

REVIEW ARTICLE

OPTIMIZATION OF OUTCOME AFTER LAPAROSCOPIC ANTIREFLUX SURGERY

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Laparoscopic fundoplication has emerged as an effective treatment for gastro-oesophageal reflux disease. The majority of patients who have undergone antireflux surgery report an improvement in reflux symptoms and in quality of life. However, some patients are dissatisfied with the outcome of antireflux surgery, and attempts have been made by surgeons to improve the results of this surgery. Careful case selection based on objective evidence of acid reflux, refinement of the surgical technique and ‘tailoring’ the wrap to suit the patient by selective use of a partial fundoplication may help to optimize the outcome from laparoscopic antireflux surgery.

Key words: fundoplication, gastro-oesophageal reflux, laparoscopic procedure, outcome, quality control.

INTRODUCTION

Laparoscopic fundoplication has become recognized as the ‘gold standard’ surgical approach for the management of gastro-oesophageal reflux disease. The outcome of surgery is good to excellent for the majority of patients with respect to an improvement in both symptoms and quality of life.¹ However, some patients are dissatisfied with the outcome of the operation. This could be the result of failure of the wrap or hiatal disruption that may lead to the development of recurrent reflux or a paraoesophageal hernia.² Other patients have symptoms such as dysphagia, heartburn or ‘wind’ problems and a few have no easily identifiable cause for the poor result.³

Laparoscopic fundoplication has undergone technical refinements in recent years in order to improve the outcome.^{4,5} Several modifications to the standard laparoscopic Nissen 360-degree wrap have been devised in an attempt to reduce the unwanted side-effects of surgery.^{6–8} An understanding of the factors that affect outcome may help surgeons to select cases more appropriately or to tailor the operation to suit the patient. Recently, it has been suggested that psychological factors such as anxiety, depression and illness behaviour should be considered when preparing a patient for surgery.^{9–11} Influences such as these have received relatively little attention in published reports. However, in a disorder where stress and anxiety are believed to play a role, attention to these matters has the potential to improve the outcome of an antireflux procedure.^{12,13} Conversely, a failure to recognize such factors might lead to poorer results despite a competently carried out operation. This review of the published reports focuses on the patient-related, clinical and surgical variables that might affect the outcome of laparoscopic antireflux surgery.

METHODS

We performed Ovid Medline and National Library of Medicine PubMed database searches for relevant publications in English

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using the terms ‘gastro-oesophageal reflux’, ‘laparoscopic procedure’, ‘fundoplication’, ‘treatment outcome’, ‘clinical trials’ and ‘randomized controlled trials’ as medical subject headings. Our search strategy also included text word searches for ‘reflux’, ‘laparoscopic’, ‘fundoplication’, ‘Nissen’ and ‘Toupet’. The highest quality of data available (preferably level I evidence) was considered wherever possible.

Patient factors

Demographic details

Increasing age has been identified as an independent predictor of a requirement for long-term acid suppression treatment in gastro-oesophageal reflux.¹⁴ However, there is no evidence that age influences outcome after laparoscopic antireflux surgery.^{15,16} Male patients have a better outcome in terms of improvement in heartburn score and satisfaction 5 years after surgery compared with female patients, and an association between having private health insurance and a better outcome has been reported.¹⁶ This may be a reflection of the seniority and the experience of the surgeons performing private operations or could relate to the better general health of this group of patients compared with those belonging to lower socio-economic groups. Patients who had their antireflux procedure carried out in a public hospital may have had a trainee performing the surgery. However, they are unlikely to have been at a disadvantage because the outcome of laparoscopic fundoplication performed by supervised trainees is similar to that of more experienced surgeons.^{16,17} If the difference in outcome between public and private patients is because of a reversible variable and if the variable can be identified and reversed, then it is possible that patients who are uninsured might have better results.

Obesity

One might expect preoperative obesity to influence outcome after antireflux surgery. However, at least two studies have shown no correlation between obesity (body mass index greater than 30 kg/m²) and a poor outcome despite a significant difference in operating time for this group of patients.^{18,19} Another group investigated laparoscopic antireflux surgery in black compared with white Americans.²⁰ They found a significant difference in bodyweight

and conversion rate between the groups among female patients, but no overall difference in satisfaction with surgery was reported.²⁰ A study that investigated the influence of obesity on outcome for antireflux surgery that included open thoracic Belsey type IV repair showed that recurrent symptoms were more frequent in patients who were morbidly obese.²¹ The interpretation of results from this mixed series of cases with respect to laparoscopic fundoplication is inconclusive. It appears that weight and ethnicity do not influence outcome after laparoscopic fundoplication.

Whether laparoscopic fundoplication is the most appropriate antireflux treatment for the morbidly obese patient is currently under debate. It has been shown that both reflux symptoms and measurements of oesophageal acid exposure are significantly reduced a year after Roux-en-Y gastric bypass.²² Other bariatric procedures such as vertical banded gastroplasty and the adjustable gastric band may have less of an antireflux effect.^{23,24} Laparoscopic fundoplication and gastric bypass are similarly effective in controlling reflux in patients who are morbidly obese.²⁵ A gastric bypass rather than a fundoplication may be a more appropriate operation for morbidly obese patients with reflux, with the advantage of providing more rapid and sustained weight loss.^{25,26} However, this does ignore whether a patient wishes to have a severe restriction placed on his or her food intake. This clinical dilemma has yet to be resolved in a randomized controlled trial.

Anxiety and depression

The contribution of anxiety and depressive illness to gastro-oesophageal reflux symptoms is well recognized.^{12,13} The presence of psychoemotional disorders such as anxiety and depression is associated with dissatisfaction after antireflux surgery.¹¹ However, if patients with stress-related gastro-oesophageal reflux receive psychological intervention before surgery, the outcome of laparoscopic fundoplication can be improved.²⁷ Interestingly, patients with depressive illness who have a laparoscopic fundoplication develop more postoperative dysphagia and chest pain after a Nissen compared with a posterior 180-degree partial fundoplication (Toupet procedure).¹⁰ This raises the question of whether certain patients may benefit from being selected for a partial fundoplication rather than a total wrap on the basis of psychological factors.

Abnormal illness behaviour

Preoperative evidence of hypochondriasis or mood disturbance has been correlated with poor satisfaction after a laparoscopic Nissen fundoplication.⁹ In the same study, there was no significant correlation between illness behaviour and reflux symptoms after surgery.⁹ In order to improve satisfaction, some patients with abnormal illness behaviour may benefit from being offered an alternative to a Nissen fundoplication. There are some data to suggest that it may be reasonable to offer a partial wrap to patients who express concerns regarding the side-effects of antireflux surgery or if the surgeon judges that a patient will cope poorly with postoperative symptoms.²⁸ Although the study was not randomized, it provides some evidence that tailoring the operation according to personality factors in selected patients may optimize the outcome of laparoscopic fundoplication.

Clinical considerations

Symptoms and treatment response

It is acknowledged that patients with typical reflux symptoms such as heartburn and regurgitation benefit from laparoscopic

fundoplication.²⁹ A complete or partial response to proton pump inhibitors, good compliance with antireflux medication and objective preoperative evidence of acid reflux are predictors of a good outcome.^{30,31} Patients with atypical symptoms such as chronic cough and asthma may also benefit from laparoscopic fundoplication with respect to improved quality of life, especially if there is objective evidence of reflux disease measured on pH studies.^{32,33} However, Chen and Thomas reported that atypical symptoms improved in only 54% of cases when associated with more typical reflux symptoms.³⁴ Therapeutic failure of laparoscopic fundoplication is more likely in patients with atypical symptoms, weak preoperative objective evidence of reflux disease and poor compliance with and response to antireflux medication.^{31,35,36}

Endoscopic evidence of oesophagitis

There is a poor correlation between lower oesophageal acid exposure and evidence of oesophagitis on endoscopy.³⁶ The outcome of laparoscopic antireflux surgery is good to excellent for patients with erosive and non-erosive gastro-oesophageal reflux.^{15,16,37,38} However, 15% of patients with symptomatic gastro-oesophageal reflux show no evidence of oesophagitis on endoscopy and physiologically normal oesophageal pH studies.³⁹ These patients are a challenge to the laparoscopic surgeon, because a normal preoperative pH study is a predictor of poor outcome.⁴⁰ Provided the patients with non-erosive, normal pH reflux have typical symptoms (such as heartburn or regurgitation that responds to acid inhibition), the outcome of laparoscopic fundoplication is usually excellent.³ For patients with atypical symptoms (such as cough or chest pain) and no objective evidence of acid reflux or response to acid inhibition, the outcome of laparoscopic fundoplication is so poor that these factors should probably preclude an operation being undertaken.³

Barrett's oesophagus

The aim of antireflux surgery performed on patients with Barrett's oesophagus without dysplasia is to control reflux symptoms and perhaps to prevent the progression of intestinal metaplasia. Reflux symptoms improve in more than 90% of cases and are abolished in 70% of cases of Barrett's oesophagus following laparoscopic fundoplication, although recurrent symptoms have been reported in up to 26% of patients.⁴¹⁻⁴³ The short-term to medium-term outcome of laparoscopic antireflux surgery is unaffected by the presence of Barrett's oesophagus.^{37,44}

Regression of intestinal metaplasia (which is defined as a loss of histological evidence of intestinal metaplasia) is reported in 14-47% of cases after laparoscopic antireflux surgery.^{43,44-48} When lengths of columnar-lined oesophagus less than 3 cm (short segment) are considered, regression may be as high as 59%.^{41,46,48} For segments greater than 3 cm in length (long segment), regression of between 0 and 20% is reported.^{41,46,48} Complete regression of intestinal metaplasia to squamous oesophageal mucosa after surgery has been reported in 24% of short-segment and 12% of long-segment Barrett's cases.⁴⁸

Histological regression of low-grade dysplasia to intestinal metaplasia is less well reported owing to smaller numbers of cases. A recent study by Gurski *et al.* that investigated 77 patients with Barrett's oesophagus who had undergone antireflux surgery (with 53% of cases performed laparoscopically) found evidence of regression in 17 of 25 patients (68%) with dysplasia.⁴⁶ Regression was again significantly more likely with a short-segment compared with a long-segment Barrett's.⁴⁶ Further studies of a larger series of laparoscopic cases but of only small numbers

with dysplasia showed histological regression in two of three and in six of eight cases.^{43,45}

Although there is some evidence for the regression of intestinal metaplasia and dysplasia after antireflux surgery performed on patients with Barrett's oesophagus, progression to adenocarcinoma may occur.^{41,45,47-49} A meta-analysis of all previously published work found no overall evidence for the prevention of progression to carcinoma of the oesophagus by antireflux surgery.⁵⁰ Endoscopic surveillance of patients with Barrett's oesophagus is therefore necessary after antireflux surgery and patients should be made aware of this.

Oesophageal dysmotility

Poor oesophageal motility is often associated with gastro-oesophageal reflux and may be a reflection of increased disease severity.⁵¹ Laparoscopic fundoplication effectively controls reflux symptoms in patients with poor oesophageal motility.^{52,53} There have been concerns regarding the side-effects, in particular dysphagia, following laparoscopic fundoplication performed on patients with dysmotility. Beckingham *et al.* showed no correlation of oesophageal dysmotility (defined as less than 50% primary oesophageal peristalsis following repeated wet swallows) with postoperative dysphagia.⁵⁴ Others have shown that oesophageal motility improves after surgery.⁵⁵⁻⁵⁷ Baigrie *et al.* found no significant difference in the outcome of laparoscopic Nissen fundoplication in patients with disordered peristalsis compared with those with normal motility.⁵⁵ Preoperative dysphagia scores for the majority of patients from this group were improved 1 year after surgery.⁵⁵ Therefore, either the dysmotility caused by the reflux has responded to surgery or the oesophageal peristalsis has increased to compensate for a raised lower oesophageal sphincter pressure after the operation. There appears to be no evidence that performing a partial rather than a total fundoplication alters the outcome for patients with oesophageal dysmotility.⁵⁸ Oesophageal dysmotility should not be regarded as a contraindication to laparoscopic antireflux surgery.

Surgical technique

Oesophageal bougie

An oesophageal bougie is sometimes used during laparoscopic fundoplication to assist with the fashioning of a loose wrap to prevent postoperative dysphagia. Inadvertent malpositioning of the bougie can result in oesophageal or gastric perforation. A retrospective review of laparoscopic fundoplication without the use of a bougie identified persistent postoperative dysphagia in 4 of 68 (6%) patients and recurrent reflux symptoms in 8 (12%) patients.⁵⁹ A prospective, blinded, randomized trial showed a significantly lower incidence of postoperative dysphagia in the group where a bougie was used, albeit at the expense of a single oesophageal perforation from 81 patients.⁴ It would seem advisable to use an intraoperative bougie to avoid a high incidence of postoperative dysphagia. Nevertheless, there are perhaps two situations where it is not used: first, whenever placement of the bougie cannot be closely monitored, such as after narrowing a hiatus following a paraoesophageal hernia repair, and second, after a partial fundoplication when there is no particular reason to use one.

Division of short gastric vessels

The decision as to whether to divide the short gastric vessels during mobilization of the fundus for a Nissen fundoplication is

controversial. There are those who routinely suggest dividing the vessels and those who avoid it.⁶⁰⁻⁶⁴ Attempts have been made to identify an optimal method of division of the short gastric vessels either by using ultrasonic dissecting shears or bipolar cutting forceps or by clipping and dividing.^{65,66} None of these approaches has shown a significant advantage other than greater technical ease in the case of the ultrasonic shears.⁶⁵

Comparative (non-randomized) studies have shown a higher incidence of early and persistent dysphagia with Nissen-Rosetti fundoplication (without division of the short gastric vessels) compared with a Nissen or Toupet fundoplication.⁶⁴ There may be individual differences in the fundal length available for plication: insufficient length may be increased by division of the short gastric vessels.⁶⁷ There could be some situations when division of the short gastric vessels is unavoidable.

A randomized trial of laparoscopic Nissen fundoplication with or without routine division of the short gastric vessels showed an increased operating time and incidence of gas bloat with division.⁶⁸ However, two randomized trials have shown no significant difference in outcome with or without division of the short gastric vessels.^{69,70} Long-term follow up has shown an increased incidence of wind-related problems in the group that had the short gastrics divided.⁵ Based on current level I evidence, it rests with those who suggest routine division of the short gastric vessels to prove its necessity.

Partial versus total fundoplication

There has been considerable debate regarding the merits or otherwise of a partial versus a total fundoplication. Both approaches achieve similar physiological effects at the gastro-oesophageal junction,⁷¹ but a partial fundoplication may produce fewer troublesome side-effects compared with the traditional 360-degree floppy Nissen fundoplication.^{6,7}

A randomized trial by Laws *et al.* showed no significant difference in outcome between laparoscopic Nissen and Toupet fundoplication.⁷² In another study, Hagedorn *et al.* identified significantly more wind-related problems in patients undergoing laparoscopic Nissen fundoplication (without division of the short gastric vessels) rather than the Toupet procedure and no other significant differences in outcome.⁷³ Zornig *et al.* found a significantly higher incidence of dysphagia at 4 months for Nissen versus Toupet fundoplication in their randomized trial.⁷⁴

A randomized comparison of laparoscopic anterior 180-degree partial versus Nissen fundoplication (without division of the short gastric vessels) found significantly less dysphagia and greater satisfaction with surgery after 6 months for a partial fundoplication.⁷⁵ A multicentre, randomized trial reported less postoperative dysphagia and wind-related problems and better satisfaction with surgery at 6 months follow up for anterior 90-degree partial fundoplication compared with the 360-degree Nissen.⁷⁶ However, there was a higher rate of recurrent reflux in those who underwent a partial fundoplication.⁷⁶ Five-year follow-up data have recently been reported for a randomized trial comparing anterior 180-degree partial versus Nissen fundoplication.⁷⁷ Despite some significant differences in dysphagia and wind symptoms, there was no significant difference in overall outcome with surgery. Interestingly, 3 out of 50 cases (6%) of partial fundoplication underwent a revision for recurrent reflux, whereas 3 out of 51 cases (6%) of Nissen fundoplication underwent a revision for dysphagia.⁷⁷

Comparisons of outcome between different types of partial fundoplication have been infrequent. Hagedorn *et al.* compared

anterior partial with posterior partial fundoplication in a randomized trial and found significantly less recurrent reflux with the Toupet procedure.⁷⁸ It was noteworthy that the rate of recurrent reflux in the anterior fundoplication group was much higher than that in other series using an anterior wrap.⁷⁸

Overall, it appears that a partial fundoplication may be more likely to lead to recurrent reflux than a total fundoplication, but this is counterbalanced by less dysphagia and wind-related problems after a partial fundoplication. Whether a Toupet procedure is superior to an anterior partial fundoplication for the prevention of recurrent reflux requires confirmation.

Short oesophagus

A short oesophagus seldom poses a problem during laparoscopic fundoplication but may be seen in association with an oesophageal stricture, a Barrett's oesophagus, a paraoesophageal hernia or a revision fundoplication.⁷⁹ Many of these patients will have sufficient length for a fundoplication once the oesophagus has been adequately mobilized.⁸⁰ Although a short oesophagus is associated with an increased incidence of early paraoesophageal herniation, it does not appear to alter the requirement for a reoperation after laparoscopic fundoplication.⁸¹

Rarely, a patient may have an irreducible oesophagus so that a lengthening procedure is required if a wrap is to be performed in the abdomen. This may be achieved with acceptable morbidity and mortality by minimally invasive means such as a Collis gastroplasty.^{79,80,82} Here, the stomach is divided using a linear stapler placed across the stomach in the region of the angle of His, adjacent and parallel to an oesophageal bougie.^{80,82} The situations in which an oesophageal lengthening procedure are really necessary and the long-term results of laparoscopic oesophageal lengthening procedures, both remain to be determined.

CONCLUSIONS

The technique of laparoscopic antireflux surgery has been refined during the past 10 years so that the majority of patients are satisfied with their outcome. Dissatisfaction with the surgery and a poor outcome may be reduced by careful case selection taking into account factors that include psychological issues such as anxiety, depression and illness behaviour. A laparoscopic total fundoplication may be offered to patients where the primary aim of the surgery is the control of reflux symptoms and the prevention of their recurrence. When there is concern regarding the side-effects of surgery such as dysphagia or wind problems, perhaps a partial fundoplication should be considered, albeit with an increased risk of recurrent reflux. The very long-term durability of laparoscopic partial fundoplication requires continued surveillance.

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