a large number of major reoperations and their risks.

These results should ideally be confirmed by a large randomized study with long follow-up. Ethical considerations might prevent potential investigators, however, from setting up a study where one treatment arm seems to be clearly inferior to the other and where the lack of equipoise makes patient information and accrual difficult if not impossible. At the present time, RYGBP seems clearly superior to GB when treating morbidly obese patients, who should be informed accordingly.

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REFERENCES

1. Buchwald H, Oien DM. Metabolic/bariatric surgery worldwide 2008. *Obes Surg.* 2009;19(12):1605-1611.
2. le Roux CW, Welbourn R, Werling M, et al. Gut hormones as mediators of appetite and weight loss after Roux-en-Y gastric bypass. *Ann Surg.* 2007;246(5):780-785.
3. le Roux CW, Aylwin SJ, Batterham RL, et al. Gut hormone profiles following bariatric surgery favor an anorectic state, facilitate weight loss, and improve metabolic parameters. *Ann Surg.* 2006;243(1):108-114.
4. Pournaras DJ, Osborne A, Hawkins SC, et al. The gut hormone response following Roux-en-Y gastric bypass: cross-sectional and prospective study. *Obes Surg.* 2010;20(1):56-60.
5. Sugerman HJ, Londrey GL, Kellum JM, et al. Weight loss with vertical banded gastroplasty and Roux-Y gastric bypass for morbid obesity with selective versus random assignment. *Am J Surg.* 1989;157(1):93-102.
6. Sugerman HJ, Starkey JV, Birkenhauer R. A randomized prospective trial of gastric bypass versus vertical banded gastroplasty for morbid obesity and their effects on sweets versus non-sweets eaters. *Ann Surg.* 1987;205(6):613-624.
7. Fobi MA. Vertical banded gastroplasty vs gastric bypass: 10 years follow-up. *Obes Surg.* 1993;3(2):161-164.
8. Capella JF, Capella RF. The weight reduction operation of choice: vertical banded gastroplasty or gastric bypass? *Am J Surg.* 1996;171(1):74-79.
9. Howard L, Malone M, Michalek A, Carter J, Alger S, Van Woert J. Gastric bypass and vertical banded gastroplasty: a prospective randomized comparison and 5-year follow-up. *Obes Surg.* 1995;5(1):55-60.
10. Brolin RL, Robertson LB, Kenler HA, Cody RP. Weight loss and dietary intake after vertical banded gastroplasty and Roux-en-Y gastric bypass. *Ann Surg.* 1994;220(6):782-790.
11. Nguyen NT, Slone JA, Nguyen XM, Hartman JS, Hoyt DB. A prospective randomized trial of laparoscopic gastric bypass versus laparoscopic adjustable gastric banding for the treatment of morbid obesity: outcomes, quality of life, and costs. *Ann Surg.* 2009;250(4):631-641.
12. Angrisani L, Lorenzo M, Borrelli V. Laparoscopic adjustable gastric banding versus Roux-en-Y gastric bypass: 5-year results of a prospective randomized trial. *Surg Obes Relat Dis.* 2007;3(2):127-132, discussion 132-133.
13. Cottam DR, Atkinson J, Anderson A, Grace B, Fisher B. A case-controlled matched-pair cohort study of laparoscopic Roux-en-Y gastric bypass and Lap-Band patients in a single US center with three-year follow-up. *Obes Surg.* 2006;16(5):534-540.
14. Weber M, Müller MK, Bucher T, et al. Laparoscopic gastric bypass is superior to laparoscopic gastric banding for treatment of morbid obesity. *Ann Surg.* 2004;240(6):975-982, discussion 982-983.
15. Hell E, Miller KA, Moorehead MK, Norman S. Evaluation of health status and quality of life after bariatric surgery: comparison of standard Roux-en-Y gastric bypass, vertical banded gastroplasty and laparoscopic adjustable silicone gastric banding. *Obes Surg.* 2000;10(3):214-219.
16. Biertho L, Steffen R, Ricklin T, et al. Laparoscopic gastric bypass versus laparoscopic adjustable gastric banding: a comparative study of 1,200 cases. *J Am Coll Surg.* 2003;197(4):536-544, discussion 544-545.
17. Jan JC, Hong D, Pereira N, Patterson EJ. Laparoscopic adjustable gastric banding versus laparoscopic gastric bypass for morbid obesity: a single-institution comparison study of early results. *J Gastrointest Surg.* 2005;9(1):30-39, discussion 40-41.
18. Mognol P, Chosidow D, Marmuse JP. Laparoscopic gastric bypass versus laparoscopic adjustable gastric banding in the super-obese: a comparative study of 290 patients. *Obes Surg.* 2005;15(1):76-81.
19. Parikh MS, Shen R, Weiner M, Siegel N, Ren CJ. Laparoscopic bariatric surgery in super-obese patients (BMI>50) is safe and effective: a review of 332 patients. *Obes Surg.* 2005;15(6):858-863.
20. Bowne WB, Julliard K, Castro AE, Shah P, Morgenthal CB, Ferzli GS. Laparoscopic gastric bypass is superior to adjustable gastric band in super morbidly obese patients: a prospective, comparative analysis. *Arch Surg.* 2006;141(7):683-689.
21. Galvani C, Gorodner M, Moser F, et al. Laparoscopic adjustable gastric band versus laparoscopic Roux-en-Y gastric bypass: ends justify the means? *Surg Endosc.* 2006;20(6):934-941.
22. Kim TH, Daud A, Ude AO, et al. Early U.S. outcomes of laparoscopic gastric bypass versus laparoscopic adjustable silicone gastric banding for morbid obesity. *Surg Endosc.* 2006;20(2):202-209.
23. Parikh MS, Laker S, Weiner M, Hajiseyedjavadi O, Ren CJ. Objective comparison of complications resulting from laparoscopic bariatric procedures. *J Am Coll Surg.* 2006;202(2):252-261.
24. Rosenthal RJ, Szomstein S, Kennedy CI, Soto FC, Zundel N. Laparoscopic surgery for morbid obesity: 1,001 consecutive bariatric operations performed at The Bariatric Institute, Cleveland Clinic Florida. *Obes Surg.* 2006;16(2):119-124.
25. Jan JC, Hong D, Bardaro SJ, July LV, Patterson EJ. Comparative study between laparoscopic adjustable gastric banding and laparoscopic gastric bypass: single-institution, 5-year experience in bariatric surgery. *Surg Obes Relat Dis.* 2007;3(1):42-50, discussion 50-51.
26. Campos GM, Rabl C, Roll GR, et al. Better weight loss, resolution of diabetes, and quality of life for laparoscopic gastric bypass vs banding: results of a 2-cohort pair-matched study. *Arch Surg.* 2011;146(2):149-155.
27. Boza C, Gamboa C, Awruch D, Perez G, Escalona A, Ibañez L. Laparoscopic Roux-en-Y gastric bypass versus laparoscopic adjustable gastric banding: five years of follow-up. *Surg Obes Relat Dis.* 2010;6(5):470-475.
28. Tice JA, Karliner L, Walsh J, Petersen AJ, Feldman MD. Gastric banding or bypass? a systematic review comparing the two most popular bariatric procedures. *Am J Med.* 2008;121(10):885-893.
29. Giusti V, De Lucia A, Di Vetta V, et al. Impact of preoperative teaching on surgical option of patients qualifying for bariatric surgery. *Obes Surg.* 2004;14(9):1241-1246.
30. Suter M, Giusti V, Worreth M, Héraief E, Calmes JM. Laparoscopic gastric banding: a prospective, randomized study comparing the Lapband and the SAGB: early results. *Ann Surg.* 2005;241(1):55-62.
31. Suter M, Giusti V, Héraief E, Zysset F, Calmes JM. Laparoscopic gastric banding. *Surg Endosc.* 2003;17(9):1418-1425.

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32. Suter M, Giusti V, Héraief E, Zysset F, Calmes JM. Laparoscopic Roux-en-Y gastric bypass: initial 2-year experience. *Surg Endosc*. 2003;17(4):603-609.
33. Oria HE, Moorehead MK. Bariatric Analysis and Reporting Outcome System (BAROS). *Obes Surg*. 1998;8(5):487-499.
34. Suter M, Calmes JM, Paroz A, Giusti V. A new questionnaire for quick assessment of food tolerance after bariatric surgery. *Obes Surg*. 2007;17(1):2-8.
35. Jelliffe DB. The assessment of the nutritional status of the community (with special reference to field surveys in developing regions of the world). *Monogr Ser World Health Organ*. 1966;53:3-271.
36. Deitel M, Gawdat K, Melissas J. Reporting weight loss 2007. *Obes Surg*. 2007; 17(5):565-568.
37. Ternovits CA, Tichansky DS, Madan AK. Band versus bypass: randomization and patients' choices and perceptions. *Surg Obes Relat Dis*. 2006;2(1):6-10.
38. Balsiger BM, Ernst D, Giachino D, Bachmann R, Glaettli A. Prospective evaluation and 7-year follow-up of Swedish adjustable gastric banding in adults with extreme obesity. *J Gastrointest Surg*. 2007;11(11):1470-1476, discussion 1446-1447.
39. Boza C, Gamboa C, Perez G, et al. Laparoscopic adjustable gastric banding (LAGB): surgical results and 5-year follow-up. *Surg Endosc*. 2011;25(1):292-297.
40. Weichman K, Ren C, Kurian M, et al. The effectiveness of adjustable gastric banding: a retrospective 6-year U.S. follow-up study. *Surg Endosc*. 2011;25(2):397-403.
41. Flum DR, Belle SH, King WC, et al; Longitudinal Assessment of Bariatric Surgery (LABS) Consortium. Perioperative safety in the longitudinal assessment of bariatric surgery. *N Engl J Med*. 2009;361(5):445-454.
42. Mittermair RP, Obermüller S, Perathoner A, Sieb M, Aigner F, Margreiter R. Results and complications after Swedish adjustable gastric banding-10 years experience. *Obes Surg*. 2009;19(12):1636-1641.
43. Himpens J, Cadière GB, Bazi M, Vouche M, Cadière B, Dapri G. Long-term outcomes of laparoscopic adjustable gastric banding. *Arch Surg*. 2011;146(7):802-807.
44. Suter M, Donadini A, Calmes JM, Romy S. Improved surgical technique for laparoscopic Roux-en-Y gastric bypass reduces complications at the gastrojejunostomy. *Obes Surg*. 2010;20(7):841-845.
45. Paroz A, Calmes JM, Romy S, Giusti V, Suter M. A new type of internal hernia after laparoscopic Roux-en-Y gastric bypass. *Obes Surg*. 2009;19(4):527-530.
46. Brown WA, Burton PR, Anderson M, et al. Symmetrical pouch dilatation after laparoscopic adjustable gastric banding: incidence and management. *Obes Surg*. 2008;18(9):1104-1108.
47. te Riele WW, Boerma D, Wiezer MJ, Borel Rinkes IH, van Ramshorst B. Long-term results of laparoscopic adjustable gastric banding in patients lost to follow-up. *Br J Surg*. 2010;97(10):1535-1540.

INVITED CRITIQUE

ONLINE FIRST

Can We Safely State That Laparoscopic Roux-en-Y Gastric Bypass Is a Better Weight Loss Procedure Than Adjustable Band Gastroplasty?

According to Romy et al,[1] RYGBP is a "better" bariatric procedure than GB. I personally agree with them. However, before we make from this conclusion a paradigm, a few caveats remain.

First, case-control studies can suffer from bias when one treatment is sensed as better than the other ab initio.[2] Since prospective randomized studies comparing the 2 procedures are hardly realizable, better evidence could be obtained by prospectively comparing matched patients submitted to either procedure in 2 different centers with recognized expertise in GB or RYGBP.

Second, the GB appears to be operator dependent with remarkably better results in some centers (and countries!).[3] Some surgeons have become "band champions," and it is likely that they would obtain quite different results than reported herein. In any case, a well-performed GB is better than a poorly executed RYGBP.

Third, the limited (if any) influence of the GB on incretins and other gastrointestinal hormones might turn out to be an advantage in the long-term. A growing number of patients have problems linked with glucose metabolism like neuroglycopenia[4] and diabetes recurrence[5] late after RYGBP. The exact origin of this evolution appearing several years after RYGBP remains unclear, but it is a source of increasing concern.

Last, for most surgeons, the GB is more easily reversible than the RYGBP and the threshold for conversion, lower. Whereas with the presently available treatment modes patients do poorly with a second procedure after reversal of the GB, a stomach that is anatomically intact after band removal would, without doubt, present better conditions for future (active) medications or for another bariatric procedure (perhaps endoscopically).

Notwithstanding these words of caution, Suter et al must be commended for their scientific rigor and zealous follow-up. Both constitute an enlightening example for all of us bariatric surgeons.

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1. Romy S, Donadini A, Giusti V, Suter M. Roux-en-Y gastric bypass vs gastric banding for morbid obesity: a case-matched study of 442 patients [published online January 16, 2012]. *Arch Surg*. 2012;147(5):460-466.
2. Kopec JA, Esdaile JM. Bias in case-control studies: a review. *J Epidemiol Community Health*. 1990;44(3):179-186.
3. Niville E, Dams A, Reremoser S, et al. A mid-term experience with the Cousin Bioring-adjustable gastric band [published online May 5, 2011]. *Obes Surg*. doi:10.1007/s11695-011-0427-9.
4. Patti ME, Goldfine AB. Hypoglycaemia following gastric bypass surgery: diabetes remission in the extreme? *Diabetologia*. 2010;53(11):2276-2279.
5. DiGiorgi M, Rosen DJ, Choi JJ, et al. Re-emergence of diabetes after gastric bypass in patients with mid- to long-term follow-up. *Surg Obes Relat Dis*. 2010; 6(3):249-253.

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