

# Abdominal pain and internal hernias after Roux-en-Y Gastric Bypass: are we dealing with the tip of an iceberg?

Francesco Tartamella<sup>1</sup>, Antonio Ziccarelli<sup>1</sup>, Stefano Cecchini<sup>1</sup>, Michelina Ferro<sup>2</sup>, Matteo Riccò<sup>3</sup>, Edoardo Baldini<sup>4</sup>, Ruj Mancini<sup>5</sup>, Marco Anselmino<sup>5</sup>, Federico Marchesi<sup>1</sup>

<sup>1</sup>Dipartimento di Medicina e Chirurgia, Sezione di Clinica Chirurgica Generale, Università degli Studi di Parma, Parma, Italia;

<sup>2</sup>Unità Operativa di Anestesia e Rianimazione e Terapia del Dolore, Azienda ospedaliero Universitaria di Parma, Parma, Italia;

<sup>3</sup>Azienda Provinciale per i Servizi Sanitari della p.a di Trento, UOPSAL, Trento, Italia; <sup>4</sup>Unità Operativa Chirurgia Generale, Ospedale "G. da Saliceto", Piacenza, Italia; <sup>5</sup>UOC Chirurgia Bariatrica e Metabolica, Azienda Ospedaliero Universitaria Pisana, Pisa, Italia

**Summary.** *Background:* Abdominal pain is the most frequent cause of hospital admission after Roux-en-y gastric bypass (RYGB). Among numerous possible underlying causes, internal hernias represent one of the most peculiar and insidious conditions, setting challenging diagnostic and therapeutic problems for the surgeon. The aim of this study is to analyze aspecific abdominal pain incidence and characteristics after RYGB, discriminating peculiar aspects suggestive of internal hernias. *Methods:* 13 patients submitted to internal hernia repair after laparoscopic antecolic RYGB and a group of 49 controls (non-complicated RYGB) have been assessed using a specific questionnaire. Overall aspecific abdominal pain incidence and characteristics have been analysed. Typical pain traits and predisposing conditions for internal hernias have been investigated. *Results:* 33% of controls reported aspecific abdominal pain after RYGB, mainly early postprandial, deep, remittent, colicky, located in the upper left abdomen. 77% of the case patients reported prodromal episodes of pain similar to the controls. The only significant differences between prodromal and acute episodes were pain intensity and quality (continuous). Excess weight lost at 3 months significantly correlated with internal hernia occurrence (p: 0.002). *Conclusions:* Based on abdominal pain characteristics, we can reasonably postulate the presence of remittent bowel torsions (remittent internal hernia) in many patients after antecolic RYGB, only occasionally complicating. Therapeutic management of these cases remains controversial, being laparoscopic exploration a reasonable option when symptomatology is suggestive. ([www.actabiomedica.it](http://www.actabiomedica.it))

**Key words:** abdominal pain, gastric bypass, obesity, Peteresen hernia, internal hernia

## Introduction

Roux-en-Y gastric bypass (RYGB) has become the most used bariatric procedure worldwide (1), given its high effectiveness for weight loss and comorbidities resolution, with a well-demonstrated improvement in quality of life (2-6).

While standardization of the surgical techniques and amelioration of postoperative care have reduced

postoperative complications, long-term morbidity still remains an important issue for bariatric surgery and, in particular, for RYGB (7-9).

Internal hernias represent the most peculiar late complication of RYGB, being related to altered anatomy which the different types of limb reconstruction entail.

The extremely variable clinical presentation and low reliability of diagnostic imaging (10) make the management of patients with suspected internal her-

nias extremely challenging, with high risk of unnecessary explorations or delayed treatments (11).

Abdominal pain, which is the key symptom of internal hernias, is reported quite frequently by patients after RYGB: its variable presentation and the wide range of possible causes make differential diagnosis extremely challenging (12).

This study aims at identifying possible specific features in the clinical presentation of patients with suspected internal hernias after RYGB, with specific focus on abdominal pain.

## Materials and methods

A total of 13 cases of internal hernias after RYGB, 4 operated on at Parma University Hospital, 6 at Pisa University Hospital, 3 at Piacenza Hospital between 2007 and 2013, were retrospectively assessed. Indication for surgery was based on symptoms characteristics (severity and frequency) and diagnostic procedures findings. All the patients had previously undergone antecolic-antegastric laparoscopic RYGB, with posterior hand-sewn/mechanical gastrojejunal anastomosis (right oriented alimentary limb) and side-to-side jejuno-jejunostomy; no mesenteric defect closure was performed.

Abdominal pain was investigated by having the patients answer a novel specific questionnaire (Bariatric Postoperative Pain Assessment - BAPPA), by phone or direct interview. The 15 items non validated test was designed based on the Rome III test (13) and changed upon advice of an expert panel including a neurologist, a psychiatrist, a gastroenterologist and an anaesthesiologist; it aims at identifying pain location and frequency, its correlation with meals and bowel movements, any presence of reflex events (nausea and vomiting) and use of analgesics. Pain intensity has been measured by the visual analogic scale (VAS). For patients reporting recurrent pain episodes before surgery, pain characteristics in prodromal and acute episodes were separately examined.

A group of 49 patients having undergone laparoscopic RYGB at Parma University Hospital answered the same questionnaire, in order to identify two subgroups: positive controls (patients reporting abdomi-

nal pain) and negative controls (patients not reporting abdominal pain). The set pain cut-off criterion was the presence of abdominal pain other than occasional and as already experienced before surgery. As potentially confounding factors, the following were considered as exclusion criteria:

- Less than 6 months from bariatric procedure
- Patients linguistic difficulties;
- Presence/persistence of psychopathologic traits and eating disorders
- Presence of specific causes of abdominal pain (gallstones, GERD, anastomotic ulcers, incisional hernias, ...)

Biometric data were collected from the follow-up registries of the Centres.

Continuous variables were compared through Student's t test or ANOVA, when appropriate. Univariate analysis of discrete variables was conducted using the chi-square with Yates' correction. All tests were two-tailed, and statistical significance was set at  $p < 0.05$ . All statistical analyses were performed using IBM SPSS Statistics 22.0 for Macintosh (IBM Corp. Armonk, NY).

The study was approved by the Institutional Review Board, and informed consent was obtained from all participants.

## Results

The overall incidence of Petersen hernias, estimated across the three centers was 3.3%.

Among the 60 controls recruited for the interview, 7 were excluded for the presence of typical pain (2 biliary colics, 2 renal colics, 2 dysmenorrhea, 1 diverticular disease) and 4 did not complete or refused the interview. Out of 49 enrolled patients, 16 (33%) reported abdominal pain and 34 no abdominal pain (69%). As reported in table 1, case patients and controls were similar as to demographics, biometric data and comorbidities.

### *Internal hernia clinical/pain characteristics*

Mean time lapse from RYGB to reintervention was  $27 \pm 17$  months. Diagnostic imaging (Tc scan) re-

**Table 1.** Demographics and clinical data

	<b>Cases</b>	<b>Controls</b>	
<b>n</b>	13	49	<b>p</b>
<b>Gender</b>			
<b>M/F</b>	3/10	5/44	
<b>(%)</b>	(30% / 70%)	(11% / 89%)	0,347
<b>Mean age at 1<sup>st</sup> operation</b>	38,33 ± 3,8	38,59 ± 9,8	0,938
<b>BMI - T<sub>0</sub></b>	43,2 ± 6,7	46,2 ± 6,4	0,142
<b>Comorbidities</b>			
Diabetes II	3	12	0,682
Depression	1	5	1,000
OSAS	1	6	1,000
Arthrosis	1	8	1,000
Hypertension	0	4	1,000
Endometriosis	1	0	0,155
Polycystic ovaries	1	2	0,403
Hiatal hernia	1	3	0,501
Asthma	1	0	0,155
Thyroid disease	1	0	0,155
Thrombocytosis	1	0	0,155
Cauda equina syndrome	1	0	0,155
<b>Complications</b>	0	0	1,000

vealed signs of internal hernias in 8/13 case patients (61.5%), being the swirl sign the most common finding. At surgical exploration, 11 Petersen hernias (85%) and 2 mesenteric hernias were found (15%). All interventions were carried out with a laparoscopic approach: the defect involved was repaired with direct suture; no bowel resection was necessary.

Only 1 out of 13 patients (7.7%) was in shock.

The majority of the patients (77%) reported prodromal episodes of abdominal pain, similar but less intense than the one leading to the operation.

During the acute episode, pain was defined as deep (100%), continuous rather than intermittent (colicky) (69%), with gradual onset (92%).

The left upper abdominal quadrant was the most common pain site (61.5%) (figure 1). Acute/prodromal episodes normally started during the first 6 months after RYGB (54%), occurred 2-3 times/month (54%) and usually lasted less than 24 hours (92%). In 9/13 patients (69%) pain appeared or worsened after a meal, most of the times within the first 20 minutes (78%). Vomiting was reported in 38% of the case patients

**Table 2.** Pain characteristics

Pain characteristics	Cases	C +	p
Onset (% within 6 month after RYGB)	7/13-53.8%	10/16-62.5%	0.927
< 1/week	11/13-85%	13/16-81%	
Frequency			
>1/week	2/13-15%	3/16-19%	0.798
Quality: Intermittent (colicky)	4/13-31%	14/16-87.5%	0.008
Continuous	9/13-69%	2/16-12.5%	0.024
Quality: deep (%)	13/13-100%	13/16-81.2%	0.699
VAS (mean)	8.9	6.2	0.0049
Analgesic use	13/13-100%	3/13-18.7%	<0.0001
Correlation with meals	9/13-69%	8/16-50%	0.505
Changing in bowel movements	4/13-30.7%	6/16-37.5%	0.704
Alleviation by defecation	3/13-23%	2/16-12.5%	0.798
Vomiting	5/13-38%	3/16-18.7%	0.445

**Table 3.** Peculiar traits of internal hernias pain presentation

	Internal hernias	p
Continuous pain	9/13-69%	0.024
VAS (mean)	8.9	0.0049
Analgesic use	13/13-100%	<0.0001
>EWL% T3	49.3%	0.002

only and in most cases did not alleviate the symptoms. Bowel frequency did not usually change during the episodes (69%) and pain was not alleviated by defecation (77%). Pain intensity was reported with an average of 8.9/10 on VAS scale. No typical antalgic position was identified. NSAIDs were reported as the most effective analgesics. In addition to lower intensity, prodromal episodes, when present, were different from the acute ones as to location (epigastric 86%) and quality (intermittent 86%) only.

No patient reported abdominal pain after reoperation.

#### *Differential diagnosis*

As well as the case patients, positive controls mainly reported deep (81.2%) abdominal pain, with gradual onset (81.2%), starting in the first 6 months after surgery (62.4%). Episode frequency was not sig-

nificantly different between the groups. Epigastrium was more frequently involved (37.5%,  $p$ : 0.185) (figure 1), and, differently from the case patients, the pain was defined mainly as intermittent (87.5%,  $p$ : 0.008). Pain intensity was reported significantly higher in case patients (8.9 vs 6.2,  $p$ : 0.0049), causing the patients to use analgesics more frequently (100% vs 18.6%,  $p$ : <0.0001). When was correlated with meal pain occurred more frequently in the first 20 minutes. In positive controls, as for the case patients, bowel movements were not changed by pain (62.5%) and pain was not alleviated by defecation (68.8%). Vomiting was more frequent in case patients (38% vs. 18.8%), even though the difference was not found to be statistically significant.

#### *Predictive conditions*

As shown in figure 2, EWL at 3 months significantly correlated with internal hernias occurrence ( $p$ : 0.002), while no correlation was found with comorbidities.

## **Discussion**

The exponential increase in minimally-invasive bariatric procedures over the last decades contributed

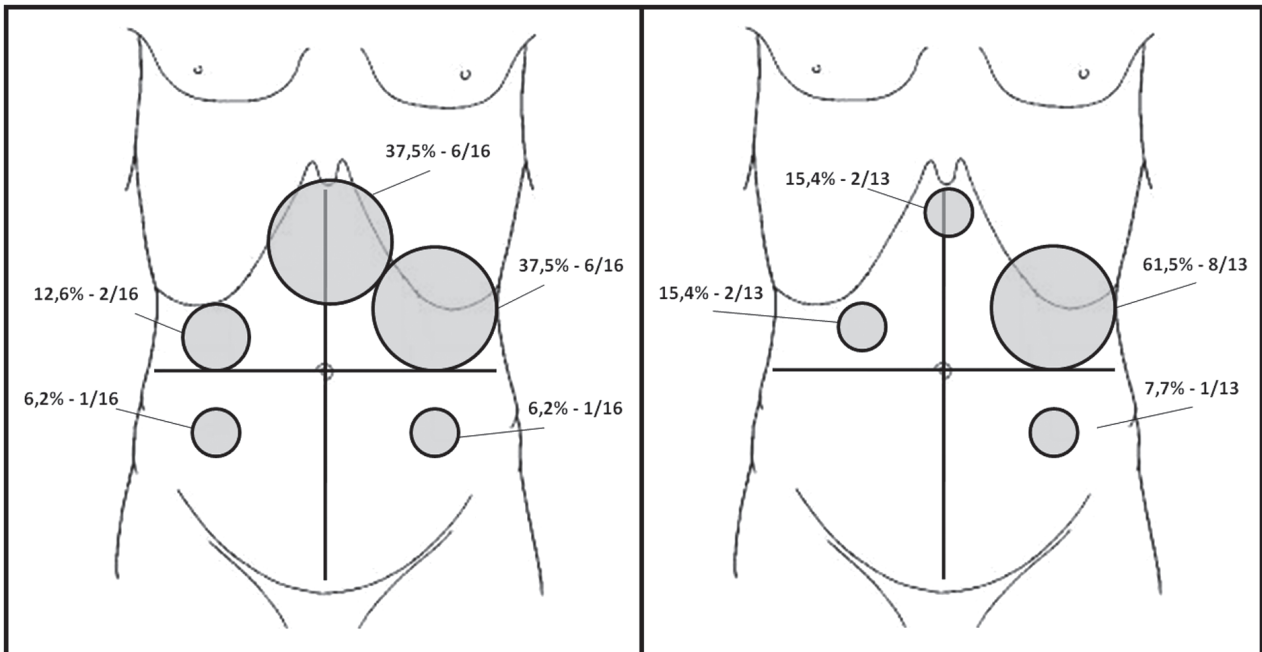


Figure 1. Pain site

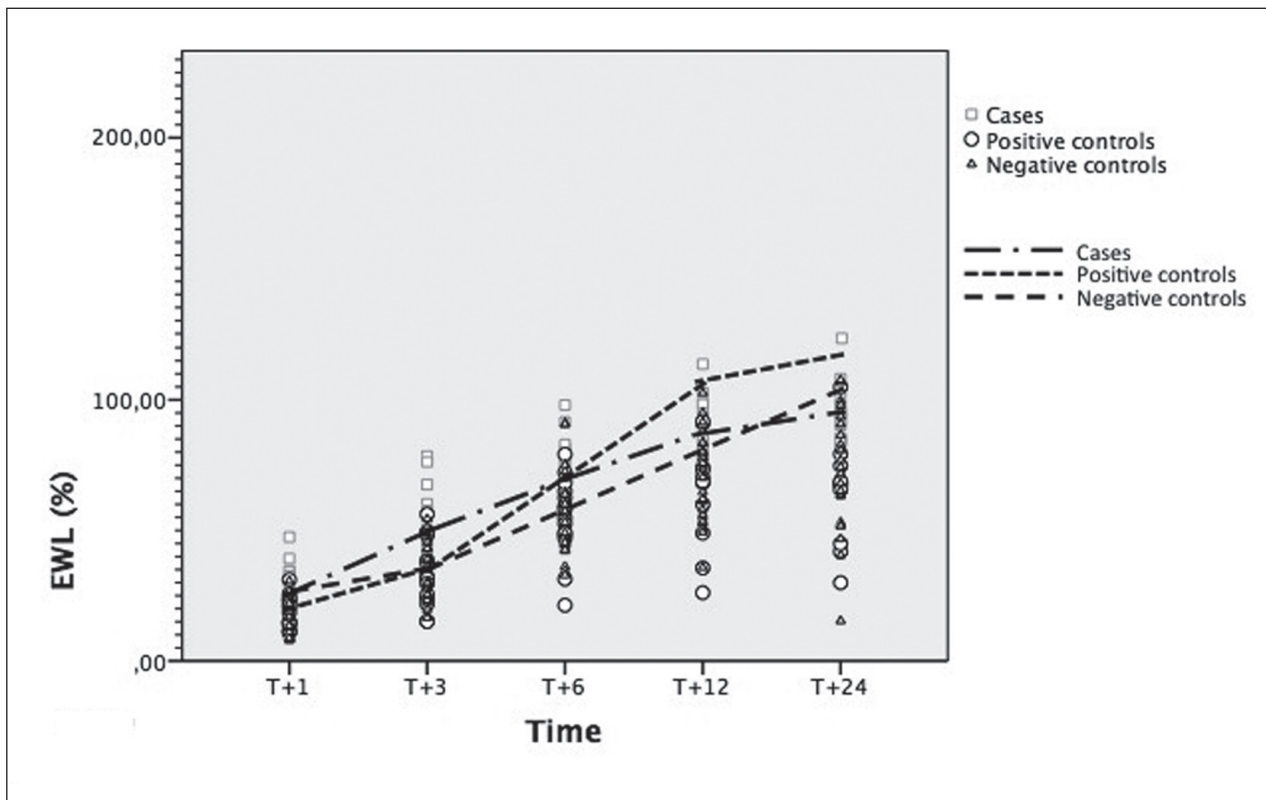


Figure 2. Weight loss

to make internal hernias a new and relevant pathology chapter in general surgery units.

Indeed, while alimentary tract reconstructive techniques and rapid weight loss after bariatric surgery create wide internal hernias defects, the reduction of bowel adhesions provided by the laparoscopic approach created the conditions (increased bowel mobility) for the significant increase in this threatening complication (14).

RYGB is the bariatric procedure more frequently complicated by internal hernias, although the real incidence is extremely variable among series, ranging from 0.2% to 9% (15). However, many are the reasons why the above data might be underestimated: rather than the patients lost at follow-up, quite common in bariatric surgery, it is the extremely variable clinical presentation that makes internal hernias incidence hard to quantify.

Beside a small number of life-threatening cases, with bowel occlusion and ischemia, it is plausible that the majority of internal hernias after RYGB is represented by paucisymptomatic spontaneously resolved cases, with abdominal pain as the only clinical symptom. This is typical of antecolic reconstruction, where internal defects are wide, allowing spontaneous reduction of the herniated bowels.

Moreover, imaging low sensitivity (15-17), especially in absence of occlusive or ischemic scenarios, makes surgical exploration the most reliable diagnostic tool for internal hernias (11).

Differently from other series (18), none of the patients operated on in our series showed a clear occlusive syndrome and only 8 (61.5%) had specific CT signs. This is why we believe that a precise and scrupulous definition of abdominal pain after RYGB is mandatory, especially for patients for whom internal hernia suspicion is less clear.

Abdominal pain was quite frequent in our series: up to 43% of the patients, excluding the ones operated on for internal hernia. Our data are even higher than the ones reported by recent literature (12, 19), and most of the times (70%) the causes were aspecific. The lower pain threshold of obese patients (20) is an additional confounding factor.

Most of the patients operated on in our series (77%) reported a history of worsening abdominal pain.

Pain characteristics were similar in case patients and positive controls: pain intensity and frequency, along with radiological findings, where present, were indications for surgical exploration.

For the above reasons, it is hard to determine whether prodromal pain episodes in patients and recurrent episodes in positive controls could amount to clinical expression of non-complicated spontaneously-resolved internal hernias, but it certainly is a plausible hypothesis. In this sense, pain characteristics reported by most patients (early postprandial, deep, epigastric/left hypochondrial) can suggest a bowel/vascular torsion mechanism, with some traits of angina abdominis (21). Moreover, when asked about prodromal episodes, the patients also reported a mainly intermittent (colicky) (86%), epigastric abdominal pain, which became continuous and located in the left hypochondrium during the acute episode leading to surgical exploration.

The entity and velocity of weight loss has been already reported as a predisposing condition for internal hernias after RYGB (22). Our data confirm this trend (figure 2), especially during the first months after surgery; the different performance at 1 year, with positive control showing higher weight loss, can be explained by impairment in eating caused by the persistent pain, which is expected to be solved in the cases that already had surgical repair.

Laparoscopic exploration has been advocated as a reasonable option in case of unexplained abdominal pain after RYGB (12, 17). In addition to its low morbidity and high diagnostic and therapeutic effectiveness, laparoscopic exploration proved very rarely an unnecessary measure (11, 23), as confirmed by our series (no false positives in our experience). Moreover, in absence of treatable causes, a prophylactic suture of internal hernia defects could be more safely and easily performed than during RYGB, owing to the lower amount of visceral adiposity.

Most of the series (15, 19, 24, 25) report higher incidence of internal hernias in patients undergoing retrocolic rather than antecolic RYGB. Because of the smaller defects of retrocolic reconstruction (mesocolic defect), a plausible cause is, rather than overall higher incidence of internal hernia, a higher number of severely symptomatic cases. As previously commented,

the operated patients could represent just the tip of the iceberg of internal hernias, especially for antecolic RYGB.

In this sense, the threshold for laparoscopic exploration should be lower for retrocolic reconstructions.

## Conclusion

Diagnostic limitations make the real incidence of internal hernias after RYGB hard to determine. In presence of recurrent and worsening episodes of early postprandial, epigastric, colic, deep abdominal pain after antecolic RYGB, an explorative laparoscopy could be a correct option, even with no radiological signs and with no severely compromised clinical conditions.

Informed consent was obtained from all individual participants, for whom identifying information is included in this article.

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

**Conflict of interest:** Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article

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Correspondence:

Federico Marchesi

Università degli Studi di Parma

Dipartimento di Medicina e Chirurgia

Sezione di Clinica Chirurgica Generale

Via Gramsci, 14 - 43100 Parma (Italy)

Tel. +39 0521 702156 - Fax +39 0521 940125

E-mail: fede53@lycos.com