

# Conversions and Complications of Laparoscopic Treatment of Gastroesophageal Reflux Disease

D. Collet, MD, *Bordeaux, France*, G.B. Cadière MD, *Brussels, Belgium*, and the Formation for the Development of Laparoscopic Surgery for Gastroesophageal Reflux Disease Group

**BACKGROUND:** It is now known that laparoscopic surgery is associated with less discomfort and less pain during the patient's postoperative course. Laparoscopic treatment of gastroesophageal reflux disease (GERD) is technically feasible. The advantages of this minimally invasive surgical route seem well adapted to a basically functional surgery. However, it is important to know whether laparoscopic access adds a specific risk to this type of surgery.

**PATIENTS AND METHODS:** A retrospective survey was conducted among members of the Formation for the Development of Laparoscopic Surgery (FDCL) group during 1993. A form was filled in anonymously for each patient who had had either a conversion or a postoperative complication following a laparoscopic procedure for GERD. Items concerned preoperative workup, technical details of surgery, and postoperative course. Another form was used to ascertain how many surgical procedures for GERD had been performed during the same period, either laparoscopically or via an elective laparotomy. Nineteen surgeons from the FDCL group took part in the study. From 1991 to 1993, 758 patients underwent a laparoscopic procedure for GERD, while during the same period 38 patients underwent an elective laparotomy.

**RESULTS:** In the laparoscopic group, there were 294 Nissen, 334 Nissen-Rossetti, and 106 Toupet procedures, and 24 Angelchik prosthesis placements. No deaths occurred. The operation had to be converted to an open procedure in 32 cases (4.2% conversion rate). In 7 cases the conversion was due to an intraoperative complication, whereas in 25 cases the conversion was done because of technical difficulties. In 6 cases an intraoperative complication was treated la-

paroscopically without conversion. Thirty postoperative complications were recorded (morbidity 4%), leading to a reoperation in 12 cases. Five major complications were observed: 2 esophageal perforations, 2 gastric perforations, and 1 bowel perforation.

**CONCLUSION:** These results compare favorably with those of open surgery and suggest that laparoscopic treatment of GERD is as safe as open surgery when performed by a surgeon experienced in laparoscopy.

Five years after the first laparoscopic cholecystectomy, the use of the laparoscope has been extended by digestive surgeons to many abdominal procedures. The advantages of this surgical route no longer need to be demonstrated, after the numerous studies that have been carried out on laparoscopic cholecystectomy. Laparoscopic access improves and shortens the postoperative course and adds a real benefit, provided that it does not increase the surgical risk for the patient. This route seems particularly well adapted to the treatment of gastroesophageal reflux disease (GERD), which is basically a functional surgery. The first laparoscopic treatment of GERD was reported in 1991 by Geagea<sup>1</sup> and Dallemagne et al.<sup>2</sup> Since then, this procedure has found great success among surgeons, physicians, and patients. However, as some severe and sometimes lethal complications have been reported, it seems important to define accurately the rates of morbidity and mortality of the laparoscopic treatment of GERD. That was the aim of this multicenter retrospective study.

This study was carried out by the GERD group of the Formation for the Development of Laparoscopic Surgery (FDCL), an international group of surgeons comprising 48 experts in laparoscopic surgery. It was founded in 1992, and since that date has been working on several topics in the field of laparoscopic surgery. It is organized in several groups, each of them focused on a particular topic of laparoscopic surgery. The group for GERD includes 19 surgeons, all of whom took part in the present study.

## PATIENTS AND METHODS

A survey was conducted among patients who had either a conversion to laparotomy or a postoperative complication following a laparoscopic procedure for gastroesophageal reflux disease performed between 1991 and 1993 by the members of the GERD group. Data were collected retrospectively and anonymously by the operating surgeon. A form was filled out for each patient who had had either a conversion or a postoperative complication. The form included items about: preoperative workup; the surgeon's previous experience in laparoscopic surgery of GERD; technical details of the operation, namely, the type

From the General and Digestive Surgery Service (DC), Center for Laparoscopic Surgery, Bordeaux, France and the Department of Surgery (GBC), Hopital Saint Pierre, Brussels, Belgium.

The remaining members of the Formation for the Development of Laparoscopic Surgery for Gastroesophageal Reflux Disease group are: R. Baumer, MD, J.C. Berthou, MD, J.C. Bertrand, MD, J. Boulez, MD, G. Champault, MD, P. Chastan, MD, J.P. Le Calvé, MD, J. Domergue, MD, F. Drouard MS, J.L. Dulucq, MD, P. Espalieu, MD, C. Mazarguil, MD, H. Mosnier, MD, C. Peraldi, MD, L. Potiron, MD, G. Samama, MD, and C. de Seguin, MD.

Requests for reprints should be addressed to D. Collet, MD, Service de Chirurgie Générale et Digestive, Centre de Chirurgie Laparoscopique (Pr J. Périssat), 311 Boulevard du Président Wilson, 33200 Bordeaux, France.

Manuscript submitted March 18, 1994 and accepted in revised form July 26, 1994.

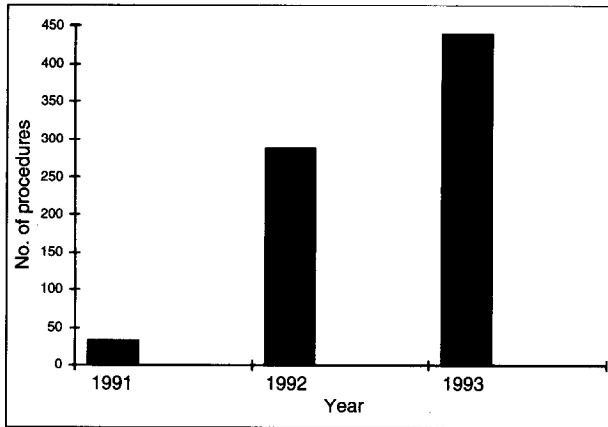


Figure 1. Number of procedures performed per year.

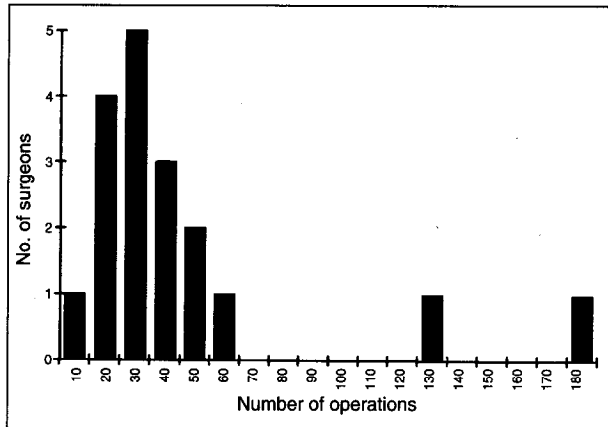


Figure 2. Surgeons' experience: number of operations performed per surgeon.

of procedure and characteristics of the wrap; reasons leading to a conversion, if any; and postoperative course and complications, if any.

As the GERD group is a small group, it was easy to have frequent contact with participating surgeons, so we are confident that this study took into consideration all complications or conversions. In addition, another form was used to identify the type of surgical procedure and the number of patients operated on over the study period, either laparoscopically or via an elective laparotomy. Data were collected on a personal computer by one of the authors (DC). Owing to the method used, there is no information about the patients who had neither conversion nor postoperative complications.

### Statistical Methods

Chi-square analysis was used to compare qualitative criteria. A value of  $P < 0.05$  was considered significant.

### RESULTS

Between 1991 and 1993, 758 laparoscopic procedures for GERD were performed by the 19 surgeons who took part in this study (Figure 1). The number of operations performed per surgeon is shown in Figure 2.

Laparoscopic access was decided in the absence of a contraindication for pneumoperitoneum. During the same period, 38 patients underwent a surgical procedure for GERD

TABLE I

#### Surgical Procedures Used for 758 Laparoscopic Treatments of Gastroesophageal Reflux Disease

Procedure	No. of Cases	Percent	No. of Surgeons*
Nissen	294	38.8	10
Nissen-Rossetti	334	44.1	12
Toupet	106	14.0	10
Angelchik prosthesis	24	3.2	1

\*Number of surgeons performing the procedure.

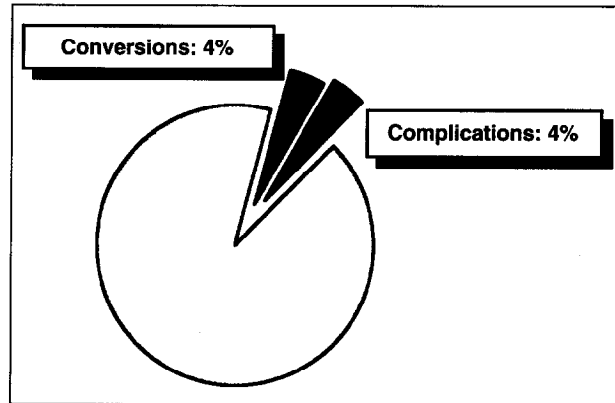


Figure 3. Results of laparoscopic treatment of 758 cases of gastroesophageal reflux disease.

with an elective laparotomy due to either a contraindication for pneumoperitoneum or a concurrent procedure necessitating a laparotomy.

### Surgical Techniques

The surgical technique (Table I) was left to the surgeon's discretion, as was the site of placement of the cannulas and the height of the wrap. Four techniques were routinely used:

- The Nissen procedure ( $n = 294$ ). A  $360^\circ$  fundoplication is performed once the short vessels have been divided, in order to ensure a tension-free wrap.
- The Nissen-Rossetti procedure ( $n = 334$ ). A  $360^\circ$  fundoplication is performed with the anterior aspect of the stomach without dividing the short vessels.
- The Toupet technique ( $n = 106$ ). A  $270^\circ$  valve is created with the fundus without dividing the short vessels.
- The Angelchik prosthesis placement ( $n = 24$ ). A prosthesis is placed around the abdominal esophagus, as described primarily by Angelchik and colleagues.<sup>3</sup>

All these operations are similar to the equivalent open procedure. The height of the wrap ranges from 3 to 5 cm. Most surgeons calibrate the esophagus with a 50-Fr bougie.

The results of laparoscopic treatment of GERD are shown in Figure 3. No deaths occurred in this series, for a mortality rate of 0%.

### Conversions

The operation had to be converted (Table II) to an open procedure in 32 cases (a 4.2% conversion rate).

In 7 instances, conversion was done owing to the onset of an intraoperative complication that could not have been managed laparoscopically (conversion for necessity). There

TABLE II

Conversions to Laparotomy in 32 of 758 Cases (4.2%) of Gastroesophageal Reflux Disease

	No. of Cases
Conversions for comfort of use	25 (3.3%)
Technical difficulty	17
Enlarged left hepatic lobe	7
Device failure	1
Intraoperative complication	7 (1%)
Hemorrhage	2
Esophageal injury	2
Poor tolerance to pneumoperitoneum	1
Pleural injury	1
Omental hematoma	1

were 2 patients with esophageal injuries, intraoperatively diagnosed by a methylene blue test; the perforation was sutured and the postoperative course was uneventful. In 2 other cases, hemostasis could not be achieved satisfactorily through the scope; the bleeding that came from the crura hindered the delineation of the anatomy. And in another case, a pleural injury led to a pneumothorax, requiring interruption of the pneumoperitoneum due to its hemodynamic consequences.

In 25 cases, the conversion was not due to a complication but to technical difficulties (conversion for comfort). In 17 cases, the surgeon did not feel comfortable and preferred to switch to a traditional route. In 7 cases, an enlarged left hepatic lobe precluded a good exposure of the hiatal area, and in 1 patient, a technical problem obliged the surgeon to stop the laparoscopic procedure.

The conversion rate decreased according to the surgeon's experience, and dropped to 0% beyond the 25th case. The conversion rate was 3% for the Nissen operation, 4.7% for the Nissen-Rossetti operation, 2.8% for the Toupet operation, and 16.6% for the Angelchik prosthesis. The difference is not statistically significant.

#### Intraoperative Complications Without Conversion

In 6 cases, an intraoperative complication could be treated laparoscopically, without conversion—4 gastric perforations were successfully sutured without subsequent complications, and 2 pleural injuries were repaired with either a suture or a thoracostomy placed during the operation.

#### Complications

Thirty postoperative complications (a 4% morbidity rate) were recorded, as given in **Table III**, consisting of 4 parietal (0.1%), 12 intra-abdominal (1.6%), 12 respiratory (1.6%), and 2 miscellaneous (0.2%) complications. A reoperation was necessary in 12 cases (40% of postoperative complications). These reoperations were 7 laparotomies, 4 laparoscopies, and 1 thoracotomy. The complication was medically cured in 7 cases, a thoracostomy was necessary for a few days in 6 cases, and the complication resolved spontaneously and did not require a specific treatment in 5 cases.

Five major complications were observed, which were treated with a reoperation. Two patients had esophageal perforations, which were successfully sutured on postoperative days 3 and 8 with a laparotomy; these patients were

TABLE III

Postoperative Complications in 30 of 758 Cases (4%) of Gastroesophageal Reflux Disease

	No. of Cases*
Abdominal wall complications	4 (0.1%)
Postoperative hernia	2
Hematoma	1
Wound infection	1
Intra-abdominal complications	12 (1.6%)
Hemorrhage	4
Gastric perforation	2
Esophageal perforation	2
Plication migrated into the thorax	2
Bowel perforation	1
Bowel occlusion	1
Respiratory complications	12 (1.6%)
Pneumothorax	6
Atelectasis	5
Pleural effusion	1
Miscellaneous	2 (0.2%)
Unexplained fever, suspicion of esophageal injury	1
Posterior truncal vagus divided	1

\*Percentages in parentheses are rounded.

discharged 48 and 10 days, respectively, after the reoperation. Two patients had gastric perforations, 1 of which was sutured with a thoracotomy and the other treated by fundic resection via a laparotomy. One patient had a bowel perforation, which was treated with a laparotomy; this patient had had several previous laparotomies.

Miscellaneous complications included 1 instance of the posterior truncal vagus nerve being inadvertently divided, without any consequence on postoperative gastric emptying. In another case, a surgical exploration was decided on owing to a suspected esophageal injury because of fever and abdominal pain during the first postoperative days; at reoperation, there was neither esophageal perforation nor any intra-abdominal complication.

The morbidity rate was 12.5% after the Angelchik prosthesis placement, 5% after the Nissen-Rossetti procedure, 2.8% after the Toupet operation, and 2.3% after the Nissen procedure.

#### COMMENTS

It is now admitted that laparoscopic access shortens the discomfort, morbidity, and disability that follow laparotomy, as previously demonstrated by many studies on laparoscopic cholecystectomy. Thus, this minimally invasive route seems particularly suitable for the treatment of functional diseases such as GERD.<sup>1,2,4,5</sup> Insofar as the laparoscopic procedures reproduce the classical operations used for GERD, one can expect the same functional results. However, the question remains whether laparoscopic access is associated with a higher mortality or morbidity rate, and whether the advantages of laparoscopic access are not reduced by a possibly higher surgical risk. Compared with the results of other series (**Table IV**),<sup>1,6-13</sup> the results reported herein suggest that laparoscopic treatment, when performed by an experienced laparoscopic surgeon, is as safe as open surgery. There was no mortality, and morbid-

TABLE IV

Results of Surgical Treatment of Gastroesophageal Reflux Disease						
	Year	No. of cases	Mortality (%)	Morbidity (%)	Splenectomy (%)	Conversion (%)
Open Surgery						
Donahue et al <sup>6</sup>	1985	77	1.3	5.2	3.9	
De Meester et al <sup>7</sup>	1986	100	1	13	1	
Segol et al <sup>8*</sup>	1989	52	0	7	1.9	
Siewert et al <sup>9</sup>	1989	94	0	6.3	4.2	
AFC <sup>10*</sup>	1989	943	0.9	18.2	3.6	
Laparoscopic Surgery						
Geagea <sup>1</sup>	1991	10	0	0	0	10
Cuschieri et al <sup>11*</sup>	1993	116	0	13	0	0.8
Weerts et al <sup>12</sup>	1993	132	0	0	0	3.3
Bittner et al <sup>13</sup>	1994	35	0	25.7	0	14.3
FDCL <sup>*</sup>	1994	758	0	3.98	0	4.2

\*Multicenter studies.

AFC = French Surgical Association; FDCL = Formation for the Development of Laparoscopic Surgery.

ity compared favorably; hence, laparoscopic treatment seems to have more advantages than disadvantages.

This study includes the learning step of laparoscopic surgery for GERD for most of the participating surgeons. Nevertheless, all had previous wide experience in laparoscopic surgery. During the same period, an elective laparotomy was done in 38 patients to treat this disease. Thus, the bias induced by the selection for laparoscopy seems very mild, as this route was suitable for 95% of the patients referred for surgical treatment of GERD.

### Conversion to Open Procedure

In this study, the rate of conversion to an open procedure was 4.2%. All the conversions occurred at the beginning of the surgeon's experience, and this rate dropped to 0% beyond the 25th case. Obviously, the learning curve plays an important part in the conversion rate; however, such a conversion is always possible, even for an experienced surgeon. The aim of the operation is to treat the reflux rather than to perform a laparoscopic procedure at any cost. Conversion brings the patient back to the conditions of a conventional procedure, which is not really a complication when performed by a digestive surgeon, provided that the patient is aware of the risk.

Conversion may be necessary in two types of circumstances. In the first instance, the conversion is done for comfort of use; namely, the surgeon does not feel at ease during laparoscopy. A patient's obesity, adhesions, enlarged left hepatic lobe, or annoying oozing of blood may lead to converting the operation—the most frequent reason for conversion in this series (78% of the entire conversion group). It seems wise to convert if the operation is not progressing well after 1 hour of difficult surgical work, even in the absence of any complication. With some experience, these difficulties can be circumvented. For example, technical details such as proper placement of the cannulas according to the patient's morphology, or correct exposure of the hiatal area can play an essential role in the feasibility and the ease of performing the procedure under laparoscopy.

In the second instance, conversion may be necessary owing to the onset of an intraoperative complication that cannot be managed laparoscopically. The most severe complication is the perforation of the posterior aspect of the

esophagus. Although it is theoretically possible to repair it laparoscopically, the advisable attitude is to switch to a laparotomy. However, a careful dissection of the esophagus should prevent this complication: actually, dissection concerns the hiatal orifice instead of the esophagus itself, as has been previously described by one of us.<sup>5</sup> The surgeon must start on the right crus, having divided the upper part of the gastrohepatic ligament, and continue further down until the junction with the left crus is reached. Then the left crus must be followed in order to reach the left subdiaphragmatic space. This technique makes it possible to perform a thorough dissection, to create a large retroesophageal window, and to expose clearly the posterior aspect. This visual control cannot be obtained during open surgery. The vagus nerves are easily identified during this dissection. A methylene blue test through the nasogastric tube is firmly recommended, particularly when the dissection has been tedious. In this series, 2 esophageal injuries were diagnosed intraoperatively and sutured successfully after a conversion. Furthermore, keeping close to the hiatal orifice also prevents pleural laceration and a possible pneumothorax.

### Intraoperative Complications Without Conversion

The onset of an intraoperative complication does not lead to a conversion in all cases; for 6 patients, a complication was laparoscopically managed without further consequence. A gastric perforation occurred in 4 patients; the lesion was recognized intraoperatively and sutured through the scope. For these patients, the perforation was due to the Babcock clamp used to grasp the stomach. This type of forceps is not really atraumatic and should be used very cautiously, with the clamp shifted to other sites on the gastric wall at regular intervals during the procedure in order to prevent a gastric injury.

### Postoperative Complications

Twelve abdominal complications were recorded in this series. The most severe were 2 esophageal perforations, 1 of which was successfully sutured at postoperative day 3 with an uncomplicated postoperative course, whereas the other necessitated a long stay in the intensive care unit. This type of complication is associated with a lethal risk

and is the reason for most of the deaths that have occurred after laparoscopic treatment of GERD. Again, a rigorous technique of esophageal dissection should prevent this complication.

Two gastric perforations were diagnosed during the postoperative period. In the first instance, the perforation was the consequence of an acute gastric dilatation caused by too early a withdrawal of the nasogastric tube. The mechanism of the perforation for the other case is not clear, but this patient had a liver cirrhosis. At reoperation, the fundus was found to be necrotized, possibly as a consequence of the devascularization of the greater curvature.

The parietal complication rate in this series was 0.05%, which is much less than the 4.4% observed after open surgery.<sup>10</sup> However, it means that even laparoscopic surgery does not eliminate all the complications related to the abdominal wall, and that orifices of cannulas must be carefully closed.

A respiratory complication was observed in 12 patients (1.6%). The same type of complication, namely, atelectasis and pleural effusion, is observed after open surgery, with a slightly higher frequency—5% as reported by De Meester et al.<sup>7</sup> A normal diaphragmatic course due to the absence of pain may explain the lower frequency of respiratory complications after laparoscopic surgery.

Finally, no laparoscopic series reports any splenectomy for hemostasis, whereas the rate of splenectomy for open surgery ranges from 1% to 4.2% (Table IV).

## CONCLUSION

Laparoscopic treatment for GERD seems as safe as open surgery when performed by an experienced surgeon. Laparoscopy obviates all the disadvantages of laparotomy and makes it possible to reproduce exactly the same procedures as those routinely performed with a laparotomy. This surgery requires good training in laparoscopic surgery and should be performed by experienced laparoscopic surgeons only. Obviously, a study on long-term results is nec-

essary to evaluate laparoscopy. As the procedures are the same, however, one can expect to obtain results similar to those obtained by traditional surgery.

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