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Review article

Salvage banding for failed Roux-en-Y gastric bypass

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Abstract

Background: After Roux-en-Y gastric bypass (RYGB), a substantial number of patients do not achieve successful long-term weight loss. In cases of loss of restriction, the application of an adjustable gastric band ("salvage banding") over the gastric pouch, or gastrojejunostomy, could prevent weight regain or increase weight loss. The objective of this literature review is to provide an overview of the studies that report the effect of salvage banding after failed RYGB.

Methods: A systemic literature search was conducted in PubMed, Google Scholar, Medline, the Cochrane Library, and the online websites of specific bariatric surgery journals to identify all relevant studies describing salvage banding after failed RYGB.

Results: Seven studies, with a total of 94 patients, were included for a systemic literature review. Inclusion criteria for salvage banding varied from unsuccessful weight loss to technical pouch failure. After salvage banding, all studies reported further weight loss, varying from 55.9%–94.2% excess body mass index loss (EBMIL) after 12–42 months of follow-up. In the included study group, 18% (17/94) of the patients developed long-term complications requiring a re-revision in 17% (16/94) of the cases.

Conclusion: The results of all 9 studies that were included in this review report a further increase in weight loss after salvage banding for failed RYGB. In case of insufficient weight loss or technical pouch failure after RYGB, all reports suggest that salvage banding is a safe and feasible revisional procedure. Prospective studies are necessary to determine to the success of direct application of an adjustable gastric band in primary RYGB. (Surg Obes Relat Dis 2012;8:803–808.)

Keywords: Review; Conversion; Reoperations; Gastric bypass; Gastric banding

Obesity is one of the biggest health threats in the Western world, and today, more than 10% of the world's adult population is obese [1,2]. The most severe form of obesity, morbid obesity, is associated with a vast number of comorbidities that significantly decrease life expectancy [3]. Currently, the most effective therapy for morbid obesity is weight reduction by bariatric surgery [4]. The gastric bypass procedure was suggested as an effective means to lose excess weight 4 decades ago [5]. Throughout the years, the number of Roux-en-Y gastric bypass (RYGB) procedures increased, and the most recent report suggests that RYGB is still the most widely performed bariatric procedure, comprising 49.0% of a yearly total number of 344.221 procedures worldwide [6]. RYGB is followed by laparoscopic adjustable gastric banding (LAGB) in 42.3% of the procedures [6]. Interestingly, in the United States and Canada, the percentage of RYGB procedures decreased from 85% to 51% over the period 2003–2008, whereas in Europe the percentage of RYGB increased from 11.1% to 39% during this period [6]. The long-term results of the RYGB are good and show significant health improvement and sustained

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weight loss [7]. Nonetheless, a subset of patients either do not achieve sufficient weight loss or regain weight over time, with percentages varying from 4.2%–7.0% of patients still having a body mass index (BMI) $>$ 35 kg/m^2 after 5–5.5 years of follow-up [8,9] to 10.7%–40.0% of patients with $<$50% excess weight loss (EWL) after 5–7 years [10–12]. The exact reason for this failure has not been defined, but very likely, both lifestyle (eating pattern, exercise) and technical factors contribute [13]. The main technical causes for weight regain after RYGB are suggested to be loss of restriction due to enlargement of the gastric pouch, dilation of the gastrojejunostomy, and enlargement of the jejunum directly after the gastroenterostomy. A possible option to obtain an adequate restriction again is the application of an adjustable gastric band over the gastric pouch or gastrojejunostomy. Several reports have described this "salvage banding" as a feasible option to control pouch size and prevent further stoma dilation. Salvage banding could control further weight gain or even increase weight loss and, most important, lead to a reduction in co-morbidities and an improvement in the patients' quality of life. This literature review summarizes the studies that report the effect of salvage banding after failed RYGB. We provide an overview of the literature on this topic and discuss the feasibility and results of salvage banding based on the existing evidence.

Methods

A systemic search was conducted to identify studies relevant to the review. The literature search was performed in the online databases of PubMed, Google Scholar, Medline, the Cochrane Library, and the online websites of the specific bariatric and metabolic surgery journals, *Surgery for Obesity and Related Diseases* (www.soard.org) and *Obesity Surgery* (www.obesitysurgery.com), using the following search terms: ("Gastric Bypass"[Mesh]) and ("Reoperation"[Mesh]) or salvage or conversion or any combination of the Mesh and non-Mesh search terms. Criteria for article inclusion on abstract basis were publication date between January 1, 1990, and February 1, 2012, written in the English language, and a patient age between 18 and 65 years. This resulted in 413 abstracts that were reviewed by 2 independent reviewers (G.V. and R.S.). If the abstract was not conclusive about the topic of the report, the whole article was also reviewed. After the review was complete, 399 studies were excluded because the studies reported on RYGB as a reoperation itself after failed LAGB or vertical banded gastroplasty (VBG). The remaining 14 articles were entirely reviewed. One study was excluded because it was a video case report without patient data on weight loss [14]. One report described the application of the Lap-Band system in case of failure of preceding procedures, such as gastroplasty (n = 35), nonadjustable gastric banding (n = 11), jejunoileal bypass (n = 2), and RYGB (n = 2) [15]. However, the results reported in this study were not further divided per procedure, and because the number of RYGB patients was low (n = 2), this study was also excluded. Three abstracts were congress abstracts; these were excluded because the reported data in the abstracts was not described in further detail.

In 2005, Bessler et al. reported on a study of a population of 8 salvage banding patients that occurred between February 2002 and November 2003 [16]. In 2010, 23 patients were described by the same author, reporting on a study that occurred between February 2002 and August 2007 with similar inclusion criteria [17]. It is likely this population of 23 patients includes the previously reported 8 patients; therefore, we included only the results of the most recent report. Similarly, Gobble et al. studied a group of 11 salvage banding patients and reported the results in 2008 [18], and recently, the authors described 43 patients included in an overlapping time window with similar inclusion criteria at the same institute [19]. Therefore, only the most recent study was evaluated [19].

After applying the aforementioned selection criteria, a total of 7 studies was included in the present review. A summary of the search results is provided in Fig. 1. All included studies reported on retrospectively analyzed patient cohort data [17,19–24], with prospectively collected data in 4 studies [17,21]. Also, the reported results were heterogeneous, including a wide range of patients in follow up as well as follow-up period. Furthermore, important aspects, such as standard deviation and survival analysis, were either not performed or not reported. As a consequence, a meta-analysis of pooled data was not possible, and therefore, the present study represents a systemic literature review. An overview of the included studies is provided in Table 1.

Results

Indications for salvage banding

Kyzer et al. reported on a group of 34 patients, with a subset of 12 RYGB patients, who all experienced weight regain after good initial weight loss (criteria for successful weight loss were not specified) [20]. All 12 RYGB patients had dilation of the gastric pouch and/or gastrojejunostomy, confirmed by endoscopy. Heath et al. reported on a similar case with a one-third increase in pouch size [22]. Bessler et al. included 22 patients who did not achieve sufficient weight loss after RYGB without further defined technical failure [17]. Three other studies included both patients with inadequate weight loss after the initial procedure and a patient group with weight regain, all of whom were offered salvage banding [19,21,24]. Of these 3 studies, only Chin et al. reported to have performed preoperative radiologic or endoscopic studies to confirm pouch dilation, but interestingly, did not observe pouch dilation. Hyperphagic behavior with a renewed need for restriction, without gastric pouch

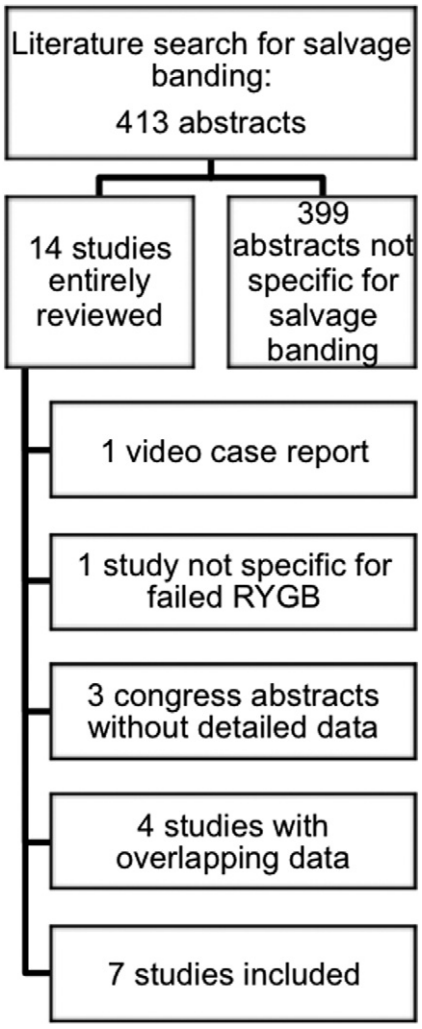

Fig. 1. Algorithm for literature search.

dilation on fluoroscopy, was an indication for salvage banding in 6 patients reported by Dapri et al. [23].

Surgical procedures

Salvage banding was performed by placement of an adjustable gastric band (AGB; several types: Lap-Band, BioEnterics Corporation, Carpinteria, CA; Lap-Band, Inamed, Irvine, CA; Lap-Band, Allergan, Irvine, CA; SAGB, Ethicon, Cincinnati, OH) in all but 1 study, which used a nonadjustable silicone ring (Bariatric Solutions, Greenville, SC) [23]. In the first report by Kyzer et al. from 2001, all bands were placed via laparotomy, and Chin et al. used this technique in their report from 2009 [20,21]. In the group studied by Bessler et al., the first 3 patients in the study group underwent placement by laparotomy, while the succeeding 19 patients all had laparoscopic placement [17]. In 4 other studies, the placement was established by laparoscopy [19,22–24]. During the procedure Irani et al. reported 3 (3/26) conversions [19].

Operative time was reported in 4 studies and varied from a mean of 74 minutes [19] to 113 minutes [21]. No major intraoperative complications were reported. Postoperatively, 1 study reported an enterotomy that required band removal with good recovery but without accompanying weight loss data, which was lost to follow-up [19]. Furthermore, it is not reported in which part of the digestive tract the enterotomy occurred. Meesters et al. reported 1 pneumothorax and 1 intra-abdominal hematoma [24]. Mean hospital stay (reported in 5 studies) varied from 33 hours [19] to 4 days [20].

Several long-term complications were reported that required reoperation. Kyzer et al. described 1 gastric volvulus due to adhesions and 3 ventral hernias that needed repair after laparotomy [20]. In another report, the tubing system caused small bowel obstruction after salvage banding, requiring trimming of the tubing [17]. Two separate studies reported 1 band slippage requiring band revision [17,19]. In addition, 2 band erosions causing intragastric band migration were observed and needed band removal [19]. Finally, 1 patient experienced severe dysphagia that could be solved only by band removal [19].

In summary, of the 94 patients in all 7 studies, 17 patients (18%) developed 17 long-term complications that needed 16 reoperations (17%).

Follow-up

The reported follow-up percentages were high: 100% in 5 studies and 60% and 80% in the 2 remaining studies [17,21]. The period of follow-up ranged from 12 to 42 months. One report described a follow-up period of up to 60 months [17]. However, because the number of subjects available for follow-up decreased below 45% after 12 months, the data from this study were interpreted at the 12-month time point (follow-up percentage of 60%; Table 1).

Weight loss after salvage banding

All studies reported an increased weight loss after salvage banding for failed RYGB (Table 1). To be able to compare the effect of salvage banding in all included studies, data for weight loss is expressed as the percentage of excess BMI loss after revision (%EBMIL = 100 − [(follow-up BMI − 25/revision BMI − 25)] × 100; Fig. 2). If the data was not reported as %EBMIL, the reported values were recalculated to %EBMIL (Fig. 2). However, 1 report expressed weight in terms of BMI at the moment of the initial procedure and revision, but after revision, weight loss was expressed in percentage of excess weight loss (%EWL). The amount of excess weight in %EWL is calculated as an individual value based on the Metropolitan Life Insurance Company tables [25]. Nonetheless, because individual patient data is not reported and %EWL is not reported at the moment of revision, data from this report could not be compared [17]. In the study by Kyzer et al., no initial weight was reported. Other weight loss data were reported in 2

Table 1
Overview of included studies

Author	Year	Patients (n)	FU	BMI			%EBMIL		Pouch dilation?	Band	Complications	
				Initial	Revision	FU	Revision	FU			<30 days	>30 days
Kyzer (A*)	2001	12	27	—	29.9	25.4	—	—	Yes	AGB[1]	—	Gastric volvulus (n = 1), tubing tear (n = 1), ventral hernia (n = 3)
Kyzer (B*)				—	44.8	33.4	—	—	Yes	AGB[2]		
Chin	2009	8	12	62.6	48.4	41.6	37.8	55.9	No	AGB[2]		Port flip (n = 2), wound hematoma (n = 1)
Heath	2009	1	42	42.1	31.0	26.0	64.9	94.2	Yes	AGB[3]	—	—
Dapri	2009	6	14	36.3	29.5	26.4	60.2	87.6	No	NAGB[4]	—	—
Bessler	2010	22	12†	52.6	44.8	—	28.3	—	ND	AGB[5]	—	Small bowel obstruction (n = 1), band slippage (n = 1), port infection (n = 1)
Irani	2011	42	26	50.4	43.3	33.8	28.0	65.4	ND	AGB[2]	Enterotomy (n = 1)	Band slippage (n = 1), band erosion (n = 2), dysphagia (n = 1)
Meesters	2012	12	28	47.8	39.6	34.2	36.0	59.6	ND	AGB[2]	Pneumothorax (n = 1), Intra-abdominal hematoma (n = 1)	Gastrojejunal ulcer (n = 1), band leakage (n = 1)

Shown are the 7 included studies with reported year of publication, number of included patients, mean follow-up (FU) in months, body mass index (BMI), and percentage excess body mass index loss (%EBMIL).

Initial = values for the first RYGB-procedure; Revision = values for the moment of salvage banding; FU = values after maximal follow-up; Pouch? = suspicion of pouch dilation; ND = the presence or absence of gastric pouch dilation was not described in the study; Band = band type; AGB = adjustable gastric band; and NAGB = nonadjustable gastric band with type and manufacturer further specified per study.

([1] Lap-Band, BioEnterics Corporation, USA; [2] Lap-Band, Allergan, USA; [3] SAGB, Ethicon, USA; [4] Nonadjustable silicone ring, Bariatric Solutions, USA; [5] Lap-Band, Inamed, USA).

* Data reported for two groups: group A, immediate salvage banding; group B, long-term weight gain (see also Results).

† Follow-up decreases below 45% after 12 months; therefore, data were interpreted at the 12 months time-point (follow-up percentage, 60%).

subgroups; group A operated directly after weight regain and group B, after a longer period of weight regain (number of patients and periods not specified). Weight loss data of this study is reported for the subgroups (Table 1).

Discussion

When it is not possible to obtain sufficient long-term weight loss after RYGB, literature suggests several options to increase weight loss or prevent any further weight gain. Conservative options could be considered; this includes a careful evaluation of the patient's psychological status and eating pattern [26,27]. Nutritional counseling could be effective and further increased weight loss in 86% of the patients by a range of 1.2–1.8 kg/mo, although the studied intervention periods are generally short (3 mo) [26]. If conservative treatment remains unsuccessful, revisional surgery nowadays comprises an increasing number of possible procedures. Conversion of the RYGB-construction to a longer Roux (or alimentary) limb (and a shorter common limb) theoretically increases malabsorption and could lead to a further increase in weight loss. However, conversion to long-limb RYGB can result in severe malnutrition due to the extremely short common-limb, sometimes requiring re-revision to a short-limb RYGB to restore nutritional status [28,29]. In addition, prospective studies comparing different alimentary limb lengths do not show increased weight loss in long-limb procedures [30]. Conversion of RYGB to a biliopancreatic diversion with duodenal switch (BPD/DS) further increased weight loss in 26 [31] and 12 patients [32]. The technically complex procedure requires a high level of experience in bariatric surgery and consists of restoring gastric continuity and subsequently performing a sleeve gastrectomy, which is then followed by the BPD/DS (described in full detail in [32]). Several less invasive options have evolved, mostly focusing on revising pouch and stoma restriction. The Stomaphyx (EndoGastric Solutions Inc.,

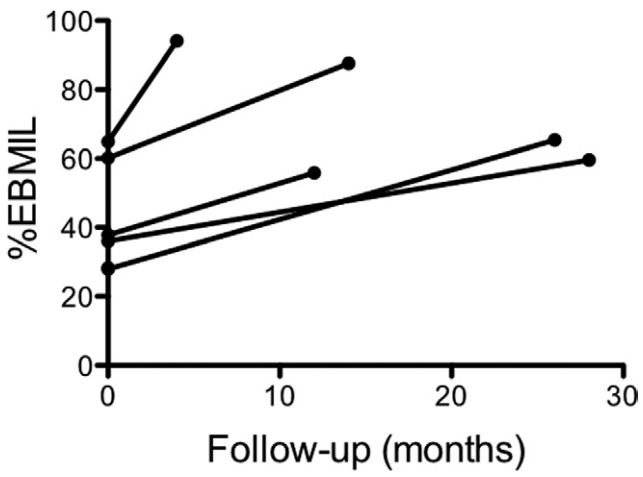

Fig. 2. Excess body mass index loss (%EBMIL) after revision. Values shown for follow-up (in months) after revisional surgery (t = 0). Further details on individual studies can be found in Table 1.

Redwood City, CA) [33], Endocinch (Bard Inc., Murray Hill, NJ) [34], Spiderman (Ethicon Endosurgery Inc., Cincinnati, OH) [35], and g-Prox (USGI Inc., San Clemente, CA) [36] are endoluminal fastener/stitching systems that decrease the gastric pouch size and gastrojejunostomy diameter by creating plications. This induced further weight loss in RYGB patients with insufficient weight loss (Stomaphyx mean 10 kg, n = 39; Endocinch mean 10 kg, n = 8), but the follow-up period and follow-up percentage were low (1 year, n = 6/39 for Stomaphyx and 4 mo, n = 6/8 for Endocinch); the other techniques have been tested only in feasibility studies. Therefore, further prospective studies are necessary to determine the effect of endoscopic revisional tools.

Injections with the sclerosing agent sodium morrhuate at the level of the gastrojejunostomy increased weight loss with a mean of 6.7–19.9 kg after 6–18 months of follow-up [37,38]. However, 25%–36% of the patients in these studies did not lose weight after the injections, and long-term follow-up studies are not available.

The studies described in this review suggest that the addition of a LAGB to RYGB (salvage banding) further increases weight loss. LAGB is a safe and feasible procedure, even when performed in revisional settings [39,40]. Salvage banding is considered less invasive than changing the Roux-en-Y-limb construction or conversion to BPD/DS. Moreover, the option to adjust the band diameter by postoperative insufflation allows for noninvasive alteration of restriction without (unnecessarily) increasing malabsorption. In addition, the effect of salvage banding can relatively easily be reversed by total band desufflation or band removal. However, to prevent possible technical failures, such as band slippage [17,19] and erosion [19], salvage banding should be performed carefully with adequate fixation of the band. It should be noted that after salvage banding in the reviewed cohort of 94 patients, 18% (17/94) of the patients developed long-term complications that required a re-revision in 17% (16/94) of the studied group. Currently, salvage banding is seen as a revisional procedure after technical pouch failure and weight gain. Possibly, the number of revisions of initial RYGB could be reduced by the direct application of an LAGB during the initial RYGB procedure. Dillemans et al. performed RYGB with an adjustable gastric band around the gastric pouch in 6 super obese patients with a BMI > 60 kg/m^2 who did well after evaluation 6 weeks postoperatively; unfortunately, no weight loss data was reported [41]. Fobi et al. have been applying a nonadjustable silastic ring during the initial RYGB for several decades and retrospectively show a percentage of excess weight loss of 69.8% after 10 years of follow-up (follow-up percentage not given) [42,43]. The first prospective, randomized, double-blind trial showed a significantly higher excess weight loss (73.4% versus 57.7%) in banded (nonadjustable gastric band, n = 46) versus nonbanded (n = 44) RYGB patients after 36 months of follow-up [44]. However, the difference was not present after 12 and 24 months of follow-up, and the authors describe the number of patients after 36 months of follow-up as low (exact number not reported). Currently, a prospective, randomized, controlled trial is performed to compare banded RYGB (with application of an adjustable gastric band) with conventional RYGB (GABY-trial, ClinicalTrials.gov Identifier: NCT01015469, estimated n = 384, expected completion in 2015).

Conclusion

In conclusion, all 7 studies included in this review, with a total number of 94 patients, reported a further increase in weight loss after salvage banding. The reported results were heterogeneous, and more prospective studies are necessary to compare salvage banding with less invasive conservative or endoluminal procedures. However, in case of unsuccessful weight loss or weight regain after an initially successful weight loss after RYGB, all reports suggest that an adjustable gastric band around the pouch is a safe and feasible revisional procedure.

Disclosures

The authors have no commercial associations that might be a conflict of interest in relation to this article.

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