Editorial Commentary

Partial *vs.* total fundoplication for gastroesophageal reflux disease (GERD): has the debate really settled in a tie?

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Rise in the incidence of gastroesophageal reflux disease (GERD) across the globe has propelled antireflux procedures into the forefront of the modern surgical practice. Multiple factors have contributed to this phenomenon, predominantly associated with Western diet and increasing rates of obesity (1,2).

The field was pioneered by Rudolf Nissen with the development of the classical antireflux procedure, currently known as Nissen fundoplication. The development of the procedure was somewhat accidental, performed in the case of perforated esophageal ulcer with the serosal patch reinforcement by fundus wrap, i.e., the fundoplication. Later on, Dr. Nissen applied these principles for the surgical intervention in a patient with reflux esophagitis (3). Traditionally performed via laparotomy, the procedure saw a new era after development of the minimally invasive approach, the laparoscopic surgery.

Minimally invasive revolution of 1990s jump started an explosive growth of many surgical procedures, traditionally performed via laparotomy, including significant increase of antireflux interventions. One of the first reports on laparoscopic Nissen fundoplication came in 1991, just within few years of first laparoscopic experience (4). Whereas laparoscopic Nissen fundoplication provided excellent reflux control, concerns for predominantly mechanical complications led to the development of other, less obstructive, although similar interventions. Toupet modification is a procedure where a posterior, partial wrap is performed to address some of the obstructive nature of the Nissen fundoplication (5). Even more alternatives to the Nissen procedure had penetrated the market recently, owing to the dissatisfaction of surgeons and patients with some of the outcomes (6).

One of the first comparison of the reflux control in both of these procedures was performed in the elegant experimental paper by Richardson *et al.* in 1997. Analyzing the results of the *ex-vivo* porcine model, authors concluded that both procedures effectively prevent reflux (7). Recent new experimental study corroborated these findings, noting similar functionality and effectiveness of both Toupet and Nissen fundoplications (8). More recent study on impedance planimetry in patients after these types of procedures delineated different ideal distensibility ranges after Toupet and Nissen interventions, associated with improved patient reported outcomes (9).

In 1997 Coster *et al.*, published their experience of laparoscopic Nissen-Rosetti *vs.* modified Toupet fundoplication (10); 125 Nissen patients and 101 Toupet cases were entered into the prospective clinical study database. Authors noted that although postoperatively lower esophageal sphincter (LES) pressure was equal in both groups, Toupet patients performed better in all categories of comparison. Moreover, 8 patients developed significant postoperative dysphagia, requiring endoscopic interventions, all in Nissen group. In conclusion authors stated that both procedures are equally effective in the reflux control, but Toupet procedure has higher satisfaction rates and fewer side effects (10). This observation was further reinforced

in a randomized trial by Lund *et al.* (11). Analyzing the result of 62 patients with underlying esophageal dysmotility, authors have documented significant increase in postoperative dysphagia in Nissen group (44% *vs.* 9%) (11).

In the review of the quality-of-life (QoL) data one year postoperatively in the group of 175 consecutive patients, undergoing Nissen (107 patients) *vs.* Toupet (68 patients) fundoplications, Kamolz *et al.* noted similar quality of life and side effects profile between these two groups. Interestingly, 3 Toupet patients postoperatively were converted to Nissen due to poor reflux control, whereas 3 Nissen patients underwent conversion to Toupet procedure due to severe postoperative dysphagia (12). Several groups of authors, acknowledging the negative impact of dysphagia on the postoperative outcomes, advocated for Toupet as a preferred antireflux procedure. They, however, did not recommend tailoring the type of fundoplication in these patients, arguing poor correlation between preoperative dysmotility and rates of postoperative dysphagia (13).

To the contrary of the earlier data, Pittsburg group in their analysis of 206 consecutive patients undergoing Nissen (163 patients) *vs.* Toupet (43 patients) operations noted higher satisfaction rates in the Nissen group (93% *vs.* 79%) about 1.5 year postoperatively (14). A greater number of Toupet patients required proton pump inhibitors (PPI) postoperatively (38% *vs.* 20%). 36-Item Short-Form Health Survey (SF-36) scores were also higher in the Nissen group (85 *vs.* 74). Authors concluded that even in patients with esophageal dysmotility, Nissen fundoplication is a superior procedure. Notably, Toupet group had a high rate of the pre-existent esophageal dysmotility in this study (37.2% *vs.* 8.6%) (14).

Longer follow-up studies essentially ended up in a tie between these two procedures, with equal rates of satisfaction among the patients postoperatively. After 5 years of follow-up in a group of 100 patients randomized to Nissen *vs.* Toupet fundoplication, Shaw *et al.* noted equal rates of satisfaction. Preoperative dysmotility has improved postoperatively in the substantial proportion of patient and had no impact on the outcomes of either operation (15).

In the 2010 metanalysis of 9 randomized trials with 1,061 patients enrolled, comparing various types of the procedures (Nissen *vs.* Toupet—4, Nissen or Toupet *vs.* Dor—5), acknowledging the challenges in comparison of the studies due to lack of standardization, Fein and Seyfried noted that both Nissen and Toupet fared better that Dor patients (16). Nissen fundoplication achieved slightly better reflux control but was associated with higher rates of dysphagia and gas bloat. However, there was no clear advantage to any particular type of the procedure. The authors left the choice of the procedure to surgeon's personal preference. They also concluded that there is no indication for tailoring of the procedure according to esophageal motility (16). In another metanalysis from the same year, including 7 randomized controlled trials (RCTs) and 792 patients, some of which were included in Fein publication, Broeders *et al.*, confirmed significantly higher rates of postoperative dysphagia [relative risk (RR) =1.61; 95% confidence interval (CI): 1.06–2.44], requiring dilatation (RR =2.45; 95% CI: 1.06–5.96) and surgical re-interventions (RR =2.19; 95% CI: 1.09–2.20) after laparoscopic Nissen fundoplication (17). Whereas rates of reflux control, esophagitis, symptomatic improvement and patient satisfaction were similar, in the Nissen group there were significantly higher inability to belch (RR =2.04; 95% CI: 1.19–3.49) and gas bloat (RR =1.58; 95% CI: 1.21–2.05). Acknowledging similar rates of reflux control with lower side effects profile, authors strongly supported the Toupet fundoplication as a procedure of choice for GERD (17).

In the narrative review of antireflux procedures choice in patients with underlying esophageal motility disorders Bakhos *et al.* concluded that both Nissen and Toupet procedures achieved comparable reflux control without significant obstructive side effects (18). In the long-term analysis of the cohort of patient undergoing Nissen *vs.* Toupet fundoplication, only degree of the preoperative reflux was a statistically significant predictive factor for the recurrence (19). The type of the procedure did not have an impact on the outcomes of the intervention in up to 10 years of follow-up. In a recent metanalysis of 4 studies, including 220 patients, Hajibandeh *et al.* noted nearly 3 times lower postoperative rates of dysphagia in patients after Toupet procedure, even after significantly higher prevalence of dysphagia preoperatively (29% *vs.* 4%) (20).

Recently published article "*Clinical Outcomes of a Laparoscopic Total vs a 270° Posterior Partial Fundoplication in Chronic Gastroesophageal Reflux Disease*: *A Randomized Clinical Trial*" by Analatos *et al.* presents long-term outcomes of the double blind randomized controlled trial of laparoscopic partial (270°, Toupet) with total (360°, Nissen) fundoplication (21). Original trial included 456 patients, randomized to either a partial or a total fundoplication. All patients underwent operation at a single hospital in Sweden between 2001 and 2006 (22). Whereas both procedures demonstrated significant decrease in acid exposure, similar reflux control and quality of life, Toupet

fundoplication fared better with less dysphagia at 6 weeks, 12 and 24 months postoperatively (22). In the current paper, the original cohort of patients was contacted via mail outreach. Patients were asked to respond with the same set of questionaries as previously—SF-36, the disease-specific Gastrointestinal Symptom Rating Scale (GSRS), and a specific dysphagia score questionnaire. The primary outcome was the rate of dysphagia postoperatively, while QoL, reflux symptoms, PPI usage and additional operations were the secondary outcomes. The mean time after the procedure was 16±1.3 years. Both procedures demonstrated equally efficient reflux control and improvement in QoL scores. Previously noted differing rates of the dysphagia have converged and there was no difference between these two groups (1.2 for liquids, P=0.58 and 1.3 for solids, P=0.97); 4 (3%) patients in the Toupet group and 10 (8%) in the Nissen group underwent additional operations, all for recurrent reflux (P=0.08); 24% of patients in the Toupet group and 28% in the Nissen group used PPI daily, an increase from 10% rate of PPI use at 5 years.

The strength of the current publication is in unprecedented length of the postoperative follow-up of the original trial data, randomizing patient to one of these procedures. However, we agree with Dallemagne and Perretta opinion that more objective data is needed for a full assessment of the effects of both operations on the physiology of the gastroesophageal junction (23). There are numerous limitations of using questionnaires in the medical research, such as report distortions, recall bias and reliability and validity (24). However, large, well-balanced groups with high rate of response, in excess of 75% mitigate this type of bias in the study. Furthermore, subclinical problems, such as silent reflux may not be adequately captured by the questionnaires, especially in the settings of modified visceral sensitivity after surgical interventions (25). Interestingly, it appears that the convergence of the dysphagia scopes at 15 years mark occurred due to slight increase in the dysphagia in the partial fundoplication group. Is it possible that due to subclinical inferior reflux control these patients had developed impaired motility or even peptic strictures due to ongoing reflux? These questions are impossible to answer with the current data.

Although patient centered outcomes in this publication reveal equal outcomes of these two procedures in the long-term range, there was a higher rate of side effects in the Nissen group throughout the postoperative period. Although not statistically significant, higher proportion of patients in the Nissen group required additional procedures during the time of the follow-up, albeit all for reflux.

Whereas at present it appears that long-standing debate of the preferred intervention for reflux has settled in a tie, at least from the patient reported outcomes perspective, is it really justified for us, clinicians, equate these two procedures and ignore patients journey through their 15 years of postoperative period until they arrive at this equipoise? The authors of this current publication maintain a preference toward Toupet fundoplication in their clinical practice for patients, undergoing surgical correction of GERD.

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