Laparoscopic Gastric Bypass at a Large Academic Medical Center: Lessons Learned from the First 1000 Cases

TALAR TEJIRIAN, M.D., CANDICE JENSEN, M.D., CATHERINE LEWIS, M.D., ERIK DUTSON, M.D., AMIR MEHRAN, M.D.

From the Department of Surgery UCLA Medical Center, Los Angeles, California

Bariatric surgery is an effective and durable treatment for morbid obesity in properly selected patients. Surgical outcomes and patient management methods should routinely be reviewed to improve patient care and maintain long-term effectiveness of the bariatric operation. Over a 5-year period, 1096 laparoscopic Roux-en-Y gastric bypass operations were performed at our institution. A comprehensive prospective database was maintained, which included data for comorbidities, operative techniques, perioperative management, complications, and follow up. Many practice patterns such as the omission of routine preoperative sleep apnea testing and biliary ultrasounds remained constant and were validated by the outcomes measured. Several changes, however, were implemented based on outcomes analyses, including antecolic placement of the roux limb, a pars flaccida approach to the creation of the gastric pouch, longer alimentary limbs in superobese patients, and a selective approach to postoperative upper gastrointestinal imaging. Postoperative weight regain and inability to maintain long-term follow up in a significant per cent of patients were two identified and ongoing problems. Maintenance of a bariatric patient database is essential with its routine review resulting in changes to practice patterns and operative techniques. An effective method for long-term patient follow up remains elusive and may contribute to postoperative weight regain in some patients.

OBESITY AND ITS HEALTH consequences have developed into major public health risks in the United States.[1] Multiple studies have demonstrated that although nonsurgical treatments typically result in transient weight loss in the majority of morbidly obese patients, bariatric surgery affords durable weight loss and is effective in decreasing long-term mortality and healthcare costs.[2–5]

First introduced in 1967 by Mason and Ito, the Roux-en-Y gastric bypass (RYGB) is considered by many to be the gold standard bariatric operation.[6, 7] The introduction of the laparoscopic approach (LRYGB) in the early 1990s set the stage for what has been termed the "bariatric revolution,"[5, 8, 9] which resulted in a dramatic increase in the number of bariatric procedures and surgeons in the period between 1998 and 2003.[5] This widespread and rapid adoption of the LRYGB was not without consequence, as surgeons' inexperience and lack of proper bariatric surgery training led to an increase in complications, negative publicity, and a reimbursement crisis.[5, 10] Similar to trauma and transplant surgery, this has in turn led to a push toward centralization of bariatric surgery into higher-volume centers with better outcomes, termed Centers of Excellence.[11]

Internal quality assurance is a critical aspect of every bariatric program and constitutes a central component of a Center of Excellence (COE) designation.[10–13] In the absence of nationwide standardized surgical techniques or patient management algorithms, each individual bariatric program follows its own prevailing method. The method a program adopts must be shown to be safe and effective as evidenced by patient outcomes to be considered for a COE designation. The maintenance of a comprehensive patient database, with outcomes tracking and evidence-based changes to established practice patterns, can help assure quality and optimize surgical results.

The current bariatric surgery program at our institution was founded 5 years ago by a single surgeon

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Address correspondence and reprint requests to Amir Mehran, M.D., Department of Surgery, University of California, Los Angeles, 10833 Le Conte Avenue, Los Angeles, CA 90095-6904. E-mail: amehran@mednet.ucla.edu.

who established a foundation of quality control and evidence-based practice even before the existence of the COE initiative. This foundation has upheld many aspects of our practice; more importantly, it has provided the impetus for significant changes that have resulted in improved outcomes and reduced costs, and has also led to the identification of previously unrecognized problems.

Methods

From January 2003 through December 2007, 1096 LRYGBs were performed at our institution. Surgical technique evolved in this time, resulting in the following method, which we currently practice.[14–16] Before incision, a 32-French orogastric (OG) tube is placed (Allergan, Irvine, CA). Trocars are then inserted using an optical trocar for initial placement in the left upper quadrant. The gastric pouch is created using a pars flaccida approach. The pars flaccida is approached through the lesser omentum at its thinnest portion, typically over the caudate lobe. This area of the lesser omentum is divided to the edge of the lesser curve after which the pouch is made with blue linear 60-mm staplers (Autosuture, Mansfield, MA). The gastrojejunal (G-J) anastomosis is created using the full length of a blue linear 45-mm stapler (Autosuture) over the OG tube. The Roux limb length is dictated by preoperative body mass index (see subsequently) and once created is brought up in an antecolic and antegastric fashion. A jejunojejunostomy is then created using a white linear 60-mm stapler (Autosuture). The G-J anastomosis is leak-tested and a drain is placed. Refer to Figure 1 for a schematic of a completed bypass.

Operations were performed by four general surgeons with advanced training in minimally invasive surgery with two performing the majority of the operations (E.D. and A.M.). With approval from the Institutional Review Board, a comprehensive prospective database was established and is continually maintained. Data recorded include comorbidities, operative techniques, perioperative events, complications, and follow-up information. The latter was obtained through clinic visits as well as mail, telephone, fax, and most recently web-based surveys. Outcomes data were reviewed at least annually; if change was deemed necessary, new strategies were implemented by consensus of all team members.

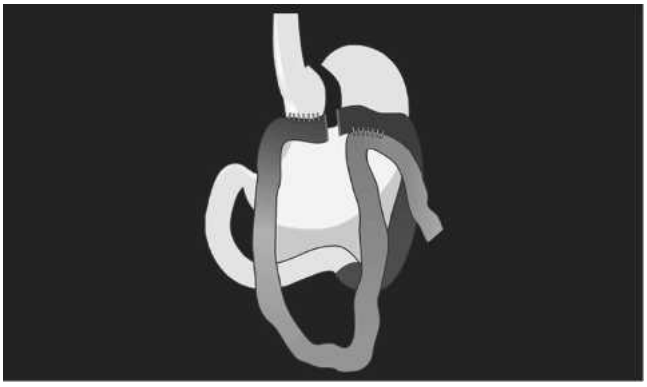

FIG. 1. Schematic of completed antecolic, antegastric Roux-en-Y gastric bypass.

Results

Patient characteristics and comorbidities are outlined in Table 1. The majority of patients were women (84%) with an average body mass index of 50.2 kg/m^2 and a typical distribution of obesity-related complications.

Table 2 outlines our operative technique. A laparoscopic approach was undertaken in all patients regardless of surgical history. There were two open conversions early in the program resulting from technical difficulties.

Table 3 outlines short- and long-term complications. Major complications were defined as bleeding, gastrointestinal obstruction, anastomotic leak, and major cardiac or pulmonary events. There were no inpatient or perioperative deaths. The 30-day readmission rate was 4.6 per cent (51 patients). The two most common reasons for readmission included nausea, vomiting, and self-limited abdominal pain in 27 patients (2.5% of patients) and gastrointestinal obstruction in 10 patients (0.9%). The 30-day reoperation rate of 2 per cent (22 patients) consisted mostly of reoperations for gastrointestinal bleeding or obstruction. The overall (major and minor) complication rate was 7 per cent. There were no documented cases of gastrojejunostomy strictures. Late (greater than 30 days) complications were typically related to marginal ulcers and perforations, occurring in 1.3 per cent and 1.4 per cent of patients, respectively. There were two known late deaths at 9 and 18 months related to complications of liver transplant and alcoholism, respectively.

Table 4 outlines long-term follow up and weight

TABLE 1. *Patient Characteristics*

Mean age (years) [range]	43.8 [16–68]
Mean weight (lbs) [range]	301 [199–561]
Mean body mass index (kg/m^2) [range]	50 [35–96]
Gender	Female: 921 (84%)
	Male: 175 (16%)
Comorbidities	DM: 603 (55%)
	HTN: 300 (27%)
	OSA: 282 (26%)
	HL: 677 (62%)

DM, diabetes mellitus; HTN, hypertension; OSA, obstructive sleep apnea; HL, hyperlipidemia.

TABLE 2. *Operative Technique**

Retrocolic/retrogastric	143 (13%)
Antecolic/antegastric	953 (87%)
Conversion to open	2 (0.2%)

* Figures are given as n (%) with total n = 1,096.

TABLE 3. *Complications**

Complication	Perioperative (30-day)	Late (>30-day)
Bleeding†	49 (4.4%)	2 (0.2%)
Obstruction	10 (0.9%)	7 (0.6%)
Leak	0	0
Ulceration	0	14 (1.3%)
Perforation	3 (0.3%	16 (1.4%)
Cardiac event‡	4 (0.3%)	0
Pulmonary embolus	1 (0.1%)	1 (0.1%)
Pneumonia/other pulmonary	12 (1%)	0
Readmission	47 (4%)	44 (4.2%)
Reoperation	20 (1.8%)	28 (2.5%)
Mortality	0	2 (0.2%)

* Figures are given as n (%) with total n = 1,096.
† Defined as: hematocrit drop greater than 8 points, melena, hematemesis, or need for transfusion.
‡ Defined as myocardial infarction, dysrhythmia, atrioventricular block,

TABLE 4. *Long-Term Weight Loss*

Postoperative Year	1	2
Mean %EWL	63%	62%
Patients with follow-up data	383 (35%)	230 (21%)

%EWL, excess body wt loss = weight lost/excess weight. Excess weight = starting weight – ideal body weight.

loss results. Of those available for follow up at 1 year and beyond, 35 per cent reported having regained more than 15 per cent of their maximum weight loss. Finally, long-term resolution of major comorbidities, including hypertension, diabetes, hyperlipidemia, and sleep apnea, are outlined in Table 5.

Discussion

Maintenance of a comprehensive patient database, outcomes tracking, and evidence-based changes to established practice patterns are vital elements of a bariatric surgery program.[10, 12, 13] Our experience with such practices has affirmed a number of our own methodologies while also providing the basis for needed change.

TABLE 5. *Per cent of Patients with Improvement and/or Resolution of Comorbidities*

Comorbidity	Improvement	Resolution
HTN	28%	58%
DM	16%	43%
OSA	8%	45%
HL	17%	51%

DM, diabetes mellitus; HTN, hypertension; OSA, obstructive sleep apnea; HL, hyperlipidemia.

Practice patterns that have been maintained and are validated by data review include the omission of routine preoperative biliary ultrasounds and obstructive sleep apnea testing.[15, 17] In addition, review of patient outcomes and complications affirmed that omitting the postoperative use of continuous positive airway pressure/bilevel positive airway pressure devices in patients with known obstructive sleep apnea is safe and that these patients can be observed in a monitored setting without admission to an intensive care unit.[17]

Gastrojejunal stricture is a well-known complication of RYGB, occurring in up to 11.4 per cent of patients.[18] Treatment typically requires one or more endoscopic dilatations, which carry an inherent risk of perforation, and reoperation or revision may be needed in refractory cases. Since our program's inception, a fully stapled G-J anastomosis has routinely been created using the full length of a blue linear 45-mm stapler over a 32-French OG tube without the use of restrictive bands or meshes. We believe the absence of G-J strictures in our series is directly related to this unconventional technique, which has been validated by initial weight loss results comparable to most other surgical series. Further maturation of our data and longer-term follow up are needed to determine whether these results remain constant over time.

A number of changes to surgical technique and perioperative patient management algorithms have been made based on routine and frequent database analysis. Observing a higher than expected rate of bowel obstructions in the first 141 patients, the retrocolic/retrogastric technique was abandoned in favor of an antecolic/antegastric approach. This modification was validated by subsequent data analysis and outcomes review, which demonstrated a lower early reoperation rate in the antecolic/antegastric group (2.0% *vs* 7.8%, $P = 0.01$).[14]

The pars flaccida approach to the creation of the gastric pouch was undertaken on a trial basis after careful review of the surgical literature.[19, 20] Subsequent data accumulation and outcomes analysis supported its usefulness and safety when compared with the conventional perigastric approach, allowing us to adopt it for all of our cases.[16]

Following established guidelines, routine postoperative upper gastrointestinal studies were obtained in the first 322 cases. Outcomes analysis, however, did not demonstrate its efficacy or meaningful contribution to patient care.[21] A selective approach to postoperative upper gastrointestinal studies was subsequently undertaken and proven to be safe and cost-effective.[22]

Initially in our practice, 80-cm Roux limbs were

created regardless of patient body mass index. Preliminary outcome measurements appeared to support this approach, demonstrating effective weight loss.[23] Long-term data analysis, however, revealed inferior excess weight loss results in the superobese population (body mass index greater than 50 kg/m^2), leading us to increase the Roux limb length to 150 cm in this group.[16] Further maturation of our data is necessary to ascertain the validity and continued safety of this approach.

Similar to other published reports, the inability to maintain long-term patient follow up has been a formidable challenge.[13, 24, 25] Limitations set by referring medical groups and healthcare plans, distance, cost, feeling well, and lack of time have all been cited by our patients as reasons for not maintaining follow up beyond the first 4 postoperative months. To overcome these obstacles, we initially resorted to conducting surveys by telephone, mail, and fax but had suboptimal results. More recently, a user-friendly web-based survey has been used (SurveyMonkey.com, Portland, OR) with some increase in response rate. This improvement has, however, led to the identification of the suspected but previously unconfirmed problem of partial weight recidivism.

Postoperative weight regain has been reported by many authors.[26, 27] In our series, 35 per cent of respondents to our web-based survey reported a 15 per cent or more weight regain from the point of maximum weight loss. Preliminary data analysis indicates a lack of regular exercise and improper dietary habits in 47 per cent and 50 per cent of patients, respectively. These findings are concerning because our patients typically undergo intensive preoperative education and have full access to our program's educational resources in the postoperative phase. The importance of ongoing, multidisciplinary care to achieve greater long-term weight loss has been suggested.[24] To this end, we are presently seeking out successful avenues for maintaining postoperative in-person follow up, which in turn might assist in reducing weight recidivism and recurrence of obesity-related comorbidities.

Conclusion

Maintenance of a comprehensive patient database is an essential component of a bariatric surgery program and its internal quality control measures. Flexibility toward changes in practice patterns is also necessary and should be based on detailed and frequent review of this database. Aggressive long-term patient follow up may be important for maintaining optimum outcomes; however, effective means to achieve this goal remain elusive and may contribute, at least in part, to postoperative weight regain in some patients.

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