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The Pros and Cons of Partial Versus Total Fundoplication for Gastroesophageal Reflux Disease

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Abstract

Laparoscopic Nissen fundoplication is currently the most commonly performed procedure for gastroesophageal reflux disease (GERD). In patients with inefficient esophageal motility, a partial fundoplication such as a Toupet 270-degree posterior fundoplication is often recommended. There is controversy as it relates to the necessity of this tailored approach to fundoplication. There is also debate when it comes to the suitability and even the superiority of a partial compared to a full fundoplication. There are numerous randomized controlled trials and meta-analyses of these trials to guide the debate. From the evidence, it would appear that a full and a partial fundoplication are associated with similar GERD-related outcomes and that a partial fundoplication is associated with fewer side effects such as bloating and dysphagia.

Keywords: Nissen, Toupet, GERD, fundoplication

Background

The Nissen 360-degree total fundoplication was first described in 1956 as a surgical treatment of gastroesophageal reflux disease (GERD).[1] The original technique as described by Nissen involved approximating the anterior and posterior walls of the gastric fundus around the distal 6 cm of the esophagus. The short gastric arteries were not divided. The fundoplication was performed around a ''large-bore intraesophageal stent''. Modifications have been added over time, mostly to avoid the side effects associated with too tight a wrap. Standard technical modifications employed by most surgeons include routine division of the short gastric arteries and creation of a shorter wrap to envelop only about 2cm of distal esophagus as recommended by DeMeester.[2] While the majority of surgeons continue to use an esophageal bougie to calibrate the wrap, this practice has been challenged recently. A prospective, blinded, randomized controlled trial conducted to examine the outcomes in Nissen fundoplications constructed either with or without a bougie was published in 2000.[3] Long-term postoperative dysphagia was present in 17% in the bougie group and 31% in the no bougie group ($P = .047$). Severe dysphagia occurred in 5% of patients in the bougie group and 14% in the no bougie group. This came at the price of a 1.2% esophageal perforation rate from bougie insertion. A review of this topic was published in 2012 and identified eight studies that were included in the analysis. Four retrospective studies showed no advantage from the use of a bougie and a 0.8% rate of esophageal perforation.[4] The Society of American Gastrointestinal and Endoscopic Surgeons published a guideline on the surgical treatment of GERD in 2010.[5] The evidence supporting the use of an esophageal bougie was rated as Grade C (low quality, one or more studies with severe limitations).

Various types of partial fundoplications have been proposed as an alternative to a total fundoplication, mostly in an effort to reduce the symptoms of gas bloat and dysphagia. An esophageal bougie is less commonly utilized in a partial fundoplication, which is a source of comfort when it comes to minimizing the risk of esophageal perforation for some surgeons. The most commonly performed partial fundoplications include the 180-degree anterior Dor[6] and the 270-degree posterior Toupet fundoplication.[7] In the United States, in comparison to Europe, a 360-degree fundoplication is the most common antireflux operation performed. European surgeons, however, favor a partial fundoplication operation.[8] The most common practice in the United States has been to perform a total fundoplication, except in cases where esophageal motility is impaired on manometry.[9] In these patients, a partial fundoplication (most often a Toupet 270-degree posterior fundoplication) is performed. The relationship between fundoplication outcomes and esophageal motility has been

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challenged, with two prospective trials failing to demonstrate a relationship between preoperative motility and postoperative rates of dysphagia.[10,11]

The laparoscopic approach to fundoplication for GERD was introduced in the early 1990s. When compared to the open technique, laparoscopic fundoplication is associated with decreased morbidity and length of stay.[12] Laparoscopic fundoplication remains very much of an art, with wide variations in technique and outcomes reported. There is even a lack of consensus on how to report outcomes following fundoplication and over what time interval. All of this variability makes it difficult to define the optimal technique for a given patient. Numerous prospective trials and meta-analyses of these trials comparing partial to full fundoplication have been published, with often discordant results. During fundoplication surgery, surgeons seek to create a competent antireflux valve that is tight enough to prevent gastric contents from passing back into the esophagus, but not so tight that bolus clearance and esophageal emptying or the ability to vent swallowed air are impaired. Too loose and patients may experience persistent or recurrent GERD symptoms. Too tight and a patient may suffer from dysphagia or bloating as well as difficulty belching. We will examine the comparative trials evaluating full versus partial fundoplication with these treatment goals in mind.

Dysphagia

Dysphagia is a common symptom before fundoplication in patients with GERD. As many as 65% of patients with moderate to severe GERD may suffer from dysphagia before any intervention.[13] Fundoplication works to correct GERD by recreating a high-pressure zone at the gastroesophageal junction (GEJ). It has also been demonstrated that the distensibility of the GEJ is dramatically decreased following fundoplication, and more so in the case of Nissen when compared to Toupet.[14] Many studies that comment on the rate of dysphagia following fundoplication fail to take into account the prevalence of this symptom before intervention. In fact, in many patients, preoperative dysphagia is resolved by fundoplication and correction of GERD.

Most comparative trials evaluating full to partial fundoplication favor partial fundoplication when reporting the rates of early postoperative dysphagia.[10,11,15] While some trials report that dysphagia rates equilibrate over time, others report that dysphagia persists more commonly for several years following full fundoplication. A recently reported prospective, randomized, controlled trial comparing Nissen to Toupet warrants a more detailed examination. Håkanson et al. randomized 456 patients to laparoscopic Nissen or Toupet fundoplication.[16] Follow-up was conducted to 5 years. Early postoperative dysphagia (6 weeks) was common in both groups. A small, but statistically significant difference in favor of partial fundoplication was noted in regard to dysphagia for liquids at 6 weeks and for solid food at 12 and 24 months.

A meta-analysis, including seven eligible randomized comparative trials of Nissen versus Toupet, revealed Nissen was associated with a significantly higher prevalence of postoperative dysphagia (relative risk [RR]: 1.61 [95 per cent confidence interval (95% CI): 1.06–2.44], $P = .02$) and dilatation for dysphagia (RR: 2.45 [1.06–5.68], $P = .04$).[17] Another more recently published meta-analysis of randomized controlled trials comparing Nissen to Toupet included nine trials where dysphagia was specifically reported.[18] Dysphagia was present in at any time postoperatively in 80/637 (12.6%) Nissen and 30/620 (4.8%) Toupet fundoplication patients (RR for dysphagia following Nissen 2.61, 95% CI [1.76–3.87], $P < .01$). In trials to report on the severity of dysphagia, 14/100 (14.00%) Nissen and 5/100 (5.00%) Toupet patients had severe dysphagia requiring endoscopic dilatation.[11] Yet another meta-analysis of randomized controlled trials comparing Nissen to Toupet examined early and late dysphagia.[19] Dysphagia during the early postoperative period (3–6 months) was significantly more common following laparoscopic Nissen fundoplication (odds ratio [OR] = 3.34, 95% CI: 2.22–5.02, $P < .00001$). Dysphagia during the later postoperative period (1–3 years) was significantly more common following Nissen fundoplication (OR = 2.81, 95% CI: 1.52–5.22, $P = .001$). It seems clear from the above references that Nissen is associated with a higher incidence of early postoperative dysphagia. This likely persists a year or more postoperation, and Nissen patients have a higher rate of severe dysphagia requiring endoscopic intervention when compared to Toupet patients.

Gas Bloat

The symptoms of gas-bloat syndrome include bloating, difficulty belching, postprandial fullness, flatulence, and epigastric pain. In the meta-analysis by Tian et al., five trials assessed the outcome of gas-related symptoms.[18] Gas-related symptoms were significantly more common following Nissen compared to Toupet (31.2% versus 23.9%, RR: 1.31, 95% CI [1.05–1.65], $P = .02$). Inability to belch occurred in 14.9% following Nissen and 8.4% after Toupet (RR: 1.79, 95% CI [1.06–3.03], $P = .03$). In the meta-analysis by Tan et al., three studies reported the occurrence of bloating during the later postoperative period (1–3 years).[19] In this analysis, there was not a statistically significant difference in bloating or diarrhea, when comparing Nissen to Toupet (OR = 1.90, 95% CI: 0.70–5.17, $P = .21$). Broeders et al. determined that gas-related symptoms were more common after laparoscopic Nissen (RR: 2.04, 95% CI: 1.19–3.49, $P = .009$).[17] Overall, these studies suggest that gas bloat and inability to belch are more common following Nissen compared to Toupet. This should be taken into consideration when selecting a procedure, especially when a patient suffers from significant bloating before fundoplication surgery. Care should be taken to ensure that a patient with severe bloating and GERD does not suffer from gastroparesis.

Reflux Control

The long-term effectiveness and ability of a less than total fundoplication to control GERD is the main topic of contention between the Nissen and the partial fundoplication proponents. A very influential study was published in 1997 describing the GERD-related outcomes to 22 months in 100 consecutive patients to undergo laparoscopic Toupet.[20] Forty-one of 74 patients (55%) underwent repeat pH testing at follow-up within the first 2 years postoperation. Ten of these patients were symptomatic and 31 were asymptomatic. Of the symptomatic patients, 90% had a positive pH study as

did 39% of the asymptomatic cohort (51% of the 41 patients to undergo this test). Based on these findings, the authors concluded that Toupet was an inadequate for GERD patients with normal esophageal motility.

The high rate of positive pH tests in the asymptomatic cohort suggests that questionnaires and other symptom-based assessments are likely not sensitive enough to detect recurrent GERD in many postfundoplication patients. Håkanson et al. conducted pH studies in their nearly 500-patient randomized controlled trial at 1 and 3 years following laparoscopic Nissen and Toupet and found no difference in esophageal acid exposure for patients in either treatment group.[16] The number of patients taking proton pump inhibitors (PPIs) postoperatively to control GERD symptoms was low, without differences between the groups. During the 5 years of follow-up, 5 patients in the partial and 4 in the total fundoplication groups required reoperation to control symptom relapse ($P = .75$). There was no difference in Gastrointestinal Symptom Rating Scale scores out to 5 years postoperation.

In the Broeders meta-analysis, there were no differences in the percentage of patients with recurrent pathological acid exposure (RR: 1.26, 95% CI: 0.82–1.95, $P = .29$) or esophagitis (RR: 1.20, 95% CI: 0.78–1.85, $P = .40$).[17] In the Tian meta-analysis, GERD symptom recurrence was reported in seven trials.[18] The overall GERD symptom recurrence rate was 22.7% following Nissen and 33% after Toupet (RR: 0.99, 95% CI [0.52–1.89], $P = .59$). Based on the currently available data, including pH study data to 3 years postoperation, it would appear that the Nissen and Toupet partial fundoplication are likely associated with a similar degree of reflux control.

Reoperation

For most patients, satisfaction rates with the symptomatic outcomes of fundoplication are high and results are durable.[21,22] Unfortunately, ~5–10% of fundoplication patients eventually undergo a revisional procedure secondary to new, persistent, or recurrent symptoms.[23] In the randomized controlled trial conducted by Håkanson et al., 2.2% of partial and 1.8% of total fundoplication patients required reoperation—primarily for recurrent GERD.[16] In the meta-analysis conducted by Broeders et al., the reoperation rate was higher in Nissen patients (RR: 2.19, 95% CI: 1.09–4.40, $P = .03$), mostly due to a higher prevalence of dysphagia.[17] In Tian et al.'s meta-analysis, the issue of reoperations was addressed in conjunction with the ongoing or recurrent need for anti-reflux medications.[18] A total of 14 of 209 patients after Nissen and 13 of 112 patients after Toupet required medication due to reflux after fundoplication, but this difference was not found to be statistically significant (Nissen 13.1% versus Toupet 11.6%, $P = .74$). Redo fundoplications for GERD recurrence were similar for complete and partial fundoplication (Nissen 4.7% versus Toupet 6.5%, $P = .77$); however, 11 patients in the Nissen group suffered from severe postoperative dysphagia and underwent reoperation. No included patients in the Toupet group required reoperation for severe dysphagia. Based on the available information, it would appear that patients undergoing laparoscopic Nissen fundoplication are at higher risk for potential reoperation, mostly related to severe dysphagia.

Satisfaction and Quality of Life

In Tan et al.'s meta-analysis, the issue of patient satisfaction following both Nissen and Toupet is addressed.[19] One mechanism of reporting satisfaction in the included trials was to use a Likert scale and report on the portion of patients indicating that they were either ''very satisfied'' or ''satisfied'' with the procedure. The second method involved the use of a Visick scale to measure the degree of patient satisfaction (Grade I, no symptoms; II, minimal symptoms, no lifestyle changes, and no need to visit a physician; III, significant symptoms requiring lifestyle changes and the help of a physician; and IV, debilitating symptoms or need for additional surgery). For the meta-analysis, Visick scale grade I/II was defined as very satisfied/satisfied. The meta-analysis revealed no statistically significant difference in satisfaction between the two groups (OR = 0.98, 95% CI: 0.61–1.56, $P = .92$). The Broeders et al.'s meta-analysis found similar rates of satisfaction.[17] The Tian meta-analysis reached the same conclusion with regard to satisfaction, but also commented on quality of life as assessed by the validated Gastrointestinal Quality of Life Index (GIQLI) questionnaire.[18] The mean GIQLI score was 96.3 ± 16.6 for Nissen and 93.7 ± 21.2 for Toupet before surgery. Postoperatively, GIQLI scores improved and to a similar degree for each procedure at 119.8 ± 15.71 for Nissen versus 115.2 ± 15.96 for Toupet. The mean GIQLI score for a healthy individual is 122.6 ± 8.5.

Comparisons with Other Types of Partial Fundoplication

The Dor anterior 180-degree fundoplication is the partial fundoplication of choice for some surgeons. There are three published meta-analysis of randomized controlled trials to compare Nissen to Dor. In a meta-analysis conducted by Du et al., a total of 266 Nissen and 265 Dor fundoplication patients were identified and included.[24] Follow-up ranged from 5 to 120 months for the included studies. When comparing Nissen to Dor, there were no significant differences with regard to patient satisfaction, quality of life, postoperative heartburn, PPI use, postoperative DeMeester scores, postoperative gas bloating, or inability to belch. Laparoscopic Nissen was associated with a higher prevalence of postoperative dysphagia, while laparoscopic Dor fundoplication was followed by more reoperation for recurrent reflux symptoms. The authors of this particular meta-analysis conclude that ''180-degree laparoscopic anterior fundoplication can reduce the incidence of postoperative dysphagia, while this is offset by a higher risk of reoperation for recurrent symptoms.'' An earlier meta-analysis comparing Dor 180-degree anterior fundoplication to Nissen included five randomized controlled trials (four were the same trials as analyzed in Du et al.) and determined that at 1 and 5 years, dysphagia and gas-related symptoms are lower after 180-degree anterior fundoplication than after Nissen, and esophageal acid exposure and esophagitis are similar, with no differences in heartburn scores, patient satisfaction, dilatations, and reoperation rate.[25]

Conclusions

Laparoscopic total and partial fundoplication are both procedures that lead to resolution of GERD-related symptoms, improved quality of life, and high degrees of patient satisfaction.

Numerous randomized comparative trials and subsequent meta-analysis of these trials have been published in the last 10 or so years. Most of these favor a partial fundoplication as an equally effective GERD intervention associated with a lower rate of adverse side effects, including gas bloat, dysphagia, and inability to belch. A population-based trend analysis was published in 2010 examining the choice of Nissen versus Toupet fundoplications during a 10-year period between 1995 and 2004, using the Swiss Association for Laparoscopic and Thoracoscopic Surgery database.[26] Interestingly, the proportion of laparoscopic Nissen versus Toupet fundoplications remained stable over time, ''indicating that literature reports of the advantages of one procedure over the other had minimal influence on surgeons' choice of technique.'' A more recent analysis has not been conducted, but anecdotally, it appears as if the Toupet is making a resurgence as a primary antireflux procedure in the United States regardless of esophageal motility status based, in part, on the data described in this article.

Disclosure Statement

Dr. Gould has served as a consultant for Torax/Ethicon and Gore. Dr. Higgins is a preceptor/consultant for Intuitive and a speaker for Gore.

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