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Comparison of results from a randomized trial 1 year after laparoscopic Nissen and Toupet fundoplications

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Abstract
Background The fundoplication of choice for the surgical treatment of gastroesophageal reflux disease (GERD) still is debated. Multichannel intraluminal impedance monitoring (MII) has not been used to compare objective data, and comparative subjective data on laparoscopic Nissen and Toupet fundoplications are scarce.
Methods This study randomly allocated 125 patients with documented chronic GERD to either laparoscopic floppy Nissen fundoplication (LNF; $n = 62$) or laparoscopic Toupet fundoplication (LTF; $n = 63$). The Gastrointestinal Quality of Life Index (GIQLI), symptom grading, esophageal manometry, and MII data were documented preoperatively and 1 year after surgery. The pre- and postprocedure data were compared. Statistical significance was set at a p value lower than 0.01 (NCT01321294).
Results Both procedures resulted in significantly improved GIQLI and GERD symptoms. Preoperative dysphagia improved in both groups, but the improvement reached significance only in the LTF group. The ability to belch was shown to be significantly more decreased after LNF than after LTF. Gas-bloat and "atypical" extraesophageal symptoms also were decreased after surgery ($p < 0.01$). However, bowel symptoms were virtually unchanged in both groups. Both procedures resulted in significantly improved lower esophageal sphincter pressures. The improvement was greater in the LNF group than in the LTF group ($p < 0.01$). The DeMeester score and the numbers of total, acid, proximal, upright, and recumbent reflux episodes decreased in both groups after surgery ($p < 0.01$). No significant difference between the procedures in terms of MII data was found. Six patients (4.8 %) had to undergo reoperation because of intrathoracic slipping of the wrap. All the patients had undergone LNF.
Conclusions Both procedures proved to be equally effective in improving quality of life and GERD symptoms. However, the reoperation and dysphagia rates were lower and the ability to belch was higher after LTF than after LNF.

Keywords GERD quality of life · Laparoscopic antireflux surgery · Nissen · Toupet

Since the first description of laparoscopic Toupet fundoplication by Cuschieri [1] in 1993, findings have shown the procedure to be safe and durable. The traditional indication for partial fundoplication has been a esophageal motility disorder.

Many centers have used the so-called "tailored approach" for years. Clinicians have assumed that by breaking the 360° ring of the Nissen fundoplication, the repair becomes less aggressive and offers less resistance in patients with reduced esophageal motility, thus lowering the dysphagia rate. In the meantime, studies have proved that both Nissen and Toupet can be applied independently of esophageal motility and that a "floppy" Nissen can be tolerated by patients with poor esophageal motility [2, 3].

Because the "tailored approach" is no longer in vogue, an ongoing discussion has focused on determining which

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antireflux procedure promises the most successful surgical outcome and should be performed in primary surgery. The potential benefits of antireflux surgery must be weighed against potential side effects.

New technologies such as multichannel intraluminal impedance-pH monitoring could provide objective data that assist in finding the optimal procedure for patients with gastroesophageal reflux disease (GERD). In addition to objective data, subjective data such as symptom resolution, duration of convalescence, patient satisfaction, well-being, and quality of life (QoL) are at least as important [4]. These subjective outcomes are particularly relevant in laparoscopic antireflux surgery for GERD because a main goal of the procedure is to improve GERD symptoms and QoL and provide subjective satisfaction [5].

Randomized controlled trials comparing Nissen and Toupet fundoplication in terms of surgery side effects, symptom control, QoL, and objective data using multichannel intraluminal impedance-pH monitoring (MII) are scarce. Comparative mid- or long-term MII data do not exist.

This study was designed to compare subjective data, objective outcomes, and surgical side effects of Nissen and Toupet fundoplication performed in a single institution by two surgeons.

Materials and methods

Between October 2007 and October 2010, 125 consecutive chronic GERD patients were randomly assigned to undergo either laparoscopic floppy Nissen fundoplication (LNF group; $n = 62$) or laparoscopic Toupet fundoplication (LTF group; $n = 63$). The primary outcome measures were improvement of symptom scores and QoL. The secondary end points were esophageal acid exposure characteristics (shown by 24-h esophageal impedance-pH monitoring) and lower esophageal sphincter pressure.

Study design

Adult patients referred to the Surgical Department of the General Public Hospital Zell am See, Zell am See, Austria, from October 2007 to October 2010 with the clinical diagnosis of GERD were considered for inclusion in the study. The participants underwent a detailed evaluation of GERD-related symptoms and QoL, esophagogastroduodenoscopy and barium swallow examination, multichannel intraluminal impedance monitoring (MII), and esophageal manometry.

For all the patients, the indication for surgery was a 1-year duration of GERD symptoms, persistent or recurrent symptoms despite optimal treatment with a proton pump inhibitor for at least 6 months, persistent or recurrent complications of GERD, reduced QoL due to increasing esophageal exposure to gastric juice, and pathologic values in the preoperatively evaluated functional parameters (MII and manometry). None of the patients had previously undergone an antireflux procedure.

The criteria for inclusion in the study were

- GERD documented by 24-h ambulatory multichannel impedance-pH monitoring of antisecretory therapy and/or gastroscopy by one or more of the following criteria: 73 or more reflux events in 24 h or a DeMeester score of 14.7 or higher (reflux related).
- Positive symptom index of 50 % or higher for symptoms troublesome to the patient, with a frequency of at least three occurrences in 24 h.
- Macroendoscopically distinct mucosal breaks.

The exclusion criteria were

- Age younger than 18 years.
- Previous gastric or antireflux surgery.
- Poor physical status (American Society of Anesthesiology [ASA] 3 or 4).
- Pregnancy.

All the patients were admitted to the study only after they had been instructed properly about the trial and had signed the appropriate informed consent form. The patients were randomly assigned to undergo either Nissen or Toupet fundoplication. The randomization was performed via random sampling numbers immediately before surgery by an independent member of the team. The patients were not blinded to the surgical procedure. The person collecting the objective and subjective data was blinded to the procedure. Study approval was obtained from the institution's ethics committee (Fig. 1).

Surgical technique

All the patients underwent laparoscopic fundoplication in a standardized manner by two experienced laparoscopic surgeons. Irrespective of preoperative manometric findings and depending on the preoperative randomization, a laparoscopic 360° LNF or a 270° LTF was performed. Our technique of laparoscopic fundoplication has been described previously in detail [6].

Quality-of-life evaluation

Quality of life was evaluated via the German Gastrointestinal Quality of Life Index (GIQLI) [7]. The GIQLI questionnaire has been validated and recommended by the European Study Group for Antireflux Surgery [8]. The general response to the 36 items of the GIQLI is graded

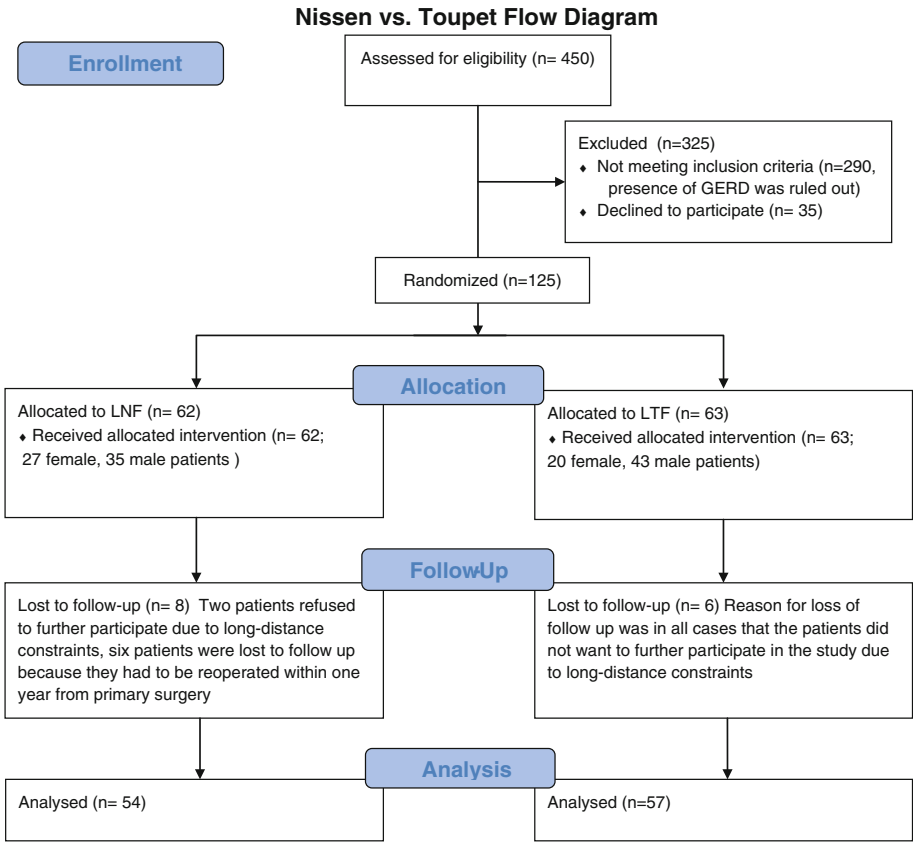

Fig. 1 Flow diagram

within a range of 0 to 144 points. The GIQLI is divided into five subdimensions: gastrointestinal symptoms (0–76 points), emotional status (0–20 points), physical functions (0–28 points), social functions (0–16 points), and a single item for stress of medical treatment (0–4 points). Higher scores indicate higher QoL.

Symptom and surgical side effects evaluation

A symptoms and postoperative side effects evaluation was performed in a standardized manner using a written questionnaire that assessed the severity and intensity of 14 symptoms on a 4-point scale. In particular, symptoms of heartburn, regurgitation, chest pain, cough, hoarseness, asthma, dysphagia, fullness, diarrhea, flatulence, constipation, belching, bloatedness, and distortion of taste were graded as none (0 points), once per week (1 point), several times per week (2 points), daily (3 points), and constantly (4 points).

Intensity of the aforementioned symptoms was graded as none (0 points), mild (1 point), moderate (2 points), severe (3 points), and extremely severe (4 points). To obtain the ultimate result, the frequency of each symptom was multiplied by its degree, resulting in scores of 0 to 16 for each symptom. Higher scores indicated more severe symptoms.

Additionally, four different scores were extracted to assess symptoms specific for reflux (heartburn, regurgitation, chest pain), gas-bloat (fullness, bloatedness), bowel dysfunction (diarrhea, constipation, flatulence), and atypical reflux symptoms (cough, hoarseness, asthma, distortion of taste).

Esophageal manometry

All the patients were studied in the supine position after an overnight fast. Manometry was performed using a conventional 4.5-mm nasoesophageal eight-lumen polyethylene catheter, with continuous water perfusion (0.5 ml/min) by a low-compliance pneumohydraulic capillary infusion pump system. Five channels with exit ports located at 5-cm intervals along the catheter's length and oriented radially around its circumference were linked to a transducer. The pressures were recorded on a computerized polygraph and analyzed on a personal computer (PC) [9, 10].

Lower esophageal sphincter (LES) resting pressure, overall length, and abdominal length were obtained as arithmetic mean values from each of the five radial side holes during a standard station pull-through. The LES resting pressure was measured as the mid-respiratory resting pressure (mmHg) in the high-pressure zone using mid-respiratory gastric pressure as zero reference.

24-h ambulatory multichannel intraluminal impedance monitoring (MII)

All the patients had discontinued antisecretory therapy at least 1 week before examination and were encouraged to maintain their normal activities and meal times. They were instructed to remain upright during the day except during one short nap that was allowed. We used an ambulatory Sleuth multichannel intraluminal impedance-pH monitoring system (Sandhill Scientific, Highland Ranch, CO, USA).

The patients were asked to report meal periods, posture changes, and symptoms by pressing one of three different event buttons on the data recorder. The reportable symptoms were heartburn, regurgitation, chest pain, and others troublesome for the patient. Meal periods were excluded from the analysis. The recorded tracings were pre-analyzed on a PC by an autoscan algorithm (Bioview Analysis, Sandhill Scientific, Highland Ranch, CO, USA) and visually revised by an expert reader in 3-min intervals. Further technical details have been published previously [11].

We used the symptom index (the number of symptoms associated with reflux events based on a 5-min time window divided by the total number of symptoms). The symptom index was declared positive if it was higher than 50 % [12]. A diagnosis of GERD was determined if the total number of reflux events in 24 h exceeded 73 [13, 14], if an abnormal esophageal acid exposition was found, if the reflux-related composite pH score according to DeMeester exceeded 14.7, or if the symptom index was positive for symptoms reported at least three times.

Follow-up evaluation

The GIQLI questionnaire and the symptom questionnaire were answered before surgery. Both were handed out at the same time. Patients returned 1 year after surgery to undergo manometry and MII measurements and to answer the GIQLI and the symptom questionnaire.

Statistical analysis

Statistical analysis was performed using SPSS statistical analysis software (SPSS Inc., Chicago, IL, USA). All data were tested for normal distribution by the Kolmogorow-Smirnow test. Comparison of pre- and postprocedural data was performed using the paired t test and the Wilcoxon signed-rank test, respectively, on a per subject basis. Population homogeneity was performed using the independent t test or the Mann–Whitney U test. All data were presented as median, 25th to 75th quartile range, and 95th percentile values. If normally distributed, the data were additionally presented as mean $\pm$ standard deviation. A p value lower than 0.01 was regarded as statistically significant. In some cases, descriptive statistics were used.

Results

The complete demographic data for all the patients subdivided into the two surgical groups are shown in Table 1. The two groups did not differ significantly in terms of demographic data such as age, gender, or body mass index (BMI).

All procedures could be completed successfully by laparoscopic means with no intraoperative complications in either surgical group. At the follow-up evaluation 1 year after surgery (mean follow-up period, 56.45 $\pm$ 5.88 weeks), 57 (90.5 %) of 63 LTF patients and 54 (87 %) of 62 LNF patients were available. In the LTF group, the reason for loss to follow-up evaluation in all cases was that the patients did not want to participate further in the study due to long-distance constraints. In the LNF group, two patients refused to participate in the study further for the same reason. The remaining six patients were lost to follow-up evaluation because they had to undergo reoperation within 1 year after primary surgery. Thus, 6 (4.8 %) of 125 patients had to undergo reoperation. All had undergone a Nissen fundoplication (6/62, 9.7 %).

The indication for reoperation was prolonged dysphagia or recurrent symptoms. Two patients underwent repeat surgery within the first 3 months after their operation due to prolonged dysphagia. The remaining patients underwent reoperation 4–10 months after the procedure because of recurrent symptoms. During reoperation, all the patients showed a recurrent hiatal hernia with intrathoracic slipping of an intact wrap. After laparoscopic reintervention and performance of a 270° Toupet hemifundoplication, all the patients are free of symptoms at this writing.

Table 1 Patients' demographics

Variable	LNF Group ($n = 62$)	LTF Group ($n = 63$)	p Value LTF/LNF
Women	27	20	NS
Men	35	43	NS
Mean age: years (range)	50.32 (20–76)	51.87 (25–81)	NS
Mean BMI: kg/m^2 (range)	28.18 (19.47–41.80)	27.32 (19.66–3.86)	NS

LNF laparoscopic floppy Nissen fundoplication, *LTF* laparoscopic Toupet fundoplication, *NS* nonsignificant difference, *BMI* body mass index

Table 2 Typical, atypical, gas-bloat, and bowel dysfunction symptom scores before Toupet fundoplication and 1 year afterward

Symptom scores Toupet group	Typical reflux		Atypical reflux		Gas-bloat		Bowel dysfunction	
	Baseline	12 Months	Baseline	12 Months	Baseline	12 Months	Baseline	12 Months
Mean	14.79	2.0	6.28	1.76	9.32	5.43	7.22	6.95
SD	8.16	3.46	7.68	3.16	6.87	5.96	5.15	5.23
Minimum	0	0	0	0	0	0	0	0
Maximum	33	12	35	15	32	32	19	19
Percentile								
25th	9.75	0	0	0	5	2	3.75	4
Median	14.50	0	4	0	8	3.5	6.5	6
75th	21.25	2	10	3	15	8	10.25	9
95th	29.05	11	24.2	8.6	22.3	16.75	18	18
p Value	<0.001		<0.001		<0.007		<0.296	

SD standard deviation

Table 3 Typical, atypical, gas-bloat, and bowel dysfunction symptom scores before Nissen fundoplication and 1 year afterward

Symptom scores Nissen group	Typical reflux		Atypical reflux		Gas-bloat		Bowel dysfunction	
	Baseline	12 Months	Baseline	12 Months	Baseline	12 Months	Baseline	12 Months
Mean	16.82	2.1	6.67	2.7	11.6	6.43	8.15	8.13
SD	9.75	2.63	8.47	4.69	8.17	6.31	6.09	5.13
Minimum	0	0	0	0	0	0	0	0
Maximum	48	10	46	19	32	18	34	22
Percentile								
25th	11	0	0	0	5.25	1	4	4
Median	15	1	4.5	0	10	4	7	7.5
75th	22	4	10	4.75	18	13	10.25	11.75
95th	36.75	8.85	23.1	15.9	28	18	18.5	16.95
p Value	<0.001		<0.003		<0.003		<0.945	

SD standard deviation

Subjective data (QoL, symptoms, and side effects)

Preoperatively, the mean general GIQLI was 96.3 ± 16.6 points in the LTF group and 93.7 ± 21.2 points in the LNF group. Compared with the healthy individuals (122.6 ± 8.5 points), the mean score of GIQLI was significantly impaired in both groups ($p < 0.01$). At the follow-up evaluation, QoL showed significant improvement in both groups. The mean QoL score was 119.8 ± 15.71 in the LTF group and 115.2 ± 15.96 in the LNF group. The two groups did not differ significantly before or after surgery in any of the five domains measured via the QoL tool.

Concerning symptoms before surgery, no significant difference between the two groups in any of the evaluated symptom scores could be demonstrated. At the follow-up evaluation, both procedures showed significant improvement in the typical GERD symptom score, and no significant difference could be demonstrated between the two groups. Preoperative dysphagia improved in both groups, from a mean of 1.80 ± 3.42 points to a mean of 0.48 ± 1.15 points after LTF and from mean of 1.61 ± 3.33 points to a mean of 1.17 ± 2.02 points after LNF, but the reduction was significant only in the LTF group.

The ability to belch decreased from a mean value of 7.02 ± 4.84 points to 3.44 ± 3.18 points after LTF and from a mean value of 6.05 ± 4.55 points to 2.37 ± 3.19 points after LNF. The reduction was significant after both procedures, but it was more pronounced in the LNF group than in the LTF group.

The postoperative gas-bloat and the atypical extra-esophageal symptoms decreased in both groups. The bowel symptoms were virtually unchanged in both groups, and no significant differences between the procedures were found. (Tables 2, 3).

Objective data (esophageal manometry and MII data)

The pre- and postoperative MII data are shown in Tables 4 and 5. The preoperative manometric and MII values were similar in the two study groups.

Table 4 Reflux episodes detected by multichannel intraluminal impedance monitoring (MII) before the Toupet procedure and 1 year afterward

Reflux episodes	Total in 24 h		Acid in 24 h		Proximal in 24 h		Upright in 24 h		Recumbent in 24 h	
	Base-line	1 Year	Baseline	1 Year	Baseline	1 Year	Base line	1 Year	Baseline	1 Year
Mean	101.54	21.42	74.75	12.08	64.43	11.39	168.3	34.11	35.59	10.87
SD	48.43	21.56	39.12	15.63	31.82	12.73	84.27	34.40	30.67	15.21
Minimum	10	0	2	0	5	0	16	0	0	0
Maximum	245	62	189	58	152	39	403	103	144	53
Percentile										
25th	71	4	46	1	40	1	116	4	12	0
Median	87	8	65	4	61	5.5	145	15	28	4
75th	125	40	99	21	85	18.25	196	68.25	58	17
95th	191.60	61.05	160.6	46.6	122.8	38.05	353.8	102.1	98.8	53
p Value	<0.001		<0.001		<0.001		<0.001		<0.001	

SD standard deviation

Table 5 Reflux episodes detected by multichannel intraluminal impedance monitoring (MII) before the Nissen procedure and 1 year afterward

Reflux episodes	Total		Acid		Proximal		Upright		Recumbent	
	in 24 h		in 24 h		in 24 h		in 24 h		in 24 h	
	Baseline	1 Year	Baseline	1 Year	Baseline	1 Year	Baseline	1 Year	Baseline	1 Year
Mean	96.60	20.58	72.24	12.78	62.32	9.58	160.8	28.43	36.19	14.33
SD	49.03	37.61	36.15	26.2	32.42	17.45	88.17	43.1	50.71	38.42
Minimum	25	0	11	0	14	0	40	0	0	0
Maximum	264	187	166	119	174	88	494	219	309	181
Percentile										
25th	65	1	46	0	41	0	112.8	1.25	11	0
Median	86	6.5	62	1	58.5	3.5	139	13	21.5	1
75th	106	19.75	92.75	12	75.25	8	178.3	43.5	39.25	9.75
95th	223.2	128.8	147.9	94.5	136.7	51.7	415	108.2	96.55	157
p Value	<0.001		<0.001		<0.001		<0.001		<0.001	

SD standard deviation

The LES pressure improved significantly, from a mean value of 7.87 ± 4.16 mmHg to 9.5 ± 3.84 mmHg after LTF and from a mean value of 8.62 ± 4.24 mmHg to 11.92 ± 2.51 mmHg after LNF. The improvement was more pronounced after Nissen than after Toupet fundoplication ($p < 0.01$). The number of reflux events decreased from a mean value of 101.54 ± 48.43 to 21.42 ± 21.56 after LTF and from a mean value of 96.60 ± 49.03 to 20.58 ± 37.61 after LNF. The DeMeester score decreased from a mean value of 24.69 ± 18.0 to 6.94 ± 13.72 after LTF ($p < 0.01$) and from a mean value of 25.15 ± 21.69 to 7.99 ± 22.30 after LNF ($p < 0.01$). The differences between the two groups concerning MII data were not significant.

Discussion

An ideal antireflux procedure should be safe, effective, and durable, resulting in minimal complications. Findings have shown the Nissen fundoplication to be safe, effective, and durable, but side effects such as dysphagia, gas-bloat, and bowel dysfunction are not infrequently described. The most common alternative procedure is the Toupet fundoplication. Because findings have proved that both procedures can be applied independently of the preoperative esophageal motor function, an ongoing debate seeks to determine which of the two procedures is superior and should be performed as a first-line surgical therapy.

The debate between the Nissen and Toupet advocates probably is so delicate because both procedures are effective in the treatment of GERD and because the outcome differences between the procedures are marginal. Fein and Seyfried [2] concluded in their review comparing laparoscopic Nissen and partial fundoplication that the relevant factor for selection of a Nissen or a Toupet fundoplication is "personal experience." The validity of this statement cannot be emphasised too strongly. However, the question remains: given the choice, does one of the procedures promise a better outcome?

To preclude bias introduced by varying experience among surgeons, two members only of the author team were allowed to perform the operations, according to our study protocol. Under these conditions and using MII technology, which has not been used for assessment of objective data at this writing 1 year after surgery, we were hoping to find objective criteria to facilitate the decision as to which operation should be preferred.

However, even with the use of MII, no significant difference between the procedures could be found. Significant reductions in the numbers of reflux episodes in all subgroups were demonstrated in both groups. Both procedures provided excellent reflux control and were equally effective.

These results of postoperative MII measurement were remarkable, considering that LES pressures were increased significantly more after LNF than after LTF. This demonstrates that the antireflux mechanism of laparoscopic antireflux surgery is dependent not only on the grade of the sphincter pressure augmentation.

But what about the subjective data? Does a clear winner emerge? The subjective outcomes are particularly relevant in laparoscopic antireflux surgery for GERD because a main goals of the procedure are to improve GERD symptoms and QoL and to provide subjective satisfaction with the treatment. The results of our study demonstrated that both procedures were equivalent in these terms. Also, concerning the so-called "side effects" (gas-bloat and bowel dysfunction), no significant difference could be found. In fact, 1 year after surgery, we could not detect any significant side effects (gas-bloat or bowel dysfunction) at all. Previously, we reported results 3 months after surgery, in which we found these side effects [15]. The results of the current study showed that the surgical side effects are temporary, confirming previous findings that fundoplication is not associated with any significant increase in nonspecific gastrointestinal complaints [16]. Even for the symptom of dysphagia, which can be a typical GERD symptom and a side effect of the operation, no significant difference between the two procedures could be found, although dysphagia scores were reduced more after LT than after LNF and two patients had to undergo reoperation after LNF because of prolonged dysphagia. We attribute these findings to the mean higher LES pressures after LNF than after LTF.

The finding in our study that after both procedures the rate of dysphagia was lower than before surgery shows that surgery can relieve patients of preoperative dysphagia. This is remarkable considering that dysphagia is supposed to be a postoperative side effect that occurs especially after LNF. The study clearly demonstrated, however, that Toupet fundoplication is superior because of a significant reduction in preoperative dysphagia 1 year after surgery.

In the LNF group, preoperative dysphagia decreased, but the reduction was not statistically significant. The two patients who had to undergo reoperation before follow-up assessment because of dysphagia showed intrathoracic "slipping" of the wrap and recurrence of hiatal hernia, indicating that the reason for dysphagia was not the wrap but a problem of the hiatal closure. The standardized technique of hiatal closure and the fact that only two experienced surgeons performed the procedures could be the explanation for the low dysphagia "side effect" rate after surgery in this study.

The ability to belch was the only symptom for which a significant difference between the procedures was found. After LTF, patients were able to belch more frequently than after LNF. But is this single subjective difference the determining factor for favoring LTF?

A recent study showed that LNF alters the belching pattern, reducing gastric belching (air venting from the stomach) and increasing super-gastric belching (no air venting from the stomach) [17]. To state a firm conclusion on the ability to belch and to conclude whether one procedure is superior to the other concerning this symptom would requiring distinguishing between gastric belching and super-gastric belching. However, it can be hypothesized that patients are able to vent air more easily after LTF.

Finally, the results of this study show that the only real significant and relevant difference between the two operations is that more patients had to undergo reoperation after LNF than after LTF. Several studies have identified intrathoracic herniation of the wrap as the most common complication after laparoscopic antireflux surgery, which may be caused by either inadequate closure of the crura or disruption of the crural closure [18–20].

Although the technique of hiatal closure was the same for both surgical groups in the current study, symptomatic slipping and recurrent hiatal hernia occurred only after the Nissen procedure. This finding could possibly be explained by the fixation of the partial wrap to the right crus. This result underscores the findings of a recent metaanalysis reporting a higher rate of reoperation after laparoscopic total versus partial fundoplication [21].

The authors of this study concluded that Toupet fundoplication should be the preferred procedure due to the lower

incidence of postoperative dysphagia, reoperation, inability to belch, and gas bloating [21]. However, the numbers of patients in the studies available for this analysis diverged, and patients were excluded or stratified according to esophageal motility. Varin et al. [22] concluded in their review focused on the same issue that many trials are of insufficient quality, too biased, or too heterogeneous for a reliable consensus to be reached on the best surgical technique. Nevertheless, existing data support the hypothesis that total fundoplication provides superior long-term results compared with partial fundoplication [23]. The choice of surgical technique to provide optimal reflux control while minimizing side effects remains controversial.

In conclusion, our study shows that both laparoscopic Nissen and Toupet fundoplication are equally effective in improving QoL and GERD symptoms. The differences in the subjective and objective outcomes between the procedures are marginal, but 1 year after surgery more patients had to undergo reoperation after LNF due to disruption of the surgically constructed anatomy, which in summary is the only distinct difference between the two procedures.

Disclosures Oliver O. Koch, Adolf Kaindlstorfer, Stavros A. Antoniou, Ruzica Rosalia Luketina, Klaus Emmanuel, and Rudolph Pointner have no conflicts of interest or financial ties to disclose.

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