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Long-term comparative outcome between laparoscopic total Nissen and Toupet fundoplication: Symptomatic relief, patient satisfaction and quality of life

B. Sgromo · L. A. Irvine · A. Cuschieri · S. M. Shimi

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Abstract
Background Laparoscopic antireflux surgery has become an established method of treatment of gastroesophageal reflux disease. This study compares the long-term outcome of total (Nissen) and partial (Toupet) fundoplication, performed in a single institution, by evaluating symptoms and quality of life.
Methods 266 patients who underwent laparoscopic Nissen or Toupet fundoplication completed a preoperative reflux symptom questionnaire. Postsurgery symptom evaluation, patient satisfaction and quality of life in reflux and dyspepsia (QOLRAD) questionnaires were sent to these patients in December 2004. The two groups were compared for each item nonparametrically.
Results Completed questionnaires were received from 161 patients (61%) of whom 99 had a laparoscopic Nissen fundoplication and 62 laparoscopic Toupet fundoplication. Both procedures were equivalent in improving reflux symptom scores in the long term, 79/99 (80%) and 56/62 (90%) were either symptom free or had obtained significant symptomatic relief. Both groups had equivalent QoL scores on the QOLRAD questionnaire. An equivalent number of patients (86% and 83.9% after Nissen and Toupet, respectively) were sufficiently satisfied to recommend antireflux surgery to a friend or relative complaining of reflux symptoms.
Conclusion In conclusion, in patients who have returned the questionnaire, long-term satisfaction, general symptom scores, and quality of life are equivalent after laparoscopic Nissen (complete) or Toupet (partial) fundoplication. There is however, a significant increased prevalence of persistent heartburn after laparoscopic Toupet fundoplication.

Keywords Reflux · Laparoscopic total and partial fundoplication · Long-term symptomatic relief · Quality of life

B. Sgromo · L. A. Irvine · A. Cuschieri · S. M. Shimi (✉)
Department of Surgery and Molecular Oncology, University of Dundee, Ninewells Hospital and Medical School, Dundee, Scotland DD1 9SY, UK
e-mail: s.m.shimi@dundee.ac.uk

Although medical treatment of gastroesophageal reflux disease (GERD) is able to improve symptoms in the majority of sufferers, in 20% of cases symptoms prove refractory to medication or the patients develop intolerable side-effects to pharmacotherapy. Surgical treatment for GERD has been one of the therapeutic options since the 1950s. It aims at restoration of an effective antireflux mechanism and normal lower oesophageal sphincter pressure (by various procedures), in addition to restoring a normal length of abdominal oesophagus.

Total (Nissen) fundoplication was first described in 1956 and soon became widely accepted [1]. In 1963 Toupet proposed a posterior crurally fixed partial fundoplication [2] that was subsequently modified [3] and appealed to some because of its potential to reduce specific morbidity [4]. The introduction of minimal access surgery in 1991 with the associated reduction in morbidity and mortality has popularized these procedures for long-term effective reflux control.

The Nissen procedure produces excellent symptomatic control [5, 6] but some studies have reported a high postoperative dysphagia rate and specific side-effects such as inability to belch and vomit, and gas bloat syndrome [7]. The Toupet procedure is thought to produce less postoperative side-effects than the Nissen procedure but some studies have indicated that the recurrence rate of reflux symptoms may be higher after this procedure [8, 9].

The aim of the present study was to compare the long-term outcome of Nissen and Toupet fundoplication performed in a single institution by evaluating symptoms and quality of life.

Materials and methods

In the period January 1994 to December 2003, 266 patients with symptoms of gastroesophageal reflux disease and abnormal 24-hour pH monitoring underwent laparoscopic Nissen (n = 156) or Toupet (n = 110) fundoplication at the upper gastrointestinal (Upper GI) unit, Ninewells Hospital and Medical School, Dundee. Each patient was assessed preoperatively in the clinic and had a preoperative standardized symptoms evaluation, oesophagogastroscopy, oesophageal manometry, and 24-hour pH monitoring. Patients who had an antireflux procedure (ARS) other than a laparoscopic Nissen or a Toupet fundoplication, those whose preoperative data were incomplete or missing, and patients who had a conversion from laparoscopic to open fundoplication were excluded.

All the patients involved came from the same population, and were referred, independently, to two consultant surgeons experienced in both laparoscopic procedures. The selection of the procedure was based on the surgeon's preference and not on patient's characteristics. One surgeon (AC) carried out laparoscopic Toupet fundoplication and the other (SMS) laparoscopic Nissen fundoplication.

Preoperative assessment

All patients were assessed clinically at the time of preoperative investigations (manometry and 24-h pH monitoring) by a structured questionnaire investigating GERD symptoms using an ordered nominal scale. Heartburn and regurgitation were scored by frequency (infrequent, 1 point; everyday, 2 points), severity (defined in terms of interference with daily activity) to mild (1 point), moderate (2 points) or severe (3 points). Dysphagia was scored by frequency (infrequent,1 point; everyday, 2 points) and severity (solid foods, 3 points; liquids, 5 points). The presence or absence of odynophagia, nausea, waterbrash, hoarseness, fullness, and coughing or choking was also scored (1 point for each variable). The use of medication for reflux was also scored (intermittent, 1 point; daily, 2 points). The total score for each patient was entered into a database and used for subsequent analysis. Furthermore, the DeMeester score obtained from pH-metry and the preoperative LES resting pressure obtained from manometry for each patient was entered into the database and considered for analysis.

Questionnaire

In December 2004, the entire cohort of patients (all 266 patients) were invited to complete symptom inventory, outcome, and quality-of-life questionnaires.

The symptom inventory questionnaire was of a similar nature to the one administered preoperatively and covered the same questions. The outcome questionnaire enquired about patient satisfaction with the results of the operation, overall improvement in reflux symptoms, and the development of untoward side-effects after surgery.

The quality of life in reflux and dyspepsia (QOLRAD) questionnaire [10] was used as the quality-of-life measurement tool. This is a disease-specific questionnaire designed to address the health concerns of people with GERD and dyspepsia. The measure contains 25 items in five domains of importance to patients: emotional distress, sleep disturbance, eating and drinking issues, physical and social functioning, and vitality. Each item is scored on a seven-point Likert scale and domain scores were calculated by averaging the items scores in that domain so that the results of each domain range from 1 to 7, with a higher value representing better QoL. This psychometric questionnaire is thought to have good reliability in terms of both internal consistency and stability [10].

Statistical analysis

Group and interval data and values are expressed as mean and/or percentage unless otherwise stated. For statistical evaluation, nonparametric tests were used. The analysis was performed using SPSS software version10. Statistical significance was set at $p \leq 0.05$.

Results

Responders

Completed questionnaires were received from 161 patients (return rate of 61%).

Ninety-nine patients underwent a laparoscopic Nissen fundoplication (response rate 63%) and 62 a laparoscopic Toupet fundoplication (response rate 56%). Responses were received from 94 females and 67 males. The mean interval from surgery to the beginning of this study was 76 months (range 12–107 months). Mean age at operation was 51 years (range 22–80 years).

Comparison between the two groups before surgery

The Toupet group contained 62 patients (34 F/28 M), with a mean age at the time of surgery of 48 and 37 years,

respectively. The mean time interval from operation to the present assessment study was 88 months (range 18–107 months). The Nissen group contained 99 patients (60 F/39 M), with a mean age at the time of surgery of 51 and 30 years, respectively. The mean time interval from operation to the present comparative study was 72 months (range 14–106 months).

Statistical analysis of demographic data did not show any differences between the two groups, regarding sex distribution, age at operation, preoperative DeMeester score, preoperative symptoms incidence, and preoperative symptoms severity score. A statistically significant difference was found between the two groups in terms of the mean number of months from operation to the beginning of this study, this being greater in the Toupet group (88 versus 72); and the ability to belch, which was reported by 81% of patients in the Toupet group and in 61% of patients in the Nissen group (see Table 1).

Comparison between the two groups after surgery

The analysis of the postoperative data showed very similar results in the two groups with respect to most of the variables studied. A statistically significant difference was found in the number of patients complaining of heartburn (Toupet group 55%, Nissen group 36%) and the number of patients complaining of regurgitation (Toupet group 50%, Nissen group 34%). Table 2 shows the pooled results of the patient questionnaires both pre- and postfundoplication for both the Nissen and Toupet groups.

Gas bloat syndrome

To evaluate the postoperative development of the gas bloat syndrome in the two groups, patients were asked about their ability to belch and vomit and postprandial fullness after the operation. Analysis of the responses did not reveal any significant difference between the two groups (Table 3).

Comparison between pre- and postoperative data

Symptoms

Both procedures improved overall reflux symptoms as shown by the significant reduction in the symptoms questionnaire score (Table 2). In the Toupet group, there were 40 patients suffering from dysphagia preoperatively, while 22 patients had some dysphagia postoperatively. This difference was statistically significant. In the Nissen group, 56 patients suffered from dysphagia preoperatively while 48 patients complained of dysphagia postoperatively. This difference however was not significant. Other symptoms such as nausea, waterbrash, and hoarseness were significantly improved by either of the two procedures in a similar proportion of patients. The atypical symptom of coughing was however not improved in the two groups.

Medications intake

Of 161 patients, 91 patients (56.5%) recommenced medical therapy at varying periods after fundoplication. Seventy

Table 1 Preoperative demographical data for the two groups

	Nissen group (n = 99)	Toupet group (n = 62)	p
Sex (M/F)	39/60	28/34	ns
Mean follow up (months)	72	88	0.001
Mean age at operation (years)	52.5	48.4	ns
Mean total preoperative symptom score	9.40	9.19	ns
DeMeester score	31.28	33.63	ns
No. with heartburn (%)	81 (82%)	54 (87%)	ns
Mean heartburn score	1.69	1.69	ns
No. with regurgitation (%)	66 (67%)	50 (81%)	ns
Mean regurgitation score	1.76	1.76	ns
No. with dysphagia (%)	56 (57%)	40 (65%)	Ns
Mean dysphagia score	5.25	5.30	ns
Ability to belch (%)	60 (61%)	50 (81%)	0.021
No. with pain on swallowing (%)	31 (32%)	19 (31%)	ns
No. with nausea (%)	42 (42%)	22 (30%)	ns
No. with waterbrash (%)	54 (55%)	36 (58%)	ns
No. with hoarseness (%)	34 (34%)	18 (29%)	ns
No. with coughing (%)	40 (40 5)	19 (31%)	ns
Mean LES pressure (mm Hg)	12.08	15.85	ns

(t test, Mann–Whitney U test; $p < 0.05$)

Table 2 Pre- and postfundoplication results for the Nissen and Toupet groups

	Nissen group (n = 99)			Toupet group (n = 62)			
	Pre-op.	Post-op.	p pre./post.	Pre-op.	Post-op.	p pre./post.	p post./post.
Symptom questionnaire score	9.40	4.57	0.001	9.19	4.48	0.001	ns
Number with heartburn	81	36	0.000	54	34	0.000	0.022
Heartburn score	1.69	1.39	ns	1.69	1.24	0.001	ns
Number with regurgitation	66	34	0.000	50	31	0.000	ns
Regurgitation score	1.76	1.35	ns	1.76	1.29	0.001	ns
Number with dysphagia	56	48	ns	40	22	0.002	ns
Dysphagia score	5.25	5.21	ns	5.20	5.64	Ns	ns
Number with nausea	61	40	0.003	41	24	0.002	ns
Number with hoarseness	34	18	0.002	18	10	0.046	ns
Number with waterbrash	55	26	0.000	35	21	0.011	ns
Number with coughing	41	32	ns	19	21	ns	**ns**

(t test, Mann–Whitney U test; $p < 0.05$)

Table 3 Patients with gas bloat syndrome post fundoplication

Symptoms	Nissen group (n = 99)	Toupet group (n = 62)	p
Number able to belch (%)	25 (25%)	7 (13%)	ns
Number able to vomit (%)	35 (35%)	25 (40%)	ns
Number with post prandial fullness (%)	65 (66%)	46 (74%)	ns

(Mann–Whitney U test; $p = 0.05$)

patients (43.5%) had not used anti-acid medication since surgery. Fifty out of 91 patients back on medications (73.5%) reported relief of reflux symptoms with the medication, whilst 18 patients (11.2%) did not.

In the Nissen group, 44 out of 99 patients (44.4%) were on antireflux medications, with 11 (11.1%) not obtaining symptoms improvement. In the Toupet group, 26 out of 62 patients (41.9%) resumed antireflux medication, seven of whom (11.3%) without gaining symptomatic improvement.

Satisfaction

Seventy-nine patients (80%) in the Nissen group were satisfied after their antireflux surgery with 51% being asymptomatic. In contrast, 90% (56 patients) of the Toupet group had an improvement in their reflux symptoms by surgery, but fewer 37% were totally asymptomatic (Table 4).

Antireflux surgery was unsuccessful in improving reflux symptoms in 14% (14 patients) of the Nissen group and in 5% (3 patients) of the Toupet group. A similar proportion of patients felt their symptoms were worsened by antireflux surgery (6% and 5% of the Nissen and Toupet groups, respectively).

Table 4 Patient satisfaction with the operation and medication usage postoperatively

	Nissen group (n = 99)	Toupet group (n = 62)	p
Number without symptoms (%)	50 (51%)	23 (37%)	ns
Number improved (%)	29 (29%)	33 (53%)	ns
Number unchanged (%)	14 (14%)	3 (5%)	ns
Number worsened (%)	6 (6%)	3 (5%)	ns
Number who used anti-reflux medication (%) since operation	44 (44%)	26 (41%)	ns

(t test, Mann–Whitney U test; $p < 0.05$)

Quality of life after antireflux surgery

Both groups scored favourably in the five domains of the QOLARAD quality-of-life test (Table 5). There was no detectable difference between the two groups in any of the five domains measured in the quality-of-life tool used in this study.

Discussion

We consider the 61% response rate to the long-term follow-up questionnaire to be satisfactory, though not ideal considering the average long time period between surgery and the questionnaire in this study. Although some published studies obtained better response rates for shorter duration of follow-up, some obtained similar or poorer response rates with similar or longer duration of follow-up [9]. The mean postoperative follow-up time was 72 and 88 months for the Nissen and Toupet fundoplication groups, respectively. This difference is statistically significant and reflects the fact that more of the earlier procedures were

Table 5 Quality-of-life questionnaire results

Domain	Nissen group (n = 99)	Toupet group (n = 62)	p
Emotional distress mean score	6.02	6.14	ns
Sleep disturbance mean score	5.93	6.03	ns
Food/drink problems mean score	5.85	5.81	ns
Physical/social problems mean score	6.18	6.24	ns
Vitality mean score	5.86	5.94	ns

(t test, Mann–Whitney U test; $p < 0.05$)

partial fundoplications, as this was the practice of the more senior author (AC). No other preoperative demographical difference between the two groups reached a statistically significant difference apart from the ability to belch which was higher in the Toupet group (81% versus 61%).

Although the results of the overall symptom questionnaire score for both groups was significantly improved after surgery, a statistical improvement in the heartburn and regurgitation scores was only detected in the Toupet group. However, in both groups the number of patients who had an improvement in the heartburn and regurgitation scores after surgery was statistically significant. This may imply that symptomatic patients in the Toupet group had less episodes of heartburn and regurgitation or milder symptoms preoperatively in comparison to symptomatic patients in the Nissen group.

The postoperative results for both procedures show no statistical difference in overall symptoms score, GERD symptom specific scores, and the number of patients with regurgitation, dysphagia, nausea, waterbrash, hoarseness, and coughing. However, the number of patients with heartburn postoperatively was higher in the Nissen group.

Fifty-six (57%) and 40 (65%) patients, in the Nissen and Toupet groups, respectively, complained of dysphagia preoperatively. This incidence is higher than that in the reported literature. It is not clear whether this high preoperative dysphagia rate is unique to this study population or whether it reflects the prospective and systematic evaluation of symptoms preoperatively done in this study. We strongly suspect the latter explanation.

Forty-eight patients complained of dysphagia following a Nissen fundoplication. Of these, only eight patients complained of severe dysphagia (frequent, more than once a week and for solid, liquid or both). This incidence of severe dysphagia is similar to that reported for the series reviewed by Catarci et al. [11]. Twenty-two patients complained of dysphagia in the Toupet group after surgery, this being severe in six patients (8.9%). Several factors have been advocated to explain this complication, including the emotional state of the patient, surgical technical errors and intrinsic oesophageal dysmotility [12, 13]. None of these factors were evaluated in the present study.

Thirty-three patients (33%) in the Nissen group and 23 patients (37.3%) in the Toupet group reported the development of untoward postoperative side-effects, the most frequent being early satiety and the gas bloat syndrome. All patients were made aware of the gas bloat syndrome during preoperative counselling and during the consent procedure. The gas bloat syndrome [14] incorporates the inability to belch and vomit as well as postprandial fullness (bloating). In this study, 25% and 13% of patients in the Nissen and Toupet group, respectively, had maintained the ability to belch. In the Nissen and the Toupet group 35% and 40% of patients were able to vomit, respectively. Early satiety was reported in 66% of patients following Nissen and in 74% of patients following Toupet fundoplication. Thus the gas bloat syndrome is common to both total and partial wraps. The incidence is thought to be higher in the initial period after surgery and to reduce progressively thereafter [15]. In the present study, the full-blown gas bloat syndrome was present in around 30% of patients seven years after surgery.

In the Nissen and the Toupet group, 44% and 26% of patients, respectively, were using anti-acid/ acid suppression therapy 7 years after surgery. It is difficult to place too much emphasis on this finding. Often, medication intake is occasional and is not always effective in controlling the patient's symptoms, which may not be reflux related [16, 17]. In the present study, 72% of patients in either group reported relief of perceived reflux symptoms after medication intake. The remaining 27–28% of patients did not achieve symptom relief by anti-acids or acid suppression medication.

In the Nissen group 82% of patients, and in the Toupet group 83%, reported satisfaction with the overall result of surgery. An equivalent number of patients, 86% and 83.9%, in the Nissen and in the Toupet group, respectively, were sufficiently satisfied to recommend antireflux surgery to a friend or relative complaining of reflux symptoms. Two published studies have investigated patient satisfaction following antireflux surgery. Both Zornig [18] and Stewart [19] reported a similar degree of satisfaction following Nissen and Toupet fundoplications.

Patient satisfaction is a reasonable and accurate tool to assess outcome after functional surgery especially when combined with other specific measures such as GERD-specific symptom scores and medication intake. When all these factors are taken into consideration, around 60% of patients in either the Nissen or Toupet groups were satisfied with the surgical procedure, have lower GERD-specific symptom scores, have not developed untoward side-effects, and have not had to recommence antacids or acid suppression therapy at 7 years follow-up.

The short-term results of several randomized and non-randomized clinical trials have shown that both the complete and partial wraps produce excellent symptoms control, and some of those studies showed a good objective control of reflux [18, 20, 21]. However, long-term results following laparoscopic antireflux procedure became available only recently and some doubts have been raised on the durability of partial wraps [22].

A technically successful antireflux procedure is not always a guarantee for the resolution of GERD symptoms, and indeed some patients may continue to experience reflux symptoms, indicating deterioration in individual functional status and general well-being following surgery [23]. Hence the importance of evaluating quality of life (QoL) following surgery for reflux disease. Equivalent QoL data were observed in the two surgical groups at 7 years in the present study.

This study suffers from lack of objective evaluation of gastroesophageal reflux by pH-metry or endoscopy. This study however was focused on symptoms, patient satisfaction, and quality of life (QoL). We believe that symptom control and its effect on QoL is one of the primary objectives in antireflux surgery for the majority of patients. We also recognize shortcomings in different modalities of objective assessment of reflux particularly demonstrated by combined multichannel intraluminal impedance and pH-metry [24].

In conclusion, in patients who returned the questionnaire, long-term satisfaction, general symptom scores, and quality of life were equivalent after laparoscopic Nissen (complete) or Toupet (partial) fundoplication. There is however, a significant increased prevalence of persistent heartburn after laparoscopic Toupet fundoplication.

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