Original article

Gastrointestinal symptoms and food intolerance 2 years after laparoscopic Roux-en-Y gastric bypass for morbid obesity

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Background: **Laparoscopic Roux-en-Y gastric bypass (LRYGB) is an effective treatment for morbid obesity, but might aggravate gastrointestinal complaints and food intolerance. The long-term prevalence of these symptoms has not been well studied.**

Methods: **In a cross-sectional study, all patients who underwent primary LRYGB from May to October 2012 were approached 2 years after surgery to complete a general health questionnaire, the Gastrointestinal Symptom Rating Scale (GSRS), and a food intolerance questionnaire. The results were compared with those for a control group of morbidly obese patients.**

Results: **A total of 249 patients were included for analysis, representing a response rate of 93·9 per cent. Mean(s.d.) total weight loss was 30·8(8·7) per cent. The total mean GSRS score was higher in patients who had LRYGB (median 2·19 *versus* 1·75 in unoperated patients; $P < 0·001$); the difference in symptoms of indigestion was most notable ($P < 0·001$). Food intolerance for specific products was reported by 70·7 (95 per cent c.i. 64·8 to 76·0) per cent of the postoperative patients, for a median of 4 foods. There was a positive correlation between food intolerance and score on the GSRS. There was no correlation between either food intolerance or the total mean GSRS score and weight loss, but there was a correlation between weight loss and abdominal pain.**

Conclusion: **At 2 years after surgery, patients undergoing LRYGB for morbid obesity have more gastrointestinal complaints than obese controls. Food intolerance is a common side-effect of LRYGB independent of degree of weight loss or the presence of other abdominal symptoms.**

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Introduction

The prevalence of obesity and associated co-morbidities is increasing. Bariatric surgery is the most effective treatment for morbid obesity in the long term, of which laparoscopic Roux-en-Y gastric bypass (LRYGB) is most commonly performed worldwide[1,2]. Patients with morbid obesity experience more gastrointestinal complaints than controls of normal weight[3]. Several studies, both longitudinal and cross-sectional, have described the course of gastrointestinal complaints after LRYGB. Most have shown that in the first year after surgery gastrointestinal complaints are slightly better compared with either the preoperative state or those in an obese control group. However, some specific complaints, such as dysphagia, might worsen[4–7]. It is likely that the complaints in the first year after surgery are not representative of those in the longer term, because weight and diet are still changing in this first year[8]. Studies investigating gastrointestinal symptoms more than 12 months after surgery all have limitations, such as small sample size and high loss to follow-up, which may lead to underestimation of the symptoms[9].

LRYGB also has a profound influence on tolerance to food. Approximately two-thirds of patients experience food intolerance, with red meat reported most often[10–12]. However, studies on food intolerance generally suffer from the same flaws as those concerning gastrointestinal symptoms.

This study was designed to investigate gastrointestinal complaints and food intolerance more than 2 years after LRYGB, and to compare these with complaints and food intolerance in a prebariatric surgery group.

Methods

A cross-sectional study was performed in a high-volume bariatric centre. All patients who underwent LRYGB from May to October 2012 (a randomly chosen time interval) were approached to complete written questionnaires. When this was not possible, the questionnaires were sent by e-mail or completed over the telephone. All patients had undergone a standardized LRYGB with a 4 × 8-cm gastric pouch, 50-cm biliary limb and 150-cm antecolic, antegastric alimentary limb.

Both patients with a primary LRYGB and those with revisional LRYGB after a previous bariatric intervention were included. Owing to low numbers, patients who had a revisional LRYGB were not included in the final analysis. Data for the patients undergoing revision are shown in *Tables S1–S4* (supporting information).

For the control group, consecutive obese patients who fulfilled the criteria for bariatric surgery (BMI above 40 kg/m^2, or with a BMI between 35 and 40 kg/m^2 with obesity-related co-morbidities) and who attended the clinic for preoperative screening were asked to complete the questionnaires.

Questionnaires

Patients were asked to complete both a general questionnaire, the Gastrointestinal Symptom Rating Scale (GSRS), and a food intolerance questionnaire. The general questionnaire concerned co-morbidities (diabetes mellitus, hypertension and obstructive sleep apnoea syndrome (OSAS)), medication use and any medical treatment since the LRYGB procedure. Co-morbidities were considered present when self-reports were confirmed by physical or laboratory examination. Patient characteristics, such as height and weight measurements at the outpatient clinic, age, smoking habits and postoperative complications (using the Clavien–Dindo classification[13] to determine severity), were derived from patients' files.

The GSRS is a previously validated questionnaire that is specific for gastrointestinal complaints. A revised version was used, because the original GSRS did not contain a question on dysphagia, an important complaint after LRYGB. This version consists of 16 gastrointestinal symptoms, each scored on a seven-point Likert scale[4,14]. The scores for each individual symptom, the total mean score and the scores for symptom clusters are presented. The following clusters were defined: abdominal pain (abdominal pain, hunger pain and nausea), reflux syndrome (heartburn and acid regurgitation), diarrhoea syndrome (diarrhoea, loose stools and urgent need for defaecation), indigestion syndrome (borborygmus, abdominal distension, eructation and flatus) and constipation syndrome (constipation, hard stools and feeling of incomplete evacuation)[15]. A cluster score was calculated only when all questions in the cluster had been answered. A total mean score was calculated when at least six questions had been answered.

The food questionnaire was developed specifically for this study and is therefore not validated (*Fig. S1*, supporting information – a Dutch version was administered to the patients). The first three questions were concerned with whether or not the patient experienced food intolerance, its severity, and whether it was present before the gastric bypass. Food intolerance was defined as any adverse event (for example nausea, dumping syndrome or abdominal pain) after ingestion of a particular food type that resulted in the patient not eating this food any more. When patients experienced food intolerance, they chose one or more of the foods from a list of 33 types of food for which intolerance is known to be common after LRYGB. There was also the possibility to enter free text.

Ethical approval

This study was performed in accordance with the ethical standards of the Helsinki Declaration. Patients gave written consent to use their data, which were stored anonymously. The medical ethics committee certified that formal ethical review was not required.

Statistical analysis

Data analysis was performed using the statistical programs SPSS® version 21 (IBM, Armonk, New York, USA) and Confidence Interval Analysis (University of Southampton; http://www.som.soton.ac.uk/research/sites/cia)[16]. To determine the influence of method of administration of the questionnaire (written, by e-mail or by telephone), the total mean GSRS score and the prevalence of food intolerance in the three groups were compared with the Kruskal–Wallis and χ^2 test respectively.

GSRS scores are presented as medians with 95 per cent c.i. and i.q.r because of non-normal distribution. Comparison was made between the separate, cluster and total mean scores of postoperative patients and obese controls using the Mann–Whitney *U* test. Correlations between the total score on the GSRS and percentage total weight loss (%TWL) and current BMI, between %TWL and specific symptoms of the GSRS (abdominal pain, nausea

Table 1 Characteristics of patients and controls

	Postoperative patients ($n = 249$)		
	Before surgery	After surgery	Controls ($n = 295$)
Age (years)*	45·6(9·6)	–	43·3(11·5)
BMI (kg/m^2)*	43·2(5·5)	29·8(4·7)	43·5(5·4)
Previous abdominal surgery	106 (42·6)	–	129 (43·7)
Total weight loss (%)*	–	30·8(8·7)	–
Hypertension	111 (44·6)	53 (21·3)	111 (37·6)
Diabetes mellitus	73 (29·3)	23 (9·2)	66 (22·4)
OSAS	36 (14·5)	12 (4·8)	42 (14·2)
Smoker	36 (14·5)	33 (13·3)	54 (18·3)

Values in parentheses are percentages unless indicated otherwise; *values are mean(s.d.). OSAS, obstructive sleep apnoea syndrome.

Table 2 Scores on the Gastrointestinal Symptom Rating Scale

GSRS	Postoperative patients ($n = 249$)	Controls ($n = 295$)	P*
1 Abdominal pain	1 (1, 2) (1–3)	1 (1, 1) (1–2)	< 0·001†
2 Heartburn	1 (1, 1) (1–1)	1 (1, 1) (1–1)	0·057
3 Acid regurgitation	1 (1, 1) (1–2)	1 (1, 1) (1–2)	0·001‡
4 Hunger pains	2 (2, 2) (1–4)	3 (3, 3) (2–4·5)	< 0·001‡
5 Nausea/vomiting	1 (1, 1) (1–3)	1 (1, 1) (1–1)	< 0·001†
6 Borborygmus	4 (4, 4) (2–5)	2 (2, 2) (1–3)	< 0·001†
7 Bloating	1 (1, 2) (1–3)	1 (1, 1) (1–3)	0·149
8 Eructation	2 (2, 3) (1–5)	2 (2, 2) (1–3)	0·012†
9 Dysphagia	1 (1, 2) (1–3)	1 (1, 1) (1–1)	< 0·001†
10 Flatulence	4 (3, 4) (2–6)	2 (2, 3) (1–4)	< 0·001†
11 Hard stools	2 (1, 2) (1–4)	1 (1, 2) (1–3)	0·008†
12 Constipation	1 (1, 1) (1–3)	1 (1, 1) (1–1)	< 0·001†
13 Loose stools	2 (2, 2) (1–4)	2 (1, 2) (1–3)	0·059
14 Diarrhoea	1 (1, 1) (1–2)	1 (1, 1) (1–2)	0·024†
15 Urgent need for defaecation	1 (1, 1) (1–2)	1 (1, 1) (1–2)	0·136
16 Incomplete evacuation	1 (1, 2) (1–3)	1 (1, 1) (1–2)	0·002†
Total mean score	2·19 (2·0, 2·38) (1·63–2·88)	1·75 (1·63, 1·81) (1·38–2·31)	< 0·001†

Values are median (95 per cent c.i.) (i.q.r.). GSRS, Gastrointestinal Symptom Rating Scale. *Mann–Whitney U test. †Score significantly higher in postoperative group; ‡score significantly higher in control group.

and vomiting, and dysphagia), and between the number of foods for which intolerance was reported and the total mean GSRS score, were determined with Spearman's rank test. The difference in total mean GSRS score between patients with and without abdominal complications in the first 30 days after surgery, and with and without food intolerance, was determined with the Mann–Whitney U test.

The prevalence of food intolerance in postoperative patients and obese controls was compared using the χ^2 test. The relation between the presence of food intolerance and %TWL and current BMI was tested with Student's t test; correlation between the number of food intolerances and %TWL and current BMI was determined using Spearman's rank test. Several correlations between intolerance for specific food types and specific complaints were hypothesized beforehand: dysphagia and red meat; dysphagia and bread; indigestion cluster and milk. This was determined with subgroup analysis using the Mann–Whitney U test. For all analyses, $P < 0·050$ was considered statistically significant. No correction for multiple testing was performed because the study was designed to be an exploratory analysis of gastrointestinal complaints.

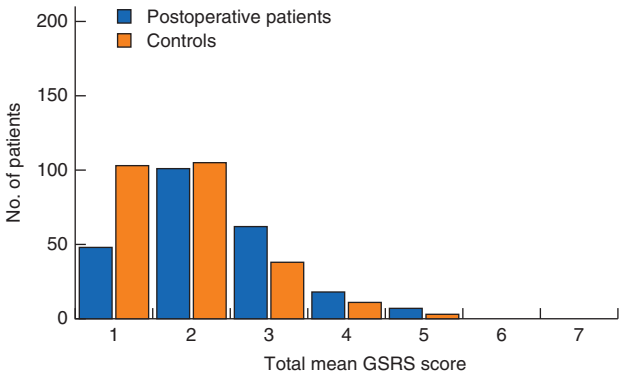

Fig. 1 Total mean scores on the Gastrointestinal Symptom Rating Scale (GSRS) for postoperative patients and controls. $P < 0·001$ (Mann–Whitney U test)

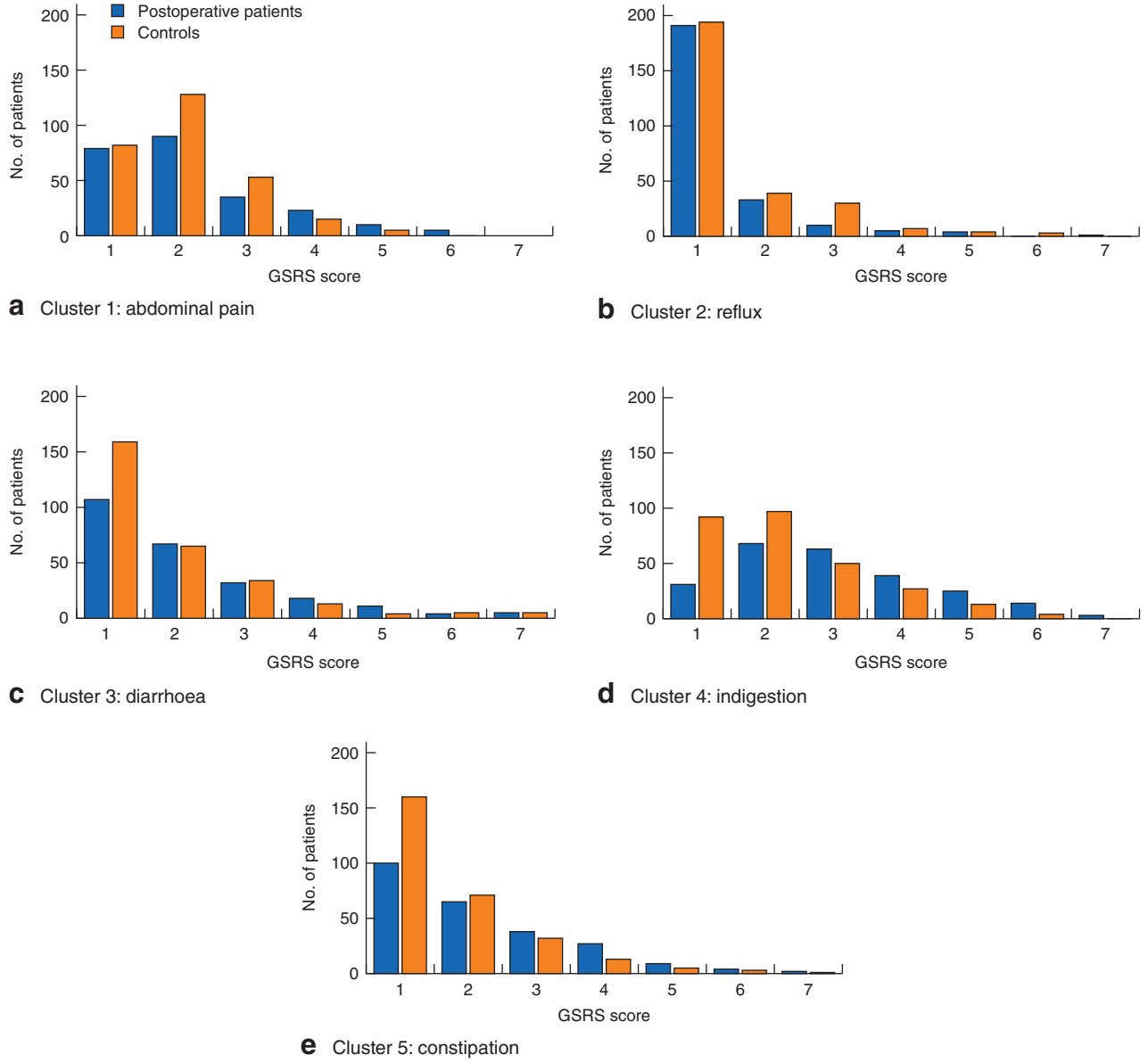

Fig. 2 Scores on the five clusters of the Gastrointestinal Symptom Rating Scale (GSRS) for postoperative patients and controls: **a** abdominal pain; **b** reflux; **c** diarrhoea; **d** indigestion; **e** constipation. **a** $P = 0{\cdot}620$, **b** $P = 0{\cdot}002$, **c** $P = 0{\cdot}016$, **d,e** $P < 0{\cdot}001$ (Mann–Whitney U test)

Results

Response rates

The questionnaire was answered by 294 of 313 postoperative patients from the predefined cohort, giving a response rate of 93·9 per cent. Of the 19 patients who did not fill in the questionnaire, one died from a cause unrelated to LRYGB, six were still in follow-up but refused to participate, and 12 were lost to follow-up. Of the 294 patients, 249 had undergone primary LRYGB; 45 patients had revisional LRYGB and were not included in further analyses.

The questionnaire was completed in written form by 204 patients, by e-mail for 16 patients, and by telephone in 29. The method of administration of the questionnaire had no significant influence on the total mean GSRS score ($P = 0{\cdot}326$) or presence of food intolerance ($P = 0{\cdot}311$).

In the preoperative group, 318 patients (63·2 per cent of those eligible) completed the questionnaire, including 295

patients who had not had previous bariatric surgery, who served as the control group. Characteristics of postoperative patients and controls are shown in *Table 1*.

For postoperative patients, the mean time to response after surgery was 27 (range 23–33) months.

Postoperative complications and morbidity

Eight of the 249 patients (3·2 per cent) had a severe abdominal complication (Clavien–Dindo grade III or IV) within the first 30 days after surgery. During follow-up, 85 patients (34·1 per cent) underwent additional surgery, excluding reoperation for 30-day complications. Common reasons for surgery were cholecystectomy (21 patients, 8·4 per cent of the total), body-contouring surgery (17 patients, 6·8 per cent) and suspicion of internal herniation (12 patients, 4·8 per cent) (*Table S5*, supporting information). Twenty-two patients (8·8 per cent) developed symptomatic gallstone disease after surgery. No postoperative ursodeoxycholic acid prophylaxis was prescribed, nor was standard concomitant cholecystectomy performed. Upper endoscopy was performed in 32 patients (12·9 per cent).

Gastrointestinal Symptom Rating Scale scores

GSRS scores are shown in *Table 2*. In 13 postoperative patients and 35 controls, one or more scores on the GSRS were missing; in two postoperative patients and eight controls no total mean GSRS score could be calculated. There was a significant difference in total mean score and several cluster and symptom scores between postoperative and control patients (*Figs 1* and *2*). Most symptoms that differed significantly were scored higher by patients who had undergone LRYGB; only acid regurgitation and hunger pains were scored lower than in the control group.

The total mean score on the GSRS did not correlate with the %TWL ($r_S = 0{\cdot}052$, $P = 0{\cdot}413$) or the current BMI of postoperative patients ($r_S = -0{\cdot}111$, $P = 0{\cdot}081$). The %TWL correlated with abdominal pain ($r_S = 0{\cdot}156$, $P = 0{\cdot}014$), but not with nausea and vomiting ($r_S = 0{\cdot}009$, $P = 0{\cdot}884$) or dysphagia ($r_S = 0{\cdot}056$, $P = 0{\cdot}385$). There was no difference in total mean GSRS score between patients with and those without abdominal complications within the first 30 days after surgery ($P = 0{\cdot}221$).

Food intolerance

Food intolerance was reported by 176 of the 249 postoperative patients (70·7 (95 per cent c.i. 64·8 to 76·0) per cent), and by 50 of the 295 controls (16·9 (13·1 to 21·7) per cent) ($P < 0{\cdot}001$).

Table 3 Overview of food intolerances

Food type	Postoperative patients ($n = 249$)	Controls ($n = 295$)
Fried products	75 (30·1; 24·8, 36·1)	13 (4·4; 2·6, 7·4)
Carbonated drinks	70 (28·1; 22·9, 34·0)	5 (1·7; 0·7, 3·9)
Cake, pie, pastries	58 (23·3; 18·5, 28·9)	4 (1·4; 0·5, 3·4)
Whipped cream	52 (20·9; 16·3, 26·4)	4 (1·4; 0·5, 3·4)
Chocolate	48 (19·3; 14·9, 24·6)	7 (2·4; 1·2, 4·8)
Red meat	47 (18·9; 14·5, 24·2)	4 (1·4; 0·5, 3·4)
Alcohol	39 (15·7; 11·7, 20·7)	7 (2·4; 1·2, 4·8)
Candy	36 (14·5; 10·6, 19·4)	2 (0·7; 0·2, 2·4)
Egg	36 (14·5; 10·6, 19·4)	3 (1·0; 0·3, 2·9)
Pasta	34 (13·7; 9·9, 18·5)	2 (0·7; 0·2, 2·4)
Other meat	34 (13·7; 9·9, 18·5)	6 (2·0; 0·9, 4·4)
Rice	33 (13·3; 9·6, 18·0)	2 (0·7; 0·2, 2·4)
Bread	32 (12·9; 9·3, 17·6)	1 (0·3; 0·1, 1·9)
Juice	30 (12·0; 8·5, 16·6)	8 (2·7; 1·4, 5·3)
Milk	29 (11·6; 8·2, 16·2)	13 (4·4; 2·6, 7·4)
Oil	25 (10·0; 6·9, 14·4)	4 (1·4; 0·5, 3·4)
Cabbage	24 (9·6; 6·6, 13·9)	10 (3·4; 1·9, 6·1)
Yoghurt	23 (9·2; 6·4, 13·8)	7 (2·4; 1·2, 4·8)
Cookies	21 (8·4; 5·6, 12·5)	3 (1·0; 0·3, 2·9)
Water	19 (7·6; 4·9, 11·6)	0 (0; 0, 1·3)
Chicken	14 (5·6; 3·4, 9·2)	1 (0·3; 0·1, 1·9)
Fruit	13 (5·2; 3·1, 8·7)	6 (2·0; 0·9, 4·4)
Fish	13 (5·2; 3·1, 8·7)	3 (1·0; 0·3, 2·9)
Butter	13 (5·2; 3·1, 8·7)	2 (0·7; 0·2, 2·4)
Nuts	13 (5·2; 3·1, 8·7)	6 (2·0; 0·9, 4·4)
Salad	12 (4·8; 2·8, 8·2)	2 (0·7; 0·2, 2·4)
Mash pot	11 (4·4; 2·5, 7·7)	1 (0·3; 0·1, 1·9)
Potato	10 (4·0; 2·2, 7·2)	0 (0; 0, 1·3)
Cheese	9 (3·6; 1·9, 6·7)	6 (2·0; 0·9, 4·4)
Mashed potatoes	8 (3·2; 1·6, 6·2)	0 (0; 0, 1·3)
Ice cream	7 (2·8; 1·4, 5·7)	1 (0·3; 0·1, 1·9)
Coffee	7 (2·8; 1·4, 5·7)	7 (2·4; 1·2, 4·8)
Spicy food	6 (2·4; 1·1, 5·2)	6 (2·0; 0·9, 4·4)
Cooked vegetables	4 (1·6; 0·6, 4·1)	0 (0; 0, 1·3)
Tea	3 (1·2; 0·4, 3·5)	3 (1·0; 0·3, 2·9)

Values are numbers of patients with percentages and their 95 per cent c.i. in parentheses.

For postoperative patients who reported food intolerance, the median number of intolerances was 4 (range 1–28); patients in the control group reported intolerance to a median of 2 (1–11) foods. In 162 of the postoperative patients (92·0 per cent), the food intolerance had developed after LRYGB. Only 24 of these 176 patients (13·6 per cent) indicated that this bothered them much or very much (4 or 5 on a scale of 1–5). The foods reported most often by postoperative patients were fried products, carbonated drinks, and cakes, pies or pastries. Thirty-five of the 249 patients (14·1 per cent) noted a food intolerance in the free-text box: ice cream (7) and spicy food (6) were reported most.

Patients in the control group mostly reported intolerance to milk and fried products (both 4·4 per cent). A complete list of all food intolerances in both groups is shown in *Table 3*.

In the postoperative patients there was no relation between %TWL and the presence of food intolerance ($P = 0{\cdot}840$) or the number of food intolerances ($P = 0{\cdot}765$), nor between current BMI and food intolerance ($P = 0{\cdot}443$) or the number of food intolerances ($P = 0{\cdot}594$).

The total mean score on the GSRS correlated with the presence of food intolerance ($P = 0{\cdot}006$) and with the number of food intolerances ($r_S = 0{\cdot}267$, $P < 0{\cdot}001$). Patients with intolerance to red meat scored higher for dysphagia ($P = 0{\cdot}001$). There was also more dysphagia in patients intolerant of bread ($P = 0{\cdot}005$). Intolerance to milk did not influence the score on the indigestion cluster ($P = 0{\cdot}899$).

Discussion

This study shows that patients who have undergone LRYGB experience more gastrointestinal complaints after surgery than similar obese controls at preoperative baseline. Flatulence and borborygmus are most prominent. Food intolerance, especially to food with a high fat or sugar content and to red meat, is a common side-effect of LRYGB. There was a positive correlation between gastrointestinal symptoms and food intolerance, but weight loss correlated only weakly with abdominal pain.

The results on the general questionnaire confirm the findings of previous studies. In the majority of postoperative patients, obesity-related co-morbidities were in remission. The high percentage of symptomatic gallstone disease in the first 2 years after LRYGB is a known effect of weight loss[17].

Patients who underwent gastric bypass surgery had significantly more gastrointestinal complaints than obese controls. Whether all statistically significant differences are also clinically relevant is a topic of debate. The individual patient may not notice a small, though statistically significant, overall difference in gastrointestinal complaints. However, the high score on symptoms such as flatulence and borborygmus is also apparent in clinical practice. Previous publications have generally shown a decrease in complaints in the first year after surgery. Studies with follow-up after the first year are sparse and have methodological limitations, such as small study groups, high loss to follow-up, or cross-sectional design without specifying the original population from which participants were derived[6,18–21]. This is important when interpreting the results, as it is possible that patients with many complaints, or those with no complaints at all, have a greater chance of being lost to follow-up.

Furthermore, the majority of postoperative patients experienced food intolerance, in contrast to obese controls. The food types most often reported were all non-essential, such as fried products and pies. Of the more healthy food types, red meat was reported most frequently. This has been described previously[11], and may contribute partly to the high prevalence of iron deficiency after LRYGB. There was a clear positive correlation between food intolerance and gastrointestinal complaints. This seems logical, as ingestion of food and gastrointestinal function are naturally closely related. There was no correlation between the amount of weight lost and either the total score on gastrointestinal symptoms or food intolerance. The clinical relevance of the weak positive correlation between weight loss and abdominal pain is unclear. It could be hypothesized that patients who experience more abdominal pain eat less, but further research is needed to confirm this.

The results of this study contribute to better knowledge of the long-term effects of LRYGB. This is essential, as it provides a context for clinicians confronted by patients with postoperative symptoms. Furthermore, it facilitates better preoperative counselling of the patient. Finally, the fact that, apart from abdominal pain, gastrointestinal symptoms and food intolerance do not influence weight loss suggests that other effects of the LRYGB, such as alterations in metabolism or increased satiety, are more important factors.

This study has limitations. Because of its cross-sectional design, preoperative and postoperative complaints of the same patient cannot be compared. The food intolerance questionnaire was developed for this study and has not been validated. However, none of the previously published questionnaires on food intolerance has been validated. Some address only a small number of food types, and others are specific for the eating habits of the country they were developed in. Therefore, the present authors considered that the development of a new questionnaire for this study was justified. Strong aspects of this study include the high response rate, uniformity of the study group in terms of duration and methods of follow-up and surgical procedure, and the use of a validated and commonly used gastrointestinal complaints questionnaire, the GSRS. Many previous studies have used the Gastrointestinal Quality of Life Index (GIQLI) to assess gastrointestinal complaints. This is, however, not a symptom-specific questionnaire but determines the influence of symptoms on quality of life.

Future research should include a longitudinal study with follow-up extending for more than 1 year after operation. In addition, adequate study of the long-term symptoms of other procedures, such as sleeve gastrectomy, revisional surgery after gastric banding, and new procedures such as the omega-loop gastric bypass, is essential.

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Supporting information

Additional supporting information may be found in the online version of this article:

Table S1 Characteristics of postoperative revisional patients and controls who underwent previous bariatric surgery (Word document)

Table S2 Scores on the Gastrointestinal Symptom Rating Scale for postoperative revisional patients and controls who underwent previous bariatric surgery (Word document)

Table S3 Statistical analysis of difference in scores on the Gastrointestinal Symptom Rating Scale between postoperative patients who underwent primary laparoscopic Roux-en-Y gastric bypass *versus* postoperative revisional patients (Word document)

Table S4 Overview of food intolerances (Word document)

Table S5 Indications for surgery during follow-up (Word document)

Fig. S1 English translation of the food questionnaire developed specifically for this study (Word document)

Editor's comments

This study reports an alarming number of gastrointestinal complaints after laparoscopic gastric bypass surgery. There was a high frequency of food intolerance, but even water was not tolerated in up to 8 per cent of individuals. Abdominal pain developed frequently and was reported as severe in one in seven patients. Not reported here were the number of added hospital admissions, outpatient visits, and further endoscopic and imaging investigations caused by symptoms after the surgery. Also, days of sick leave, number requiring disability pension, as well as prescriptions of drugs, including painkillers, need to be investigated to gather a full picture of the health effects of bariatric surgery. While obesity remains a major health challenge in many countries, this study highlights the factors that need to be considered when accepting patients for treatment, and when evaluating the consequences of bariatric surgery.

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