Surg Endosc (2007) 21: 1388–1392
DOI: 10.1007/s00464-007-9223-y

SURGICAL ENDOSCOPY
and Other Interventional Techniques

Laparoscopic revision from LAP-BAND® to gastric bypass

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Received: 30 August 2006/Accepted: 9 October 2006/Online publication: 14 March 2007

Abstract
Background: While the majority of patients achieve good outcomes with the LAP-BAND®, there is a subset of patients who experience complications or fail to lose sufficient weight after the banding procedure. This study examines the feasibility and outcome of performing laparoscopic Roux-en-Y gastric bypass (RYGBP) as a single-step revision surgery after a failed LAP-BAND procedure.
Methods: In the past five years we have performed more than 1400 LAP-BAND procedures. We laparoscopically converted 33 (30 females) of these patients (mean age = 43.8 years) from LAP-BAND to RYGBP because of inadequate weight loss and/or complications. Key steps in the revision procedures were (1) identification and release of the band capsule; (2) careful dissection of the gastrogastric sutures; (3) creation of a small gastric pouch; and (4) Roux-en-Y anterior colic anterior gastric pouch-jejunum anastomosis. Revisions took place at a mean 28.2 months (range = 11–46; SD = 11.3) after the original gastric banding. Change in body mass index (BMI) between pre- and postrevision was evaluated with paired *t* tests.
Results: Among the 33 patients who would undergo revision surgery, the mean BMI before the LAP-BAND procedure was 45.7 kg/m^2 (range = 39.9–53.0; SD = 3.4) and the mean weight was 126 kg (range = 99–155; SD = 17). The lowest BMI achieved by this group with the LAP-BAND before revision was 39.7 kg/m^2 (range = 30–49.2; SD = 4.9); however, the mean BMI at the time of revision was 42.8 kg/m^2 (range = 33.1–50; SD = 4.8). The mean revision operative time was 105 min (range = 85–175), and the mean hospital stay was 2.8 days (range = 1–10). Complications included one patient who underwent open reoperation and splenectomy for a bleeding spleen and one patient who required repair of an internal hernia. After conversion to RYGBP, mean BMI decreased to 33.9 kg/m^2 at 6 months ($p < 0.001$) and 30.7 kg/m^2 (range = 22–39.6; SD = 5.3) at 12 months or more of followup (average = 15.7 months; $p < 0.0001$).
Conclusions: Laparoscopic conversion from LAP-BAND to RYGBP is safe and can be an alternative for patients who failed the LAP-BAND procedure. However, revision surgery is technically challenging and should be performed only by surgeons who have completed the learning curve for laparoscopic RYGBP.

Key words: Bariatric — Laparoscopic — Gastric bypass — Revision — Conversion — LAP-BAND

The gastric banding procedure is gaining popularity worldwide because it is minimally invasive, adjustable, and reversible and has been shown to produce good weight loss results [1, 2, 16, 18]. In addition, complications associated with gastric banding are generally minor compared with those seen with other more aggressive weight-loss procedures. While the majority of patients achieve good outcomes with the LAP-BAND, there is a subgroup of patients that experience complications or fail to lose sufficient weight after the banding procedure [2, 5, 9, 18, 21, 25]. For these patients, we offer a laparoscopic single-step revision from the LAP-BAND System to RYGBP. In this report we present the technique and results of 33 of our patients who underwent this revision procedure.

Methods

In the past five years we have performed more than 1400 LAP-BAND procedures. As a result of inadequate weight loss and/or complications (Table 1), we laparoscopically converted 33 of these 1400+ patients from LAP-BAND to RYGBP. Data were collected prospectively and the changes in body mass index (BMI) between pre- and postrevision were evaluated with paired *t* tests.

Before the laparoscopic conversions we performed two successful open conversions: one due to band erosion and one because the patient had failed to lose sufficient weight.

Presented at the Annual Scientific Session of the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES), Dallas, TX, 26–29 April 2006

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Table 1. Reasons for revision from LAP-BAND to RYGBP

Reason for revision[a]	Number of patients *n* (%)
Inadequate weight loss	25/33 (76%)
Gastric pouch dilatation	21/33 (64%)
Intolerance	10/33 (21%)
Band slippage	4/33 (12%)

[a] Some patients had more than one reason for the revision

We used a surgical technique similar to the total stapled, total intra-abdominal (TSTI) technique that has been described before [6]. This technique uses a linear stapling approach for the Y anastomosis (Ethicon Endo-Surgery, Cincinnati, OH) and intra-abdominal transgastric anvil placement using a combination of linear and circular staples (Ethicon Endo-Surgery) for the pouch jejunal anastomosis. The enteric limb is positioned in an anterior-colic and anterior-gastric fashion.

The procedure starts by freeing the left lobe of the liver from the LAP-BAND surgical area so that it can be lifted upward. The path of the silicone band tube is followed and the fibrous capsule of the band is dissected so that the band can be rotated. Previously placed pouch-gastric sutures may have formed extensive tissue connections; they should be separated before the band is removed. During the dissection, care should be taken to avoid injuring the pouch side of these pouch-gastric connections; therefore, dissection should be performed on the stomach side—even at the cost of injuring the stomach wall.

The band serves as a good guide for the dissection—only when all of the gastrogastric connections have been eliminated should it be cut and removed. To create the new gastric pouch dissection is then performed at the lesser curvature of the stomach, approximately 1–2 cm below the band capsule, aiming to enter the lesser sac. The pouch is created using the transabdominal approach for introducing the anvil of the 25-mm circular stapler into the gastric pouch [15]. Calibration of the gastroesophageal junction and pouch is performed with a 28–30 Fr bougie.

The dissection of the pouch-gastric sutures may have injured the stomach wall; therefore, it is important, when creating the pouch, to pull this dissected fundus wall (where the sutures were) away from the staple line and away from the boundaries of the small pouch. Later, this part of the gastric fundus can be repaired or wedge-resected. Sometimes, significant pouch dilatation occurs. Many of these pouches are made of an upper gastric component as well as a distal lower esophagus component. If there is a large and significant pouch dilatation, a wedge resection of the pouch can be performed, removing the redundant pouch tissue and creating a distal neoesophageal segment. This part of the procedure is performed by retracting the pouch laterally to the left while the anesthesiologist places a 28–32 Fr bougie all the way to the antrum. The surgeon applies the linear stapler over the pouch—first, horizontally from left to right, reaching the calibration bougie. Then, the surgeon applies the linear stapler vertically toward the angle of Hiss along the bougie, transecting the redundant pouch. In this way, a neo-esophagus is created over the calibration bougie. We do not oversaw or add anything else to the staple line. The procedure is completed by performing jejunal pouch anastomosis using the transabdominal 25-mm circular stapler in an anterior-colic anterior-gastric fashion. A closed drain is left at the left upper quadrant. Patients undergo a radiologic upper gastroenteric study with water-soluble contrast material on the first or second postoperative day to check for leaks.

Results

The mean age of the 33 patients who underwent revision was 43.8 years (range = 31–62); 30 (91%) of them were female. The mean BMI before the LAP-BAND procedure was 45.8 kg/m^2 (range = 39.9–53.0; SD = 3.4) and the mean weight was 126.4 kg (range = 99–155; SD = 15.7). The lowest BMI achieved by this group with the LAP-BAND before revision was 39.7 kg/m^2 (range = 30–49.2; SD = 4.9); it was achieved at a mean of 11 months (range = 1–24; SD = 7.1). Revision procedures took place a mean of 28.2 months (range = 11–46; SD = 11.3) after the original gastric banding.

All of the revisions from LAP-BAND to RYGBP were successfully completed laparoscopically. The mean revision operative time was 105 min (range = 85–175) and the mean hospital stay was 2.8 days (range = 1–10). Pre- and postrevision contrast studies are shown in Figure 1.

The mean BMI at the time of revision was 42.8 kg/m^2 (range = 33.1–50; SD = 4.4.). After conversion to RYGBP, mean BMI decreased to 33.9 kg/m^2 at 6 months' followup ($p < 0.001$). Eighteen of the 33 patients were followed for more than 12 months. Before revision, this group of 18 patients had a mean BMI of 42.4 kg/m^2, which was similar to that of the series as a whole. At a mean followup of 15.7 months (range = 12–26), the mean BMI in this group had decreased to 30.7 kg/m^2 (range = 22–39.6; SD = 5.3; $p < 0.0001$), as shown in Figure 2.

There were two complications: One patient required reoperation and splenectomy for bleeding splenic hilum vessels and one patient underwent laparoscopic repair of a Petersen's type internal hernia one year after the revision procedure.

In the followup of this series, no difference in weight loss was found between patients with and without preoperative pouch dilatation.

Discussion

As with any other restrictive bariatric procedure, a subgroup of patients who receive the LAP-BAND fail to lose enough weight. Although we believe that much of the failure is probably related to compliance and lifestyle issues, we also believe that some of these patients may have required a more aggressive procedure. We have found that gastric bypass, which has both restrictive and malabsorptive components, is a good second-line choice for patients who did not do well with the band.

Conversion from LAP-BAND to gastric bypass has generally been performed as an open procedure and considered a difficult operation. However, some surgeons have reported initial positive experience performing the revision procedure laparoscopically [10, 12, 22].

Recently, Mognol and colleagues [14] in France reported the conversion of 70 patients from LAP-BAND to gastric bypass. In their series a single procedure was performed in 47 patients (67%). The other patients underwent a two-step procedure (i.e., laparoscopic band removal followed by laparoscopic RYGBP a few months later).

We find no theoretical or practical advantage in performing the revision procedure in two steps. In fact, the band itself serves as a guide to better identify the anatomy at the gastroesophageal junction and helps to

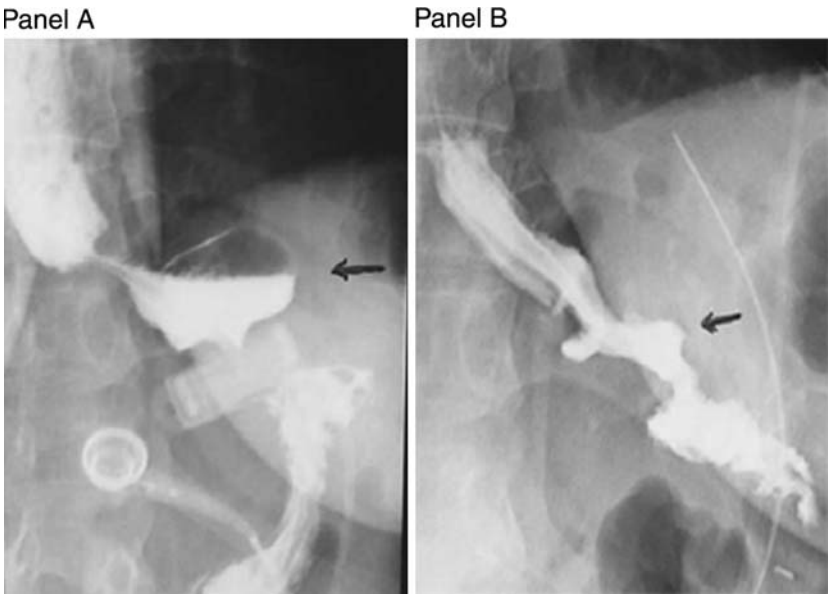

Fig. 1. Radiologic upper gastroenteric studies with water-soluble contrast material. **A** Prerevision contrast study showing a component of pouch dilation. **B** Postrevision and esophagoplasty contrast study shows a very small gastric pouch, good contrast flow, and no leaks.

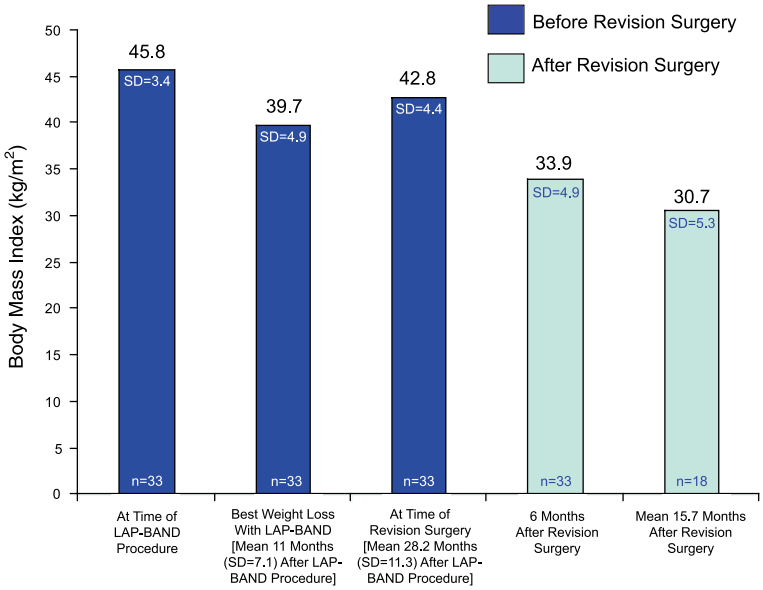

Fig. 2. Change in body mass index (BMI) over time. The mean BMI at the time of revision was 42.8 kg/m^2 (range = 33.1–50; SD = 4.4.). After conversion to RYGBP, mean BMI decreased to 33.9 kg/m^2 at 6 months' followup ($p < 0.001$). Eighteen of the 33 patients were followed for more than 12 months. Before revision, this group of 18 patients had a mean BMI of 42.4 kg/m^2, which was similar to that of the series as a whole. At a mean followup of 15.7 months (range = 12–26), the mean BMI in this group had decreased to 30.7 kg/m^2 (range = 22–39.6; SD = 5.3; $p < 0.0001$).

identify the pouch-gastric sutures and connections. The most critical technical issue we found was separating the pouch-gastric sutures on the stomach side and then pulling this area away from the linear stapler that creates the boundaries of the new small pouch. The idea is to prevent this potentially weak gastric wall from becoming part of the new pouch. After the pouch is created, this area on the stomach side can then be removed or repaired. It is also important, after removal of the band, to calibrate the pouch using a 28–32 Fr bougie to prevent inadvertent stapling and occlusion of the gastroesophageal junction. Larger-size bougies are not needed and may not pass easily through the stricture left by the band capsule just below or at the gastroesophageal junction.

It is important to create a small gastric pouch at a fresh area, we prefer anastomosis at a fresh area of gastric tissue just below the gastroesophageal junction. Sometimes, as a result of band restriction, there is evidence of pouch dilatation proximal to the band. These pouch dilatations are usually consistent, at least in part, with a component of distal esophageal dilatations and do not represent only gastric wall pouch. Many times these pouches are reversible after revision surgery and are shown to have collapsed on followup contrast studies. Nevertheless, we tend to perform esophagoplasty calibrated by bougie in cases in which we find significant distal esophageal dilatation.

Serious perioperative complications, including anastomotic leaks with major wound infections, staple line disruptions, small-bowel obstructions, marginal ulcers, or stomal stenoses, have been reported in 11%–18% of patients in studies of revision surgery [4, 8, 19, 24]. The rate of complications among our series of LAP-

BAND-to-RYGBP revision patients is comparable to that reported in primary (initial) RYGBP series [3, 17, 23] and is lower than that reported in revision series from vertical-banded gastroplasty (VBG) or silastic ring vertical gastroplasty (SRVG) to RYGBP [4, 7, 8, 11, 19, 20, 24]. It is especially important to note that no leaks or other serious complications occurred in our series of revision patients. It is our opinion that this low rate of complications occurred because the LAP-BAND does not cause adhesions to the gastric wall and therefore can be very easily removed (''shelled out'') after the fibrous capsule of the band has been dissected. The only reason we do not remove the band earlier in the revision procedure is that the band serves as an anatomic guide for the boundaries of the pouch, allowing us to completely identify the pouch-gastric connections. After the separation of the pouch-gastric sutures and the opening of the fibrous capsule, the band is removed without leaving dense adhesions to the esophagus or stomach. The anatomy of the patient who has had the LAP-BAND has not changed much and, in contrast to revisions from VBG, there is no line of staples to consider and the surgical area has few or no problems with adhesions or decreased vascularization.

In our series of revision patients, one patient required re-exploration and splenectomy to remedy postoperative bleeding. Although there is always a technical factor leading to such a complication, we believe that the liberal use of low-molecular-weight heparin given preoperatively for deep venous thrombosis prophylaxis played a major role in this complication. Similar bleeding (although with less severe consequences) has occurred with our regular bypass series when we have used preoperative heparin or low-molecular-weight heparin for deep vein thrombosis prophylaxis. One other patient required laparoscopic exploration and repair of an internal (Petersen's space) hernia one year after the revision procedure. We now close these potential defects on all of our gastric bypass patients.

Postoperatively, the weight loss in our series has been comparable to what has been shown with primary laparoscopic RYGBP [17, 23].

Conclusions

In our experience, although laparoscopic conversion of LAP-BAND to RYGBP is technically demanding, it is much less complicated than conversion from other bariatric procedures. The ability to safely convert failed LAP-BAND cases to gastric bypass in a single surgery, especially using a laparoscopic technique, is very important and contributes to the acceptance not only of the LAP-BAND procedure but also of bariatric surgery in general. Many patients who are on the light side of the bariatric scale do not want to consider ''aggressive'' procedures like RYGBP but they can still benefit from and will consider the LAP-BAND System, especially if a revision to a bypass is possible later on, if necessary.

Surgeons who routinely perform bariatric operations, including the LAP-BAND, will undoubtedly encounter a certain percentage of patients who either fail to lose an acceptable amount of weight or have a complication that requires revision. Laparoscopic conversion from LAP-BAND to RYGBP is technically challenging but safe and allows weight loss to continue. However, we believe that only surgeons who have passed the learning curve for performing the laparoscopic gastric bypass should approach this procedure.

References

1. Allen JW, Coleman MG, Fielding GA (2001) Lessons learned from laparoscopic gastric banding for morbid obesity. Am J Surg 182: 10–14
2. Angrisani L, Furbetta F, Doldi SB, et al. (2003) Lap Band adjustable gastric banding system: the Italian experience with 1863 patients operated on 6 years. Surg Endosc 17: 409–412
3. Balsiger BM, Kennedy FP, Abu-Lebdeh HS, et al. (2000) Prospective evaluation of Roux-en-Y gastric bypass as primary operation for medically complicated obesity. Mayo Clin Proc 75: 673–680
4. Behrns KE, Smith CD, Kelly KA, Saarr MG (1993) Reoperative bariatric surgery. Lessons learned to improve patient selection and results. Ann Surg 218: 646–653
5. Belachew M, Belva PH, Desaive C (2002) Long-term results of laparoscopic adjustable gastric banding for the treatment of morbid obesity. Obes Surg 12: 564–568
6. Calmes JM, Giusti V, Suter M (2005) Reoperative laparoscopic Roux-en-Y gastric bypass: an experience with 49 cases. Obes Surg 15(3): 316–322
7. Carrasquilla C, English WJ, Esposito P, Gianos J (2004) Total stapled, total intra-abdominal (TSTI) laparoscopic Roux-en-Y gastric bypass: one leak in 1000 cases. Obes Surg 14: 613–617
8. Cordera F, Mai JL, Thompson GB, Sarr MG (2004) Unsatisfactory weight loss after vertical banded gastroplasty: is conversion to Roux-en-Y gastric bypass successful? Surgery 136: 731–737
9. Favretti F, Cadiere GB, Segato G, Himpens J, De Luca M, Busetto L, De Marchi F, Foletto M, Caniato D, Lise M, Enzi G (2002) Laparoscopic banding: selection and technique in 830 patients. Obes Surg 12: 385–390
10. Gagner M, Gentileschi P, de Csepel J, Kini S, Patterson E, Inabnet WB, Herron D, Pomp A (2002) Laparoscopic reoperative bariatric surgery: experience from 27 consecutive patients. Obes Surg 12: 254–260
11. Jones KB Jr (2001) Revisional bariatric surgery-safe and effective. Obes Surg 11: 183–189
12. Kothari SN, DeMaria EJ, Sugerman HJ, Kellum JM, Meador J, Wolfe L (2002) Lap-band failures: conversion to gastric bypass and their preliminary outcomes. Surgery 131: 625–629
13. Martin MJ, Mullenix PS, Steele SR, See CS, Cuadrado DG, Carter PL (2004) A case-match analysis of failed prior bariatric procedures converted to resectional gastric bypass. Am J Surg 187: 666–670
14. Mognol P, Chosidow D, Marmuse JP (2004) Laparoscopic conversion of laparoscopic gastric banding to Roux-en-Y gastric bypass: a review of 70 patients. Obes Surg 14: 1349–1353
15. Murr MM, Gallagher SF (2003) Technical considerations for transabdominal loading of the circular stapler in laparoscopic Roux-en-Y gastric bypass. Am J Surg 185: 585–588
16. Ren C, Weiner M, Allen J (2004) Favorable early results of gastric banding for morbid obesity. Surg Endosc 18: 543–546
17. Schauer PR, Ikramuddin S, Gourash W, Ramanathan R, Luketich J (2000) Outcomes after laparoscopic Roux-en-Y gastric bypass for morbid obesity. Ann Surg 232: 515–529
18. Spivak H, Hewitt MF, Onn A, Half EE (2005) Weight loss and improvement of obesity-related illness in 500 U.S. patients following laparoscopic adjustable gastric banding procedure. Am J Surg 189: 27–32
19. Sugerman HJ, Kellum JM Jr, DeMaria EJ, Reines HD (1996) Conversion of failed or complicated vertical banded gastroplasty to gastric bypass in morbid obesity. Am J Surg 171: 263–269

20. van Gemert WG, van Wersch MM, Greve JW, Soeters PB (1998) Revisional surgery after failed vertical banded gastroplasty: restoration of vertical banded gastroplasty or conversion to gastric bypass. Obes Surg 8: 21–28
21. Vertruyen M (2002) Experience with Lap-Band System up to 7 years. Obes Surg 12: 569–572
22. Weber M, Muller MK, Michel JM, Belal R, Horber F, Hauser R, Clavien PA (2003) Laparoscopic Roux-en-Y gastric bypass, but not rebanding, should be proposed as rescue procedure for patients with failed laparoscopic gastric banding. Ann Surg 238: 827–833
23. Wittgrove AC, Clark GW (2000) Laparoscopic gastric bypass, Roux-en-Y- 500 patients: technique and results, with 3–60 month follow-up. Obes Surg 10: 233–239
24. Yale CE (1989) Conversion surgery for morbid obesity: complications and long-term weight control. Surgery 106: 474–480
25. Zinzindohoue F, Chevallier JM, Douard R, Elian N, Ferraz JM, Blanche JP, Berta JL, Altman JJ, Safran D, Cugenac PH (2003) Laparoscopic gastric banding: a minimally invasive surgical treatment for morbid obesity: prospective study of 500 consecutive patients. Ann Surg 237: 1–9