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ORIGINAL CONTRIBUTIONS

Applying an Anti-reflux Suture in the One Anastomosis Gastric Bypass to Prevent Biliary Reflux: a Long-Term Observational Study

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Abstract

Introduction The one anastomosis gastric bypass (OAGB) is an effective treatment to induce sustained weight loss in morbidly obese patients. Concerns remain regarding the development of reflux. The aim of this study was to investigate the effect of an "anti-reflux suture" as anti-reflux modification to prevent reflux.

Method This is a single-center retrospective cohort study of patients who underwent a primary OAGB at the Center Obesity North-Netherlands (CON) between January 2015 and December 2016. Reflux was defined as symptoms of acid/bilious regurgitation or pyrosis. This was consequently asked and reported at each follow-up visit. Outcomes of patients with an anti-reflux suture were compared to those without.

Results In 414 (59%) of the 703 included patients, an anti-reflux suture was applied. Follow-up at 3 years was 74%. The incidence of reflux did not differ between patients with or without an anti-reflux suture (57 versus 56%, respectively; $P = 0.9$). The presence of an anti-reflux suture was significantly associated with a lower incidence of conversion to Roux-en-Y gastric bypass (RYGB) for reflux (OR 0.56, 95%CI 0.34–0.91). Patients preoperatively diagnosed with gastroesophageal reflux disease (GERD) were 5.2 times more likely to need a conversion to RYGB for reflux (95%CI 2.7–10.1).

Conclusion The presence of preoperative GERD should be weighted heavily in the decision to perform an OAGB as this is a major risk factor for conversion surgery due to reflux. The anti-reflux suture might be a valuable addition to the procedure of the OAGB because it results in fewer conversion surgeries for reflux.

Keywords Bariatric surgery · One anastomosis gastric bypass · Mini gastric bypass · Biliary reflux · Gastroesophageal reflux disease

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Introduction

Gastroesophageal reflux disease (GERD) and obesity are strongly linked, as 70% of preoperative bariatric patients suffer from symptoms of GERD [1]. There is a growing concern regarding the effect of bariatric surgery on GERD. The Roux-en-Y gastric bypass (RYGB) is considered the gold standard in obese patients with GERD. It has been associated with an improvement of GERD symptoms by lowering acid production, rapid pouch emptying, and decreasing abdominal pressure [2–7]. However, recent studies reported persistent symptoms of reflux in up to 22% and new symptoms in 11% of patients after RYGB [2, 8–10]. The association between sleeve gastrectomy (SG) and GERD remains controversial, with a majority of the studies reporting an increase of GERD symptoms after SG [11–18].

The one anastomosis gastric bypass (OAGB) was introduced by Rutledge in 1997. It contains a long gastric pouch anastomosed with a jejunal omega loop [19]. Compared to the RYGB, it consists of only one anastomosis, resulting in shorter operation time, shorter learning curve, and ease of reversibility and revision. The OAGB has shown excellent results in terms of weights reduction and treatment of comorbidities and has proven to be an equivalent or even better weight loss procedure compared to the RYGB [20–26]. In a modified Delphi consensus, experts agreed with the statement that the OAGB is an adequate operation for morbid obese patients with preoperative GERD [27]. However, research is still inconclusive about the effect of the OAGB on preoperative GERD [20, 28]. Furthermore, the OAGB remains controversial due to concerns regarding the risk of developing bile reflux postoperative and the fear of the development of gastric or esophageal cancer [29, 30]. The omega loop construction can cause reflux of bile acids into the gastric pouch, which can result in symptoms of biliary vomiting and GERD [31]. Bile reflux after OAGB is seen in 0.6–10% of the patients depending on the definition in different studies [21–23, 25, 31]. In experiments with rats, long-term and persistent reflux causes esophageal metaplasia and esophageal adenocarcinoma [32]. However, up till now, evidence regarding a carcinogenic effect of the OAGB is lacking and has not been confirmed in over 20 years [33].

Anti-reflux modifications such as a longer pouch and a latero-lateral gastrojejunal anastomosis have been introduced to reduce the incidence of reflux after OAGB [22, 25, 34, 35]. Carbajo et al. first described an anti-reflux technique by fixing the afferent jejunal loop to the lateral side of the stomach pouch in an upward direction (8–10 cm) using 6 to 10 sutures [22]. Presumably, due to gravity and the lateral connection, biliopancreatic secretions are more prone to follow their route into the jejunum and therefore minimize the contact of the bile secretions with the gastric mucosa. It may also prevent the contents of the pouch to enter the biliopancreatic limb and follow a retrograde path. To our knowledge, no study has investigated the effect of this "anti-reflux suture." This study aimed to investigate the effect of the anti-reflux suture on the incidence and clinical consequences of reflux.

Method

Study Population

This is a single-center retrospective cohort study including all patients who underwent an OAGB at the Center Obesity North-Netherlands (CON) of the Medical Center Leeuwarden, from January 2015 to December 2016 (N = 906). All patients who underwent bariatric surgery provided written informed consent to use their medical data for research purposes. Exclusion criteria were previous bariatric surgery (band or gastric sleeve) (n = 162), lost to follow-up (n = 29), or symptoms of reflux during pregnancy (n = 12). All data were extracted from the electronic patient record. Patients received care according to the standardized protocol for ambulant patients of the CON. The study was approved by the local medical ethical committee (RTPO Leeuwarden, nWMO 20200036). All patients who underwent an OAGB had an operation indication in agreement with the international IFSO guidelines.

Preoperative Workup

Bariatric surgery candidates underwent screening by a multidisciplinary team including an endocrinologist, a dietician, and a psychologist. Screening involved a detailed medical history, mental health evaluation by the psychologist, physical condition evaluation, and evaluation of motivation of postoperative lifestyle adaption. Patients received multiple months of counseling from a dietician to prepare for the postoperative lifestyle regimen, including eating 6–8 times a day, separating eating and drinking, eating high-protein and healthy nutritional products, and abstinence of alcohol and carbonated drinks. A preoperative *Helicobacter pylori* stool antigen test was performed. If positive, patients received eradication therapy.

Surgical Technique

The surgical technique has been described before by Apers et al. [35]. The gastric pouch was created using a 34 Fr calibration tube, which was held toward the lesser curvature. First, the stomach was divided horizontally at the level of the crow's foot and thereafter the gastric pouch was completed with 5–6 lines of staples against the tube up to the angle of His. The anti-reflux suture was placed by attaching the proximal (afferent) jejunum at the left lateral side of the gastric pouch, approximately 3 cm proximal of the gastrojejunostomy (Video 1 and Fig. 1), using

one absorbable suture (Ethicon® vicryl 2–0). The application of the anti-reflux suture was done on individual surgeon preference. Biliopancreatic limb length varied from 150 to 250 cm adjusted according to the preoperative BMI and at the discretion of the surgeon. All procedures were performed by four experienced bariatric surgeons or by surgical residents under the direct supervision of a bariatric surgeon.

Follow-Up

PPIs were prescribed during the first postoperative year. The patient's follow-up visits took place after 1 month and thereafter yearly, up to 5 years postoperative. Follow-up data were included until the 1st of June 2020.

At each visit, standard care included inquiry after well-being and complaints, current medication use, side effects, adverse events, comorbidities, and measurement of body weight. Reflux was defined as symptoms of acid/bilious regurgitation/vomiting or pyrosis. Symptoms of reflux were asked by default and noted at every follow-up visit. In case of symptomatic reflux, treatment was started in three subsequent steps: lifestyle changes, medication, and conversion to RYGB. Lifestyle changes included not eating 3 h before sleeping, no smoking, no alcohol, eating small portions 6–8 times a day, and separate drinking and eating. If lifestyle changes were insufficient to reduce symptoms, medication was started. Pharmacological treatment included PPI and sucralfate and was started based on the severity and frequency of the reflux symptoms. Sucralfate was only started if treatment with PPI was insufficient. Therapy-resistant reflux was treated with a conversion to RYGB and was defined as symptoms of reflux multiple times a week during the last few months, aspiration or damage of the teeth due to reflux, despite maximal dosage of medication and compliance with the lifestyle advice. Before conversion to RYGB, an upper gastrointestinal endoscopy (UGE) was performed in most

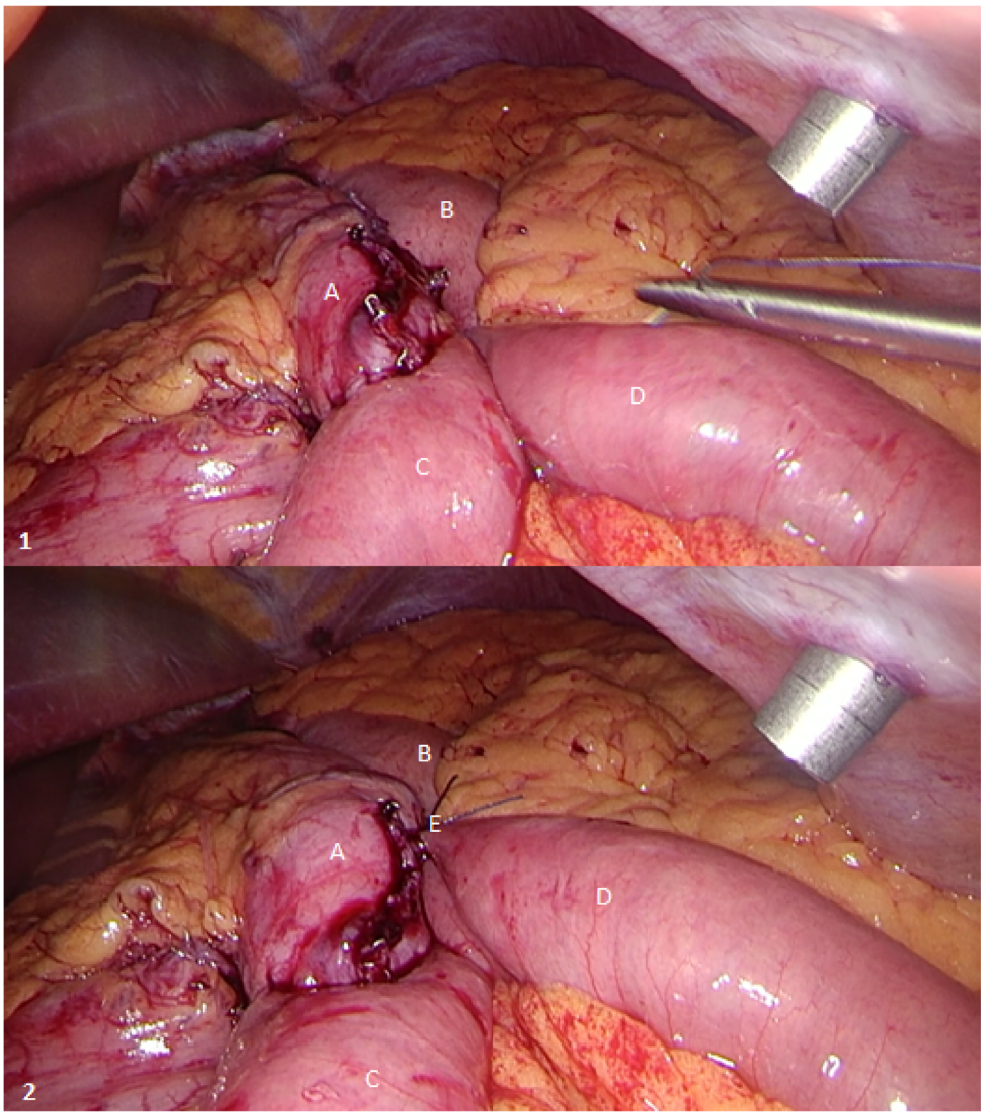

Fig. 1 Technique of the anti-reflux suture. **1** Surgical anatomy before applying the anti-reflux suture. **2** Surgical anatomy after applying the anti-reflux suture. **a** gastric pouch, **b** excluded stomach, **c** common channel, **d** biliopancreatic limb, **e** anti-reflux suture

patients to rule out esophageal dysplasia due to reflux or other gastroesophageal abnormalities. Furthermore, during the 5-year follow-up, UGE was used to confirm the persisting complaints.

The percent of excess weight loss (%EWL) was defined as ([initial weight]–[postoperative weight])/([initial weight]–[ideal weight]) × 100. Ideal weight was defined as the weight corresponding to a BMI of 25 kg/m^2. The percent of total weight loss (%TWL) was defined as ([initial weight–postoperative weight]/initial weight) × 100. The diagnosis preoperative GERD was defined as symptoms of biliary or acidic regurgitation and pyrosis treated with a proton pump inhibitor (PPI). Partial remission of hypertension and T2D was defined as a decreased dosage of medication compared with the preoperative dosage. Total remission was defined as discontinuation of the medication with normalization of blood pressure or HbA1c.

Statistical Analysis

Normally distributed continuous variables were expressed as mean ± standard deviation. Skewed distributed variables were presented as median [interquartile range] and categorical variables were expressed as number (percentages). To test for differences across baseline, normally distributed values were compared using a *t* test, skewedly distributed variables were compared using the Mann-Whitney U test, and for categorical data, the Chi-squared test was used. In the logistic regression analysis, conversion surgery due to reflux was chosen as outcome variable, whereas age, preoperative weight, anti-reflux suture, and preoperative GERD were selected as predictor variables based on univariate regression analyses. Multivariable logistic regression was performed using backward stepwise selection. A two-sided *p* value of ≤ 0.05 was considered statistically significant. Statistical analyses were assessed in SPSS version 24.

Results

In total, 703 patients were included and analyzed. Mean age was 48 ± 11 years and 576 patients were female (82%). The preoperative weight was 127 ± 20 kg and the mean preoperative BMI was 43 ± 5 kg/m^2. Preoperative GERD was documented in 48 (7%) patients. Three patients died during the follow-up, not related to the OAGB procedure (0.4%). Follow-up percentages after 1 and 3 years were 95 and 74%, respectively.

In 414 patients (59%), an anti-reflux suture was applied during surgery. There was no difference in sex, age, BMI, and preoperative GERD between the patients with or without anti-reflux suture (Table 1). The incidence of reflux after surgery did not differ between the groups with or without anti-reflux suture (57 versus 56%, respectively; $P = 0.9$).

Table 1 Comparing characteristics of patients with and without anti-reflux suture

Variables	Without anti-reflux suture (*N*=289)	Anti-reflux suture (*N*=414)	*P* value
Male, *n* (%)	56 (19%)	71 (17%)	0.45
Age, years (±SD)	48±11	48±11	0.65
Preoperative weight, kg (IQR)	123 [114–135]	125 [112–140]	0.62
BMI, kg/m^2 (IQR)	42 [39–45]	43 [39–47]	0.21
Preoperative GERD, *n* (%)	17 (6%)	31 (7%)	0.41
Hypertension, n (%)	98 (34%)	140 (34%)	0.98
T2D, *n* (%)	57 (20%)	90 (22%)	0.52
Reflux postoperative, *n* (%)	164 (57%)	233 (56%)	0.90
Months after operation (IQR)	22 [10–32]	22 [10–33]	0.80
BMI, kg/m^2 (IQR)	29 [27–33]	30 [26–33]	0.80
%EWL (IQR)	75 [59–89]	74 [59–92]	0.94
%TWL (IQR)	30 [24–36]	30 [24–37]	0.73
Treatment			
Lifestyle changes, *n* (%)	45 (27%)	82 (35%)	0.10
Medication (PPI), *n* (%)	78 (48%)	113 (49%)	0.85
Conversion RYGB, *n* (%)	41 (25%)	37 (16%)	0.02
Months after operation (IQR)	20 [10–27]	26 [14–36]	0.04
Undo, *n* (%)	0 (0%)	1 (0.4%)	0.40

Values are mean ± standard deviation; median [interquartile range]; or number (%) of subjects. BMI, body mass index; GERD, gastroesophageal reflux disease; T2D, diabetes mellitus type 2; EWL, excess weight loss; TWL, total weight loss; PPI, proton pump inhibitor; RYGB, Roux-en-Y gastric bypass

Treatment of reflux with lifestyle changes (35 versus 27%, with and without suture, respectively; $P = 0.1$) or pharmacological treatment (49 versus 48%, respectively; $P = 0.85$) did not differ between the two groups. As shown in Table 1, more patients with reflux underwent surgical conversion to RYGB when no anti-reflux suture was applied (25%), compared to patients with the anti-reflux suture (16%, $P = 0.02$).

Furthermore, patients with anti-reflux suture underwent the conversion significantly later after the primary surgery than patients without (26 [14–36] months versus 20 [10–27] months, $P = 0.04$). One patient underwent an undo of the OAGB because of severe reflux and malabsorption of psychotropic medication resulting in disruption of psychiatric illness (0.1%). Weight loss and remission of comorbidities showed no differences between the groups (Table 2).

After adjustment for sex, age, and preoperative GERD, the presence of an anti-reflux suture was significantly associated with a lower incidence of conversion to RYGB for reflux (OR 0.56, 95%CI 0.34–0.91) (Table 3). Preoperative GERD status was also significantly associated with a conversion to RYGB for reflux with an OR of 5.2 (95%CI 2.7–10.1). UGE was performed in 99 patients (Table 4). Twenty-eight patients underwent a UGE multiple times and 53 (68%) of the patients who underwent conversion to RYGB had a UGE before the surgery. An ulcer was an endoscopic finding in 24 patients (24%), reflux esophagitis in 3 patients (3%), gastritis in 2 patients (2%), biliary reflux in 5 patients (5%), and Barrett esophagus in 2 patients (2%).

Table 3 Multivariable logistic regression of predictors for conversion surgery

Variable	OR (95% CI)	*P* value
Anti-reflux suture	0.56 (0.34–0.91)	0.02
Age	1.02 (1.00–1.05)	0.07
Weight preoperative	0.99 (0.98–1.00)	0.08
GERD preoperative	5.20 (2.67–10.11)	< 0.001

OR, odds ratio; CI, confidence interval; GERD, gastroesophageal reflux disease

Discussion

This retrospective study shows that the incidence of reflux after OAGB did not differ between patients with the anti-reflux suture and those without. However, patients with an anti-reflux suture were less likely to need a conversion surgery due to severe symptoms of reflux. Additionally, this study shows that patients diagnosed with preoperative GERD were five times more likely to need a conversion to RYGB.

The results of this study suggest that the anti-reflux suture does not prevent all acid and biliopancreatic secretions to flow into the gastric pouch and esophagus. Nevertheless, by placing the anti-reflux suture, patients were less likely to need a conversion to RYGB and were operated upon 6 months later on average. This suggests that the suture reduces the extent of reflux symptoms resulting in fewer conversions to RYGB. Symptoms of reflux are caused by gastric or biliary fluids

Table 2 Weight loss and resolution of comorbidities

Variables	Without anti-reflux suture (*N*=289)	Anti-reflux suture (*N*=414)	*P* value
Year 1	*N*=268	*N*=397	
Weight, kg (IQR)	84 [78–96]	85 [76–97]	0.88
%EWL (IQR)	78 [63–90]	76 [64–91]	0.96
%TWL (IQR)	31 [27–35]	31 [27–36]	0.48
Year 3	*N*=202	*N*=318	
Weight, kg (IQR)	88 [76–99]	85 [76–97]	0.29
%EWL (IQR)	75 [58–91]	76 [61–93]	0.28
%TWL (IQR)	31 [22–36]	31 [25–38]	0.34
Remission HT, *n* (%)			
Total	48 (49%)	68 (49%)	0.96
Partial	38 (39%)	61 (44%)	0.41
None	12 (12%)	9 (6%)	0.13
Unknown	0 (0%)	2 (1%)	
Remission T2D, *n* (%)			
Total	42 (73%)	67 (75%)	0.88
Partial	14 (25%)	21 (23%)	0.88
Unknown	1 (2%)	2 (2%)	

Values are median [interquartile range]; or number (%) of subjects

EWL, excess weight loss; TWL, total weight loss; HT, hypertension; T2D, diabetes mellitus type 2

Table 4 Endoscopic findings

	Total	Without anti-reflux suture	Anti-reflux suture	Months after surgery
Number of patients	99	47	52	30 [15–41]
Normal	61 (62%)	29 (62%)	32 (62%)	30 [13–41]
Ulcer	24 (24%)	11 (23%)	13 (25%)	31 [16–44]
Biliary reflux	5 (5%)	4 (9%)	1 (2%)	16, 38, 38, 51, 56
Reflux esophagitis	3 (3%)	0	3 (6%)	26, 45, 61
Gastritis	2 (2%)	1 (2%)	1 (2%)	5, 35
Barrett esophagus	2 (2%)	1 (2%)	1 (2%)	8, 19
Postoperative bleeding	2 (2%)	1 (2%)	1 (2%)	0

Values are median [interquartile range]; or number (%) of subjects

flowing back into the esophagus. Bile reflux into the stomach does not cause symptoms of GERD, as it is a physiologic phenomenon also seen in healthy unoperated controls without GERD [36–38]. A possible explanation for our results is that the anti-reflux suture does decrease the frequency of bile reflux resulting from backflow of biliopancreatic fluids but has no influence on reflux of acid fluids produced in the gastric pouch. Symptomatic patients with anti-reflux suture could therefore mainly suffer from acidic reflux. The lesser degree of bile reflux in patients with an anti-reflux suture could result in less severe reflux symptoms and less conversion surgeries. Furthermore, PPI is a sufficient therapy for acid reflux and not for bile reflux, which may also contribute to the result of less conversion surgeries in the group with suture [39]. Nevertheless, in this study, no objective measurements were performed and therefore acid and biliary reflux cannot be distinguished from each other. There is limited research on acid and bile reflux after OAGB using objective measurements. Doulami et al. performed 24-h multichannel intraluminal impedance pH metry in 11 patients 1 year after OAGB and found elevated esophageal acid exposure and an increase of nonacid episodes of reflux, indicating that both acid and biliary reflux contribute to the pathophysiology of reflux after OAGB [40].

The RYGB has been used as an anti-reflux procedure because it is associated with improvement of GERD symptoms by lowering acid production, rapid pouch emptying, and decreasing abdominal pressure [2–7]. However, recent studies reported persistent symptoms of reflux in up to 22% and new symptoms of GERD in 11% of patients after RYGB [2, 8–10]. Borbély et al. evaluated 47 patients with persistent GERD symptoms after RYGB and found a high percentage of hiatal hernias, hypotensive lower esophageal sphincter, and severe esophageal motility disorders [41]. Despite the small gastric pouch, acid reflux still exists or increases after RYGB and this most likely also applies for patients after OAGB. Borbély also found abnormal esophageal acid exposure in 61% of the patients with an enlarged pouch after RYGB [41]. As the gastric pouch in the OAGB is longer compared to the pouch created in the RYGB, this can result in even more acid production in the pouch after OAGB.

Carbajo et al. first described the use of an anti-reflux suture when performing the OAGB. We used a modification of the technique described by Carbajo, using one single suture when performing the anti-reflux suture [42]. However, up till now, no study investigating the clinical effect of this anti-reflux suture has been published [22, 42]. Using the modified Delphi approach, 101 OAGB experts from 39 countries voted on statements about controversies of the OAGB procedure. The majority of the experts (81%) agreed that the standardization of the anti-reflux suture described by Carbajo et al. was not strictly necessary [27]. This suggests that in most bariatric centers, the anti-reflux suture is not routinely applied when performing the OAGB. In our institute, the application of the suture was left to the discretion of the surgeon during the study period.

Patients preoperatively diagnosed with GERD and treated with a PPI were five times more likely to need conversion surgery because of symptomatic reflux. GERD is caused by multiple mechanisms, such as impaired lower esophageal sphincter resting tone, hiatus hernia, visceral hypersensitivity, and impaired mucosal resistance [43]. We hypothesize that the presence of those underlying GERD mechanisms is also associated with the development of acid and bile reflux after an OAGB. A recent cohort study of 200 patients undergoing an OAGB investigated the association between reflux and hiatus hernia by routinely performing preoperative UGE and barium swallow in all patients. They found a significant correlation between hiatus hernia and reflux with a more than two times higher incidence of reflux when patients had a hiatus hernia [44]. Only patients without preoperative GERD were included because in those patients RYGB was performed. This corresponds with the theory that mechanisms associated with the development of GERD are also associated with the development of reflux.

Our results are contradictory to previously reported OAGB cohort studies, describing an improvement of preoperative diagnosed GERD postoperative and defining the OAGB as a possible protective anti-reflux procedure [20, 31]. However, those studies did not report how postoperative reflux was

assessed, which could explain the difference compared to our results. A more recent multicenter retrospective study investigating the complications following the OAGB in 2678 patients found a correlation between reflux and preoperative GERD, where 22% of the patients with preoperative GERD needed conversion surgery [28]. They recommend to be careful in advising an OAGB to patients with preoperative GERD and prefer a RYGB in this situation [28]. Furthermore, Doulami et al. performed 24-h multichannel intraluminal impendence pH metry in 11 patients after OAGB and found a worsening of already existing GERD in all patients [40]. In our study, 35% of the patients with preoperative GERD needed conversion surgery. Based on our results, in our bariatric center, we do not perform an OAGB as primary bariatric surgery in patients with preoperative GERD anymore.

We found an incidence of reflux of 56%, in our cohort. This high incidence can be explained by our definition as patients who just had one episode of reflux were marked as suffering from reflux. In total, 38% of the patients had symptoms of reflux for which medication or conversion surgery was necessary. We consider this a representative incidence of reflux in our study population. Large cohort studies in OAGB reported an incidence of reflux of 0.6–10% [21–23, 25, 31, 45]. More recent studies show a higher incidence of reflux. Kermansaravi et al. found an incidence of 19.3% 1 year postoperative using a GERD symptom questionnaire [44]. Saarinen et al. performed the first prospective study on bile reflux in 40 patients after OAGB using endoscopies and scintigraphy measurements. They found bile reflux in the gastric pouch in 31.6% associated with abnormalities suggestive of bile reflux in UGE and new symptoms of reflux in 20% of the patients [46]. Furthermore, the high incidence found in our study can be explained by consequently questioning all patients about reflux at each follow-up appointment, a low threshold of starting a PPI, and close monitoring of patients with reflux in our cohort. Our results correspond with the results of more recent studies, implying that the incidence of reflux is most likely higher than described before.

Surgical conversion to RYGB was performed in 11% of the patients and those patients can be considered suffering from severe symptoms of therapy-resistant reflux. In a systematic review, the incidence for conversion surgery was 0.4–1.6%, including revisional surgery for severe reflux [45]. A probable explanation for the high rate of conversion surgery in our population is that the threshold for conversion to RYGB in our center is low because of the ease of the operation and the low complication rate. It is possible that in other centers, stricter criteria for conversion to RYGB are used, for example, only in case of Barrett or esophagitis/gastritis. Only a few small studies have been published about conversion of OAGB to RYGB for reflux [47–51]. Bolckmans et al. retrospectively analyzed 28 patients who underwent conversion to RYGB, six of whom because of reflux. Conversion was indicated in case of clinically severe reflux which was defined as symptoms of reflux at least daily and proven reflux by UGE, which indeed are stricter criteria compared to our center [49]. In another study, 32 patients (1.2%) were converted to RYGB because of invalidating reflux resistant to medical management and lifestyle rules [52], which corresponds with the indication for conversion in our population.

The potential risk of the development of gastric or esophageal cancer due to reflux results in controversies on the use of the OAGB [53]. However, the OAGB has been performed for over 20 years and only one case of esophageal cancer has been reported. The patient was diagnosed 2 years after the OAGB, which makes it unlikely that it was caused by reflux [54]. Furthermore, Bruzzi et al. performed histological analysis of the esogastric segments in obese rats after OAGB and found no precancerous or cancerous lesions [55]. In our study, UGE was only performed as a diagnostic tool or before conversion surgery. Barrett esophagus was diagnosed in two patients. Although there was a selection bias and the follow-up period in this study is short, this low incidence of Barrett esophagus in our population is reassuring. In this study, we found no dysplasia in any of our patients who underwent UGE. In order to solve the controversy on the risk of malignancy, long-term UGE screening studies after OAGB are needed.

The high incidence of reflux strengthens the need to active asking the patients for complaints of reflux after the OAGB. More research is necessary to determine the exact incidence of reflux using both questionnaires and objective measurement methods. Studies with objective measurements are necessary to distinct acid from bile reflux after OAGB; this discrimination is relevant to understand the pathophysiology of reflux and to provide patients adequate treatment of their reflux.

This is the first study investigating the effect of the anti-reflux suture using a large and representative population, with data on multiple time points. The loss to follow-up over 3 years is 26%, which are realistic data from a bariatric center in the Netherlands.

Limitations of this study were the retrospective and non-blinded study design and the lack of a structured questionnaire on symptoms and frequency of reflux, thereby lacking a clear definition of reflux. However, by using a subdivision into lifestyle, medical, and surgical treatment, semiquantative data could be explored making it a more representative incidence of reflux. UGE was only performed to assess secondary damage to reflux. The indication for a conversion surgery was determined by the bariatric surgeon based on their own cut-off values, which could have result in a certain bias.

In conclusion, the presence of preoperatively diagnosed GERD should be weighted heavily in the decision to perform an OAGB as this is a major risk factor for developing severe symptoms of reflux needing conversion to RYGB. The results of this study suggest that the anti-reflux suture might be a valuable addition to the OAGB procedure because it leads to less often conversion to RYGB for reflux.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s11695-021-05238-8.

Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Approval For this type of study, formal consent is not required.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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