



Safety of one-stage conversion surgery after failed gastric band: our experience and review of the literature

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Abstract

The laparoscopic adjustable gastric band (AGB) has fallen out of favor due to poor long-term weight loss and frequent complications. Many patients stand to benefit from elective conversion of AGB to more durable procedures such as sleeve gastrectomy (SG) or Roux-en-Y gastric bypass (RYGB). Whether it is safer to perform this conversion in one or two stages, however, remains controversial. We performed an IRB-approved review of prospectively collected data from all one-stage band conversions performed at our institution from January 2012 to December 2017. Patients were separated into two groups: those who underwent conversion to either a RYGB or SG. Demographics, indications, and outcomes of each group were compared using Fisher's exact test, Mann–Whitney rank sums, and chi-squared tests. Outcomes were recorded within a 1-year follow-up period and compared to published outcomes for one-stage band conversions. Thirty-eight patients were included for analysis. Average age and BMI were 50.8 years and 41.1 kg/m², respectively. The average operative time (164 min, 105–258 min) and length of stay (2.2 days, 1–5 days) did not differ between indication and procedure performed. Overall, early (<30 day) and late (>30 day) major complication rates were 7.9% and 5.3%, respectively. There were no leaks and no deaths. Within a 1-year postoperative period, seven re-interventions were performed. Elective one-stage band conversion to RYGB or SG can be performed safely.

Keywords Gastric band · Conversion · Gastric bypass · Sleeve gastrectomy · One stage · Safety

Introduction

Due to its historical popularity [1–3], AGB are still present in many individuals. With growing evidence of weight regain or complications [4–7], many stand to benefit from band removal and conversion to a stapled bariatric procedure. The surgeon's approach to the conversion remains debated. Early research into conversion associated previous banding with increased leak and morbidity rates [8], single-stage conversions with increased rates of anastomotic strictures [9], and conversion to Roux-en-Y gastric bypass (RYGB) with higher peri-operative morbidity [10–12].

However, as surgeon experience increases with demand for conversions, staging and the type of stapled bariatric procedure performed have both received considerable attention. A 2016 meta-analysis of 11 studies by Dang et al. comparing the two techniques suggested that a one-stage procedure has similar rates of morbidity to two-stage procedures [13]. Other large single-center studies have supported the safety and feasibility of one-stage conversion [11, 14] as well as

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non-inferior morbidity compared to two-stage conversion [15].

Patients in our practice are increasingly interested in a one-stage procedure, as it possesses the advantage of accomplishing the same end goal with only one hospital stay, potentially decreasing the total length of stay and associated cost. Our objective was to review our preferential experience for one-stage elective band conversion to determine the safety of our cohort compared to the current literature.

Materials and methods

Approval was obtained from our center's Institutional Review Board, which granted exemption from obtaining informed consent. We conducted a retrospective study of patients undergoing laparoscopic removal of adjustable gastric band from January 2012 to December 2017. Only those patients that underwent a subsequent stapled bariatric procedure were included in the analysis. Data were acquired from our institution's prospectively maintained eMD database (Exemplo Medical, Oldsmar, FL, USA). Additional perioperative variables, including patient demographics, surgical history, complications, and postoperative outcomes, were abstracted from review of the Allscripts and Epic electronic medical records (Allscripts Healthcare Solutions, Chicago, IL, USA; Epic, Verona, WI, USA). Inclusion and exclusion criteria were identical to those for primary bariatric procedures.

Inclusion criteria

- Age ≥ 18 and Attendance at an informational seminar and support group
- Clearance for surgery by a registered dietician and certified social worker
- Negative pregnancy test
- American Society of Anesthesiology scores 1–3
- Ability to understand instructions and comply with all study requirements
- No contraindication for procedure based on upper endoscopy or fluoroscopy findings
- Preoperative cardiac consultation for risk stratification
- Evaluation by a sleep medicine specialist to identify risk factors for sleep apnea, with treatment for at least 2 weeks prior to surgery when deemed appropriate
- Attendance of a team meeting 2 weeks prior to surgery to educate patients and review expectations following surgery

Exclusion criteria

- Presence of uncontrolled mental disorder

- Emergency procedure
- Active eating disorder such as bulimia nervosa (BN), binge eating disorder (BED), or compulsive overeating (COE)
- Underlying endocrine disorder (e.g., hypothyroidism)
- Failure to comply with preoperative regimen
- Planned pregnancy in the next 18 months
- Schizophrenia or psychosis
- Inpatient psychiatric care in the previous 2 years

Postoperative complications were reported classified as early (< 30 days) or late (> 30 days) and major or minor according to the American Society of Metabolic and Bariatric Surgeons [16]. Re-interventions, defined as any invasive procedure requiring sedation in surgery, radiology, or endoscopy suites, are reported separately.

Preoperative work-up: weight regain (WR) pathway

Patients whose body mass index (BMI) and comorbidities qualified them for bariatric surgery (BMI > 40 kg/m² alone or > 35 kg/m² with obesity-associated diseases) within 24 months following their index procedure were considered for revision. After full evacuation of their band, patients were required to follow 3–6 months of a physician-guided medical weight loss regimen, and obtain dietician and psychiatrist consultations. A preoperative upper gastrointestinal series and diagnostic upper endoscopy were performed to determine anatomy; computed tomography was used selectively to clarify equivocal findings of other diagnostic modalities. If maximal medical therapy failed to produce satisfactory results, the patient was scheduled for revision.

Preoperative work-up: refractory complications (RC) pathway

Postoperative complications prompting consideration for conversion included gastroesophageal reflux disease (GERD), chronic nausea and vomiting, band slippage, and dysphagia. After full evacuation of the band, all patients initially underwent upper GI and endoscopy; patients experiencing GERD also underwent ambulatory pH monitoring. This was followed by non-operative therapy including proton pump inhibitors, cytoprotective medication, endoscopic dilatation, dietary modification, or other interventions as indicated. Again, computed tomography was used selectively to clarify equivocal findings of other diagnostic modalities. Failure to resolve complications with non-operative therapies prompted consideration for surgical revision.

Operative technique

All cases were performed laparoscopically using a 5-trocar technique with a Nathanson liver retractor. Patients were fitted with intermittent pneumatic compression devices and received peri-operative DVT prophylaxis with subcutaneous heparin or enoxaparin in the preoperative holding unit. Patients also received a single dose of antibiotic 30 min prior to the procedure.

All patients undergoing a single-stage procedure had a urinary catheter placed after intubation which was removed prior to emergence. After removal of the gastric band, the capsule surrounding the proximal stomach was routinely dissected from the diaphragm and stomach tissue and excised. An upper endoscopy was performed intraoperatively to check for bleeding and leak. For gastric bypass, stapled and hand-sewn anastomoses were selectively used depending on tissue quality. For sleeve gastrectomy (SG), a 36 French bougie was used for calibration. A 19 French Blake drain was placed intraabdominally in all cases. Exposed staple lines were oversewn using absorbable suture. No staple line buttress materials were used.

Postoperative management

All patients were made nil per os and admitted to a telemetry floor with continuous cardiac monitoring. Every patient was placed in a chair and ambulated upon arrival to the floor. Patients with sleep apnea were instructed to use their positive pressure airway devices as directed. On postoperative day 1, patients underwent an upper gastrointestinal radiographic series to assess for leaks; if negative, a clear liquid diet was started. Discharge criteria included tolerance of liquid diet (defined as ability to tolerate at least 1 oz of liquid diet every 15 min), the absence of nausea and vomiting, stable hemoglobin and hematocrit, lack of tachycardia at rest, frequent ambulation without assistance, and oxygen saturation of at least 93%. The surgical drain was removed in clinic at the first postoperative visit.

Statistical analysis

We compared demographics, indications, and outcomes between the two groups using Fisher’s exact test, Mann–Whitney rank sums, and chi-squared tests. Descriptive data are reported due to heterogeneity and low statistical power.

Results

Thirty-eight patients underwent elective one-stage band conversion at our center from January 2012 to December, 2017. Whether separated based on indication for conversion or type of stapled bariatric procedure performed, there were no significant demographic differences observed (Table 1, all comparisons $p > 0.05$). The average patient age at the time of surgery was 50.8 years. The average preoperative body mass index (BMI) was 41.1 kg/m². Our cohort included 30 women and 8 men. The presence of obesity-related comorbidities did not significantly differ among groups when separated based on indication or procedure; however, patients undergoing conversion from band to RYGB at our center did have a higher rate of diabetes, hypertension, obstructive sleep apnea, and GERD than those converted to a sleeve. Those undergoing conversion for weight regain had a higher BMI than those with band-related complications, but this difference was not significant (42.5 versus 39.7 kg/m², respectively, $p = 0.19$).

Operative indications are shown in Table 2. Almost half of the conversions were performed for weight regain as the primary reason ($N = 18$), with the majority performed for complications ($N = 20$) that included reflux, band slippage, gastric outlet obstruction, and symptoms such as pain, nausea, or dysphagia. Most patients had more than one indication for conversion following full diagnostic evaluation.

Peri-operative outcomes are displayed in Table 3. The average overall operative time (164 min, 105–258 min) and length of stay (2.2 days, 1–5 days) did not differ between indication and procedure performed. For patients

Table 1 Demographics per procedure

Conversion group	Age mean + SD ^a	Gender	Preoperative BMI ^b mean + SD	Diabetes, <i>N</i> (%)	Hypertension, <i>N</i> (%)	Obstructive sleep apnea, <i>N</i> (%)	Reflux, <i>N</i> (%)
Sleeve (<i>n</i> = 10)	51.4 + 9.7	8 female (80%) 2 male (20%)	39.6 + 8.6	2 (20%)	4 (40%)	2 (20%)	6 (60%)
Bypass (<i>n</i> = 28)	50.6 + 9.4	22 female (78.6%) 6 male (21.4%)	41.6 + 5.5	7 (25%)	16 (57.1%)	10 (35.7%)	22 (78.6%)
Total (<i>N</i> = 38)	50.8 + 9.3	30 female (78.9%) 8 male (21.1%)	41.1 + 6.4	9 (23.7%)	20 (52.6%)	12 (31.6%)	28 (73.7%)

SD standard deviation, BMI body mass index (kg/m²)

Table 2 Indications for revision of gastric band to RYGB or SG

Indication for revision	RYGB, n (%)	SG, n (%)	All, n (%)
Insufficient weight loss	13 (46.4%)	5 (50%)	18 (47.4%)
Band slippage	9 (32.1%)	2 (20%)	11 (28.9%)
Chronic nausea/vomiting	17 (60.7%)	5 (50%)	22 (57.8%)
Intractable reflux	11 (39.3%)	3 (30%)	14 (36.8%)
Intractable dysphagia	8 (28.6%)	3 (30%)	11 (28.9%)

RYGB Roux-en-Y gastric bypass, SG sleeve gastrectomy

undergoing AGB removal for WR, those converted to RYGB did experience greater decrease in BMI at year compared to SG, but this difference also failed to reach significance (Δ BMI 12 versus 6.3, respectively, $p = 0.07$).

Early complications included three major and two minor; late complications included two major and three minor.

As shown in Table 4, complications included one deep surgical site infection, one deep incisional surgical site infection, two incisional hernias, two bleeding events, and one pulmonary embolus. Within a 1-year postoperative period, seven re-interventions were performed. This included upper endoscopies on two patients that were performed for nausea and dysphagia. There were no leaks and no deaths. The one deep surgical site infection presented several weeks after the original surgery, and after repeat oral contrast-enhanced imaging, there was no leak present and the abscess was not adjacent to the staple line. Notably, one patient with the highest preoperative BMI in our cohort (61 kg/m²) accounted for three complications (two major, one minor) and three re-interventions following conversion to SG.

Table 3 Perioperative outcomes per procedure

Outcomes	RYGB mean (%/range)	SG mean (%/range)	All mean (%/range)
Operative time (min)	164 (105–258)	163.5 (108–236)	164 (105–258)
Hospital stay (days)	2.2 (1–5)	2.3 (2–3)	2.2 (1–5)
No complications	25 (89.3%)	9 (90%)	34 (89.5%)
Early ^a complication	3 (10.7%)	2 (20%)	5 (13.2%)
Abscess	–	1	1
Bleeding	1	–	1
Pulmonary embolus	1	–	1
Incisional hernia	1	1	2
Late ^b complications	4 (14.3%)	1 (10%)	5 (13.2%)
Abscess	–	1	1
Bleeding	1	–	1
Incisional hernia	1	–	1
Nausea	1	–	1
Dysphagia	1	–	1

RYGB Roux-en-Y gastric bypass, SG sleeve gastrectomy

^a< 30 days

^b> 30 days

Table 4 Short- and long-term major complications and re-intervention detail

Patient	Preoperative BMI (kg/m ²)	Indication	Procedure	Early complications (re-interventions)	Late complications (re-interventions)
1	61	WR	SG	Deep surgical site infection (laparoscopic drainage) Incisional hernia (hernia repair)	Deep incisional SSI (wound closure)
2	34.6	RC	RYGB	Bleeding Pulmonary embolus (IVC ^f filter placement)	
3	40.5	RC	RYGB		(Endoscopy)
4	40.3	RC	RYGB		(Endoscopy)
5	45	WR	RYGB		Incisional hernia
6	36.3	RC	RYGB		Bleeding (remnant gastrectomy)

Re-intervention: any invasive procedure requiring sedation taking place in surgical, radiologic, or endoscopy suites

BMI body mass index, WR weight regain, SG sleeve gastrectomy, SSI surgical site infection, RC refractory complications, RYGB Roux-en-Y gastric bypass, IVC inferior vena cava

Discussion

According to data published by the American Society for Metabolic and Bariatric Surgery, the rate of AGB placement has declined precipitously in the US [6], coincident with findings of high long-term weight regain and complications [4, 5]. The corresponding increase in revisional bariatric surgery has much to do with the high rate of band removal. AGB was once the most popular bariatric surgery [3], and many surgeons continue to recommend their placement due to their low-risk profile and fully reversible nature.

Given the high rate of weight regain or persistent obesity following simple band removal, many surgeons are recommending the conversion from AGB to a more permanent bariatric procedure involving stapling of the gastrointestinal tract. Two-stage procedures are presently recommended in the setting of band erosion into the intraluminal space, concomitant infection, and in the case of emergency. Elective two-stage procedures have been advocated in favor of fewer complications [9, 15], though a 2016 meta-analysis and systematic review of 11 comparative studies by Dang et al. revealed no significant difference in complications, morbidity and mortality between one- and two-stage procedures, suggesting that either procedure may be safely performed [13]. Our early morbidity is within the range reported in recent reports of one-stage conversion to RYGB (1.8–10.7%) [10, 11, 13, 14, 17, 18]. Our morbidity for conversions to SG was notably higher than reported ranges (20% versus 0–15.9% [10, 11, 13, 17–21]); however, all complications following conversion to SG were attributed to a single patient with the highest BMI of our entire cohort (Table 4). The deep surgical site infection encountered in this particular patient was not attributed to a leak upon thorough work-up including repeat imaging and endoscopy. However, the unlikely possibility of an occult, sealed leak that led to an abscess cannot be definitively ruled out.

While RYGB is routinely recommended in our practice to patients experiencing GERD due to their band, many patients opt for SG due to a lower side-effect profile [22]. We believe that excision of the offending foreign body, close attention to repairing any hiatal defect encountered intraoperatively, and evidence of increased gastric motility following SG [23] can mitigate the development or worsening of GERD otherwise associated with SG.

Operative time of conversion to SG was notably longer in our cohort than other recent reports (163.5 min versus 122.5–133.1 min [13, 19, 24]). This may be largely attributed to the time necessary for meticulous dissection of the fibrous capsule formed around the proximal stomach. This technique is similar to that reported by Alqahtani

et al. in 2016, though that study did not report operative time [21]. The variables involved in successful exposure of the stomach and diaphragm, such as the presence of a previous hiatal hernia repair or gastropexy around the band, can create a substantial amount of chronic inflammation that we believe must be resected totally to minimize the risk of stapling or suturing through thick and underperfused tissue. As described by Tan et al., histologic analysis of gastric sleeve specimens following previous AGB removal showed varying degrees of chronic inflammation and foreign body reaction that did not fully resolve despite an interval of up to 3 years between AGB removal and SG [25]. This study has also, notably, been cited as justification for equivalent safety between 1- and 2-stage conversions.

The average age of our patients (50.8 years) was notably older than those reported in recent literature (32.9–48.3 years [8, 10, 11, 13, 14, 17–21]). This is a phenomenon we predict will be reproduced in future studies of band removals and conversions as the population of band recipients continues to age. According to a 2018 review of the Scandinavian Obesity Register by Gerber et al., age > 50 significantly increased the risk of 30-day complications, including infection, leak, and bleeding following primary RYGB [26]; however, these rates remained acceptably low. As older patient cohorts become increasingly considered for conversion or revision, there remains a paucity of research in this patient population that may well be addressed by the increase of large, prospective national databases.

Our study has important limitations. Small sample size and short follow-up window not only prevent the identification of significant differences between our own cohorts of RYGB and SG conversions, but also limit the extent to which our experience can be reliably compared to larger reviews, although underpowered series are frequently included therein [10, 13]. Also hindering our analysis is a potential selection bias seen in the trend toward higher rates of comorbidity in patients converted to RYGB versus SG, which may reflect our recommendation of RYGB for greater comorbidity resolution compared to SG. This assertion, however, underscores the lack of comorbidity resolution data in our study. Finally, our study is limited to the peri-operative time period and lacks insight into weight loss following conversion to RYGB or SG; prevailing literature has demonstrated acceptable albeit lower percent excess weight loss following revisional bariatric surgery compared to primary cases [18].

Conclusion

One-stage conversion of AGB to RGYB or SG is a safe procedure that can be performed with complication rates at or below reported values for two-stage conversions. Full

excision of the AGB-induced fibrous capsule when performing conversion is advisable, but a comparative study of conversion techniques is lacking.

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Compliance with ethical standards

Conflict of interest All authors including Peter W Lundberg, Abigail Gotsch, Eonjun Kim, Leonardo Claros, Jill Stoltzfus, and Maher El Chaar have no conflicts of interest to disclose.

Research involving human participants and/or animals All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. For this retrospective study, formal consent is not required.

Informed consent As this study involved a retrospective review of a prospectively maintained, de-identified database, obtaining informed consent did not apply, and we obtained an exemption from informed consent by our center's Institutional Review Board.

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