Laparoscopic Refundoplication With Prosthetic Hiatal Closure for Recurrent Hiatal Hernia After Primary Failed Antireflux Surgery

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Background: One of the most frequent complications after laparoscopic antireflux surgery is estimated to be the intrathoracic herniation of the wrap into the chest. Therefore, in up to 5% of patients, revisional surgery is necessary.

Hypothesis: Patients who undergo laparoscopic refundoplication for postoperative intrathoracic wrap herniation using a circular polypropylene mesh for hiatal closure have a good to excellent functional outcome, during a complete follow-up of 1 year.

Design: Prospective nonrandomized trial of a consecutive sample.

Setting: University-affiliated community hospital.

Patients: Twenty-four patients undergoing laparoscopic refundoplication for persistent or recurrent symptoms of gastroesophageal reflux disease as a result of postoperative intrathoracic wrap migration.

Intervention: All patients underwent laparoscopic refundoplication with a circular polypropylene mesh for hiatal closure.

Main Outcome Measures: Recurrences, complications, postoperative lower esophageal sphincter pressure, DeMeester score, esophagogastroduodenoscopy results, and barium swallow results.

Results: All refundoplications were completed laparoscopically. There were no intraoperative complications. Twenty-one patients underwent laparoscopic Nissen fundoplication; in 3 patients, a laparoscopic Toupet fundoplication was performed. Previous antireflux procedures included an open Nissen fundoplication (n = 5), a laparoscopic Nissen fundoplication (n = 15), and a laparoscopic Toupet fundoplication (n = 4). Postoperatively, one patient had severe dysphagia and had to undergo pneumatic dilatation once. During a follow-up of 1 year after surgery, no patient developed a recurrent hiatal hernia, with or without intrathoracic wrap herniation. The mean lower esophageal sphincter pressure increased significantly (P < .01) at 3 months (12.2 mm Hg) and 1 year (11.9 mm Hg) after refundoplication. The mean DeMeester score decreased significantly (P < .01) from 50.5 points preoperatively to 16.0 points at 3 months and 14.7 points at 1 year after refundoplication.

Conclusion: Laparoscopic refundoplication with prosthetic hiatal closure is a safe and effective procedure for preventing recurrent intrathoracic wrap herniation, with good to excellent functional outcome for a complete follow-up of 1 year.

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During the past decade, laparoscopic fundoplication has emerged as the most successful procedure in the surgical treatment of severe gastroesophageal reflux disease (GERD). Thousands of laparoscopic antireflux operations have been performed since Dallemagne et al first described the possibility of minimally invasive access in 1991, with good to excellent functional and symptomatic outcome and a significant improvement of patients’ quality of life. However, some studies have shown that there is a small group of patients in whom antireflux surgery fails and revisional surgery for persistent or recurrent GERD symptoms is required. One of the most frequent morphological reasons for refundoplication is estimated to be recurrent hiatal hernia, with or without migration of the wrap into the chest. Therefore, many researchers prefer a routine hiatal closure during laparoscopic fundoplication. Some studies have shown that it might be useful to use prosthetic materials for reinforcement of the hiatal crura to prevent postoperative hiatal disruption.

This prospective study presents the surgical outcome and functional results in
patients who underwent laparoscopic revisional surgery with prosthetic hiatal closure using a circular polypropylene mesh for recurrent hiatal hernia as the cause of failure of primary antireflux surgery.

**METHODS**

Until May 1, 2000, a group of 24 patients underwent laparoscopic refundoplication for persistent or recurrent GERD symptoms at our surgical department. In all patients, a postoperative intrathoracic wrap migration was the morphological reason for refundoplication (Figure 1). There were 6 female and 18 male patients (mean age, 35 years; range, 33-67 years). Previous antireflux procedures were an open Nissen fundoplication (n=5), a laparoscopic Nissen fundoplication (n=15), and a laparoscopic Toupet fundoplication (n=4). Crural closure was performed during primary surgery in every patient. The mean period between primary antireflux surgery and laparoscopic revisional surgery was 2.8 years (range, 4 months to 12 years).

The preoperative workup in all patients included esophagogastroduodenoscopy (EGD) and a barium swallow test (resulting in a cinematographic x-ray film) for visualization of the anatomical-morphological reason for failure. In addition, esophageal manometry and 24-hour pH monitoring were performed routinely in every patient preoperatively. The type of refundoplication was tailored to the results of esophageal manometry. Laparoscopic 360° Nissen fundoplication was performed in all patients with normal esophageal motility, whereas patients with poor esophageal motility (a pressure of <30 mm Hg in the lower esophageal segments in response to wet swallows) or disordered peristalsis (>40% simultaneous contractions in wet swallows) underwent laparoscopic 270° Toupet fundoplication.

**SURGICAL TECHNIQUE**

The beginning of laparoscopic refundoplication is performed in accord with standard procedure using a 5-port system with 11-mm trocars, as described previously.15 After establishing the pneumoperitoneum with a maximum pressure of 12 to 14 mm Hg, the operation starts with an extended adhesiolysis. After mobilizing the left liver lobe, a liver retractor is placed through the rightmost port for elevation of the liver off the hiatal region. By careful dissection with the harmonic scalpel (Ultra-cision; Ethicon Endo-Surgery, Vienna, Austria), the herniated fundoplication is identified and brought back intra-abdominally using anatraumatic Babcock grasper. The distal esophagus and the gastroesophageal junction are dissected carefully by blunt dissection, and the right and left crura are identified. After complete mobilization, the old wrap is taken down in every patient (Figure 2). After breakdown of the wrap, the esophagus is mobilized posteriorly and the retroesophageal window is created. The right and left crura and the crural commissure are dissected exactly (Figure 3). After exact identification of the hiatal crura, crural closure is performed using interrupted 2-0 Polysorb sutures (Figure 4). After closing the crura posteriorly, the esophagus has to be lying loose in the hiatus. An oval sheet will be cut out of a 10 × 15-cm polypropylene mesh (TYCO Healthcare, Vienna), which we normally use for transabdominal preperitoneal hernia repair. For the esophageal body, a 3- to 4-cm keyhole in the center of the oval mesh is cut out. After bringing the mesh intra-abdominally, it is placed around the esophagus at the gastroesophageal junction, so that the esophageal body is lying through the keyhole of the mesh (Figure 5). The circular mesh is fixed onto the diaphragm using a hernia stapler (Ethicon Endo-Surgery) (Figure 6). Then, the 360° floppy Nissen fundoplication is fashioned as described previously (Figure 7 and Figure 8).13

**RESULTS**

All procedures could be completed successfully laparoscopically. There were no intraoperative complications. Twenty-one patients underwent laparoscopic Nissen fundoplication; in 3 patients, a laparoscopic Toupet fundoplication was performed. Postoperatively, 1 patient had severe dysphagia and had to undergo pneumatic dilatation. After pneumatic dilatation, the patient was free of symptoms at follow-up. The mean operating time was 145 minutes (range, 105-235 minutes).

**EGD RESULTS**

Six weeks postoperatively, 21 patients underwent EGD surveillance at our surgical department; the remaining 3 patients underwent EGD at their local gastroenterologist. All patients showed no endoscopic signs of recurrent hiatal hernia or intrathoracic wrap migration.

**LOWER ESOPHAGEAL SPHINCTER PRESSURE**

Preoperatively, the lower esophageal sphincter pressure was 2.9 ± 1.6 mm Hg, and increased significantly (P<.01) to 12.2 ± 4.2 mm Hg at 3 months after surgery and remained stable (11.9 ± 4.5 mm Hg) at 1 year after surgery. Data are shown in Figure 9.
DeMEESTER SCORE

The DeMeester score decreased significantly ($P<.01$), from $50.5 \pm 15.3$ preoperatively to $16.0 \pm 10.4$ at 3 months postoperatively and $14.7 \pm 9.9$ at 1 year after surgery. As these data show, some patients ($n=4$) showed pathologic values during 24-hour pH monitoring, but did not report any kind of recurrent symptoms at follow-up. Data are shown in Figure 10.

CINEMATOGRAPHIC X-RAY FILM

An esophageal barium swallow test (resulting in a cinemagraphic x-ray film) was performed in 19 patients.

Figure 2. Breakdown of the old wrap.

Figure 3. Preparation of the hiatus.

Figure 4. Crural closure.
1 year postoperatively. It showed a correct subdiaphragmatic position of the fundoplication, with no signs of anatomical or morphological complications in all these patients. An x-ray film was not obtained for the remaining 5 patients who showed normal functional values and were free of symptoms at follow-up.

Generally, laparoscopic antireflux surgery (LARS) has become the most successful surgical treatment option for patients with severe GERD, and has emerged as an established procedure in centers worldwide. Numerous large
studies have proved LARS to be safe and effective, with excellent symptomatic and functional outcomes for long-term follow-up periods. However, there have been some reports in the literature describing some complications unique to the laparoscopic technique. The most common technical failure seems to be in relation to the crural closure. Therefore, the most common morphological reason for recurrent symptoms after primary laparoscopic fundoplication is the intrathoracic migration of the intact wrap. The intrathoracic wrap migration is a result of inadequate closure of the hiatal crura or postoperative disruption of the crural closure. Other reasons are estimated to be inadequate mobilization of the esophagus or a so-called short esophagus. Resulting symptoms are postoperative dysphagia, recurrent reflux, or a combination of both. In most patients with recurrent symptoms after primary antireflux surgery, refundoplication becomes necessary because of this anatomical failure.

In a study by Horgan et al., 48 patients underwent a subsequent laparoscopic operation for primary failed open antireflux surgery or LARS. In this group, postoperative wrap herniation was the most common reason for the subsequent operation. Laparoscopic refundoplication can be a safe procedure in patients in whom a primary intervention failed, with results inferior to those after initial surgery; nevertheless, there is good symptomatic and morphological outcome for short-term and midterm follow-up.

The main challenge of laparoscopic refundoplication in patients with intrathoracic wrap migration seems to be closure of the hiatal crura. In a few patients who underwent laparoscopic refundoplication for that failure, the procedure failed again and the patients had to undergo revisional surgery twice or more. The problem of postoperative breakdown of the crura has led us to use a polypropylene mesh for reinforcement of the hiatal crura during laparoscopic refundoplication.

The underlying morphological reason for fundoplication failure and, therefore, indication for refundoplication in all 24 patients of the present study was an intrathoracic wrap migration. All patients underwent laparoscopic refundoplication with a circular polypropylene mesh that was fixed on the hiatus for crural reinforcement. During a complete follow-up of 1 year after surgery, none of these patients developed a recurrent crural disruption, with or without intrathoracic wrap migration. In addition, we saw no mesh-related complications, such as esophageal erosion, or other events related to the mesh implantation. The postoperative controls by cinematographic x-ray film showed a correct subdiaphragmatic position of the fundoplication in all patients. During follow-up, no patient had clinical or symptomatic recurrence of GERD. Functional variables, such as lower esophageal sphincter pressure and DeMeester score, showed normal values at 3 months and 1 year after refundoplication.

There have been few studies reporting about the use of a mesh prosthesis in laparoscopic refundoplication, but there are some reports dealing with the use of prosthetic materials during primary LARS for GERD and/or hiatal hernia. Prosthetic reinforcement of the hiatal crura...
has been successfully described by Basso et al. A group of 65 patients who underwent LARS with simple interrupted sutures for hiatal closure were compared with 67 patients who underwent LARS with a 3 × 4-cm polypropylene mesh for crural closure. For a mean follow-up of 22.5 months, no patient in the mesh group developed a recurrent hiatal hernia, whereas 13.8% of the patients in the nonmesh group developed a recurrence within the first 4 months after surgery.

Similar experiences have been shown in a recently published large nonrandomized series. Of 531 patients who underwent primary LARS at our surgical unit, 170 underwent hiatal closure using a 1 × 3-cm polypropylene mesh supporting the reinforcement of the hiatal crura. In this group, in 1 patient (0.6%), a postoperative wrap herniation occurred during 1 year of follow-up, whereas 22 patients (6.1%) developed a wrap herniation in the group with simple interrupted sutures used for crural closure.

Carlson et al described 31 patients with GERD and a hiatal hernia (>8 cm) who were randomized to Nissen fundoplication and with either simple posterior cruroplasty or cruroplasty using a polytetrafluoroethylene onlay mesh. As a result, 3 patients (18.8%) in the nonmesh group developed a recurrence, whereas no patient in the mesh group developed a recurrent hiatal hernia for a follow-up from 12 to 36 months.

In a recently published prospective randomized trial, Frantzides et al presented 72 patients who underwent laparoscopic Nissen fundoplication for large hiatal hernia repair. Thirty-six patients underwent fundoplication using posterior cruroplasty and simple interrupted sutures, whereas the remaining 36 patients underwent posterior cruroplasty with onlay of a polytetrafluoroethylene mesh. Besides the fact that the operation was longer in the polytetrafluoroethylene group, patients had similar complications and duration of postoperative hospital stay in both groups. A significant difference in recurrence of hiatal hernia could be evaluated: in the primary repair group, 8 recurrent hiatal hernias occurred postoperatively, in contrast to no recurrence in the polytetrafluoroethylene group.

It might be a case of discussion to use prosthetic material intra-abdominally in terms of the possibility for foreign body erosion into the esophagus or transmural migration of suture material into the esophagus after fundoplication; however, in our experience, erosion of a foreign body or migration of a prosthetic mesh into the esophagus or stomach is a rare complication and, along with other researchers, we have not seen this complication after prosthetic placement of a mesh in the hiatal region in our patients.

Like data from other groups that had proved prosthetic hiatal closure during hiatal hernia repair or primary LARS to be a protective factor regarding recurring hiatal hernia, our present study shows the efficacy of crural closure using a circular polypropylene mesh in laparoscopic refundoplication. For a complete follow-up of 1 year postoperatively, this procedure seems to be a safe and effective treatment option to prevent recurrent intrathoracic wrap migration, with symptomatic and functional results comparable to those for patients who underwent primary LARS. However, a longer follow-up is needed to evaluate certain long-term complications.

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REFERENCES

coscopic antireflux surgery: surgical outcome and analysis of failure after 500 lap-
4. Laflambre D, Watson DJ, Jamieson GS, Myers JC, Ganne PA, Devitt PG. Laparo-
coscopic Nissen fundoplication: five-year result and beyond. Arch Surg. 2001;136:
180-184.
of laparoscopic fundoplication for gastroesophageal reflux disease and para-
595-604.
9. Soper NJ, Dunnean D. Anatomic fundoplication failure before laparoscopic an-
with routine mesh-hipploysty in the treatment of gastroesophageal reflux dis-
12. Basso N, De Leo A, Gracco A, et al. 360° laparoscopic fundoplication with tension-
free hiplplasty in the treatment of symptomatic gastroesophageal reflux dis-
coscopic Nissen fundoplication is an effective treatment for gastroesophageal re-
15. Caridie GB, Bruins J, Himpens J, Verbruyen M. Intrathoracic migration of the wrap
18. Horgan S, Pohi D, Bogetti D, Eubanks D, Pellegrini C. Failed antireflux surgery:
19. Granderath FA, Kamolz T, Kamolz UM, Pointner R. Failed antireflux surgery:
quality of life and surgical outcome after laparoscopic refundoplication. Int J Col-
20. Granderath FA, Kamolz T, Schweiger UM, Pointner R. Long-term follow-up after
laparoscopic refundoplication for failed antireflux surgery: quality of life, symp-
21. Carlson MA, Richards CG, Frantzides CT. Laparoscopic prosthetic reinforcement
22. Frantzides CT, Madan AK, Carlson MA, Stavropoulos GP. A prospective, ran-
23. Arendt T, Stuber E, Monig H, Filsch UR, Katsoulis S. Dysphagia due to trans-
mural migration of surgical material into the esophagus nine years after Nissen