



ORIGINAL ARTICLE

SECONDARY ANTIREFLUX SURGERY

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Aim: With the introduction of laparoscopy, the number of antireflux surgeries (ARS), and consequently failed funduplications, had increased many folds. We report the mechanisms of fundoplication failure in patients having ARS, and present our experience in surgical correction of such failure.

Methods: Twenty three patients who had failed fundoplication were reoperated. Pre- and postoperative evaluation of patients included symptom severity, endoscopy, barium study, esophageal motility and 24-hour pH metry.

Results: The initial procedures were Nissen in 13, Toupet in 8, and Nissen-Rossetti in 2 patients. The causes of failure were transdiaphragmatic migration of fundoplication (n=6), disrupted fundoplication (n=5), tight fundoplication (n=4), slipped/misplaced fundoplication (n=3), paraesophageal herniation (n=3), and tight crural repair (n=2). The secondary ARS performed were Nissen (n=12), Toupet (n=7), paraesophageal hernia repair with crural repair (n=2), widening of a tight crural repair (n=1), and taking down fundoplication (n=1). Per- (n=4) and postoperative (n=5) complications were minor with no mortality. At Follow-up, symptoms were significantly improved.

Conclusion: Reoperations for failed ARS may be performed safely with excellent results. Proper patient selection and paying attention to some technical details at initial ARS could save the patient another surgery.

Keywords: Antireflux surgery, reoperation, fundoplication.

INTRODUCTION

Laparoscopic Nissen fundoplication was first introduced in 1991⁽¹⁾ as an alternative to open antireflux procedures. It is now an established surgical treatment of severe reflux disease and its complications.⁽²⁻⁴⁾ Data from all over the world have demonstrated a three- to fivefold increase in the number of funduplications performed for gastroesophageal reflux disorder (GERD) over the last decade.⁽⁴⁾ Failure of open fundoplication occurs in 9% to 30% of patients, depending on how failure is defined and how long until follow-up.⁽⁵⁻⁷⁾ Published failure rates of laparoscopic Nissen fundoplication are 2% to 17%,⁽⁸⁻¹²⁾ depending on the definition of failure and the experience of the surgeons. The lower rate published for laparoscopic surgery may reflect the shorter follow-up possible for this new procedure.

Failures may occur because of anatomic reasons or

misdiagnosis of the underlying problem. When symptoms recur after surgery, patients may choose to be treated medically or with reoperation. Emergency surgery is rarely required and is usually due to a wrap that may be too tight or to acute hiatal herniation with gastric strangulation. In the past, laparotomy or thoracotomy was used to surgically correct recurrent symptoms.^(4,13-23) In the most severe cases, esophagectomy was recommended.^(13,23,24) Laparoscopic antireflux reoperation has been performed successfully after primary operative failure.^(13,25,26) The results of laparotomy vs laparoscopy have recently been compared prospectively for primary antireflux surgery⁽⁴⁾ and indicate that laparoscopic surgery results in a lower morbidity.⁽⁴⁾

The aim of this study was to determine the mechanism of symptomatic fundoplication failures after fundoplication (open or laparoscopic) for GERD or paraesophageal hernia. A second aim was to determine revision surgery is safe and effective.

PATIENTS AND METHODS

Between January 1999 and October 2005, 23 patients were referred to Gastro-enterology Surgical Center, Mansoura University for surgical treatment of a failed primary antireflux procedure. The initial operation was performed at our hospital in 20 patients (87%) and at other institutions in 3 patients (13%). All patients underwent a prior laparotomy or laparoscopy as the initial procedure for the treatment of gastroesophageal reflux disease (n=20) or paraesophageal hernia (n=3). No patient had prior thoracotomy or thoracoscopy. The previously performed operations are listed in Table 1.

Table 1. Type of primary antireflux surgery.

Operation	Patients No	%
Open Nissen fundoplication	10	43.5
Open Toupet fundoplication	6	26.1
Laparoscopic Nissen fundoplication	3	13.0
Laparoscopic Nissen-Rossetti fundoplication	2	8.7
Laparoscopic Toupet fundoplication	2	8.7

There were 5 (22%) female and 18 (88%) male patients. The mean age was 39.4 years (age range from 21-60 years). Information about previous antireflux procedures done at our hospital was recorded prospectively on a computerized database. Data from the initial operation done outside our center could not be obtained from the surgical team, but the type of fundoplication could be easily identified at reoperation. Nissen procedure consisted of a 360-degree fundoplication with sectioning of the short gastric vessels; Nissen-Rossetti operation consisted of a 360-degree fundoplication without sectioning of short gastric vessels. Toupet procedure was a 270-degree posterior fundoplication with or without dividing the short gastric vessels.

The indications for reoperation were mainly based on the analysis of a detailed clinical history, barium contrast study of the upper gastrointestinal tract, esophagogastroduodenoscopy, esophageal manometry, and 24-hour pH monitoring. Symptom severity was scored before and after surgery on a 4-point scale as shown in Table 2. Additionally, the well-being score was assessed according to Table 3. Manometric criteria for definition of an incompetent lower esophageal sphincter were a low resting pressure (< 10 mm Hg) and/or a short overall (< 2 cm) or abdominal length (< 1 cm). Manometric criteria indicating an esophageal body dysfunction were a low-amplitude peristalsis (< 30 mm Hg) and/or a greater than 30% incidence of abnormal waves. Abnormal esophageal acid exposure was defined by percentage of total reflux time and De Meester's score.⁽²⁷⁾

Table 2. Symptom severity scale.

Symptom	Grade	Description
Heartburn	No	No
	Mild	Occasional episodes
	Moderate	Main reason for the medical visit
	Severe	Continuous interferes with daily activities
Chest pain	No	No
	Mild	Occasional episodes
	Moderate	Frequently present
	Severe	Interferes with daily activities
Dysphagia	No	No
	Mild	Occasional, short duration
	Moderate	Requires liquids to clean
	Severe	Episodes of bolus obstruction requiring medical attention

Fundoplication revision was recommended when the preoperative evaluation revealed a surgically correctable anatomic or functional disorder that corresponded with the patient's symptoms. Patients in whom postoperative symptoms could be adequately managed conservatively without reoperation were excluded. The need for a reoperation was determined by the inability of prior symptoms to resolve, the recurrence of symptoms, or the development of new symptoms after an antireflux operation. The indications for surgical reoperation were persistent or recurrent GERD, severe dysphagia, or presence of paraesophageal hiatal hernia Table 3. The decision to reoperate patients with persistent or recurrent GERD was based mainly on the presence of severe symptoms, absence of major risk factors, radiologic, endoscopic and pH monitoring findings, presence of hiatal hernia, and patient's preference to be reoperated rather than to take proton pump inhibitors. Patients with severe dysphagia were initially treated with bougie dilation. If dysphagia persisted, reoperation was considered after at least 3 months.

Table 3. Well-being score.

Grade	Description
Excellent	Completely recovered
Good	Major improvement with minor problems
Fair	Major improvement but still some significant symptoms or side effects
Poor	Minor or no improvement or even worsening

The technique of secondary surgery was similar for both open and laparoscopic access except in the access. For laparoscopic access, the abdomen was entered using the Hasson or Veress needle techniques in the left upper quadrant. This area is most commonly free of adhesions. Carbon dioxide gas is insufflated, a 10-mm port is placed, and a camera is inserted. Blunt dissection is used to separate adhesions. The camera is switched to a second port after its placement 2 to 3 cm above the umbilicus in the midline. The remainders of the ports are placed in the usual manner for a laparoscopic Nissen fundoplication.^(1,3) In case of laparotomy, the abdomen is entered through an upper midline incision skirting the umbilicus. The procedure then continues, depending on the situation.

Careful dissection of the hiatal region, upper segment of the stomach, and distal esophagus was the most crucial and difficult step of the reoperation. These structures and the fundoplication must be completely identified and isolated to establish the precise diagnosis of the problem and correct it.

The type of secondary operation was determined by preoperative esophagogastric assessment and intraoperative findings. Transdiaphragmatic migration of fundoplication and paraesophageal hiatal hernia were managed by adequate esophageal mobilization and reduction of all herniated stomach followed by posterior crura repair. When the hiatus was still wide, one or two sutures were occasionally necessary in the anterior portion of the crura. No patient required prosthetic enforcement of a wide hiatus. If the fundoplication was disrupted or slipped/misplaced (the integrity of fundoplication was tested by air insufflation into the stomach through a nasogastric tube), the fundoplication was reconstructed. Reconstruction into either complete or partial wrapping was determined by the results of esophageal manometry (weak esophageal body peristalsis indicated a partial wrap). If the patient had significant gastroesophageal reflux, with intact fundoplication and no hiatal hernia, the fundoplication was refashioned from a 270-degree to a 360-degree valve. When a tight hiatus was the cause of the dysphagia, the hiatus was widened by either removing one or more crura repair sutures or dividing the crura. If the hiatus was not tight but the wrap appeared tight, the fundoplication was refashioned as a posterior partial fundoplication. Collis gastroplasty was not done for any patient even with apparently short esophagus, as extensive and adequate esophageal mobilization was found to be sufficient to return the gastroesophageal junction and 2 cm of distal esophagus to the abdomen without tension.

Open access was offered for all of first revisions but with increased experience in laparoscopy, laparoscopic access

was tried in the late cases. Laparoscopic access was recommended only if the patient had initial operation by laparoscopy. The preoperative and postoperative symptomatic outcome and well-being scores were determined postoperatively by personal interview. Statistical analysis of the well-being score was performed using the Student t test.

RESULTS

MECHANISM OF FAILURE: Preoperative evaluation and intraoperative observation were used to determine the reason for failure Table 4. The most common cause for persistent or recurrent GERD was herniation of the fundoplication and was detected in 6 (26.1%) patients (Figs. 1a,b). The fundoplication was intact in 5 (83.3%) of these patients and it was disrupted in one patient (16.7%). Disruption of fundoplication was the second most common cause for persistent or recurrent GERD. The disruption was complete in 2 patients (Fig. 2) and partial in the other two (Fig. 3). The main reason for severe dysphagia was tight fundoplication (Fig. 4).

Table 4. The reason for failure of fundoplication (n=23).

Cause of failure	Patients No	%
Persistent or recurrent GERD		
Transdiaphragmatic migration of fundoplication	6	26.1
Disruption of Fundoplication	4	17.4
Slipped/misplaced fundoplication	3	13
Migration and disruption of fundoplication	1	4.3
Patients with severe dysphagia		
Tight fundoplication	4	17.4
Tight crural repair	2	8.7
Patients with paraesophageal hernia		
Paraesophageal herniation	3	13



Fig 1a. Barium study showing a migrated up wrap. Note the compression on the esophagus by the migrated portion.



Fig 1b. Retroflexed endoscopic view showing a migrated wrap with a big paraesophageal diverticulum.

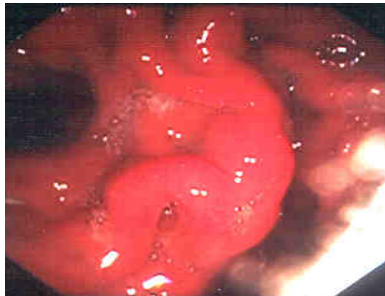


Fig 2. Retroflexed endoscopic view showing a totally disrupted wrap.

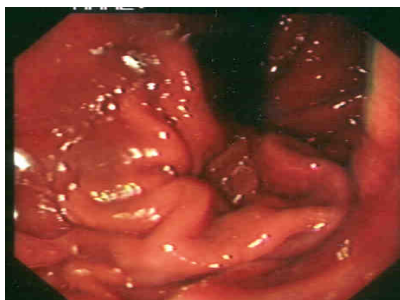


Fig 3. Retroflexed endoscopic view showing a partially disrupted wrap.



Fig 4. Barium study showing a tight wrap.

SURGICAL DETAILS: The type of secondary antireflux surgery is outlined in Table 5. Secondary antireflux surgery was performed and completed laparoscopically in one patient only. Another patient had a laparoscopic trial but converted to laparotomy. The main reason for conversion was impossibility to dissect the hiatal region safely owing to the presence of intense adhesions from previous operation.

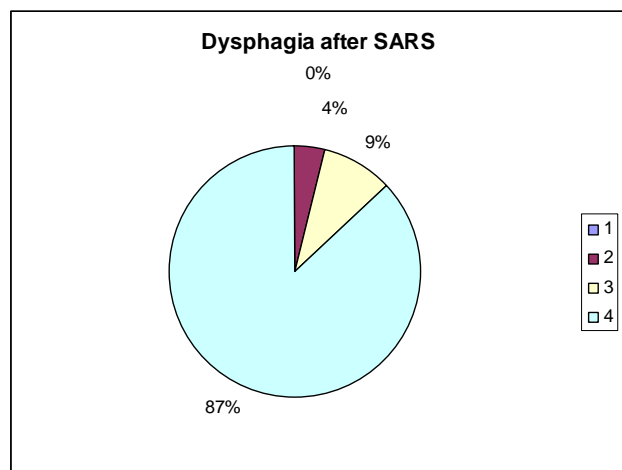
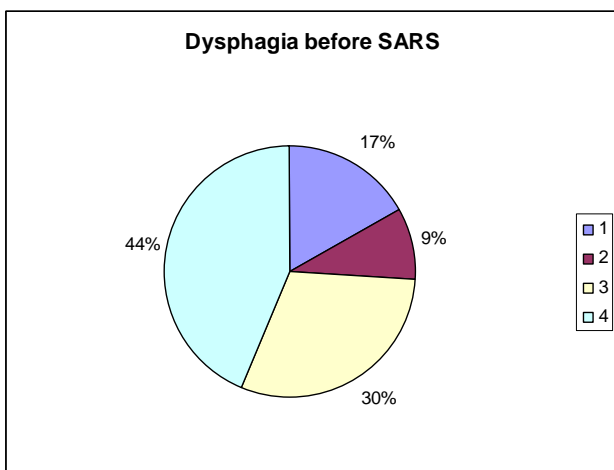
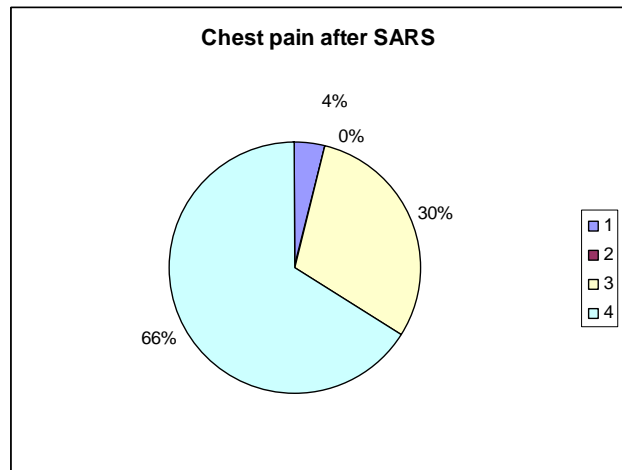
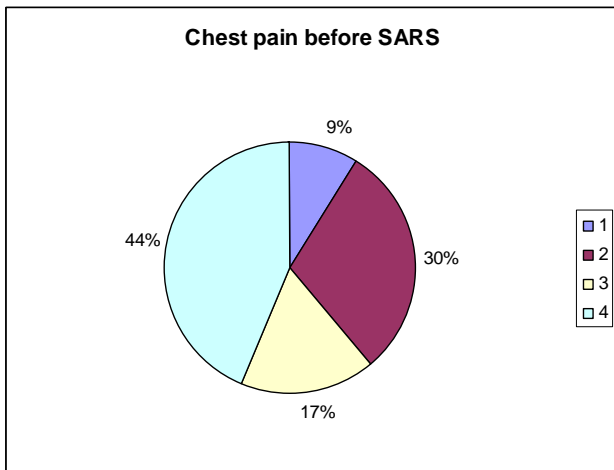
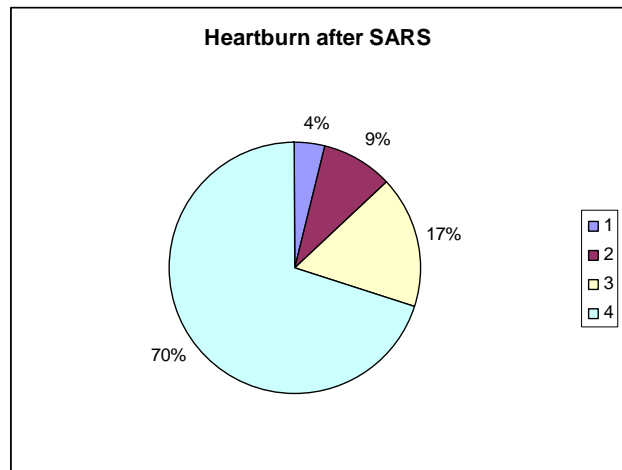
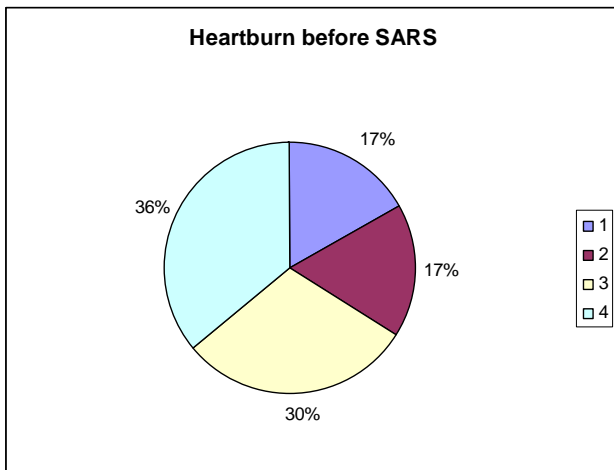
Table 5. Type of secondary antireflux surgery.

	Patients No	%
Nissen fundoplication	12	56.5
Toupet fundoplication	7	30.4
Paraesophageal hiatal repair with crural repair	2	8.7
Crural widening	1	4.3
Taking down fundoplication	1	4.3

The average postoperative hospital stay was 4.9 days, with a range of 3-16 days. The patient whose reoperation was completed laparoscopically stayed in hospital for 3 days. Operative time varied from 72 to 280 minutes, with an average of 132 + 39 minutes. The intraoperative blood loss was not significant and no patient required blood transfusion.

SYMPTOMATIC OUTCOME: Follow-up was possible in all patients at 28.2 + 11.8 months. The well-being score for all patients was 3.4 + 2.1 before and 1.3 + 2.4 after surgery ($p < 0.001$). Of patients interviewed, 18 (78.3%) were satisfied with their decision to have a reoperation. Twenty patients (87%) reported good to excellent control of heartburn and regurgitation, with the remainder reporting fair or poor control. Twenty patients (87%) had no dysphagia; however, two patients reported occasional dysphagia, and one patient was still significantly bothered by dysphagia (Fig 5). Endoscopic dilatation was required for him.

OBJECTIVE OUTCOME: Assessment of the wrap by barium study and esophagogastroduodenoscopy at follow up had shown that only three patients had complicated fundoplication; one had transdiaphragmatic migration of fundoplication, one had a disrupted wrap, and last one had severe reflux despite an intact wrap. Esophageal manometry and 24-hour pH metry were done to 21 (91%) patients Table 6.



1=severe, 2=moderate, 3=mild, 4=no, SARS=secondary antireflux surgery

Fig 5. Symptomatic outcomes after secondary antireflux surgery (minimum follow-up, 2 months).

Table 6. Results of esophageal manometry and 24-pH metry studies before and after secondary surgery.

	Before secondary surgery n=21	After secondary surgery n=21
Esophageal manometry		
LESP (mmHg)	14.6+/-7	18.4+/-6.7
Distal body amplitude (mmHg)	34+/-8.2	35.3+/-11.3
24-hour pH metry		
* % total reflux time	4.5+/-7.8	1.0+/-1.7
* De Meester score	14.2+/-24.2	3.4+/-7.2

*P Value is <0.001.

COMPLICATIONS: There was one conversion to the open procedure, which were a result of dense adhesions and fundic perforation Table 7.

Table 7. Complications during and after secondary surgery.

Complications	Patients No.	%
Peroperative		
Gastric perforation	2	8.7
Left pneumothorax	1	4.3
Bleeding >200 mL	1	4.3
Postoperative		
Wound infection	1	4.3
Incisional hernia	1	4.3
Transdiaphragmatic wrap migration	1	4.3
Disrupted wrap	1	4.3
Severe reflux	1	4.3

There was no mortality. Four patients (17.4%) had intraoperative complications. Left pneumothorax was identified in one patient and was due to perforation of the left pleura behind the diaphragmatic crus during encircling of the esophagus. No treatment was necessary. One patient had major bleeding (>200 mL) due to persistent blood oozing from spleen during division of short gastric vessels. The bleeding was controlled with careful use of cautery and sponge compression of the oozing area. No blood transfusion or splenectomy was necessary. Gastric perforation occurred in two patients; one of them was detected intraoperatively and sutured in two layers. This patient had good outcome. The perforation was not detected intraoperatively in the other patient and he had a gastrocutaneous fistula that closed after 9 days on conservative means.

Five patients (21.7%) had postoperative complications. One

patient had wound infection, one patient had incisional hernia (incisional hernia was observed in the patient who had wound infection and this patient underwent hernia repair with good recovery), one patient had transdiaphragmatic migration of fundoplication, one patient had a partially disrupted wrap, and one patient had severe reflux. The last three patients were treated medically without further surgery.

Most patients complained of dysphagia, abdominal distention, and increased flatus after the procedure, but the symptoms were usually mild and temporary, disappearing spontaneously within a few months in most of these patients. Only one patient had one session of endoscopic pneumatic dilatation for relief of dysphagia

DISCUSSION

Failed antireflux operations are seen now more frequently than in the last decade.⁽²⁸⁻³⁰⁾ This reflects the dramatic increase of the number of laparoscopic fundoplications. This mishap occurs in 5 to 10% of the patients.^(8,11,26) This failure may be due to incomplete preoperative evaluation, bad choice of the operation, technical errors, or poor patient selection.^(23-26,31) Precise identification of the cause for failure of the primary antireflux procedure is essential for the correction of the problem.⁽³¹⁾

The main mechanisms of failure after antireflux procedures are herniated fundoplication, slipped or misplaced fundoplication, disrupted fundoplication, paraesophageal hernia, tight fundoplication, and tight hiatus.^(9,35) Persistent or recurrent GERD and dysphagia were the most common causes for failure of primary antireflux procedures in this series.

Herniation of the fundoplication followed by partial or total disruption of the fundoplication were the most common causes of persistent or recurrent GERD following failed antireflux operation. Revisional procedures were able to cure GERD in most patients. Most hernias arise in the early postoperative period, but they may not be recognized initially.^(7, 34) A prosthetic patch repair may be required.⁽¹³⁾ We did not require mesh repair in this study. Adequate mobilization of the esophagus is a cornerstone for creation of a fundoplication not exposed to undue tension.⁽⁹⁾ Future technical modifications should focus on the prevention of herniation because this was the most commonly encountered anatomic defect in our patients. A misplaced Nissen fundoplication is the result of a technical error in which the fundoplication is incorrectly placed over the stomach. A slipped Nissen fundoplication is due to slippage of the stomach up through an intact wrap. A tight wrap occurs because of poor surgical technique or the misdiagnosis of achalasia. A tight crural repair is usually caused by surgical inexperience. A tight wrap must be taken down. Fibrotic scars must also be released to resolve

dysphagia.⁽²⁶⁾ A bougie is considered helpful in preventing postoperative dysphagia, but the use of a bougie results in a higher incidence of esophageal perforations.⁽³¹⁾ A bougie was not used in any of our study patients but it caused a perforation in one patient operated in our center in the past. Because of this, we have now abandoned the use of bougies.

Dysphagia following laparoscopic fundoplication has been reported from 2.1% to 31%.^(32,39) This wide variation may be associated with different methods employed for clinical assessment of this complication and differences of operative technique. It has been suggested that either partial fundoplication or division of the short gastric vessels may reduce postoperative dysphagia.^(32,39) Dysphagia was reduced by the routine use of partial fundoplication in one recent randomized study.⁽³²⁾ However, division of the short gastric vessels did not decrease postoperative dysphagia in two randomized studies.^(32,38) Severe dysphagia was the second major cause leading to revisional operation in our series. Tight fundoplication was the most common cause of severe dysphagia.

The most appropriate time to reoperate patients with dysphagia following antireflux procedures is controversial.^(7,10) Most patients complain of dysphagia following fundoplication, but it is usually mild and temporary. This symptom disappears spontaneously within few months of the operation in most of these patients.⁽³⁶⁾ Esophageal dilation was performed in patients with persistent or severe dysphagia. We indicated revisional operation only in patients with no dysphagia improvement after at least 3 months of the operation and after failure of endoscopic dilation. However, some authors indicate reoperations earlier. Yau et al referred that laparoscopic reoperation performed at an early stage is easy and associated with minimal morbidity and fast postoperative recovery.⁽⁷⁾ On the contrary, if not performed early, the reoperation would be much more difficult at a later stage. With this approach, however, some patients with dysphagia that would improve with time or dilation might be subjected to unnecessary reoperation. Revisional operation for dysphagia usually consisted of either widening of the hiatus or reconstruction of fundoplication in our study.

Differential diagnosis between herniated fundoplication and paraesophageal hernia may be difficult.⁽³³⁾ However, barium esophagogram and operative findings usually establish the diagnosis.^(5,40-42) A variable cephalad migration of the whole gastroesophageal junction with the fundoplication through the hiatus into the posterior mediastinum is characteristic of herniated fundoplication. In distinction, the gastroesophageal junction with the fundoplication remains within the abdomen in the

paraesophageal hernia and only part of the stomach herniates through a large hiatal defect.

Reoperation after a failed antireflux procedure is not devoid of complications as reoperations are more difficult than the primary procedure due to adhesions from previous operation that make identification of anatomic planes difficult. The chances of esophagus or stomach perforation, pneumothorax, diaphragm injury, vagal nerve injury, splenic trauma, and bleeding are increased when a reoperation is undertaken.^(8,11,12) Most series show a mortality rate of approximately 0.5% to 2% and a morbidity of 15 to 40%.^(12,43) In the present series, most operative complications were minor and there was no mortality. Digestive tract perforation occurred in only two cases.

Several authors have reported that the success rate with revisional operations was inferior to that of primary procedures.^(31,36-38) Antireflux reoperation with the open technique has a higher mortality than the initial procedure, with an average mortality of 2.8% and success rate of 79%.⁽¹⁵⁾ Our 0% mortality attests to the safety of these procedures. Revisions of failed fundoplication have been performed traditionally by means of an open operation, but recent studies suggest that laparoscopic approach may be preferred.^(35,38,44-49)

The present study demonstrates that a secondary antireflux surgery to correct previous antireflux surgery may be performed safely. The incidence of complications was high compared with that of a primary procedure. This did not lead to significant morbidity, however. The high patient acceptance rate indicates that postoperative symptoms are more tolerable than preoperative symptoms. Careful patient selection and preoperative evaluation are necessary to determine appropriate candidates for reoperation and the correct choice of operation to be performed.

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