



# Management strategies of anastomotic ulcer after gastric bypass and risk factors of recurrence

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## Abstract

**Background** Marginal ulcers (MU) after gastric bypass are a challenging problem. The first-line treatment is a medical therapy with eviction of risk factors but is sometimes insufficient. The management strategies of intractable ulcers are still not clearly defined. The aim of our study was to analyse the risk factors for recurrence, the management strategies used and their efficiencies.

**Methods** Based on a retrospective analysis of all MU managed in our tertiary care centre of bariatric surgery during the last 14 years, a descriptive analysis of the cohort, the management strategies and their efficiency were analysed. A logistic regression was done to identify the independent associated risk factors of intractable ulcer.

**Results** Fifty-six patients matched inclusion criteria: 30 were referred to us (13 Roux-en-Y Gastric Bypass—RYGB and 17 One Anastomosis Gastric Bypass—OAGB), 26 were operated on in our institution (24 RYGB and 2 OAGB). 11 patients had a complicated inaugural MU requiring an interventional procedure in emergency: 7 perforations, 4 haemorrhages. The majority of MU were treated medically as a first-line therapy ( $n=45$ ; 80.4%). 32 MU recurred: 20 patients required surgery as a 2nd line therapy, 6 were operated on as a 3rd line therapy and 1 had a surgery as a 5th line therapy. The OAGB was the only risk factor of recurrence ( $p=0.018$ ). We found that the Surgical management was significantly more frequent for patients with a OAGB (84% versus 35% for RYGB,  $p=0.001$ ); the most performed surgical procedure was a conversion of OAGB to RYGB ( $n=11$ , 37.9%).

**Conclusion** Surgery was required for a large number of MU especially in case of recurrence, but recurrence can still occur after the surgery. The OAGB was the only risk factor of recurrence identified and conversion to RYGB seemed to be effective for the healing.

**Keywords** Bariatric surgery · Marginal ulcer · Roux-en-Y gastric bypass · One anastomosis gastric bypass · Intractable marginal ulcer · Recurrence

Gastric bypass is a gold standard procedure in bariatric surgery with a powerful effect on metabolic comorbidities and weight loss. The morbidity of gastric bypass is around 10% [1]. Several long-term complications can occur: marginal

ulcer (MU) is one of these complications, its incidence is very variable in the literature, ranging from 0.6 to 16% [2, 3]. Marginal ulcer is a challenging problem which can cause significant morbidity. Several causes have been described

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including mechanical factors (pouch size, surgical technique, sutures and staples), smoking status, or comorbidities (diabetes, arterial hypertension, dyslipidaemia, coronary artery disease—CAD) [1, 4] but the pathogenesis remains unclear.

The first-line treatment is a medical therapy using proton pump inhibitors (PPIs) with eviction of risk factors. Marginal ulcers can lead to severe acute complications like massive bleeding or perforation that can reveal the pathology, and which require surgery in emergency. Even if medical therapy is often efficient, in case of failure, the MU becomes chronic and is then difficult to treat. The management strategies of intractable ulcers are still not clearly defined. Surgery is sometimes unavoidable, but the type of procedure and its efficacy on chronic MU is uncertain. Whereas chronic ulcer after gastric bypass is a recurrent problem in current practice, there are little data in the literature on the management of this tricky pathology.

Based on a retrospective analysis of all the MU after gastric bypass managed in our tertiary care centre of bariatric surgery, the aim of our study was to analyse the risk factors for recurrence, the management strategies used and their efficiencies.

## Methods

From November 2007 to September 2021, we recorded all the patients treated for a MU in our high-volume tertiary care centre of bariatric surgery.

Patients were identified by the computer software easily@ which contains all the clinical files of the university hospital of Lyon (Hospices Civils de Lyon) using the keywords: “bariatric surgery”, “gastric bypass”, “gastroscopy”, “Marginal Ulcer” and “gastro-jejunal anastomosis”.

All the patients were included in the BariaSurg cohort, declared under the Number CNIL 15-107, NCT02857179.

Informed consent was obtained for patients operated on and included in the Study.

Inclusion criteria were an age greater than 18 years, a history of gastric bypass (Roux and Y Gastric Bypass—RYGB or one anastomosis gastric bypass—OAGB) and a MU identified either by an upper GI endoscopy or during surgery for a complication (perforation, haemorrhage).

Demographic data were recorded including gender, age at the time of diagnosis of the MU, history of previous bariatric surgeries, body mass index before the gastric bypass. We seek for potential risk factors of MU including gastroesophageal reflux disease (GERD), diabetes, nicotine use, nonsteroidal anti-inflammatory drug or corticosteroid use.

The comorbidities already reported to be associated with marginal ulcer were recorded as dyslipidaemia, coronary artery disease (CAD), chronic lung disease (asthma and

chronic obstructive pulmonary disease), hypothyroidism and arterial hypertension.

A descriptive analysis was conducted regarding the date and type of gastric bypass and the characteristics of the MU: time of occurrence, localization (gastric, anastomotic, jejunal), symptoms, complications (perforation, haemorrhage), findings of the upper GI endoscopy.

The management strategies and their efficiency were analysed according to their type: medical, endoscopic or surgical management.

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS®) version 22 software (SPSS, Chicago, Illinois, USA). Categorical variables were expressed as frequencies and proportions and were compared with  $X^2$  or Fisher’s test for the bivariate analysis. Continuous data were expressed as a mean or median with standard deviation (SD). A Student’s *t* test was performed for data with a normal distribution or a Mann–Whitney *U* test when appropriate. A logistic regression was done to identify the independent associated risk factors for intractable ulcer.

## Results

### Descriptive data of the population studied

Using the keywords previously cited, 360 medical files were identified by the software easily@. After specific analysis, 56 patients matched inclusion criteria. Thirty patients (53.6%) were referred by other institutions including 13 RYGB and 17 OAGB.

Twenty six patients over 737 gastric bypass performed in our institution were diagnosed with a MU (26/737; 3.5% including 24 RYGB and 2 OAGB). 299/737 had a revisional gastric bypass (40.6%) and 71/737 (9.6%) were OAGB. In our centre, the rate of MU among the OAGB was 2.8% (2/71) and 3.6% for the RYGB (24/666). All the patients who had benefited from a bariatric surgery in our centre or hospitalized because of a complication were registered in a prospective database (BARIASURG, National Clinical Trial 02857179).

Mean age at the time of diagnosis of the MU was 46.6 years [23; 70]—median 49 years.

Forty-five patients were women (80.4%); 19 patients (33.9%) had a OAGB and 37 (66.1%) had a RYGB. The average time between the gastric bypass and the occurrence of the MU was 24.5 months (median: 16 months).

Twenty-four patients (42.9%) had a previous history of bariatric surgery before the gastric bypass including 13 adjustable gastric bands (23.2% of all patients), 6 sleeve gastrectomies (10.7%), 2 Vertical Banded Gastroplasties

(3.6%) and 3 with both an adjustable gastric band and a sleeve gastrectomy (5.4%).

Mean body mass index (BMI) before the gastric bypass was 43 kg/m<sup>2</sup> [18.5; 59.8]—median 44 kg/m<sup>2</sup>. Among the patients requiring surgical management for the MU, the mean % total weight loss was 35.4% [7.5; 65]—median 34.5% and the mean loss of BMI was 16.7 kg/m<sup>2</sup> [2.2; 44.9]—median 14.5 kg/m<sup>2</sup>.

In the population, 14 patients had Type 2 Diabetes Mellitus (25%), 20 were smokers (35.7%) and 32 (57.1%) had at least one comorbidity including dyslipidaemia ( $n = 23$ , 41.1%), CAD ( $n = 1$ , 1.8%), chronic lung disease ( $n = 16$ , 28.6%), hypothyroidism ( $n = 4$ , 7.1%) and arterial hypertension ( $n = 23$ , 41.1%).

Twelve patients suffered from GERD (21.4%)

### Diagnostic means and management strategies of the MU

On the upper GI endoscopy, the most common location of the MU was the gastrojejunal anastomosis (71.4%) followed by the jejunal limb adjacent to the anastomosis (12.5%).

The majority of MU were treated medically as a first-line therapy ( $n = 45$ ; 80.4%) with PPI alone or combined with sucralfate; 11 patients had a complicated inaugural MU requiring an interventional procedure in emergency: 7 perforations, 4 haemorrhages.

Twenty four were acute ulcers and did not recur. Among the 32 recurrent ulcers, 20 patients required surgery as a second-line therapy, 6 were operated on as a 3rd line therapy and 1 had a surgery as a 5th line therapy (cf Fig. 1).

Among the 56 marginal ulcers, 29 patients (51.8%) required a surgery at least once or even more. Among the 29 patients operated on at least once, 28 patients had a recurrent ulcer and only one had an acute perforated ulcer which did not recur after surgery.

The median time from the diagnosis to the first surgery was 5 months [0; 108]. At the time of surgery, the mean BMI was 27.6 kg/m<sup>2</sup> [16.3; 48]—median 28.1 kg/m<sup>2</sup>, the mean percentage of Total weight lost was 35.4% [7.5%; 65%]—median 34.5%.

The most performed surgical procedure was a conversion of OAGB to RYGB ( $n = 11$ ; 37.9%). The other procedures were a revision of the gastrojejunostomy for 8 patients (27.6%), a reversal of the gastric bypass to normal anatomy for 5 patients (17.2%), a suture of the perforation for 4 patients (13.8%) and a drainage for one patient with a perforation (3.4%).

Among the 11 conversions from OAGB to RYGB, 3 patients had a recurrence of which one needed a revision of the gastrojejunostomy. Among the 8 patients who had a revision of the gastrojejunostomy, 3 needed a second surgery with 2 redo revisions and 1 total gastrectomy. After suture of

the perforation, 2 patients had a recurrence, and one needed a surgery for revision of the gastrojejunostomy. Among the 5 bypass reversal, 2 patients had a recurrence, but none needed a surgery.

Of the 28 patients with recurrent ulcer which were managed surgically, 11 had a recurrence (39.3%), 5 of whom (45.5%) needed another surgery.

These 28 patients were the patients with a recurrent ulcer and who required a surgical approach at least once or more during the follow-up. Among these 28 patients who had a surgical treatment:

- Thirteen patients had a RYGB including:
  - 4 Perforations.
  - 1 Haemorrhage treated first by endoscopy, and finally required surgery.
  - 7 After failure of medical therapy.
  - 1 After failure of a primary medical treatment, and after failure of a secondary endoscopic therapy.
- Fifteen patients had a OAGB including:
  - 2 Perforations.
  - 2 After failure of a primary endoscopic treatment.
  - 11 Patients after several lines of treatment.

This is illustrated in Fig. 1.

### Associated risk factors of intractable ulcers

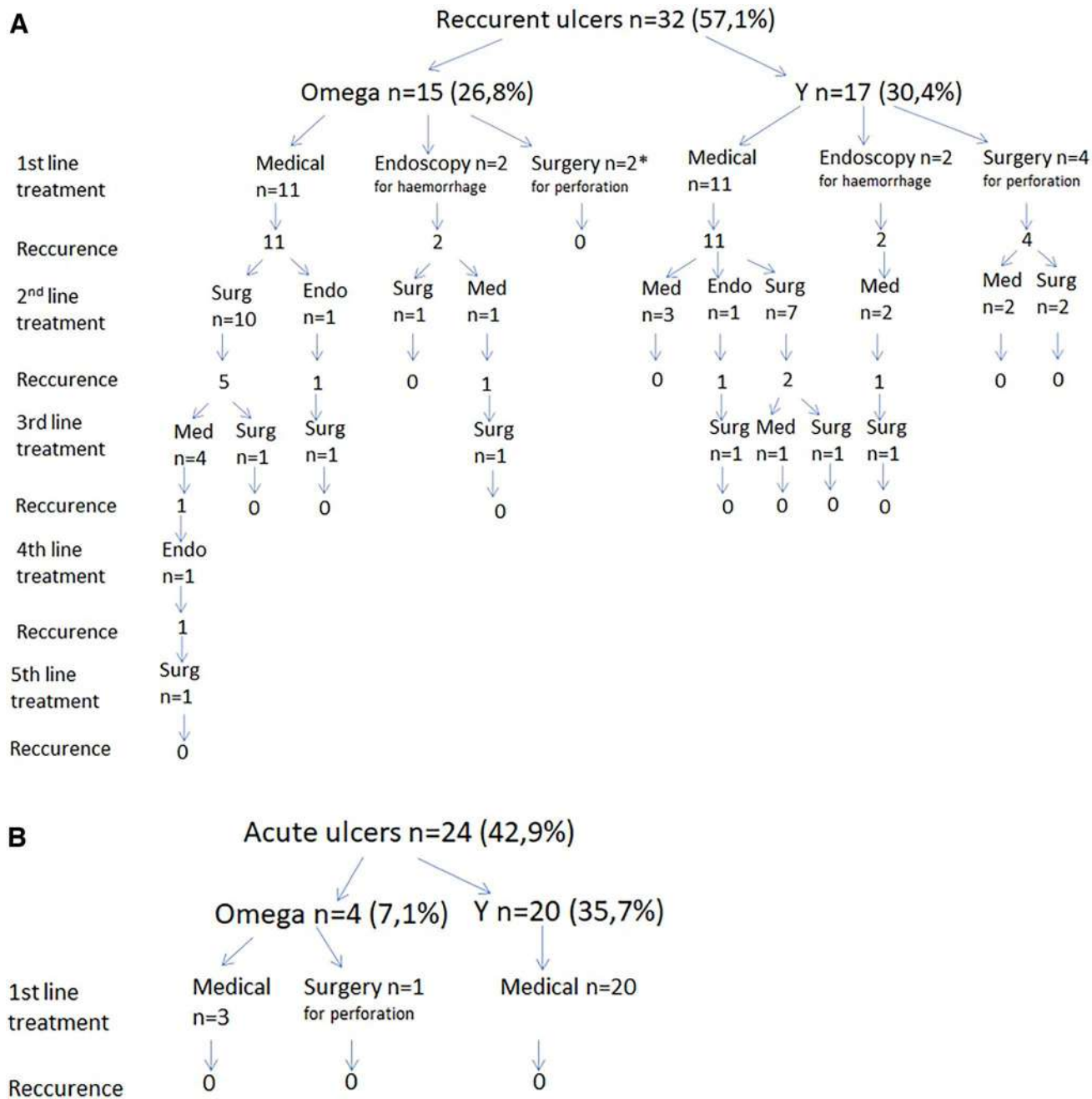
Comparing the group of acute ulcers to the recurrent ulcer group, we found that patients with a OAGB appeared at risk of MU recurrence ( $p = 0.018$ ; Table 1).

Gender, nicotine use, nonsteroidal anti-inflammatory drug use, aspirin and corticosteroid were not identified as risk factors for intractable ulcers. Hypothyroidism, arterial hypertension, dyslipidaemia, diabetes and CAD were neither associated with recurrence of MU.

Previous history of bariatric surgery before the gastric bypass was not identified as a risk factor of intractable ulcer.

Chronic lung disease was identified as a risk factor for acute ulcer ( $p = 0.013$ ; Table 1).

Comparing the characteristics and findings of the patients with a MU function of their type of gastric bypass (OAGB vs RYGB), the groups were mostly comparable. Nevertheless, we found that the Surgical management was significantly more frequent for patients with a OAGB ( $p = 0.001$ ; Table 2). Out of the 19 patients with a MU after OAGB, 16 were managed surgically (84.2%). In the RYGB group, 13 patients out of 37 were managed surgically (35.1%).



**Fig. 1** Flowchart management of marginal ulcers after RYGB or OAGB ( $n=56$ ). **A** Management of recurrent ulcers after RYGB and OAGB. **B** Management of acute ulcers after RYGB and OAGB. *Endo*

endoscopy, *Med* medical, *Surg* surgery. \*Symptoms had been developed for several months without treatment before perforation

**Discussion**

This retrospective analysis of 56 MU after gastric bypass managed in our tertiary care centre of bariatric surgery is one of the largest published on the topic [1, 5–12]. The incidence of this complication seems underestimated, due to “nomad” patients, managed in other centres than those where they had the gastric bypass initially: in our centre, the

incidence rate was 3.5% (26/737), whereas more than a half of the MU treated (30/56–53.6%) had their gastric bypass performed in another centre.

Data in the literature are poor with small series and case reports [1, 5–12], and there is no consensus on the way to treat intractable ulcers whereas this pathology remains a tricky problem in daily practice.

**Table 1** Risk factors of recurrent marginal ulcer

	Marginal ulcers (whole population) <i>n</i> = 56	Recurrent ulcers <i>n</i> = 32	Acute ulcers <i>n</i> = 24	<i>p</i>
Demographic data				
Female (%)	45 (80.4)	27 (84.4)	18 (75.0)	0.382
Previous bariatric surgeries (%)	24 (42.9)	15 (46.9)	9 (37.5)	0.483
Comorbidities				
Diabetes (%)	14 (25.0)	6 (18.8)	8 (33.3)	0.212
Hypothyroidism (%)	4 (7.1)	2 (6.3)	2 (8.3)	0.765
Hypertension (%)	23 (41.1)	12 (37.5)	11 (45.8)	0.53
Dyslipidaemia (%)	23 (41.1)	12 (37.5)	11 (45.8)	0.53
Chronic lung disease (%)	<b>16 (28.6)</b>	<b>5 (15.6)</b>	<b>11 (45.8)</b>	<b>0.013</b>
CAD (%)	1 (1.8)	0	1 (4.2)	0.244
Potential risks factors				
Nicotine use (%)	20 (35.7)	9 (28.1)	11 (45.8)	0.171
NSAID use (%)	4 (7.1)	3 (9.4)	1 (4.2)	0.454
Aspirin (%)	7 (12.5)	2 (6.3)	5 (20.8)	0.102
Corticosteroid (%)	1 (1.8)	1 (3.1)	0	0.382
Surgical technique				
OAGB (%)	<b>19 (33.9)</b>	<b>15 (46.9)</b>	<b>4 (16.7)</b>	<b>0.018</b>

CAD coronary artery disease, OAGB one anastomosis gastric bypass, NSAID nonsteroidal anti-inflammatory drug

Bold values are significant values

Several studies had described some risks factors: use of NSAID, smokers, arterial hypertension, corticosteroid, diabetes, hypothyroidism, chronic lung disease, CAD [4–6].

In our series, the type of gastric bypass and especially the OAGB was the only risk factor of recurrence of MU ( $p=0.018$ ). In the current literature, all the studies available on MU are about RYGB and no data comparing the impact of the surgical technique on recurrence (OAGB vs RYGB) have been published.

In our centre, the rate of MU after OAGB was 2/71 (2.8%), compared to 2.24% in an online survey of surgeons which is about declarative data [8]. The rate of MU after RYGB was 24/666 (3.6%) in our study and is between 0.6 and 16% in the literature [2, 3] and probably underestimated in most of the studies. A possible explanation is the high rate of lost to follow-up in the bariatric surgery population and the medical nomadism.

Surprisingly, we found that Chronic lung disease appeared as a risk factor of acute ulcer but not at risk of chronic ulcer. This result was unexpected as we know that chronic lung disease induces nocturnal hypoxemia and chronic inflammation, one could hypothesize that nocturnal hypoxemia induced by chronic lung disease is not severe enough to prevent the healing of the ulcer.

We also found that surgery was necessary for 29 out of 56 patients with MU (51.8%) and mostly for patients with recurrent ulcers ( $n=28/32$ ; 87.5%). Patients with a OAGB were more likely to require a surgical management (84.2%

versus 35.1% in the RYGB group,  $p=0.001$ ). Most of the patients had several lines of treatment and those with a recurrent ulcer required at least one surgery; despite surgery, 37.9% had still a recurrence which illustrates the difficulties to obtain the healing.

In the literature, the recurrence rate of MU after surgical management varies from 0% after the first year in Chang's study [7] ( $n=11$ , 9 patients with more than 1-year follow-up) up to 57% in Di Palma's series [6] (28 surgeries for recurrent ulcer and 16 recurrences after surgery). The authors reported that ulcers not responding to medical treatment occurred earlier than those which did respond [6]. Conversely, we did not find any difference in the mean time of occurrence between acute and recurrent ulcer.

There are currently no recommendations for the surgical management of intractable ulcer: few techniques have been proposed including revision of the gastrojejunal anastomosis or vagotomy. Bonanno et al. had compared both strategies in 20 patients and found a similar recurrence rate between the 2 groups (14% and 15%) [8]. In this study, the authors did not describe how they deal with these new recurrences.

Chang et al. [7] realised a revision of the gastrojejunostomy with an associated vagotomy in 11 patients, with no recurrence but it is a small study and some patients were lost to follow-up.

In 2013, Steinemann conducted a survey investigating the management of MU after RYGB among surgeons [14]: this survey reflected the lack of recommendation and the absence

**Table 2** Comparison of the patients with a Marginal Ulcer function of their type of gastric bypass (OAGB versus RYGB)

Characteristics of the population <i>n</i> = 56 (%)	Omega <i>n</i> = 19 (34%)	<i>Y</i> <i>n</i> = 37 (66%)	<i>p</i>
Referred patients	17 (89.5)	13 (35.1)	<b>0.0001</b>
Previous surgery	9 (47.4)	15 (40.5)	0.62
Middle age	45 [27; 65]	47.3 [23; 70]	0.48
Female sex	18 (94.7)	27 (73.0)	<b>0.05</b>
Middle BMI before bypass	44.9 [31; 59.8]	42.2 [18.5; 56.4]	0.1
Comorbidities	Omega ( <i>n</i> = 19)	<i>Y</i> ( <i>n</i> = 37)	<i>p</i>
Diabetes	4 (21.1)	10 (27.0)	0.62
Nicotine use	8 (42.1)	12 (32.4)	0.47
NSAID use	1 (5.3)	3 (8.1)	0.69
Aspirin	2 (10.5)	5 (13.5)	0.74
Corticosteroid	1 (5.3)	0	0.15
GERD	3 (15.8)	9 (24.3)	0.46
Dyslipidaemia	5 (26.3)	18 (48.6)	0.1
CAD	1 (5.3)	0	0.15
Chronic lung disease	4 (21.1)	12 (32.4)	0.37
Hypothyroidism	2 (10.5)	2 (5.4)	0.48
Hypertension	6 (31.6)	17 (46.0)	0.3
	Omega ( <i>n</i> = 19)	<i>Y</i> ( <i>n</i> = 37)	<i>p</i>
Diagnostic gastroscopy	15 (78.9)	32 (86.5)	0.5
Mean time to gastroscopy (days)	283.4 [0.5; 1825]	112.5 [0.5; 1095]	0.53
Complicated MU	11 (57.9)	14 (37.8)	0.15
Recurrent ulcer	<b>15 (78.9)</b>	<b>17 (46.0)</b>	<b>0.018</b>
Surgical management	<b>16 (84.2)</b>	<b>13 (35.1)</b>	<b>0.001</b>
BMI at surgical revision	27.9 [18; 48]	27.2 [16.3; 39.8]	0.84
%TWL	39.7 [7.5; 65]	30.1 [12.2; 59.4]	0.09
Loss of BMI	18.3 [2.6; 31.5]	11.8 [2.2; 25]	0.02

CAD coronary artery disease, BMI body mass index, GERD gastroesophageal reflux disease, NSAID nonsteroidal anti-inflammatory drug, TWL total weight loss, MU Marginal Ulcer

Bold values are significant values

of consensus. In this survey, in case of recurrent ulcer, 56% of the surgeons opted for a medical treatment, 41% opted for revision of the anastomosis and 2% of the surgeons realised a total gastrectomy. Opinions on recurrences after surgical treatment were even less consensual: 46% realised a medical treatment, 36% opted for a revision of the anastomosis, 9% realised a total gastrectomy and 6% opted for a reversal of the gastric bypass.

Another survey was also published [15] about the management of MU after OAGB but there were only 43 patients with recurrence and the surgical strategies were variable too.

In our study, the surgical management was also diverse but in case of MU after OAGB a conversion to RYGB was the preferred strategy (11/14 surgeries) with good results; only 1 patient required another surgery. This attitude is justified by the hypothesis that diverting the bile should help the healing [16].

In case of MU after RYGB, a revision of the gastrojejunostomy was realised in 8 out of 15 surgeries but 3 patients had a recurrence and needed another surgery. This is probably why a total gastrectomy is sometimes proposed, so as to eradicate the acid production: the high risk of complications in case of an eso-gastric anastomosis, especially in those difficult cases of revisional surgery must lead to be cautious regarding this option. Eradication of the main risk factors of recurrence (tobacco, AINS, ...) and continuation of the medical treatment (PPI and sucralfate) must be systematic.

There are some limitations in our study: first it is a retrospective and monocentric study. Second, it is based on the experience of a tertiary care centre of bariatric surgery, where a lot of patients were referred after failure of several lines of treatment.

## Conclusion

In this series of 56 marginal ulcers, the OAGB was the only risk factor of recurrence identified and conversion to RYGB seemed the most often effective for the healing. Surgery was required for a large number of MU especially in case of recurrence, but recurrence can still occur after the surgery. Prospective studies are needed to validate these findings and to propose guidelines regarding the management strategies of intractable ulcers.

## Declarations

**Disclosures** Drs Bacoer-Ouzillou Ophélie, Perinel Julie, Pelascini Elise, Abdallah Mourad, Poncet Gilles, Pasquer Arnaud, Robert Maud have no conflicts of interest to declare.

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