Laparoscopic anti-reflux surgery is effective in obese patients with gastro-oesophageal reflux disease

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ABSTRACT

INTRODUCTION Obesity has long been regarded as a risk factor for the development of gastro-oesophageal reflux disease (GORD). It has been claimed that surgical efficacy of laparoscopic anti-reflux operations is decreased in obese patients. The aim of this study was to assess whether laparoscopic anti-reflux surgery is effective in obese patients with GORD compared to non-obese patients.

PATIENTS AND METHODS A total of 366 patients (mean age 44 years; range, 12–86 years) underwent laparoscopic anti-reflux surgery between 1997–2003. Of these, 74 patients were considered obese; 58 patients had a body mass index (BMI) of 30–34 kg/m² and 16 were classified as morbidly obese with a BMI $\geq$ 35 kg/m². Pre-operative symptomatic scoring, indications for surgery, pH studies, operative times and complications were compared between obese and non-obese patients. Symptomatic outcome and Visick score between the two groups were assessed at 6 weeks, 6 months and 1 year following surgery.

RESULTS Failure of medical treatment was the main reason for surgery in all groups. Operative time was longer in obese patients (mean time 93 min compared to 81 min; $P = 0.0007$), the main difficulty being gaining access because of their body habitus. All groups found the procedure to be effective in symptomatic outcome, 91% of obese patients compared to 92% of non-obese patients scored Visick I or II at 6 weeks' postoperatively. Similar Visick scoring was shown between the two groups at 6 months and 1 year, and in the morbidly obese group.

CONCLUSIONS The outcome of laparoscopic anti-reflux surgery is similar between obese and non-obese patients with no trend towards a worse outcome in the obese or morbidly obese. Obesity should not be seen as a contra-indication, although it may be more technically challenging in this group of patients. Good results can be achieved in obese patients.

KEYWORDS

Obesity – GORD – Laparoscopic anti-reflux surgery

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Obesity continues to plague our society in epidemic proportions and the association between obesity and gastro-oesophageal reflux has been widely acknowledged. Obesity is identified as a predisposing factor for gastro-oesophageal reflux disease (GORD)^{1,2} and many patients presenting for surgical management of GORD are either overweight or obese. Barak *et al.*³ found that the pathophysiology for GORD in obese patients differs from that of normal weight patients. First, obese patients tend to have a displaced lower oesophageal sphincter secondary to increased intra-abdominal pressure and thus the gastro-oesophageal gradient is increased. Second, hiatal hernias are more prevalent. Third, vagal abnormalities may cause a higher output of pancreatic and bile enzymes which make the refluxate more toxic to the oesophageal mucosa; this makes the obese patient more sensitive to the presence of acid in the oesophagus.

In addition, Barak *et al.*³ stated that some weight loss procedures (*e.g.* gastric banding) are associated with higher prevalence of reflux symptoms. Obesity may render surgical intervention technically more difficult and it has been claimed that it is a cause of poor outcome following laparoscopic anti-reflux surgery (LARS).⁴

A number of studies have addressed the surgical outcomes of obese patients undergoing anti-reflux surgery.^{4–7} Reports of surgical success are varied. Fraser *et al.*⁶ and Winslow *et al.*⁷ reported no difference in symptomatic outcome between normal weight and obese patients and no correlation between body mass index (BMI) and postoperative satisfaction. However, Perez *et al.*⁴ found that obesity was associated with a higher recurrence rate of reflux symptoms following anti-reflux operations.

Figure 1 Distribution of patients with BMI ≥ 30 kg/m² ($n = 74$).

Many patients presenting for anti-reflux surgery are obese and surgeons remain concerned since obesity may render surgery technically more difficult, complications may be more common,⁸ and long-term success of such operations may be affected by obesity.⁴

The aim of this study was to assess the effect of increased BMI on the surgical outcome of laparoscopic anti-reflux procedures by comparing the effectiveness of surgery in terms of symptom control and patient satisfaction between obese and non-obese patients.

Patients and Methods

This study was a retrospective analysis of prospectively collected data from January 1997 to December 2003 with respect to pre-operative BMI. The study population consisted of all patients undergoing primary LARS at the Royal Berkshire Hospital, Reading, UK. A total of 398 patients (237 men, 129 women) underwent LARS during this period. Thirty-two patients were excluded as either height and weight data were incomplete or unavailable ($n = 21$) or they underwent a 're-do' procedure because of failure of previous anti-reflux procedures ($n = 11$). Therefore, 366 patients were considered for this study. The mean age of this population was 44 years (range, 12–86 years). There was no upper weight limit.

All patients were interviewed by one of two research nurses and a structured questionnaire relating to their symptoms was completed both pre- and postoperatively.⁹ Pre-operative use of antacids or acid suppression therapy was recorded. Their DeMeester symptom score was calculated: the maximum score is 9 (maximal symptoms). All patients also underwent objective pre-operative evaluation including 24-h pH studies, oesophageal manometry and upper gastrointestinal endoscopy.

The majority of the patients underwent a laparoscopic floppy Nissen fundoplication (360° wrap; $n = 292$). A randomised trial comparing laparoscopic Nissen fundoplication with laparoscopic Toupet fundoplication (270° wrap) took place between 1998–2001. One patient underwent a Dor procedure (180° wrap). The procedure has been described previously.^{10,11} In brief, a 270° or a 360° wrap is constructed over a 56-French Malonie bougie after complete mobilisation of the fundus. The crura posterior to the oesophagus were approximated by interrupted non-absorbable sutures. Patients commenced on fluids on the first postoperative day and were discharged home as soon as they were tolerating fluids and a soft diet.

Postoperatively, patients were reviewed at 6 weeks by completing the structured symptom questionnaire, and their satisfaction assessed using the Visick score. Further similar reviews were undertaken at 6 months and at 1 year. Assessment of post fundoplication physiology (pH testing) was offered to all patients, but only 168 patients underwent the procedure.

Patients were separated into 2 groups – those with a BMI ≥ 30 kg/m² were classified as obese and those with a BMI < 30 kg/m² were defined as 'non-obese'. Seventy-four patients (20%) were obese (32 men, 42 women) and the remaining 292 patients (80%) were classified as non-obese (205 men, 87 women). The mean weight in the obese patients was 90 kg (± 1.324 kg) and in the non-obese group was 76 kg (± 0.71 kg). The obese group was then further separated into those whose BMI was between 30–34 kg/m² ($n = 58$) and those in whom the BMI was above 35 kg/m², classified as morbidly obese ($n = 16$), and these were separately analysed. The highest BMI was 46 kg/m² and the patient distribution can be seen in Figure 1. The mean weight of those in the obese group was 90 kg (± 1.534 kg) and in the morbidly obese group was 99 kg (± 2.608 kg).

All data were entered into an Excel database (Microsoft; Seattle, WA, USA). GraphPad Prism software (GraphPad; San Diego, CA, USA) was used for all statistical calculations. Statistical analysis between the two cohorts was carried out using the Mann-Whitney U-test and Fisher's exact test (two tailed). A P -value of ≤ 0.05 was considered significant.

Results

The mean duration of symptoms in the obese group was 107 months (range, 3–516 months) and 100 months (range, 3–408 months) in the non-obese group.

The indications for LARS are shown in Table 1. Failure of medical therapy was the primary indication in both groups (41% obese patients versus 35% non-obese patients).

The degree of GORD symptoms was similar in both groups as shown by the mean DeMeester score, which was comparable between the two groups (obese, 5.2; non-obese,

Table 1 Indication for surgery

	BMI < 30 kg/m ² (n = 292)	BMI ≥ 30 kg/m ² (n = 74)
Failure of medical therapy (%)	35	41
Patient preference (%)	26	22
Volume regurgitation (%)	23	22
Side effects of medical treatment (%)	6	4
Combination (%)	9	9

4.9; *P* = not significant). Both sets of patients suffered with heartburn more frequently than regurgitation or dysphagia. This pattern was similar between the obese and morbidly obese patients.

Table 2 shows the results of the pre-operative assessments in both groups. Pre-operative 24-h pH monitoring revealed similar acid exposure time between the two groups. Nocturnal reflux was similar in both groups. In addition, oesophageal manometry showed no difference in the lower oesophageal sphincter (LOS) pressure or motor function between the two groups. Similarly, there were no differences with respect to oesophagitis; however, there were a significantly higher percentage of hiatal hernias in the obese patients (21%) by comparison to the non-obese group (14%).

The American Society of Anesthesiologists (ASA) score was comparable between the two groups. There was no increase in score with respect to increased BMI. ASA 1 and ASA 2 were recorded in 75% and 27%, respectively, in the obese patients compared to 89% and 11%, respectively, in the non-obese group. There was no ASA 3 or ASA 4 patients in this population. There was a slight increase in the operative time in the obese group, with a mean completion time of 95 min (range, 52–180 min) compared to 81 min (range, 32–320 min) in the non-obese group (*P* = 0.007). The length of hospital stay between the two groups was similar, with a mean stay of 1.6 days (range, 1–4 days) in the obese group compared to 1.7 days (range, 1–8 days) in the non-obese group.

Further analysis of the obese group showed that acid exposure time in a 24-h period was similar between those who were obese and those who were considered morbidly obese (Table 3). The morbidly obese patients did not demonstrate more reflux nocturnally. Oesophageal manometry did not reveal a significant difference in lower oesophageal pressure and morbidly obese patients did not demonstrate more hiatus hernias when compared to the obese group.

The operating time was not significantly lengthened in the morbidly obese group; the mean completion time was 92 min (range, 58–165 min) compared to 91 min (range, 52–180 min) in the obese group. The mean length of post-operative stay was similar between the two groups, with a mean stay of 1.3 days in the morbidly obese patients compared to 1.6 days in the obese group.

Table 2 Pre-operative tests

	BMI < 30 kg/m ² (n = 292)	BMI ≥ 30 kg/m ² (n = 74)	
Acid exposure time (%) ^a			
Total (24 h)	9.5 (0.2–61.8)	9.6 (2.3–51)	
Daytime	9.5 (0.2–74.8)	10.1 (2.5–46.6)	
Night time	9.1 (0–87.4)	8.4 (0–67.1)	
Manometry ^a			
LOS ^b pressure (mmHg)	9 (2–30)	8 (3–19)	<i>P</i> = NS
Normal co-ordination (%)	46	47	
IEM ^c (%)	48	49	
Endoscopy			
Hiatus hernia (%)	14	21	<i>P</i> = 0.0468
Erosive oesophagitis (%)	23	22	

^aMean values (range).
^bLower oesophageal sphincter.
^cIneffective oesophageal motility.
 NS, non-significant.

Table 3 Pre-operative tests in obese and morbidly obese patients

	30 kg/m ² ≤ BMI < 35 kg/m ² (n = 58)	BMI ≥ 35 kg/m ² (n = 16)	
Acid exposure time (%) ^a			
Total (24 h)	9.9 (9.9–51)	8.6 (2.3–21.8)	
Daytime	10.3 (2.5–46.4)	9.6 (2.7–17.2)	
Night time	8.9 (0–67.1)	6.6 (0–30)	
Manometry ^a			
LOS ^b pressure (mmHg)	9 (3–19)	6 (4–12.7)	<i>P</i> = NS
Endoscopy			
Hiatus hernia (%)	24	13	<i>P</i> = NS
Erosive oesophagitis (%)	23	31	

^aMean values (range).^bLower oesophageal sphincter.

NS, non-significant.

There was no mortality. None of the patients in the obese group were converted from a laparoscopic to an open procedure. Four non-obese patients were converted; one was for control of bleeding, another for repair of a colonic perforation and two patients were converted because of dense adhesions from previous upper abdominal operations. Intra-operative difficulties were encountered more often in the obese patients (35%); the three most encountered problems were difficulty in gaining good visual access because of the body habitus (14%), intra-operative bleeding/oozing (9%) and pleural tear (4%). Wrap perforation occurred in one obese patient on the fourth postoperative day necessitating re-operation. Difficulties were encountered in 16% of the non-obese patients; the three frequently encountered difficulties in this group were bleeding/oozing (5%), adhesions from previous operations (2.3%) and obscured vision from omental fat (1.7%).

Intra-operative difficulties were not encountered more often in the morbidly obese (31%) compared to the obese group (34%). Apart from the difficulty in gaining access, other complications encountered in these two groups of patients included bleeding, pleural tears and adhesions.

Fifteen (4%) patients needed oesophageal dilatation postoperatively (ranging from 11 days to 3 years) to address dysphagia. Of these 15, only one patient was from the obese group (30 kg/m² ≤ BMI < 35 kg/m²); however, two dilations were required in this patient. Of the remainder, eight patients underwent one dilatation and five patients two times. One patient underwent dilatation three times and proceeded to a revision.

In total, nine patients (2.5%) required re-operation; 2.4% non-obese patients compared to 2.7% obese patients – none

of these were from the morbidly obese group. One patient (not obese) suffered with a caecal volvulus 6 weeks' postoperatively and proceeded to a right hemicolectomy; this was unrelated to the LARS operation. Eight patients were re-operated on because of complications relating to their LARS procedure; of these, two patients were obese (30 kg/m² ≤ BMI < 35 kg/m²) – wrap perforation at day four, and a wrap revision for gas bloat at 19 months. Of the remaining (non-obese) patients, three patients underwent re-operations for wrap herniation, one at 6 months and the other two at 2 years. One patient underwent revision of the wrap at 2 years for heartburn, and another underwent revision after repeated (3) oesophageal dilations. One patient suffered with necrosis of the greater curvature of the stomach requiring a partial gastrectomy.

Table 4 shows the number of patients attending (or contactable) for follow-up. Time to return to normal daily activities and work was slightly greater in the obese patients by comparison to the non-obese subjects (*P* = 0.0244 and *P* = 0.0212, respectively; Table 5). The time taken by the mor-

Table 4 Availability of patients for follow-up

	BMI < 30 kg/m ² (n = 292)	BMI ≥ 30 kg/m ² (n = 74)
6 weeks	280 (96%)	70 (95%)
6 months	219 (75%)	57 (77%)
1 year	183 (63%)	35 (47%)

Table 5 Postoperative indices

	BMI < 30 kg/m ² (n = 292)	BMI ≥ 30 kg/m ² (n = 74)
Return to work (days)*	23 (1–93)	28 (5–98)
Return to normal activity (days)*	19 (1–150)	24 (2–140)
24-h pH testing	n = 133	n = 35
Total acid exposure time (%)*	2.2 (0–77)	1.8 (0–40)

*Mean values (range).

bidly obese patients to return to work or normal daily activities was comparable with the obese group (23 days versus 29 days and 27 days versus 23 days, respectively).

Approximately half of the patients from both groups consented to have a 24-h pH monitoring postoperatively at 6 months. The mean percentage 24-h acid exposure was less than pre-operatively in both sets of patients (Table 5); 9% (3 out of 35) obese patients ($30 \text{ kg/m}^2 \leq \text{BMI} < 35 \text{ kg/m}^2$) and 10% (13 out of 133) non-obese patients had a pH < 4 over 4% of time over a 24-h period postoperatively.

Both sets of patients graded their symptoms using the Visick score postoperatively. At 6 weeks, the majority of the patients from both groups (91% obese patients versus 92% non-obese patients) graded themselves as Visick I (asymptomatic) or Visick II (minor symptoms, not interfering with life or requiring medication), corresponding to an 'excellent' or 'good' result from surgery. Similar scoring was achieved at 6 months and at 1 year. There was no statistical

Table 6 Medications used at 6 months

	BMI < 30 kg/m ² (n = 219)	BMI ≥ 30 kg/m ² (n = 57)
Proton pump inhibitor	8 (3.7%)	1 (1.8%)
H2-receptor antagonist	2 (0.9%)	–
Antacids	12 (5.5%)	3 (5.3%)
Combination	–	1 (1.8%)

difference between the two groups of patients. A small percentage of patients graded themselves as Visick III (residual symptoms, interfering with life and requiring medications) or Visick IV (complete failure to improve symptoms), which corresponds to a 'bad' or 'poor' result and the number of patients were similar between the two groups (Fig. 2). Out of the whole population, only seven patients (1.9%) graded themselves as Visick IV; of these, only one patient was obese.

Similar Visick scores were seen in comparison between the obese and the morbidly obese patients. At 6 weeks, 93% of morbidly obese patients compared with 91% of obese patients graded themselves as Visick I or II ($P = 0.7953$); however, at the 6 months' follow-up, all the morbidly obese patients (100%) graded themselves as Visick I or II compared with 90% of the obese patients ($P = 0.0015$). This dropped to 88% at 1 year compared to 93% in the obese group ($P = 0.2383$).

At the 6 months' follow-up, a total of 27 patients required anti-reflux medication with more patients from the non-obese group (22) needing medications postoperatively (Table 6). Nine patients needed a proton pump inhibitor (PPI); none was from the morbidly obese group. The need for a PPI was not necessarily related to a failed pH test since only 6 out of these 9 patients underwent 24-h pH monitoring and, of these, only 3 had a positive pH test.

When asked postoperatively about satisfaction with LARS, the majority of patients from all groups replied that they were happy with the result in regards to their symptoms of GORD (94% obese versus 93% non-obese). Overall, there was no indication of a poorer outcome in the obese or morbidly obese patients.

Discussion

Laparoscopic anti-reflux surgery has gained popularity in recent years due to its advantages over open surgery in terms of shorter hospital stay, postoperative pain, rapid recuperation and cosmesis. Laparoscopic repair gives the potential to treat GORD effectively^{9,12,13} whilst minimising

Figure 2 Follow-up Visick scores at 6 weeks, 6 months and 1 year

the complications and morbidity associated with open surgery and large abdominal incisions. The laparoscopic approach provides an unparalleled view of the diaphragmatic hiatus compared to open anti-reflux surgery, which can lead to poor exposure of the hiatal structures, especially in obese patients.

The suggestion that obesity is a cause of poor surgical outcome following anti-reflux procedure has been researched and results are conflicting. A multivariate analysis of factors predicting outcome found no correlation between obesity and a poor outcome;¹⁴ another study found that obesity does not affect the outcome in obese patients.⁷ The findings are confirmed by our study since the symptomatic outcome and patient satisfaction scores were similar between all groups of patients.

In terms of pre-operative disease severity, all groups of patients in this study suffered with a similar degree of symptoms. Disease severity was also comparable between all three groups as determined by 24-h pH monitoring, endoscopy and oesophageal manometry, with the exception of a slightly higher proportion of hiatal hernias in the obese group; this trend was also noted in other studies.^{6,7} However, we did not demonstrate a higher incidence of hiatus hernias in those who are morbidly obese (BMI ≥ 35 kg/m²). Hiatus hernias are a significant contributing factor to GORD¹⁵ and obese patients have a higher tendency towards them.⁵

Any surgery is more difficult subjectively in obese patients; certain LARS complications might be more common in patients with a high BMI as postoperative wrap herniation could be exacerbated by increased intra-abdominal pressure secondary to obesity. The suggestion of increased operative difficulty is supported by a slightly longer operation time in the obese group in our study; Winslow *et al.*⁷ reported similar findings. However, we showed that being morbidly obese did not significantly lengthen the operating time.

We did not find that postoperative complications and the requirement for later surgical revision were influenced by pre-operative weight. This was also demonstrated by other authors.^{6,7} Although, in our study, a small number of patients in both groups required conversion to an open procedure or a re-operation, the obese group did not have a higher conversion or re-operation rate. This was also replicated in the morbidly obese group.

There were no differences in terms of postoperative symptomatic scoring in all patient groups. The majority of patients were satisfied with the result and graded themselves accordingly on the Visick score. However, a small number of patients from all the groups postoperatively graded themselves as Visick III or IV on account of recurrent reflux symptoms, or side effects of the anti-reflux surgery (gas bloat, postprandial fullness, early satiety, inability to belch and dysphagia).⁹ Nevertheless, our findings do not support the premise that obesity is the cause of marked increase in failure rate as reported by Perez *et al.*⁴

Follow-up of patients is a difficulty encountered in many studies, as patients either refuse or become uncontactable for a variety of reasons. Similar to the problems Smith *et al.*¹⁹ encountered, we have found it difficult to obtain meaningful numbers of patients for follow-up after 1 year. It can be seen that, as time progressed, the number of patients attending follow-up decreased.

Our study did not address the validity of weight loss prior to undergoing LARS. There was no weight limit on those operated on in this study; therefore, there was no limit on the BMI. Perez *et al.*⁴ supported the idea that intensive efforts at weight loss should be maintained pre-operatively since an increased BMI adversely affects surgical outcome. However, the value of weight reduction pre-operatively remains unproven and, in reality, may prove to be difficult and unrealistic to achieve.

Our study assessed the relief of reflux symptoms by LARS and did not focus on the subject of weight loss. For the morbidly obese patient who wants to lose weight and who has significant reflux symptoms but has failed weight loss programs, a Roux-en-Y gastric bypass may be the procedure of choice, as laparoscopic fundoplication will not address the issue of weight reduction. This operation provides excellent long-term relief of GORD^{5,16-18} and has the added benefit of long-term weight loss and the associated health benefits. LARS has been found to be as equally effective as a gastric bypass in the morbidly obese in relieving reflux symptoms,²⁰ and should still be offered to patients who do not desire bariatric surgery. Bariatric surgery in the morbidly obese suffering with GORD should be treated on its own merits.

Conclusions

Obesity should not be seen as a contra-indication to laparoscopic anti-reflux surgery. Although the surgery may be technically more demanding in the obese patients, a good symptomatic outcome from anti-reflux surgery is as likely in obese as in normal weight patients.

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