



Five-year results of laparoscopic Toupet fundoplication as the primary surgical repair in GERD patients: Is it durable?

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Abstract

Introduction: Most surgeons operate on gastroesophageal reflux disease (GERD) patients using the concept of “tailored approach,” which depends on esophageal motility. We have abandoned this concept and performed laparoscopic Toupet fundoplication in all patients suffering from GERD, independent of their esophageal motility.

Methods: In a prospective trial we have assessed and evaluated our 5-year results of the first 100 consecutive patients treated with laparoscopic Toupet fundoplication. All patients were evaluated preoperatively by endoscopy and 24-h pH manometry. The patients were followed up clinically 1, 2, 6, 12 and 60 months postoperatively. The course of clinical DeMeester score, appearance and treatment of wrap-related side-effects as well as long-term outcome and patient satisfaction were evaluated.

Results: The 5-year follow-up rate was 87%. Laparoscopic Toupet fundoplication achieved a 5-year healing rate of GERD in 85%. Of all operated patients, 3.5% had to be reinstalled on a regular PPI treatment because of postoperative GERD reappearance. The median clinical DeMeester score decreased from 4.27 ± 1.5 points preoperatively to 0.47 ± 0.9 points 5 years postoperatively ($p < 0.0005$). Because of persistent postoperative dysphagia, 5% of the patients required endoscopic dilatation therapy. Persistent postoperative gas-bloat syndrome occurred in 1.1%. Wrap dislocation was identified in 3.4% of patients. Reoperation rate was 5%. Total morbidity rate was 19.5% and operative related mortality rate was 0%. Overall, 96.6% of patients were pleased with their outcome at late follow-up, and 95.4% of patients stated they would consider undergoing laparoscopic fundoplication again if necessary.

Conclusion: Our long-term results showing a low

recurrence and morbidity rate of laparoscopic Toupet fundoplication encourage us to continue to perform this procedure as the primary surgical repair in all GERD patients, independent of their esophageal motility. Laparoscopic Toupet fundoplication has proven to be a safe and successful therapeutic option in GERD patients.

Key words: Laparoscopic antireflux surgery — Toupet partial fundoplication — Long-term outcome

Gastroesophageal reflux disease (GERD) is the most common benign disorder of the upper gastrointestinal tract in the Western world.

Since the first description of laparoscopic fundoplication by Dallemagne et al. [5] in 1991, an increasing number of patients have been treated for GERD by minimally invasive or endoscopic surgery. Various operation techniques of fundoplication such as Nissen, Nissen-Rossetti, Toupet, and other variations of anterior or posterior partial wraps as well as endoscopic techniques are currently performed for the surgical treatment of GERD.

A significant number of surgeons operate on patients suffering from GERD applying the concept of a “tailored approach.” Depending on manometric findings, a Nissen fundoplication is performed in the case of normal esophageal motility, whereas a Toupet fundoplication is preferred if an esophageal motility disorder is found. The concept of a tailored approach proposes that the Nissen fundoplication offers better long-term reflux control, whereas the Toupet procedure should be reserved for patients with motility disorders, thus lowering the rate of wrap-related side effects as dysphagia or gas-bloat syndrome in comparison to the Nissen procedure.

Zornig et al. [17] were not able to substantiate the hypothesis of a tailored approach in their recent prospective randomized trial. Indeed, they found a higher

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postoperative dysphagia rate in the Nissen group compared to the Toupet group. They concluded that the concept of tailored approach should be abandoned and that laparoscopic Toupet fundoplication could become the surgical treatment of choice for symptomatic GERD.

We abandoned the concept of tailored approach as early as 1993, performing laparoscopic Toupet fundoplication in all patients suffering from GERD, independent of their esophageal motility. We published our 1-year results of the first 100 consecutive patients in 2001 [6].

After completion of the 5-year follow-up in these patients, we investigated and assessed the long-term outcome and durability of laparoscopic Toupet fundoplication as the primary surgical repair in patients suffering from GERD.

Materials and methods

Patient data

Between September 1993 and June 1998, 100 consecutive patients were treated for symptomatic GERD by laparoscopic Toupet fundoplication (by C.K.). During the period of this study no cases were excluded from the study. All patients were informed and asked for permission for participation in this prospective study. All patient data were collected prospectively and recorded in a data base. Clinical follow-up was obtained 1, 2, 6, 12, and 60 months postoperatively.

All patients were evaluated preoperatively by endoscopy and 24-h pH-manometry.

The course of clinical DeMeester score, appearance, and treatment of wrap-related side effects as well as patient satisfaction were evaluated.

Data are expressed as mean \pm SD unless stated otherwise. Normal distribution of data was tested using the Lilliefors test (software SPSS 10.0, SPSS Inc, Chicago, IL, USA). Where appropriate, differences between groups were tested for significance using the Mann-Whitney U test (software SPSS 10.0). $p < 0.05$ was considered significant.

Indication and preoperative diagnostic

The indication for operative treatment of GERD was proposed according to the SAGES criteria [13]. The consent for operative treatment was made after diagnosis of GERD by endoscopy and/or 24-h pH-manometry. In patients with nonpathological 24-h pH-manometry but typical clinical symptoms of GERD (esophagitis grade IV), the indication for operative treatment was also proposed. One or more of the following criteria had to be fulfilled by all patients:

1. Unsatisfactory response of GERD to conservative medical antireflux treatment
2. Patient wish for operative treatment
3. Development of GERD complications (esophageal strictures, Barrett esophagus, esophagitis grade III/IV)
4. Atypical reflux-related symptoms such as cough, asthma, aspiration, hoarseness GERD symptoms were evaluated pre- and postoperatively by the modified clinical DeMeester score [4]. This clinical score of GERD, which should not be confounded with the DeMeester score used in 24-h pH-manometry, includes variables such as heartburn, dysphagia, regurgitation and gastrointestinal bleeding (range 0–12 points).

Preoperatively all patients received an endoscopy (with biopsy) and 24-h pH-manometry. All patients stopped their medical treatment for GERD at least 7 days before the 24-h pH-manometry. Normal values were defined as pressure curve with a normal amplitude (> 40 mmHg) with $> 30\%$ of propulsive contractions and $< 5\%$ of retropropulsive contractions in all measures; mean time for contractions < 6 sec;

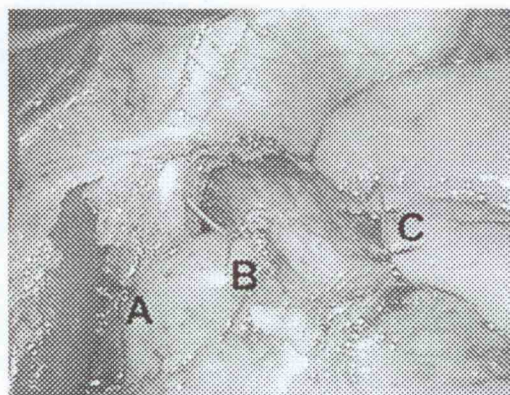


Fig. 1. Laparoscopic intraoperative view after completion of the partial posterior Toupet 270° wrap with sutures at the right crus (A), between the wrap and the esophagus (B), and between the gastric fundus and the esophagus (C).

fraction time with $\text{pH} < 4$ in less than 4% of measured time; longest reflux period < 300 sec and total incidence of reflux periods > 5 min < 2 .

In selected cases (paraesophageal or mixed hiatal hernia diagnosed at endoscopy) an x-ray barium-swallow examination was performed. Endoscopic evaluation of esophageal mucosa was made according to the Savary-Miller classification [12].

In the first 34 patients a postoperative control endoscopy and 24-h pH-manometry was performed 8 weeks postoperatively. Because of highly significant results the postoperative control endoscopy and 24-h pH-manometry were not performed in further patients due to high costs and patient discomfort.

Operative technique

All patients were operated regardless their esophageal motility by a laparoscopic partial posterior 270° fundoplication as described by Toupet [15] for open surgery. In the following we will only summarize the important operative steps, as we have described the procedure elsewhere [9, 10].

Subxiphoidal insertion of a Nathanson static liver retractor to retract the left liver lobe

Mobilization of the gastroesophageal junction without dissection of the triangular ligament

Preparation of the left and right diaphragmatic crus without dissection of the hepatogastric ligament. The short gastric vessels are not dissected.

Mobilization of the distal esophagus and the distal mediastinum with preparation and preservation of the dorsal vagal nerve. The abdominal part of the esophagus is mobilized over a length of 5–8 cm. Distal crurorraphy is performed by nonresorbable single sutures (Ethibond 2-0). A gastric tube Ch 40-60 is inserted to control the width of the neohiatus. The mobilized anterior part of the gastric fundus is passed behind the esophagus to the right and fixed with two sutures to the left crus.

Second fixation with two or three sutures to the right crus and fixation of the wrap to the anterior esophageal wall by two sutures on both sides to form a partial dorsal wrap of about 270° (Fig. 1).

In case of a paraesophageal or mixed hiatal hernia a gastrophrenicopexy with four to five single sutures was performed between the anterior gastric fundus and the left diaphragm.

Postoperative follow-up

By use of Telebrix (Guerbet AG, Zürich, Switzerland), a contrast medium-enhanced roentgenogram was usually performed during the same day of the operation. If the findings excluded esophagogastric leakage, the patients were put on a normal diet. Patients were released on the 3rd postoperative day in case of an uneventful course.

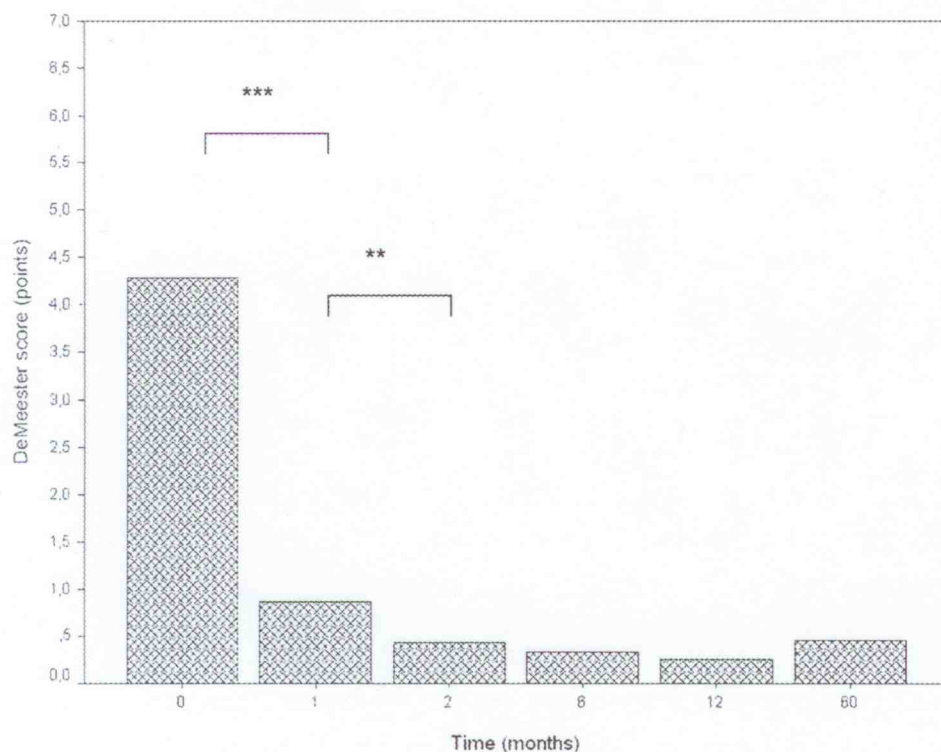


Fig. 2. Course of clinical DeMeester-score after laparoscopic Toupet fundoplication. Criteria: heartburn, dysphagia, regurgitation, gastrointestinal bleeding (range: 0–12; $n = 100$ for the first year follow-up; $n = 87$ at 5 years follow-up; mean; ** $p < 0.005$, *** $p < 0.0005$).

Results

Between September 1993 and June 1998, 100 consecutive patients (63 men, 37 women; m:w = 1.7:1) were operated by laparoscopic Toupet fundoplication. The mean age at surgery was 50.4 years (range 27–81 years).

The mean time of suffering from GERD symptoms was 114 ± 104 months (range 3–400 months). Of the patients, 98% received a preoperative medical treatment for > 3 months with PPI/H2-blockers and/or prokinetica. The mean preoperative clinical DeMeester score (range 0–12 points) was 4.27 ± 1.5 points. One month postoperatively the score had dropped to 0.86 ± 0.9 points ($p < 0.0005$). One year postoperatively the score was 0.25 ± 0.5 points. At 5 years follow-up the DeMeester score reached 0.47 ± 0.9 points (Fig. 2).

Preoperative endoscopy examination revealed an esophagitis grade I–IV according to the Savary-Miller classification in 95% of all patients. Diagnosis of endobrachyoesophagus (Barrett-esophagus) was made in 4%. Co-incidence of hiatal hernias was 92%; axial hiatal hernias were found in 72%, paraesophageal hernias in 6%, and mixed hiatal hernias in 14%. In 3.2% (three of 92 patients) a recurrence of hiatal herniation could be diagnosed during postoperative follow-up.

Preoperative manometry revealed normal esophageal motility in 71% of patients. In 29% of investigations a pathologic esophageal motility was found. A minimal reduced motility (diminished contraction amplitude in normal amount of contractions) was found in 18% and a severe pathologic esophageal motility was found in 11% of measurements. In 6% the reason was a diminished

propulsive contractility and in 5% an increased retro-pulsive contractility was found.

Preoperative 24-h pH-metry showed a mean fraction time of $\text{pH} < 4$ of $17.8 \pm 12.5\%$ (normal value $< 4\%$). For the first 34 patients a control-24-h pH-manometry was performed 8 weeks postoperatively. The mean fraction time of $\text{pH} < 4$ was significantly decreased to $0.9 \pm 1.2\%$ ($p < 0.0005$) (Fig. 3). In half of the patients (five of 10) with the preoperative diagnosis of an esophageal motility disorder, the control manometry showed an improved or even normalized esophageal motility after laparoscopic Toupet fundoplication. Especially the contractility amplitudes in the distal esophagus were found to have normalized postoperatively.

The course of postoperative dysphagia is shown in Fig. 4. At 4 weeks after procedure, a transient dysphagia was found in 43% of patients. Eight weeks postoperatively, 15% of patients still complained of mild dysphagia. One and 5 years postoperatively, 3% and, respectively, 2% of patients declared occasional dysphagia. An endoscopic intervention with balloon dilatation of the wrap for severe dysphagia was necessary in 2% of patients during the first 4 weeks after the operation. One patient had to be dilated 2 months after the procedure; another two patients received dilatation endoscopy after 6 and 12 months, giving a total rate of endoscopic dilatation therapy of 5%. Balloon dilatation therapy was necessary only during the first postoperative year.

Intraoperative complication rate, conversion rate to open fundoplication, mortality, and reoperation rate during the first year were all 0%. The 30-day morbidity rate was 9%, and the late complication rate during the first postoperative year was 9% [6].

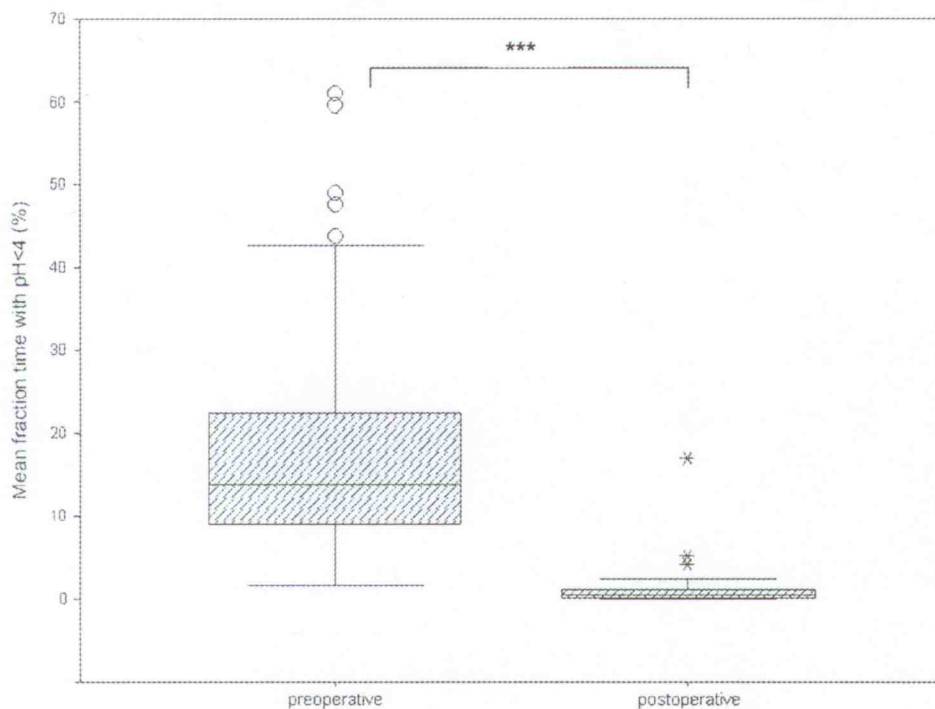


Fig. 3. 24-h pH-manometry preoperative ($n = 100$) and 8 weeks postoperative ($n = 34$) after laparoscopic Toupet fundoplication with measuring the mean fraction-time with $\text{pH} < 4$ (norm $< 4\%$). The box plots show the median score as black center line and the first (25th percentile) and third quartile (75th percentile) as the lower and upper hinges of the box. The whiskers are within 1.5 times the interquartile range. Circles represent values outside the inner fence (minor outliers); stars represent values outside the outer fence (major outliers); *** $p < 0.0005$.

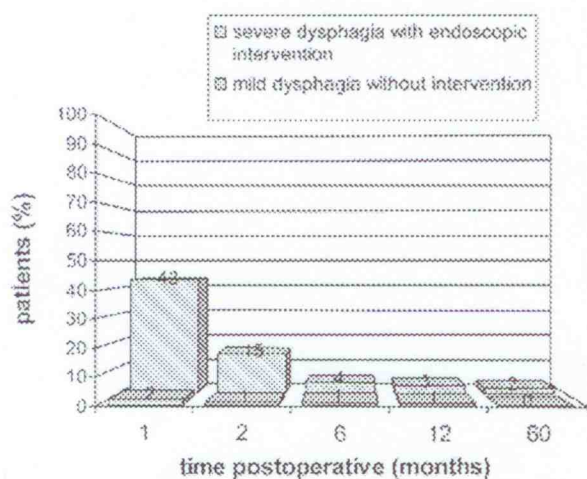


Fig. 4. Course of mild postoperative dysphagia without intervention and of severe dysphagia necessitating endoscopic dilatation therapy after laparoscopic Toupet fundoplication during 5 years follow-up.

The frequency of postoperative symptoms and side effects 1 year and 5 years after laparoscopic Toupet fundoplication is shown in Table 1. At 5 years follow-up, the symptom of heartburn (GERD recurrence) was stated by 13 patients (15%). Eight of these patients reported occasional transient mild heartburn. Two patients reported infrequent medium to strong heartburn necessitating occasional medical treatment. In three patients recurrence of GERD was sufficient to necessitate a permanent postoperative treatment with PPIs.

Treatment failure or postoperative complications requiring reoperation are listed in Table 2. One of the three patients with marked GERD recurrence received a

laparoscopic Toupet re-fundoplication. The three patients identified with wrap dislocation were reoperated all by means of laparoscopy. One patient suffered from a severe postoperative gas-bloat syndrome. In this patient the wrap was loosened by laparoscopy. Total long-term morbidity at 5 years follow-up was therefore 19.5% with a total reoperation rate of 5%. All reoperations could be performed by laparoscopy and all reoperated patients showed a further uneventful course.

Mean body weight was found to be significantly reduced during the first postoperative year from $82.2 \pm 13\text{kg}$ to $79.6 \pm 11\text{kg}$ ($p < 0.0005$). At 5 years follow-up, mean body weight returned to $81.1 \pm 12\text{kg}$ and was therefore not significantly different from the preoperative value.

Mean operating time was 112 ± 40 min (range 55–270 min). The operating time was significantly reduced from 123 ± 45 min (operation 1–50) to 99 ± 30 min (operation 51–100; $p < 0.005$). Mean hospital stay was 5.5 ± 2.1 days (range 1–16 days). Full workability was achieved at 20 days.

When patients were asked 5 years postoperatively about their satisfaction with the outcome of the operation, 96.6% of patients (84 of 87) were pleased with their outcome at late follow-up, and 95.4% of patients (83 of 87) stated that they would consider undergoing laparoscopic fundoplication again if necessary.

Discussion

The efficacy of laparoscopic fundoplication to treat GERD has been proven by several studies. A healing rate of heartburn of 89–98% has been described [1, 14].

Table 1. Frequency of symptoms/side-effects 1 and 5 years after laparoscopic Toupet fundoplication

Symptoms	After 1 year (n = 100)	After 5 years (n = 87)
None	47%	46%
Early satiety	31%	41%
Burp impossibility	25%	33%
Flatulence	15%	10%
Mild dysphagia	3%	2%
Diarrhea	8%	11%
GERD recurrence/heartburn	3%	15% ^a

^a 3 patients take PPI on a regular basis

Table 2. List of treatment failure or complications after laparoscopic Toupet fundoplication necessitating a reoperation during 5 years follow-up

Complications	Rate	Reoperations
GERD recurrence	15%	1
Wrap dislocation	3.4%	3
Gas-bloat syndrome	1.1%	1
Total morbidity rate	19.5%	
Reoperation rate		5%

Therefore, laparoscopic antireflux surgery has obtained similar healing rates as compared to conventional, open antireflux surgery. Indeed, follow-up of most laparoscopic studies ranges between 1 and 2 years, which makes long-term comparison difficult. We report herein our 5-year results after laparoscopic Toupet fundoplication. To our knowledge, this is the longest follow-up of this procedure reported in the literature. At the beginning of our laparoscopic antireflux surgery we operated on GERD patients by applying the "tailored approach." Patients with a normal esophageal motility received a Nissen-Rosetti fundoplication. Patients with a pathologic esophageal motility received a partial Toupet fundoplication. After observing a higher postoperative dysphagia rate in the patients with Nissen-Rosetti fundoplication, we abandoned the "tailored approach" in 1993 and started to perform laparoscopic Toupet fundoplication in all patients suffering from GERD, independent of their esophageal motility. At one year follow-up, we had obtained a 97% healing rate of heartburn for our first 100 consecutive patients [6]. At the same follow-up time, we could determine a low morbidity and wrap-related side-effect rate still more favorable than the rates reported for the Nissen procedure. Hence, we were convinced that a "tailored approach" had no advantage over our new concept to treat all GERD patients by laparoscopic Toupet fundoplication. Some authors have mentioned their apprehension that a partial fundoplication may fail in the long term when compared to a Nissen fundoplication [7, 16]. Jobe et al. [8] have evaluated the outcome of 100 patients operated by laparoscopic Toupet fundoplication. After a mean follow-up of 22 months they had to register a recurrence rate of 20%. According to this finding they concluded, that in pa-

tients with a normal esophageal motility a partial fundoplication should not be performed. In contrary to Jobe et al, we have found a 5-year healing rate of GERD in 85% of our patients treated all by means of a laparoscopic Toupet fundoplication. We have therefore obtained similar and comparable long-term healing rates as described for open and laparoscopic Nissen fundoplication [2, 11]. Our operative technique differs from that described by Jobe et al. [8]. First, their mobilization of distal esophagus is undertaken only for the last 3 cm. Second, they regularly divide the gastrica breves vessels and therefore the gastrosplenic ligament; and third, they do not perform a gastrophrenicopexy in the case of a concomitant hiatal hernia. Whether these differences in the operative technique are responsible for the different recurrence rate obtained remains unclear.

Favorable results were obtained during long-term follow-up when comparing the wrap-related side-effect rate to the results obtained with the Nissen procedure. The dysphagia rates of 3% at 1 year follow-up and 2% at 5 years follow-up appear to be very low. In several prospective and randomized studies comparing the Nissen fundoplication with the Toupet procedure, a higher postoperative dysphagia rate of the Nissen fundoplication in the range of 30–57% [1, 3, 17] was found. Although balloon dilatation therapy is possible by endoscopy, this complication remains a major drawback because of its risk of developing further complications and because of patient discomfort. As shown in our study, this important complication can be reduced to 5% by performing a partial fundoplication, without a higher rate of heartburn or GERD recurrence rate.

The technique of laparoscopic Toupet fundoplication is demanding, and there is certainly a learning curve. Our operative time could be reduced significantly between the first 50 procedures and the second lot. As already shown for other procedures, better outcome is achieved in high-volume centers with a higher case load per surgeon. In our opinion, a minimal personal annual case load of 10–20 laparoscopic Toupet procedures is mandatory to obtain good results.

A significant postoperative weight loss as secondary phenomenon of fundoplication was found at 1-year follow-up. However, in the long-term follow-up, patients regained their weight, proving that postoperative weight loss was only temporary.

The low morbidity and reoperation rates found in this study show that laparoscopic Toupet fundoplication is safe and durable. In case of wrap-related complications, most of them can be managed by laparoscopy again.

In summary, at 5 years follow-up of laparoscopic Toupet fundoplication we have found low recurrence and low wrap-related side-effect rates. The patient satisfaction rate was high. Based on this study, we will continue to perform laparoscopic Toupet fundoplication as the primary surgical repair in patients suffering from GERD, independent of their esophageal motility. Laparoscopic Toupet fundoplication has proven to be a safe and highly successful therapeutic option in GERD patients treated by surgery.

References

1. Alexander HC, Hendler RS, Seymour NE, Shires GT 3rd (1997) Laparoscopic treatment of gastroesophageal reflux disease. *Am Surg* 63: 434-440
2. Bloomston M, Nields W, Rosemurgy AS (2003) Symptoms and antireflux medication use following laparoscopic Nissen fundoplication: outcome at 1 and 4 years. *J Soc Laparosc Surg* 7: 211-218
3. Chrysos E, Tsiaoussis J, Zoras OJ, Athanasakis E, Mantides A, Katsamouris A, Xynos E (2003) Laparoscopic/surgery for gastroesophageal reflux disease patients with impaired esophageal peristalsis: total or partial fundoplication? *J Am Coll Surg* 197: 8-15
4. Cuschieri A (1993) Hiatal hernia and reflux oesophagitis. In: Hunter JG, Sackier JM (eds). *Minimally invasive surgery*. McGraw-Hill, New York
5. Dallemagne B, Weerts JM, Jehaes C, Markiewicz S, Lombard R (1991) Laparoscopic Nissen fundoplication: preliminary report. *Surg Laparosc Endosc* 1: 138-143
6. Holzinger F, Banz M, Tschanner GG, Merki H, Muller E, Klaiber C (2001) Laparoscopic Toupet partial fundoplication as general surgical therapy of gastroesophageal reflux. 1-year results of a 5-year prospective long-term study [in German]. *Chirurg* 72: 6-13
7. Hunter JG, Swanstrom L, Waring JP (1996) Dysphagia after laparoscopic antireflux surgery. The impact of operative technique. *Ann Surg* 224: 51-57
8. Jobe BA, Wallace J, Hansen PD, Swanstrom LL (1997) Evaluation of laparoscopic Toupet fundoplication as a primary repair for all patients with medically resistant gastroesophageal reflux. *Surg Endosc* 11: 1080-1083
9. Klaiber C, Metzger A (1995) *Manual der laparoskopischen Chirurgie*. Huber, Bern
10. Klaiber C, Metzger A, Borer D (1997) Laparoscopic Toupet partial fundoplication. In: Büchler MW, Frei E, Klaiber Ch, Krähenbühl L (eds). *Gastroesophageal reflux disease (GERD): back to surgery?* (Prog Surg, vol 23) Karger, Basel, p 222
11. Lundell L, Abrahamsson H, Ruth M, Rydberg L, Lonroth H, Olbe L (1996) Long-term results of a prospective randomized comparison of total fundic wrap (Nissen-Rossetti) or semifundoplication (Toupet) for gastro-oesophageal reflux. *Br J Surg* 83: 830-835
12. Ollyo J-B, Lang F, Fontollet C, Monnier PEA (1990) Savary-Miller's new endoscopic grading of reflux-oesophagitis: a simple, reproducible, logical, complete and useful classification. *Gastroenterology* 98: 100
13. Society of American Gastrointestinal Endoscopic Surgeons (SAGES) (1998) Guidelines for surgical treatment of gastroesophageal reflux disease (GERD). *Surg Endosc* 12: 186-188
14. Stein HJ, Feussner H, Siewert JR (1998) Antireflux surgery: a current comparison of open and laparoscopic approaches. *Hepatogastroenterology* 45: 1328-1337
15. Toupet A (1963) Technic of esophago-gastroplasty with phrenogastropepy used in radical treatment of hiatal hernias as a supplement to Heller's operation in cardiospasm [in French]. *Mem Acad Chir (Paris)* 89: 384-389
16. Wetscher GJ, Glaser K, Wieschemeyer T, Gadenstaetter M, Prommegger R, Profanter C (1997) Tailored antireflux surgery for gastroesophageal reflux disease: effectiveness and risk of postoperative dysphagia. *World J Surg* 21: 605-610
17. Zornig C, Strate U, Fibbe C, Emmermann A, Layer P (2002) Nissen vs Toupet laparoscopic fundoplication. *Surg Endosc* 16: 758-766