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Comparison of Laparoscopic 270° Posterior Partial Fundoplication vs Total Fundoplication for the Treatment of Gastroesophageal Reflux Disease
A Randomized Clinical Trial

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IMPORTANCE Restoration of the esophagogastric junction competence is critical for effective long-term treatment of gastroesophageal reflux disease. Surgical repair results in such restoration, but mechanical adverse effects seem unavoidable. Minimizing these adverse effects without jeopardizing reflux control is warranted.

OBJECTIVE To determine whether partial fundoplication (PF) or total fundoplication (TF) is superior in laparoscopic antireflux surgery.

DESIGN, SETTING, AND PARTICIPANTS In this double-blind, randomized clinical trial of 1171 patients scheduled for laparoscopic antireflux surgery at a single university-affiliated center between November 19, 2001, and January 24, 2006, 456 patients were randomized and followed up for 5 years. Data were collected from November 2001 to April 2012, and data were analyzed from April 2012 to September 2018.

INTERVENTIONS A 270° posterior PF or a 360° Nissen TF.

MAIN OUTCOMES AND MEASURES Esophageal acid exposure at 3 years after surgery.

RESULT Of the 456 randomized patients, 268 (58.8%) were male, and the mean (SD) age was 49.0 (11.7) years. A total of 229 patients were randomized to PF, and 227 patients were randomized to TF. At 3 years postoperatively, the median (interquartile range) esophageal acid exposure was reduced from 14.6% (9.8-21.9) to 1.8% (0.7-4.4) after PF and from 16.0% (10.4-22.7) to 2.5% (0.8-6.8) after TF ($P = .31$). Likewise, reflux symptoms were equally and effectively controlled. Early postoperative dysphagia (6 weeks) was common in both groups but then decreased toward normality. A small but statistically significant difference in favor of PF was noted in the mean (SD) scoring of dysphagia for liquids at 6 weeks (PF, 1.6 [0.9]; TF, 1.9 [1.3]; $P = .01$) and for solid food at 12 months (PF, 1.3 [1.0]; TF, 1.9 [1.4]; $P < .001$) and 24 months (PF, 1.3 [0.9]; TF, 1.7 [1.2]; $P = .001$). Quality of life was reduced before surgery but increased to normal values after surgery and remained so over 5-year follow-up, with no difference between the groups.

CONCLUSIONS AND RELEVANCE The results from this randomized clinical trial suggest that although PF and TF could be recommended for treatment of gastroesophageal reflux disease, PF might be superior by inducing less dysphagia.

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Invited Commentary
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Supplemental content

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The risk of developing gastroesophageal reflux disease (GERD) increases with the severity of the anatomical changes and dysfunctions of the barrier against reflux of gastric contents through the esophagogastric junction (EGJ).[1-3] One therapeutic option for patients with GERD is daily intake of proton pump inhibitors (PPIs) to control symptoms and prevent the esophageal mucosa from reflux-induced damage. As an alternative, there is one well-established therapeutic option, ie, laparoscopic antireflux surgery. Laparoscopic antireflux surgery has been reported to be superior to PPIs in terms of subjective as well as objective efficacy.[4-8] In addition to the potential advantages of surgical treatment of GERD are some serious long-term adverse effects of PPI therapy.[9,10] The obvious advantage of surgical repair is that it restores the anatomical and functional deficiencies in the EGJ. However, the problem with laparoscopic antireflux surgery is that it is generally considered too invasive and is associated with some unavoidable mechanical adverse effects, such as dysphagia and bloating.[11]

The most commonly performed laparoscopic antireflux surgery procedure is the total fundoplication (TF), as described by Nissen.[12] With the objective to minimize the mechanical adverse effects of surgical antireflux repair,[12,13] alternative surgical strategies have been explored, eg, partial wrap fundoplication (PF). In the 1960s, Toupet[14] designed his 180° posterior repair, and thereafter an anterior 180° wrap was launched. In a series of randomized clinical trials,[15,16] it has been reported that PF is followed by fewer mechanical adverse effects, in the form of less flatulence and bloating, than after TF. However, it is often argued that TF is superior to PF in terms of gastroesophageal reflux control, durability of wrap function, number of reherniations, and recurrence rate of GERD.[17-19] This prompted an attempt to further modify PF to encircle 270° of the esophageal circumference. The objective was to maintain the mechanical advantages of the partial wrap without compromising the efficacy to control duodenogastroesophageal reflux. Despite a significant number of studies carried out during recent decades to address these issues, many of the protocols were burdened with methodological weaknesses,[19-21] such as lack of blinding in all but 2 protocols, small sample sizes, and lack of follow-up extending to and beyond 5 years. Therefore, the objective of the present study was to evaluate the potential advantages of a 270° posterior PF compared with a traditional Nissen TF by performing a double-blind, randomized clinical trial incorporating more than 400 patients with follow-up for a minimum of 5 years.

Key Points

Question Is partial or total fundoplication superior in laparoscopic antireflux surgery?

Finding In this randomized clinical trial including 456 patients, partial and total fundoplication were equally effective in reducing esophageal acid exposure after 3 years, while mechanical adverse effects were more common after total fundoplication.

Meaning Although partial and total fundoplication could be recommended for treatment of gastroesophageal reflux, partial fundoplication might be superior by inducing less dysphagia.

Methods

Inclusion and Exclusion Criteria

Patients aged 18 to 75 years with typical GERD symptoms, dominated by heartburn and acid regurgitation, were eligible for inclusion. The diagnosis of GERD was verified by increased esophageal acid exposure on 24-hour ambulatory pH monitoring and/or a classification of esophagitis of at least Los Angeles (LA) grade B.[22] Excluded from enrollment were those who had previous antireflux surgery or other major upper abdominal surgical procedures, patients with type II to IV herniation unless symptoms were dominated by acid regurgitation, and those with specific motor disorders of the esophagus, such as achalasia, distal esophageal spasm, and jackhammer esophagus. Patients who fulfilled the inclusion criteria and were considered appropriate for antireflux surgery were invited to participate in the study.

The study was carried out in accordance with the Declaration of Helsinki, and the Regional Ethics Committee of Stockholm approved the study protocol (ClinicalTrials.gov identifier, NCT03659487). An English-language translation of the study protocol can be found in Supplement 1, and the original study protocol can be found in Supplement 2. Patients gave their written informed consent to participate in the trial after they had been given oral and written information about the purpose and nature of the study. Patients were also informed that to avoid bias, they would not be informed about their group allocation until the end of follow-up.

Preoperative Workup

Preoperative investigations included upper gastrointestinal tract endoscopy, 24-hour ambulatory pH monitoring, and standard esophageal manometry. For assessment of quality of life (QoL), the 36-Item Short-Form Health Survey (SF-36) and the disease-specific Gastrointestinal Symptom Rating Scale (GSRS)[23] were used. Dysphagia was scored for both solid food and liquid items.[24] Follow-up was performed at 6 weeks (QoL questionnaire), 1 year (QoL questionnaire, endoscopy, pH monitoring, and manometry), 2 years (QoL questionnaire), 3 years (QoL questionnaire, endoscopy, pH monitoring, and manometry), and 5 years (QoL questionnaire).

Randomization

Patients were randomized (1:1 ratio) and stratified according to sex, body mass index, and presence of Barrett esophagus. A computer-generated randomization list in blocks of 8 was used. The randomization process was performed after the general anesthesia had been induced by opening a sealed envelope specifying the group assignment. The subsequent operation report, which contained information on the specific type of fundoplication completed, was not included in the electronic medical record but printed out and kept in sealed envelopes. These were filed in a locked archive to maintain blinding of the specific procedure undertaken for patients, staff, and assessors, and the blinding was not broken during the follow-up, provided that no emergencies so required. During 36

months of follow-up, patients and assessors remained blinded for the patient's group affiliation.

Endoscopy

Upper gastrointestinal tract endoscopy was performed by use of the Evis Exera II videoendoscope (Olympus). Esophagitis was graded according to the LA classification.[22] Distances in centimeters from the incisors to the squamocolumnar junction, EGJ, and the hiatal diaphragmatic indentation were measured. Hiatal hernia was defined as a distance of 2 centimeters or more from the EGJ (top of gastric folds) to the hiatal diaphragmatic indentation, and the length was documented. The gastroesophageal flap valve was graded according to the classification of Hill et al.[25] However, the classification was modified in that the 2 lowest grades (I and II) of the original gastroesophageal flap valve classification were grouped together (I-II). The length of any columnar-lined esophagus was measured and graded according to the Prague C & M classification.[26]

Manometry

Standard esophageal manometry was executed with an 8-channel water perfused catheter system (Medtronic). Esophageal peristalsis and lower esophageal sphincter characteristics were analyzed to exclude specific esophageal motor abnormalities.

24-Hour Esophageal pH Monitoring

Twenty-four-hour esophageal pH monitoring was performed by use of a Slim-line dual probe catheter system (single use, 2 sensors, 15-cm spacing, 1.8-mm diameter; Medtronic). The esophageal pH probe was positioned 5 centimeters above the upper border of the lower esophageal sphincter. Percentage of the total recording time with pH less than 4 was assessed.

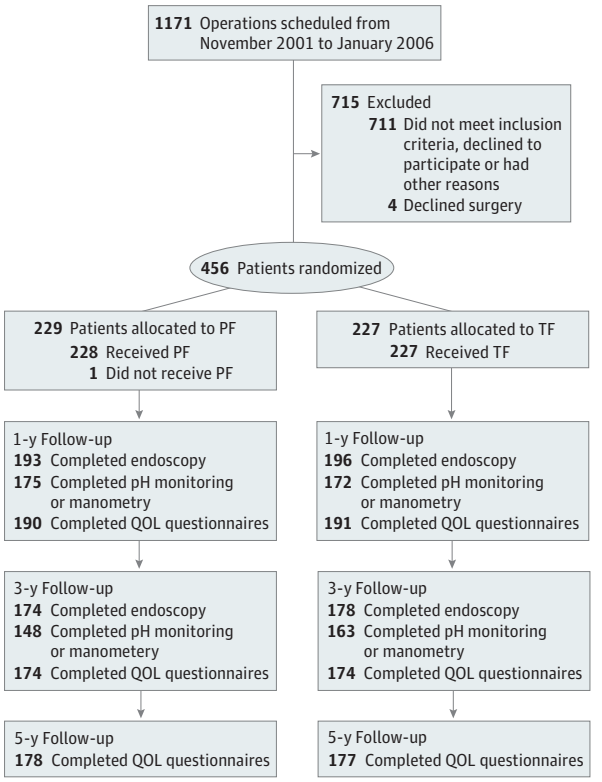
QoL Assessment

For SF-36, data are presented as physical and mental component scores. The GSRS[23] contains 5 dimensions of abdominal symptoms (ie, reflux, abdominal pain, indigestion, obstipation, and diarrhea), and the mean item scores of the domains were used. In addition, a questionnaire was used to describe the frequency of solid and liquid dysphagia, using a 4-graded scale.[24]

Surgical Procedure

A 5-trocar technique was used with the patient in the reversed Trendelenburg position with the surgeon standing between the patient's legs. For anatomic preparation and dissection, the Ultracision harmonic scalpel (Ethicon Endo-Surgery) was used. The lesser omentum and peritoneal lining over the hiatal region was incised above the hepatic branches of the anterior vagal nerve, and the left and right crus were exposed, including their confluence. The upper part of the gastric fundus was routinely mobilized by division of individual short gastric vessels. The distal esophagus was mobilized over a length of at least 5 centimeters to ensure an intra-abdominal positioning of the EGJ and the wrap. Cases of a wide hiatal orifice were closed by a posterior crural repair with interrupted 2-0 silk sutures, with the remaining opening allowing a 1-cm Babcock forceps to pass the esophagus on either side without tension. For PF, the wrap was pulled dorsally around the distal part of the esophagus and EGJ, which was encircled approximately 270°. First, the wrap was anchored dorsally to the left crus with 3 silk sutures and then to the right crus with another 3 sutures. Finally, the wrap was completed with 3-4 sutures between the edges of the wrap and the right and left side of the esophageal wall. For TF, the right and left part of the wrap was brought together and sutured with 3 interrupted 2-0 silk sutures from the EGJ and cranially to attain a length between the top and bottom sutures of at the most 2 centimeters. All wrap sutures included the esophageal muscle wall. No bougies were used in the esophagus during any of the procedures. Each procedure was either supervised or performed by 2 surgeons (B.S.H. and A.T.).

Figure 1. CONSORT Flow Diagram of Recruitment and Follow-up



PF indicates 270° partial fundoplication; QoL, quality of life; TF, total fundoplication.

Outcomes, Sample Size, and Statistics

The primary outcome variable was esophageal acid exposure. To detect a difference of 10% in total esophageal acid exposure at 3 years after surgery with a 95% probability and power of 80%, an individual group size of 228 patients was required.[4,5] Secondary outcomes were QoL, dysphagia scoring, reflux-related and reflux-unrelated abdominal complaints, PPI use, and recurrence rates. Values are given as medians and interquartile ranges (IQRs) or percentiles unless otherwise stated. An intention-to-treat analysis was applied. Comparisons of parametric data were calculated by use of *t* test, whereas nonparametric data were assessed with Mann-Whitney *U* test, Wilcoxon matched pairs test, χ^2 test, or Fisher exact test, when

Table 1. Baseline Characteristics

Characteristic	No. (%) PF (n = 229)	TF (n = 227)	*P* Value
Sex			
Male	134 (58.5)	134 (59.0)	.96
Female	95 (41.5)	93 (41.0)	
Age, mean (SD), y	47.9 (11.7)	50.2 (11.7)	.04
BMI, mean (SD)[a]	27.8 (3.8)	27.4 (3.9)	.30
Hiatal hernia			
Yes	213 (94.2)	208 (92.0)	.35
No	13 (5.8)	18 (8.0)	
Esophagitis			
Yes	51 (22.6)	54 (23.9)	.74
No	175 (77.4)	172 (76.1)	
Barrett esophagus			
Yes	47 (20.8)	40 (17.7)	.40
No	179 (79.2)	186 (82.3)	
Maximal length of Barrett segment, mean (SD), cm	2.7 (1.8)	2.5 (2.1)	.70
Total acid exposure, median (IQR), % of time pH <4	14.6 (9.8-21.9)	16.0 (10.4-22.7)	.31

Abbreviations: BMI, body mass index; IQR, interquartile range; PF, partial fundoplication; TF, total fundoplication.

[a] Calculated as weight in kilograms divided by height in meters squared.

appropriate. Shapiro-Wilks test was used for assessment of normal distribution. All *P* values were 2-tailed, and a *P* value less than .05 was considered statistically significant. Recurrence was defined as the return of clinically significant GERD symptoms and recrudescence of a clinical situation, as described in the inclusion criteria, to opt for redo antireflux therapy.

Results

Preoperative Data

Between November 19, 2001, and January 24, 2006, 460 of 1171 eligible patients consented to participate in the study (**Figure 1**). Of these, 4 patients later declined surgery, leaving 456 patients (38.9%) for randomization. A total of 229 patients were randomized to 270° posterior PF, and 227 were randomized to TF. One patient allocated to PF eventually underwent TF, as decided by the surgeon during the procedure. There were no significant differences in demographic baseline characteristics between the groups except for a higher age in the TF group (**Table 1**). The preoperative prevalence of hiatal hernia as well as occurrence of esophagitis and Barrett esophagus did not differ between groups. The median (IQR) total esophageal acid exposure was 14.6% (9.8-21.9) in the PF group and 16.0% (10.4-22.7) in the TF group (*P* = .31). There was a similar distribution of hiatal hernia grading according to the modified Hill classification except for more patients with gastroesophageal flap valve grade I-II in the PF group (eTable 1 in Supplement 3). Most patients in both groups were taking PPIs on a regular basis for relief of GERD symptoms (eTable 2 in Supplement 3). There were no differences between groups regarding preoperative global QoL on the SF-36 (eTable 3 in Supplement 3), gastrointestinal symptoms on the GSRS (**Table 2**), or dysphagia scoring (**Table 3**).

Intraoperative and Postoperative Data

Two patients were converted to open surgery, both in the TF group. As expected, mean (SD) operating time was longer in those having a PF vs a TF (85 [66] minutes vs 72 [26] minutes; *P* < .001), whereas perioperative blood loss was minimal and without differences between groups (median [IQR], 10 [0-20] mL for both PF and TF). No differences were noted in intraoperative complications, such as pneumothorax, intestinal perforation, or parenchymal-splenic injuries (11 complications in the PF group and 10 in the TF group). The postoperative courses were uneventful in both groups, with the same 30-day postoperative complication rates and number of reoperations (1 in each group). No in-hospital mortality was recorded. The median length of hospital stay was 1 day in both groups, with the same median (IQR) duration of postoperative sick leave of 15 (14-21) days in the PF group and 14 (14-21) days in the TF group.

Esophageal acid exposure was similarly reduced by both types of fundoplications at 12 and 36 months postoperatively (**Figure 2**). When the total number of patients with Barrett esophagus was compared with those without, no difference was found in terms of changes in esophageal acid exposure (data not shown). Grading of the flap valve according to the modified Hill classification was similarly improved in both groups when assessed endoscopically at 1 and 3 years after surgery (eTable 1 in Supplement 3). The number of patients taking PPIs postoperatively to control GERD symptoms was low, without differences between the groups (eTable 2 in Supplement 3). During the 5 years of follow-up, 5 patients in the PF group and 4 patients in the TF group required a reoperation to control relapse of GERD (*P* = .75).

The mean dysphagia score for solid and liquid food items was relatively high in both groups preoperatively and even slightly increased at 6 weeks after surgery, except for liquids in the PF group (Table 3). Compared with preoperatively, dysphagia scores for solid food as well as liquids were reduced in both groups during the remaining follow-up. However, dysphagia scores for solids were significantly higher in the TF group at 12 and 24 months postoperatively (Table 3).

Table 2. Gastrointestinal Symptom Rating Scale (GSRS) Scores from Baseline to 5-Year Follow-up[a]

Measure	GSRS Score, Mean (SD)		P Value
	PF (n = 229)	TF (n = 227)	
Baseline			
Reflux	4.5 (1.5)	4.5 (1.4)	.88
Abdominal pain	3.8 (1.2)	3.7 (1.2)	.28
Indigestion	3.8 (1.3)	3.7 (1.4)	.52
Diarrhea	2.4 (1.4)	2.3 (1.4)	.62
Obstipation	2.2 (1.2)	2.4 (1.4)	.11
6-wk Follow-up			
Reflux	1.3 (0.6)[b]	1.9 (1.2)[b]	.58
Abdominal pain	2.5 (1.0)[b]	2.4 (1.0)[b]	.48
Indigestion	3.7 (1.1)[b]	3.4 (1.1)[b]	.007
Diarrhea	2.0 (1.2)[b]	1.9 (1.2)[b]	.38
Obstipation	2.2 (1.2)	2.1 (1.2)[b]	.61
1-y Follow-up			
Reflux	1.5 (0.8)[b]	1.2 (0.7)[b]	.48
Abdominal pain	2.2 (1.1)[b]	2.1 (1.1)[b]	.90
Indigestion	3.2 (1.2)[b]	3.3 (1.2)[b]	.81
Diarrhea	2.2 (1.4)	2.1 (1.3)	.53
Obstipation	1.9 (1.1)[b]	2.2 (1.3)	.03
2-y Follow-up			
Reflux	1.5 (1.0)[b]	1.5 (0.9)[b]	.56
Abdominal pain	2.1 (1.2)[b]	2.1 (1.1)[b]	.85
Indigestion	3.1 (1.2)[b]	3.3 (1.2)[b]	.19
Diarrhea	2.2 (1.4)	2.2 (1.4)	.88
Obstipation	1.9 (1.1)[b]	2.2 (1.3)	.04
3-y Follow-up			
Reflux	1.5 (0.9)[b]	1.5 (0.9)[b]	.68
Abdominal pain	2.2 (1.1)[b]	2.2 (1.1)[b]	.96
Indigestion	3.1 (1.3)[b]	3.1 (1.2)[b]	>.99
Diarrhea	2.2 (1.3)	2.0 (1.3)	.21
Obstipation	2.0 (1.1)	2.0 (1.3)[b]	.79
5-y Follow-up			
Reflux	0.8 (0.3)[b]	0.5 (0.3)[b]	.61
Abdominal pain	0.9 (0.5)[b]	0.9 (0.5)[b]	.79
Indigestion	1.7 (0.7)[b]	1.8 (0.7)[b]	.60
Diarrhea	1.0 (0.9)[b]	0.9 (0.6)[b]	.73
Obstipation	2.1 (1.3)	2.1 (1.2)	.94

Abbreviations: PF, partial fundoplication; TF, total fundoplication.

[a] Scores range from 1 to 7, where 1 indicates no discomfort at all and 7 indicates very severe discomfort.

[b] $P < .05$ vs baseline.

Table 3. Dysphagia Mean (SD) Scores for Solid Food and Liquid Items[a]

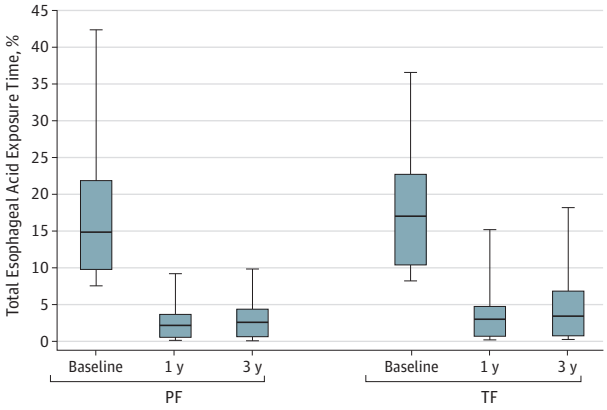
Follow-up Time	Solid Food			Liquid		
	PF (n = 229)	TF (n = 227)	P Value	PF (n = 229)	TF (n = 227)	P Value
Baseline	2.3 (1.6)	2.1 (1.4)	.57	1.8 (1.3)	1.6 (1.2)	.38
6-wk Follow-up	2.7 (1.5)[b]	2.9 (1.5)[b]	.07	1.6 (0.9)	1.9 (1.3)[b]	.01
1-y Follow-up	1.3 (1.0)[b]	1.9 (1.4)[b]	<.001	1.2 (0.8)[b]	1.3 (0.8)[b]	.31
2-y Follow-up	1.3 (0.9)[b]	1.7 (1.2)[b]	.001	1.3 (0.9)[b]	1.3 (0.8)[b]	.30
3-y Follow-up	1.5 (1.1)[b]	1.7 (1.2)[b]	.20	1.3 (0.9)[b]	1.2 (1.7)[b]	.80

[a] Scores range from 0 to 3, where 0 indicates no episodes and 3 indicates more than 3 episodes per day.

[b] $P < .001$ vs baseline.

Physical and mental aspects of global QoL assessment were significantly increased in both groups, as estimated by the physical and mental component score dimensions of the SF-36 instrument during the entire follow-up (eTable 3 in Supplement 3). Similarly, for GSRS, there were immediate and marked improvements of scores in the reflux, abdominal pain, and indigestion domains, which were maintained over the 5 years of follow-up without differences between the study groups, except for indigestion at 6 weeks postoperatively slightly in favor of the TF group (Table 2). For the diarrhea and obstipation domains, there were small but statistically significant changes throughout the study period postoperatively, presumably without clinical relevance.

Figure 2. Esophageal Acid Exposure



Total esophageal acid exposure time before and at various time points after either a 270° partial fundoplication (PF) (n = 229) or a 360° total fundoplication (TF) (n = 227). The line within the box indicates the median, the box indicates the interquartile range, and the error bars indicate the 10th and 90th percentiles.

Discussion

The main finding of this trial was that we were unable to demonstrate any differences between a laparoscopic 270° posterior PF and TF in controlling esophageal acid exposure and GERD symptoms when assessed over a 5-year period. As expected, at 6 weeks postoperatively, patients complained of some dysphagia, which subsided toward normality over time. Except for statistically significant higher dysphagia scores for solid food items in those allocated to TF, there were no differences between the 2 groups regarding any of the other study variables postoperatively, including endoscopic assessment of the gastroesophageal flap valve.[26]

Dysphagia after antireflux surgery remains a concern. One important mechanism behind this might be the overcorrection of the basal tone of the lower esophageal sphincter elicited by wrapping the top of the fundus around the EGJ. In this context, the preoperative use of an intraesophageal bougie may help to control the problem.[27] Another contributing mechanism behind the initial symptoms suggestive of impaired bolus transfer is likely owing to early postoperative changes (eg, edema and scarring), most of which are reversible. An important observation from this and other studies is that clinically significant chronic dysphagia seem not to be a major clinical issue after any kind of antireflux surgery carried out in expert centers.[5,28-33] On the other hand, the findings in the present trial suggest that PF might have the advantage of fewer swallowing complaints. This is also in corroboration with results from meta-analyses incorporating studies of smaller sizes.[16,19,21]

Data from previous studies suggest that the level of reflux control after posterior PF (measured by 24-hour ambulatory pH monitoring) is somewhat inferior compared with what is achieved by TF.[16,34] In the present study, we were not able to confirm this. If anything, esophageal acid exposure was in fact numerically lower at 3 years after PF compared with TF with a normalization (acid exposure time less than 4%) in 75% of patients in the former group. One possible explanation might be that in our study, the fundic wrap encircled as much as 270° of the esophagus, which is more than in most previous studies. It shall be recalled that even a 180° posterior PF gives a level of acid reflux control, which can, at the very best, be achieved by the administration of optimal dosing of PPIs.[18,35,36]

A Swedish study[37,38] reported deterioration of the results of antireflux repair after the introduction of the laparoscopic technique with not only a high failure rate owing to recurrent reflux[39] but also a substantial number of patients complaining of mechanical adverse effects of the operation. The 180° partial wrap (being either posterior or anterior) is followed by fewer mechanical adverse effects in the early postoperative years compared with TF.[19,21] However, it seems as if these differences subside over time,[40] and their clinical relevance, in particular over a longer time, can therefore be questioned. Nevertheless, our results comparing a posterior PF encircling 270° of the distal esophagus with a laparoscopic Nissen TF, covering a follow-up period of 5 years, revealed that differences remained at 2 years in some mechanical adverse effects (ie, dysphagia scoring for solid food items) in favor of the former procedure. One factor that might have contributed to this difference is the lack of use of a bougie, which might reduce the risk of dysphagia after TF by preventing the creation of a wrap that's too tight. On the other hand, the numerically higher esophageal acid exposure values at 12 and 36 months after surgery in the TF group compared with the PF group makes it less likely that the wrap would have been too tight per se. Interestingly, we were unable to detect any major differences between our study groups in the abdominal pain, indigestion, and diarrhea GSRS domains, suggesting that general postfundoplication complaints are of minor clinical relevance.

Limitations

Our study had limitations. No bougie was used intraoperatively, which might have made comparisons with previous studies difficult. Additionally, a large portion of eligible patients were not included, and therefore, the total time for inclusion was relatively long.

Conclusions

This double-blind randomized clinical trial demonstrates no difference between a 270° posterior PF and a Nissen TF in terms of acid reflux control, GERD symptom control, and improvement of QoL. However, the finding of a statistically significant difference in dysphagia scorings in favor of PF after 1 and 2 years suggests that PF can be recommended before the more commonly performed TF for surgical treatment of GERD.

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for the integrity of the data and the accuracy of the data analysis.
Study concept and design: Håkanson, Thorell.
Acquisition, analysis, or interpretation of data: All authors.
Drafting of the manuscript: Håkanson, Bylund.
Critical revision of the manuscript for important intellectual content: All authors.
Statistical analysis: Håkanson, Bylund, Thorell.
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Invited Commentary

Similar Effectiveness of Total and 270° Posterior Fundoplication for the Treatment of Gastroesophageal Reflux Disease

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In this issue of *JAMA Surgery*, Håkanson and colleagues[1] report the results of a randomized, double-blind study comparing the laparoscopic total fundoplication (360°) with a 270° posterior partial fundoplication. The main outcome measure was acid exposure at 3 years after surgery. Their results show that the 2 procedures were similar with respect to controlling abnormal reflux, but the partial fundoplication was associated with a lower degree of dysphagia after 2 years. This study[1] confirms the results of a randomized clinical trial[2] of open total and posterior partial fundoplication with 2 decades of follow-up, which showed that the 2 procedures result in similar control of reflux. The results of the study by Håkanson et al[1] are also supported by randomized trials and meta-analysis.[3,4]

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The debate about partial vs total fundoplication has been around for many years. In the 1990s, some groups suggested the use of a tailored approach to decrease the problem of a high incidence of postoperative dysphagia after laparoscopic total fundoplication; in this approach, a total fundoplication was performed in patients with normal esophageal peristalsis, but a partial posterior fundoplication was used when abnormal peristalsis was present.[5] The initial results confirmed that a partial fundoplication provided the same symptomatic relief and control of reflux as a total fundoplication but with a lower incidence of postoperative dysphagia.[5] However, this approach was slowly abandoned as many single-center, retrospective studies in the United States showed that while the short-term results were similar, the partial fundoplication had a recurrence rate between 40% and 50% at a longer follow-up, particularly when esophageal dysmotility was present.[6,7] In addition, a large study from the University of California, San Francisco showed that a partial (240°) fundoplication was less effective than a total fundoplication in controlling reflux, while the incidence of postoperative dysphagia was similar, even in patients with weak peristalsis.[7]

How can we reconcile the results of these studies? Regarding reflux control, it can be assumed that a 270° posterior partial fundoplication is more effective than the 180° or 240° fundoplication used in other studies.[1] Longer follow-up will determine if these findings will be maintained. As far as the lower degree of dysphagia seen after partial fundoplication, it is important to note that Håkanson et al[1] did not use a bougie, a step that has been shown to significantly decrease the incidence of postoperative dysphagia.[8] In addition, the difference in the incidence of dysphagia after the 2 procedures was quite small and of short duration.

Overall, this is an important study[1] that confirms the efficacy of a 270° posterior partial fundoplication in the treatment of gastroesophageal reflux disease, suggesting that both the total and the partial fundoplication have a place in the armamentarium of the surgeons who treat patients with gastroesophageal reflux disease.

ARTICLE INFORMATION

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