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ORIGINAL ARTICLE

Revisional bariatric surgery for failed gastric banding in Asia: A review of choice of revisional procedure, surgical technique and postoperative complication rates

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Abstract

Introduction: In Asia, long-term weight loss results of gastric banding have been unsatisfactory. Bands are associated with higher complication rates, which result in a high reoperation rate. The aim of this paper is to discuss the choice of revisional procedure, operative technique and evaluate the postoperative complication rates.
Methods: Between January 2007 and January 2010, we operated on 41 patients who were included retrospectively in this series. The most common reason for band removal was failure to lose adequate weight. Of those patients, 40 underwent band removal and conversion to a revisional bariatric surgery concomitantly; one patient's procedure was deferred to a later date. LSG was performed in 26 and LRYGB in 15. The highlights of the operative technique were meticulous dissection, complete removal of the pseudocapsule, choosing the right stapler cartridge, oversewing and inverting the entire staple line, and complete dissection of the left crus and pars flaccid.
Result: The median duration of surgery was 85 min (range, 55–180 min). There was no conversion to open surgery. The median stay in the hospital was 4 d (range, 2–7 d). There were no leaks or any other major complications in the postoperative period.
Conclusion: Concomitant revisional procedure after removal of gastric band is safe and feasible. The operative technique followed at our center has had an extremely low postoperative morbidity rate and a 0% leak rate.

Introduction

Bariatrics has evolved from the days of open vertical banded gastroplasty (VBG), jejunoileal bypasses and non-adjustable gastric bands in the late 1970s to LRYGB and LSG, which are now becoming the preferred procedures of the Asian surgeons. In the early days of bariatric surgery, LAGB was the most commonly performed procedure in Europe and Australia probably because of its technical ease, reversibility and relatively low short-term complication rate. In 2004, 42.3% of all bariatric surgeries performed in the Asia-Pacific region were LAGBs (1). Even in the USA there has been an increase in the number of bands. However, increased experience with LAGB has shown lesser excess weight loss than other procedures, a higher long-term failure rate and an increase in complications related to the prosthesis over the long term. LAGB has particularly failed in the Asian setting, as compared to Australia, probably as a result of dietary habits, patients' unrealistic expectations and inadequate follow-up. In Europe, from 2003 to 2008, the number of LAGB procedures decreased from 63.7% to 43.2% of bariatric procedures performed; This percentage decrease reflected a decrease in the actual number of procedures performed. Additionally, a high removal rate

has been reported (2). Removal of the band alone can lead to weight regain, and while successful rebanding has not been very well reported in the literature (3), other reports suggest that revision involving another procedure such as LRYGB may be a better option in these cases.

Over the last couple of years, the reoperation rate after LAGB has increased greatly, with more and more patients seeking better excess weight loss and the resolution of comorbidities. Some Asian studies have reported reoperation rates as high as 25% after LAGB (4). Revision surgeries pose the biggest challenge in any bariatric practice. Revision surgeries are not only technically demanding but are also said to be associated with high complication rates. As such, this paper aims to detail the choice of procedure and operative technique for revisional surgery after failed gastric banding at our center. It will also evaluate the complication and leak rates after gastric band removal and concomitant revisional procedures.

Materials and Methods

From January 2007 to January 2010, 41 patients were studied to assess the feasibility of removing a previously performed LAGB and concomitantly revising the surgery employing another bariatric procedure such as LSG or LRYGB. Six men and 35 women were included in the study. The median age was 32 years (range, 17–69 years). The median preoperative BMI was 39 kg/m^2 (range, 33.4–53 kg/m^2). The reasons for band removal are listed in Table 1. The most common reason for revision surgery was inadequate weight loss or failure to lose weight after LAGB. All patients were routinely evaluated preoperatively and postoperatively by the multidisciplinary team (nutritionists, endocrinologist, surgeons and psychiatrist) from the Center for Obesity and Diabetes Support.

Band removal and concomitant conversion to LSG or LRYGB was performed on 40 patients: 25 patients underwent a revisional LSG and 15 patients had revisional LRYGB.

Factors that were taken into account for deciding between LSG and LRYGB were:

- age of the patient
- BMI at the time of the primary procedure (i.e. gastric banding)
- related comorbidities
- absence or presence of a large hiatal hernia
- the ability to take multivitamin and mineral supplements on a long-term basis.

Table 1 Causes of failure of band

Cause	No of patients (n = 41)
Failure to lose weight	30
Band slippage	4
Port site complications	3
Reflux/vomiting	2
Band erosion	1
Total obstruction	1
Perforation of the stomach	0

LRYGB was preferred in patients that:

- were older and had multiple comorbidities
- had type 2 diabetes mellitus with C-peptide levels below 3 or history of diabetes more than 10 years
- had a large hiatal hernia.

LSG was preferred in younger patients who were unable to take nutritional supplements in the long term.

One patient had a band that had completely eroded into the stomach; she was excluded from a concomitant revisional procedure. In her case, gastrotomy was performed and the band was removed. Gastrogastric sutures were used to close the stomach in two layers, and omentoplasty was done. The revisional procedure was deferred, and LSG was performed 3 months after the band was removed.

Preoperative preparation

Prior to band removal and revision, patients receive counseling and are assessed to determine the causes of the first procedure's failure. The revisional procedure's likelihood (i.e. percentage) of success is also explained. We conducted plain radiographs and barium studies of the upper abdomen in all the patients, and we performed upper GI endoscopies only in cases where we had clinical suspicion of band erosion. All patients followed a high-protein, low-carbohydrate preoperative diet for a period of 7 d prior to surgery. Prophylaxes for deep vein thrombosis in the form of compression stockings, deep vein thrombosis pumps and low molecular weight heparin were administered to all patients.

Technique

All the surgeries were performed laparoscopically. A five-port technique was used for conversion to LSG and a six-port technique was used for conversion to LRYGB. In all cases, the abdominal cavity was entered using an under-vision trocar, and the port tubing was cut once the abdomen had been entered. Dense adhesions were commonly observed between the band and the left lobe of liver. The upper part of lesser curvature of the stomach was also densely adhered to the left lobe of liver, caudate lobe and buckle of the band (Figure 1).

We began by removing the adhesions using sharp dissection in the form of scissors rather than blunt dissection. In the event of an iatrogenic injury to the stomach, it was easier to repair a clean cut made by scissors rather than an irregular rent secondary to blunt dissection. Energy sources such as the Harmonic scalpel (Ethicon, Somerville, USA) and Ligasure (Covidien, Mansfield,

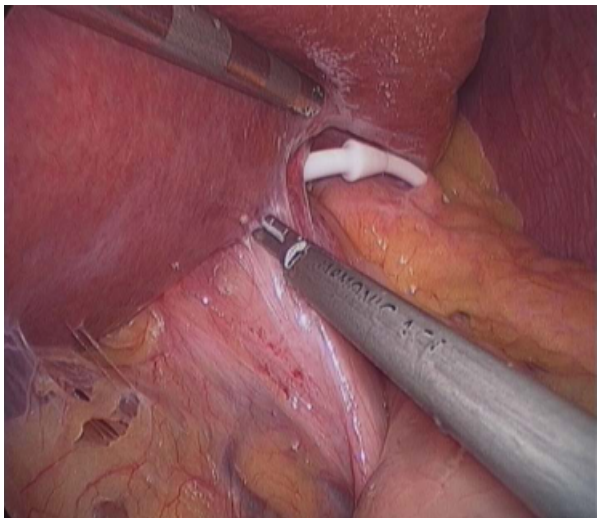

Figure 1 Adhesion between the liver, the buckle of band and the stomach.

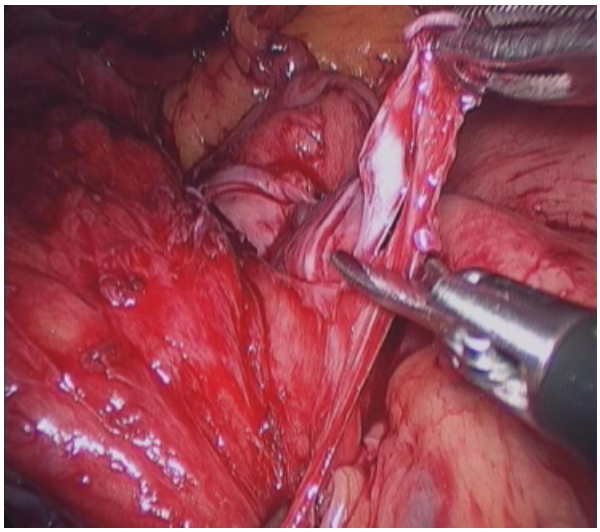

Figure 2 Dissection of the pseudocapsule from the surface of the stomach.

USA) were employed only when necessary during adhesion removal. Blood oozing from the liver capsule's dissected surface was usually self-contained, though external compression with a piece of radio opaque gauze was helpful. It was extremely important to identify the entire anatomy before proceeding with the revisional procedure; in particular, it was important to recognize the serosal surface of the stomach to avoid possible injury.

Silicon bands usually induced a fibrous reaction from the stomach called a "pseudocapsule," and dense adhesions were found in the region of the band buckle. We found it helpful if the buckle were near the caudate lobe rather than the left crus. The dissection was begun after identifying the buckle and making an incision on top of it. Even if the patient required rebanding with the same band, the technique made it less likely to damage the band. The entire band system was removed after cutting the band in the middle. The pseudocapsule of the band remained on the stomach wall, sometimes all around the stomach. Its presence on the posterior surface in the region of the right crus can hinder the entry of the calliberation bougie and can also cause strictures in the future. We strongly believe the entire pseudocapsule should be dissected from the surface of the stomach. Usually there is a plane between the serosal surface of the stomach and the pseudocapsule (Figure 2), and after it has been dissected, the entire pseudocapsule is removed from the anterior and posterior surfaces of the stomach. We believe that firing staplers without removing the pseudocapsule is a major cause of staple line disruption and leaks. This may happen for two reasons:

1. The width of the staples is insufficient to accommodate the stomach tissue and the pseudocapsule, and the wrong choice of stapler cartridges (i.e. blue or green) can lead to staple line leaks.
2. The pseudocapsule mainly consists of fibrous tissue and, hence, has a very low healing power, which may lead to delayed leaks.

In any revision surgery, the anatomy is usually distorted from the previous procedure. There is also a high chance of injuring other organs in the vicinity like the spleen, pancreas, liver and the left gastric pedicle. It is important to dissect the left crus and identify the angle of His, as this area tends to have dense adhesions after gastric banding. Proper dissection enables the complete removal of the fundus of the stomach, which is necessary for good results after any bariatric surgery. In cases of LRYGB, we usually prefer to create the pouch above the region of the band. We use green stapler cartridges in the area of the band, as there is some degree of tissue edema and thickening. The width of the blue loads, which are normally used, is insufficient for stapling edematous tissue during revision surgery. We strongly recommend inverting and oversewing staple lines in all revisional surgeries; this likely plays a major role in preventing postoperative leaks, especially as we do not use buttress materials to reinforce the staple line. While these materials do help in controlling bleeding from staple lines, no study has shown that they prevent leaks. In all the cases of revisional surgery, we left the abdominal drain *in situ* for at least 7 d, even in the absence of a documented leak on contrast studies. Delayed leaks due to poor tissue healing are known to occur in cases of revisional surgery. Leaving the drain in for 7 d creates a fistulous tract that can prevent an intra-abdominal abscess in case of a delayed leak.

A leak test with methylene blue or an underwater gastroscopy was done on table in all cases.

Postoperative care

An oral contrast study was performed 2 or 3 d postoperative, following which patients were started on oral liquids. We usually discharged the patients with the drain at 3 or 4 d postoperative and then removed the drain 7 d postoperative. Low molecular weight heparin and antibiotics are continued for 7 d postoperative. Patients are kept on a liquid diet for the first 15 d postoperative and are permitted semisolids for the next 15 d.

Results

LRYGB and LSG were the choice of procedures after failed gastric banding. Rebanding was not considered as an option in any case. The median duration of surgery was 85 min (range, 55–180 min). All cases were done laparoscopically, and there was no conversion to open surgery. In 40 patients the revisional procedure was carried out concomitantly with gastric band removal; in one patient it was deferred to a later date. The technique described in the Materials and Methods section was used for all cases. There were no major intraoperative complications. The median stay in the hospital was 4 d (range, 2–7 d). One patient had basal lung atelectasis; apart from that there were no other minor or major complications. No leaks were reported in the early or late period. There were no deaths. A comparative analysis of patients who underwent a revisional LSG or LRYGB can be found in Table 2.

Discussion

At the time of its inception in the late 1990s, bariatric surgery was synonymous in Asia with restrictive procedures like open VBG and gastric banding. With time the VBG faded away. As Asian surgeons became increasingly proficient with laparoscopic bariatric surgery, LAGB became the most commonly performed bariatric procedure on the continent. The technical ease, relatively short learning curve, lesser nutritional deficiencies and the reversibility of the procedure added to its popularity. In addition to this, the short-term complication rate after LAGB was reported to be less than after other more complex procedures such as LRYGB (5–8). However, over several years LAGB failed to deliver in Asia. The underwhelming results with regard to postoperative excess weight loss may have been caused by factors such as traditional dietary habits and poor follow-up rates. Patient attitudes and unrealistic expectations of the procedure led to a decrease in the number of LAGB over the later years. Using the Gastrointestinal Quality of Life Index, Lee *et al*. reported that the quality of life in Asian patients did not improve after LAGB, and this led to be a major detractor of banding in Asia (9). Additionally, the long-term complication rate after banding has been reported to be up to 24% (10). Consequently, banding has become associated with a high reoperation rate.

Table 2 Comparative analysis of patients undergoing revisional LSG and LRYGB

Criteria	LSG (median)	LRYGB (median)
Age	32 years (range, 17–69 years)	38 (range, 31–65 years)
Sex (M:F)	4:22	2:13
Preoperative BMI	36 kg/m^2 (range, 33–53 kg/m^2)	38 kg/m^2 (range, 33.4–52 kg/m^2)
Time for revision	3 years (range, 8 months–4 years)	2.8 years (range, 1.5–4.8 years)
Operative time	72 min (range, 55–120 min)	85 min (range, 78–136 min)
Blood loss	50 ml (range, 30–100 ml)	65 ml (range, 40–110 ml)
Hospital stay	3 d (range, 2–6 d)	3 d (range, 2–7 d)
Median weight loss at 6 months	15.5 kg (range, 10.4–24 kg)	14 kg (range, 12–19 kg)

In Asia, resolution of comorbidities was better with LSG and LRYGB than LAGB. The most common causes for revisional surgery after LAGB were the failure to lose optimum weight and pouch dilatation after the primary procedure, which eliminated rebanding as an option. In Asia, the procedures of choice for conversion are LRYGB and LSG. Duodenal switch and biliopancreatic diversion are not suitable options for the Asian population, as the high postoperative nutritional demands of both procedures are difficult to meet if patients follow traditional regional diets.

Revisional bariatric surgeries indisputably pose the highest technical challenge for any surgeon. There are four main points of contention in the short term: open versus laparoscopic conversion, the choice of revisional procedure for best outcome, the feasibility of doing the revisional procedure concomitantly with the removal of the band, and minimizing postoperative complication rates.

Laparoscopic revisional bariatric surgeries are extremely demanding procedures and are considered to be of the highest grade of difficulty. It is thought that these procedures are associated with a high complication rate. In spite of this reputation, the conversion rate of laparoscopic revision surgery to open surgery has not exceeded 4% (11). The only reason for conversion to a laparotomy is said to be severe adhesions. Van Wageningen *et al*. reported the results of two centers doing revision surgeries in Netherlands and noted no significant difference in the blood loss and complication rates of open or

laparoscopic revision surgeries (12). In our series all the procedures were done laparoscopically, and there were no conversions to open surgery. The median operating time was 85 min (range, 55–180 min), which is comparable to what Spivak *et al*. reported, and is shorter than most other reported series (13–15). The median hospital stay in our series was 4 d, which is comparable to other series (13,15).

We strongly believe that doing laparoscopic revisional bariatric surgeries needs the highest level of surgical aptitude, talent and dexterity. It should be done in high volume centers with adequate work in bariatric surgery (16). Conversion to open surgery must be minimized to enable a comparatively less painful postoperative period and early mobilization, prevent deep vein thrombosis, reduce incidence of wound infection, shorten hospital stay, promote early return to work and decrease the risk of future incisional hernias.

There are three options for patients who have failed an LAGB: remove the gastric band and restore the normal anatomy, rebanding or conversion to another bariatric procedure. Removal of the band and restoration of the anatomy leads to rapid weight regain in obese subjects, which can, in turn, lead to a resurgence of comorbid conditions such as type 2 diabetes mellitus and other components of metabolic syndrome. Weight regain also makes the revisional procedure much more complex and difficult at a later date. In our series, we deferred the revisional surgery only in one case where the band was found to be completely eroded into the stomach cavity. We had to do a gastrotomy to remove the band and close the stomach in two layers. LSG was done in this patient after 3 months. Forty out of 41 patients underwent the revisional surgery concomitantly. We recommend that band removal be accompanied by a secondary procedure at the same sitting.

Internationally the most common procedures performed after band removal are LRYGB and duodenal switch (13,17). Both procedures have an additional malabsorptive component that is considered to be necessary for success after a restrictive procedure such as LAGB has failed. DS is not a very popular procedure in Asia, and most patients undergo an LRYGB as a revision, though LSG has been gaining popularity in Asia. Our own study showed that the excess weight loss and resolution of comorbidities after an LSG is comparable to that after an LRYGB (18). This previous study included 100 patients – 50 who underwent LRYGB and 50 who underwent LSG. These patients were matched for age, gender and BMI. At the end of one year, we observed that the median percent excess weight loss was 76.1% after LSG and 62.2% after LRYGB. Also, the resolution of type 2 diabetes and other comorbidities was comparable between both the procedures. Other Asian studies by Shah *et al*. and Han *et al*. and have shown equally good resolution of comorbidities at the end of one year with LSG alone (19,20). In addition to its advantages such as low incidence of nutritional deficiencies and easy accessibility of the stomach sleeve for endoscopy, especially in centers like Japan and Korea where there is a high incidence of stomach cancers, these studies indicate that LSG is a preferred procedure in selected patients. Early results of LSG are comparable to LRYGB, making LSG a good option for revisional surgery.

The issue of rebanding is another area that needs special mention. In Asia, the most common reason for reoperation after LAGB is inadequate weight loss or pouch dilatation after the procedure. Rebanding as a salvage procedure after band failure has not produced good results, and it is not recommended as it can have the same failure rate (14).

Lastly but most importantly, revisional surgeries are associated with very high complication rates. The leak rate following revisional surgery ranges from 0% to 21% (13,15,21). The reported average complication rate is 7%, but in some series it has reached up to 19% (22). Most studies have shown no mortality. In our series the complication rate was particularly low, and there was a 0% leak rate. We attribute this to our technique as described in detail in the Materials and Methods section. Besides the basics of meticulous dissection and defining the anatomy, we believe the essential steps for successful revisional surgery are completely removing the pseudocapsule covering the band, choosing the right stapler cartridge, oversewing and inverting the entire staple line, and completely dissecting the left crus and pars flaccida. Concomitant revision LRYGB or LSG after removing the gastric band are feasible and safe. Good technique and dissection of the pseudocapsule can minimize the complication rate, particularly the likelihood of leakage.

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References

1. Lee WJ & Wang W. Bariatric surgery: Asia-Pacific perspective. *Obes Surg* 2005; **15**: 751–757.
2. Buchwald H & Oien DM. Metabolic/bariatric surgery worldwide 2008. *Obes Surg* 2009; **19**: 1605–1611.
3. Suter M. Laparoscopic band repositioning for pouch dilatation/slippage after gastric banding: Disappointing results. *Obes Surg* 2001; **11**: 507–512.
4. Wong SKH, Mui WLM, Ng EKW. Development of bariatric surgery: The effectiveness of a multi-disciplinary weight management programme in Hong Kong. *Ann Acad Med Singapore* 2009; **38**: 9–6.

5. 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**: 536–546. Comment in: *J Am Coll Surg* 2004; **198**:500–502.
6. Ganesh R, Leese T, Rao AD *et al*. Laparoscopic adjustable gastric banding for severe obesity. *Singapore Med J* 2006; **47**: 661–669.
7. Wong SK, So WY, Yau PY *et al*. Laparoscopic adjustable gastric banding for the treatment of morbidly obese patients: Early outcome in a Chinese cohort. *Hong Kong Med J* 2005; **11**: 20–29.
8. Lee WJ, Wang W, Wei PL *et al*. Weight loss and improvement of obesity-related illness following laparoscopic adjustable gastric banding procedure for morbidly obese patients in Taiwan. *J Formos Med Assoc* 2006; **105**: 887–894.
9. Lee WJ, Wang W, Yu PJ *et al*. Gastrointestinal quality of life following laparoscopic adjustable gastric banding in Asia. *Obes Surg* 2006; **16**: 586–591.
10. Chevalier J-M, Zinzindohouee F, Douard R *et al*. Complications after laparoscopic adjustable gastric banding for morbid obesity: Experience with 1,000 patients over 7 years. *Obes Surg* 2004; **14**: 407–414.
11. Cohen R, Pinheiro JS, Correa JL *et al*. Laparoscopic revisional bariatric surgery: Myths and facts. *Surg Endosc* 2005; **19**: 822–825.
12. van Wageningen B, Berends FJ, van Ramshorst B *et al*. Revision of failed laparoscopic adjustable gastric banding to Roux-en-Y gastric bypass. *Obes Surg* 2006; **16**: 137–141.
13. Spivak H, Beltran O, Slavchev P *et al*. Laparoscopic revision from lap-band to gastric bypass. *Surg Endosc* 2007; **21**: 1388–1392.
14. Weber M, Muller MK, Michel JM *et al*. Laparoscopic Roux-en-Y gastric bypass, but not rebanding, should be proposed as rescue procedure for patients with failed laparoscopic gastric banding. *Ann Surg* 2003; **238**: 827–834.
15. Gagner M, Gentileschi P, de Csepel J *et al*. Laparoscopic reoperative bariatric surgery: Experience from 27 consecutive patients. *Obes Surg* 2002; **12**: 254–260.
16. Schauer P, Ikramuddin S, Hamad G *et al*. The learning curve for laparoscopic Roux-en-Y gastric bypass is 100 cases. *Surg Endosc* 2003; **17**: 212–215.
17. Keshishian A, Zahriya K, Hartoonian T *et al*. Duodenal switch is a safe operation for patients who have failed other bariatric operations. *Obes Surg* 2004; **14**: 1187–1192.
18. Lakdawala MA, Bhasker A, Mulchandani D *et al*. Comparison between the results of laparoscopic sleeve gastrectomy and laparoscopic Roux-en-Y gastric bypass in the Indian population: A retrospective 1 year study. *Obes Surg* 2010; **20**: 1–6.
19. Shah S, Shah P, Todkar J *et al*. Prospective controlled study of effect of laparoscopic sleeve gastrectomy on small bowel transit time and gastric emptying half-time in morbidly obese patients with type 2 diabetes mellitus. *Surg Obes Relat Dis* 2010; **6**: 152–157.
20. Han MS, Kim WW, Oh JH. Results of laparoscopic sleeve gastrectomy (LSG) at one year in morbidly obese Korean patients. *Obes Surg* 2005; **15**: 1469–1475.
21. Khaitan L, Van Sickle K, Gonzalez R *et al*. Laparoscopic revision of bariatric procedures: Is it feasible? *Am Surg* 2005; **71**: 6–12.
22. Gagner M & Gumbs AA. Gastric banding: Conversion to sleeve, bypass, or DS. *Surg Endosc* 2007; **21**: 1931–1935.