



Toupet versus Nissen fundoplication for gastroesophageal reflux disease: are the outcomes different?

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Until the first half of the twentieth-century, gastroesophageal reflux disease (GERD) was not a common clinical problem. At that time, Allison (1) reported the outcomes of trans-thoracic crural diaphragmatic repair for hiatal hernia showing a modest 50% success rate. The concept of antireflux surgery (ARS) emerged following the key observation of Nissen (2) that plicating the gastric fundus for 360 degrees around the esophago-gastric anastomosis was highly effective not only to avoid leakage but also to prevent peptic esophagitis. This proof-of-concept experiment led to a change in focus from trans-thoracic crural repair to trans-abdominal fundoplication. A few years later Toupet described a partial posterior fundoplication (3), but the Nissen procedure is still quoted as the “gold standard” surgical therapy for GERD. With the inception of the laparoscopic era, restoration of the esophago-gastric antireflux barrier, including remodeling of the hiatal orifice and lower esophageal sphincter augmentation using either the Nissen or the Toupet fundoplication, have become standard procedures (4). Despite the very low morbidity and mortality rates, ARS remains underused due to the perceived risk of persistent side-effects and limited durability. As a consequence, the majority of patients referred for surgical intervention are those with refractory symptoms, recurrent esophagitis, and large hiatal hernia. Today, many gastroenterologists and patients continue to consider proton-pump inhibitors (PPIs) as the therapy of choice, and bad publicity of the “gold standard” Nissen fundoplication has largely contributed to the current decline of ARS utilization.

In an attempt to reduce the potential side-effects of the Nissen operation, partial fundoplication has emerged as the procedure of choice or as a “tailored” option for patients with poor esophageal motility. Systematic reviews and meta-analyses have shown that the Toupet fundoplication can decrease the incidence of dysphagia and gas-bloating compared to Nissen fundoplication (5,6). In some studies, the favorable outcomes of Toupet fundoplication have been offset by a higher incidence of recurrent reflux over time, and this may reflect heterogeneity due to selection bias, inclusion of patients with preoperative motility disorders, surgical approach, or variations in the circumference of the wrap (3).

The late results of a randomized clinical trial comparing Nissen and Toupet fundoplication recently shed some light on this controversial issue and fill a gap in the interpretation of long-term ARS outcomes (7). This study follows a previous report (8) showing that the Toupet procedure was beneficial because of a reduced dysphagia rate up at 2 years and equivalent control of esophageal acid exposure at 3 years. It appears now that Toupet and Nissen fundoplication are equally effective in controlling symptoms of GERD and quality of life after 15 years. These findings corroborate evidence from non-randomized studies that the Toupet fundoplication is effective and durable, and has an excellent safety profile. Limitations of this trial are the lack of pHmetry data to confirm objective long-term reflux control, and the fact that the results cannot be generalized to non-specialist surgical units where patient selection and surgical technique may be suboptimal due to lack of standardization. There are five main topics that deserve attention when

Box 1 Key technical elements of antireflux surgery that may influence clinical outcomes

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- √ Mobilization of the distal esophagus
 - √ Type of crural repair
 - √ Division of individual short gastric vessels
 - √ Symmetry of fundoplication
 - √ Circumference of wrap (for partial fundoplication)
 - √ Length of fundoplication
 - √ Tightness of fundoplication
 - √ Fixation of wrap to the esophagus
 - √ Posterior fixation of the wrap
 - √ Coronal fixation of the wrap
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putting into perspective the long-term outcomes of ARS.

Patient selection

All potential candidates for an antireflux procedure need an extensive preoperative evaluation to identify the GERD phenotype, the motility pattern of the esophageal body, the size of hiatal hernia, and the esophageal acid exposure. The appropriate baseline work-up should include symptom and quality of life assessment, upper gastrointestinal endoscopy with biopsies, barium esophagogram, high-resolution esophageal manometry, and ambulatory esophageal pH-impedance monitoring. It has been shown that the main predictors of success after laparoscopic Nissen fundoplication are the presence of typical symptoms, an abnormal 24-hour pH score, and a good response to acid suppression therapy with PPIs (9). The current American College of Gastroenterology guidelines strongly recommend ARS (both fundoplication or magnetic sphincter augmentation) with moderate level of evidence for patients with objectively proven GERD, especially those with severe reflux esophagitis, large hiatal hernias, and/or persistent troublesome symptoms (10).

Surgical technique

Lower mediastinal dissection and crural suture repair is a key procedural step before any type of fundoplication to obtain a 3 cm in length tension-free intra-abdominal esophagus. Mobilization of the gastric fundus and attention to geometry of the wrap during reconstruction are important

to provide a symmetrical and tension-free fundoplication. We secure the Nissen fundoplication with three interrupted non-absorbable stitches, the middle one including the esophageal muscle. For the 270° Toupet wrap, we secure both sides of the fundus to the esophagus using V-lock non-absorbable sutures, leaving uncovered 90 degrees of the anterior esophageal surface. In addition, two apical stitches fix the wrap to the esophageal muscle and to the crura on both sides (*Box 1*). Endoluminal functional lumen imaging probe (EndoFLIP) can be useful to measure the cross-sectional area and the distensibility index of the esophago-gastric junction and to tailor the degree of both crura repair and fundoplication (11). Dysphagia is the most common postoperative side-effect of ARS, especially after the Nissen fundoplication, but it usually subsides within 3 months with an adapted soft diet (12). However, a too tight or too long wrap, a wrap under tension from undivided short gastric vessels, or a twisted wrap made from the gastric body can lead to persistent dysphagia and need for revisional surgery (13).

Surgical learning curve and proficiency

Laparoscopic fundoplication is a complex procedure requiring a well-defined learning curve and a structured training curriculum including simulators, animal models, and clinical practice to master all technical steps. To become proficient, high-quality surgical equipment and training with mentor supervision in the simulation laboratory and in the operating room are important. Use of endoluminal bougies for hiatal and wrap calibration may be helpful during the learning curve. Studies have shown an institutional learning curve of up to 50 procedures, with a higher risk of complications observed in the first 20 cases operated by each individual surgeon (14). Adherence to a set of fundamental surgical principles is the prerequisite for successful training and for achieving competence and proficiency.

Standardization and assessment of technical performance

Laparoscopic fundoplication is safe, effective, and durable if it is standardized (15) and performed in specialized centers (16,17). A multicenter trial comparing medical therapy with fundoplication performed in selected European centers by expert surgeons who agreed on a list of technical details of the procedure showed that 92% of medical patients and 85% of surgical patients remained in remission at

5 years of follow-up (18). Technical performance is a largely underestimated predictor of outcomes in most studies. Standardization of ARS is not simply a matter of eponyms, and current European and North-American guidelines (19,20) recommend that the choice of a total versus a posterior partial fundoplication should be left to the individual surgeon according to her/his expertise and shared decision-making with the patient. Rigorous geometric principles should be applied during shaping and sizing of the wrap to obtain a symmetric, not too tight and not too floppy, fundoplication (21). Standardization is critical to provide consistent outcomes by different surgeons. We have proposed a “critical view” approach to the Toupet fundoplication that takes into account the lack of depth perception of 2D laparoscopy and aims to develop or reinforce alternative visual cues that help to make a symmetric and more reproducible fundoplication. This method of target identification makes the procedure more standardized, more reproducible, easier to learn and to teach, and possibly more effective (22). Endoluminal mechanical calibration with bougies, intraoperative manometry, or EndoFLIP to assess compliance of esophagogastric junction, may contribute to standardization of the surgical procedure (23,24). Intra- and postoperative assessment of the flap valve according to the Hill classification can evaluate changes in morphology induced by the operation (25). The impact of technical performance has not been sufficiently addressed in the literature. Technical skills and errors reflect technical performance and may outweigh cognitive skills and perioperative care in determining to the success of a surgical procedure (26). A systematic review has shown that superior technical performance is associated with improved patient outcomes, and that direct assessment of technical performance is better than using surrogate outcome variables (27). Competency and proficiency evaluation by supervision of a trained observer or the review of videorecorded procedures using specific assessment criteria may be the most reliable method to evaluate technical performance and to improve quality of care (28,29).

Patient reported outcome measures and objective follow-up

ARS aims to decrease symptoms and complications of GERD while permitting physiological swallowing and avoiding side-effects such as bloating and inability to belch and vomit. Patient-reported outcome measures (PROM)

and objective metrics should be used in combination to comprehensively assess the long-term outcome of surgery. Patient satisfaction (30), decision regret analysis (31), and normalization or 50% reduction of esophageal acid exposure (32) are important parameters to confirm the success of surgery. Last but not least, postoperative endoscopic assessment is critical in patients with Barrett's esophagus to identify histological changes occurring after ARS (33).

In conclusion, ARS has not been fully accepted by the medical and patients' community, and some bad publicity has contributed to its reduced utilization over the past decades. Referral foregut centers should provide a comprehensive diagnostic pathway and a variety of surgical techniques tailored to individual patient's characteristics and expectations. The main lesson learned from Analatos' randomized trial is that laparoscopic Toupet fundoplication is an effective procedure with long-term outcomes equivalent to the Nissen if the operation is performed by expert surgeons who adhere to key technical steps including a standardized 270-degree wrap circumference.

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