Causes of conversion in laparoscopic surgery for gastroesophageal reflux disease: An analysis of our experience

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ABSTRACT

Background: since its introduction in 1991 laparoscopic antireflux surgery has gained great success and popularity among surgeons, and now it is the gold standard for the treatment of gastroesophageal reflux disease (GERD).

Aim: to identify and evaluate the causes of conversion in the laparoscopic surgery of GERD and hiatus hernia.

Material and methods: since January 1993 to August 2007 606 laparoscopic antireflux procedures were performed in our hospital. There were 296 women and 310 men with a median age of 53.5 years. The main indication for surgery was evidence of intractable or recurrent GERD symptoms after adequate medical treatment with associated hiatal hernia. The preoperative workup included manometry, pH-metry, oral endoscopy, and barium swallow. The surgical technique was mainly the Nissen-Rossetti procedure.

Results: mean postoperative hospital stay was 2.7 days. The operation had to be converted to an open procedure in 43 cases (7%). Conversions were more frequent in the first decade of the learning curve (26 *vs.* 17, p < 0.016), and fewer among the group of experts in advanced laparoscopic surgery (15 *vs.* 28, p < 0.017). In 17 cases conversions were due to an intraoperative complication whereas in 26 cases a conversion was done because of technical difficulties. Esophageal perforation and pneumothorax rates were 0.8 and 1%, respectively, and mortality and morbidity rates were 0.1 and 12%.

Conclusion: the rate of conversion is acceptable and significantly decreases with surgeon experience.

Key words: Laparoscopic antireflux surgery. Conversion. Intraoperative complications. Hiatus hernia.

RESUMEN

Introducción: desde su introducción en 1991, la cirugía antirreflujo por vía laparoscópica ha ido adquiriendo gran popularidad hasta convertirse en el procedimiento de elección de la enfermedad por reflujo gastroesofágico.

Objetivo: identificar y analizar de forma retrospectiva las causas de conversión del abordaje laparoscópico en la cirugía de la enfermedad por reflujo gastroesofágico y de la hernia de hiato.

Material y métodos: desde 1993 a agosto de 2007 se han efectuado en nuestro centro 606 cirugías antirreflujo por vía laparoscópica, encontrando 296 mujeres y 310 varones con una edad media de 53,3 años. La indicación fundamental fue la existencia de un reflujo gastroesofágico resistente al tratamiento médico con hernia de hiato asociada. De forma preoperatoria se van a efectuar estudios manométricos y pH-métricos, endoscopia oral y tránsito esofagogastroduodenal. La técnica quirúrgica de elección fue mayoritariamente la funduplicatura tipo Nissen-Rossetti.

Resultados: la estancia media postoperatoria fue de 2,7 días, realizándose conversión a cirugía abierta en 43 casos (7%). Las conversiones fueron más frecuentes en la primera década de la curva de aprendizaje (26 *vs.* 17 p < 0,016), y menores en el grupo de cirujanos expertos en cirugía laparoscópica avanzada (15 *vs.* 28, p < 0,017). En 17 casos la conversión fue debida a una complicación intraoperatoria y en 26 casos a dificultades técnicas. Las tasas de perforación esofágica y de neumotórax fueron del 0,8 y 1%, mientras que la tasa de mortalidad y morbilidad fue del 0,1 y 12% respectivamente.

Conclusión: la tasa de conversión está dentro de los límites aceptables y ha disminuido con la experiencia.

Palabras clave: Cirugía laparoscópica antirreflujo. Conversión. Complicaciones intraoperatorias. Hernia de hiato.

INTRODUCTION

Since its introduction in 1991 (1,2) laparoscopic antireflux surgery has found great success and popularity

among surgeons, and is now the gold standard for the treatment of gastroesophageal reflux disease (GERD).

The experience acquired during these years has showed that laparoscopic surgery is going to represent more advantages than disadvantages because of its decreasing postoperative pain and shortening postoperative hospital stay (3-9).

However, laparoscopic surgery is not free of complications (gastric and esophageal perforation, hiatal stricture, pneumothorax, bleeding…), and sometimes requires difficult and high-risk reinterventions (10-13).

Logically, these complications and conversions to open surgery are decreasing as surgeon experience in laparoscopic procedures increases.

The aim of this study was to identify and assess the causes of conversion to open surgery in the laparoscopic surgery of GERD and hiatus hernia based on the experience gained at "Ramón y Cajal" Hospital during the last 14 years.

MATERIAL AND METHODS

Between January 1993 and August 2007, 606 laparoscopic fundoplications were performed at "Ramón y Cajal" Hospital. The procedure was performed by 30 different surgeons, including residents.

For the analysis of results we shall divide surgeons into two groups, according to their surgical experience in advanced laparoscopic surgery.

The principal indication for surgery was evidence of intractable or recurrent symptoms of GERD after adequate medical treatment (PPIs: Proton pump inhibitors) with hiatus hernia associated (50.6%), with cholecystectomy being also performed in 59 patients (Table I).

Preoperative workup included a complete history and physical examination for all patients, oral endoscopy in 550 patients (90.7%), barium swallow in 489 patients (80.7%), and manometry and pH-metry in 406 patients (67%).

The surgical technique was mainly the Nissen-Rossetti fundoplication (Table II). Pneumoperitoneum is created using a Veress needle, and intraabdominal pressure is maintained between 12-14 mmHg. Basically, the procedure is performed through five 10-mm trocars, and a 0-degree camera is used.

First of all we opened the gastrohepatic ligament. Care was taken not to divide the hepatic branch of the anterior

Table I. Surgical indications

Surgical indication	Number of patients
Hiatus hernia and GERD	307
Hiatus hernia	111
Intractable GERD after PPIs	90
GERD complications	
Esophagitis, grade III-IV	57
Barrett's esophagus	34
Stricture	7

Table II. Surgical technique

Surgical technique	Number of patients
Nissen-Rossetti	458
Toupet	100
Other	48
Prosthetic mesh	48

vagus nerve. The right crura of the diaphragm is identified and dissected. We reduced the hiatal hernia and fully dissected the area behind the esophagus and the left crura. When a window of appropriate size had been created, a small tape was passed around the esophagus. Using this retraction, the cardioesophageal junction can be moved from side to side, and the dissection may be completed.

We always closed the crura with non-reabsorbable Ethibond sutures (2 or 3 stiches), and performed a fundoplication (without dividing the short gastric vessels unless the passing of the fundus around the esophagus was difficult).

In case of a large hiatal defect (as usually observed in paraesophageal hernias), the closing of the crura is not tension-free, and pillars are of poor quality; a polypropilene-PTFE (Crurasoft-BARD) mesh is used to reinforce the suture, and fixed with 3-4 Ethibond stiches to the crura.

A statistical analysis was carried out using the SPSS package. For statistical comparisons the Chi-square and Fisher's tests were used. A result was considered statistically meaningful when p < 0.05.

RESULTS

There were 296 women (48.8%) and 310 men (51.2%), with a median age of 53.3 years (range, 20-82 years). Mean postoperative hospital stay was 2.7 days (range 1-48 days).

The rate of complications was around 12% (72 cases in 606 patients), and mortality was 0.1% (1 case).

The operation had to be converted to an open procedure in 43 cases (7%) (Table III).

When the rate of conversion was compared to the learning curve, it was higher (10%: 26 cases in 260 patients) in the first decade (1993-2000) versus the second decade (2001-2007) (5%, 17 cases in 346 patients) with a significant difference (p < 0.016; OR 2.15; 95% confidence interval, 1.14-4.05).

When the rate of conversions was analyzed in relation to surgical experience in advanced laparoscopic surgery, the former was smaller in the group of experts in laparoscopic surgery (15 cases in 405 surgeries) as compared to the rest (28 cases in 201 cases), with a significant difference (p < 0.017; OR: 0.45; 95% confidence interval, 0.235-0.878).

Regarding table III, the rate of conversion to open surgery was 26 cases due to technical difficulties (because of obesity, giant and non-reducible hiatus hernia, adhesions, inability to close the crura, periesophagitis, and enlarged left hepatic lobe), and 17 cases due to intra-

Table III. Causes of conversion

Causes of conversion	Number of patients
Technical difficulty by obesity	8
Bleeding	7
Giant and non-reducible hiatal hernia	6
Adhesions	4
Gastric perforation	4
Anesthetic complications	3
Esophageal perforation	3
Periesophagitis	3
Enlarged left hepatic lobe	3
Inability to close the crura	2

Table V. Intraoperative complications

Complication	Treatment	
	Open	Laparoscopic
Gastric perforation: 15 cases	4	11
Pleural injury: 6 cases		6
Bleeding: 16 cases	7	9
Hepatic hematoma: 2 cases		2
Subcutaneous emphysema: 2 cases		2

operative complications that could not be solved laparoscopically (bleeding, gastric and esophageal perforation, and anesthetic complications).

When a comparative analysis of conversion causes by decades was performed (Table IV), major causes of conversion were similar for both groups (technical difficulty by obesity and bleeding), and significant differences were only found in the rate of gastric perforations, higher during the first decade (p < 0.033).

However, an intraoperative complication not always occurred (Table V).

In all 43 cases converted to open surgery the surgical indication was evidence of intractable or recurrent GERD symptoms after adequate medical treatment in the presence of hiatus hernia in 21 cases (48.8%), giant hiatus hernia in 19 cases (44.2%), and Barrett's esophagus in 3 cases (7%).

The analysis of these surgical indications by decades showed that the most frequent cause of conversion in the first decade was the combination of hiatus hernia and GERD (61.5%: 16 of 26 cases; p < 0.007; OR: 3.77; 95% CI, 1.36-10.5); in the second decade it was giant hiatus hernia (59%: 10 of 17 cases; p < 0.024; OR: 3.091; 95% confidence interval 1.12-8.5).

DISCUSSION

Since its introduction in 1991 (1,2), laparoscopic antireflux surgery found great success and popularity among surgeons, and is now the gold standard for the treatment of gastroesophageal reflux disease (GERD).

In figure 1, which represents our experience, an exponential rise in the number of laparoscopic antireflux surgeries may be seen since 1993.

This increase has been partly due to the great success rate obtained with surgery (90% of patients asymptomatic 10 years after surgery) (14-16), and the advantages offered by the laparoscopic approach.

However, laparoscopic surgery is not free of complications, and sometimes requires difficult and high-risk reinterventions (10-13).

Fortunately, in our experience, the number of complications (12%) was not very high, and there was only one case of death (0.1%) secondary to pulmonary embolism in a morbidly obese patient, in whom laparoscopic surgery had to be converted to open surgery because of technical difficulties due to excessive intraabdominal fat.

In our experience, the rate of conversion to open surgery was 7%. Although this surgery was performed by many surgeons not exclusively devoted to laparoscopic surgery, the rate of conversion was similar to that reported by other authors (17-20), and has decreased with surgeon experience.
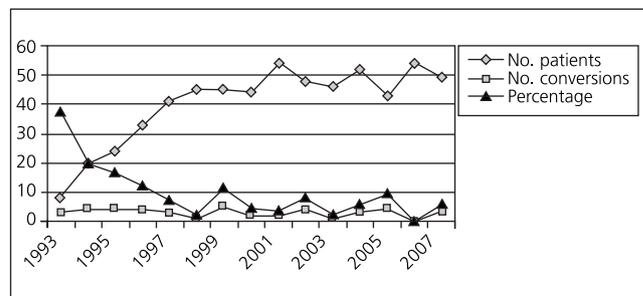

Fig. 1.

Table IV. Causes of conversion in relation to the learning curve

1993-2000	2001-2007
Technical difficulty by obesity: 5 cases (19%)	Technical difficult by obesity: 3 cases (17.6%)
Bleeding: 4 cases (15.4%)	Bleeding: 3 cases (17.6%)
Gastric perforation: 4 cases (15.4%)	Giant and non-reducible hiatus hernia: 3 cases (17.6%)
Giant and non-reducible hiatus hernia: 3 cases	Adhesions: 2 cases
Enlarged left hepatic lobe: 2 cases	Inability to close the crura: 2 cases
Periesophagitis: 2 cases	Enlarged left hepatic lobe: 1 case
Adhesions: 2 cases	Periesophagitis: 1 case
Esophageal perforation: 2 cases	Esophageal perforation: 1 case
Anesthetic complications: 2 cases	Anesthetic complications: 1 case

In this way, figure 1 shows a gradual decrease in the percentage of conversions to open surgery, from 10% in the first decade of learning (1993-2000) to 5% at present (2001-2007).

The learning curve plays an important role in result improvement and in decreasing the number of conversions. According to this affirmation, in our series we observed a lower number of conversions to open surgery in the group of experts in advanced laparoscopic surgery when compared to the rest (15 *vs*. 28).

However, we must consider that conversion to open surgery is not a surgeon's failure, or exclusive to non-expert surgeons, and the aim of the procedure is the treatment of reflux, not the performance of a laparoscopic approach at any price (18).

Most studies consider 20 patients is the minimum number of procedures to acquire experience and ability in the management of this surgery, and to start decreasing the number of conversions and complications (21-24).

Even so, we think that laparoscopic surgery for gastroesophageal reflux, although considered within the group of advanced laparoscopic surgeries, should be a surgical procedure performed at least once by residents, under the supervision of an experienced laparoscopic surgeon.

In general terms, following Collet and Cadiere (18), we are going to divide conversions to open surgery into two groups:

1. *Technical difficulties:* The conversion is done for comfort, because the surgeon does not feel at ease during laparoscopy. For example: obesity, adhesions, enlarged left hepatic lobe… We consider it wise to convert if the operation is not progressing well after 1 hour of difficult surgical work, even in the absence of any complication. A proper placement of the trocars according to the patient's morphology, and a correct exposure of the hiatal area can play an essential role in the feasibility of the procedure under laparoscopy.

2. *Intraoperative complications:* Based on surgical experience these can be managed laparoscopically or a conversion to open surgery may be performed. For example: Gastric and esophageal perforation, bleeding, etc.

On analyzing our series we observed that the most frequent causes of conversion to open surgery were: Technical difficulty because of obesity (8 cases), bleeding (7 cases), and giant, non-reducible hiatus hernia (6 cases). An analysis of the causes of conversion by decade showed that these were similar in both groups except for gastric perforation, which was the third cause of conversion to open surgery in the first decade (4 cases). The explanation is the higher experience of the surgeon in the management of laparoscopic sutures, and a more careful management of the stomach.

In relation to the analysis of conversion as based on surgical indication, we have to describe that most conversions are currently performed for giant hiatus hernia (paraesophageal hernia) due to the great difficulty of laparoscopic management. However, this is not a con-

traindication for the laparoscopic approach to this kind of hernias at present.

Of all intraoperative complications that condition conversion to open surgery bleeding stands out; however, although this complication happened in 16 patients (2.6%), it has only been the cause of conversion in 7 cases (1%). In this point we consider the harmonic and the use of swabs to stop the bleeding highly useful.

Maybe the most important and severe complication in laparoscopic antireflux surgery was esophageal perforation (mortality 26%), with rates around 1% in important series in the literature (25). In our series, this complication occurred in 5 cases (0.8%), but only in 3 cases a conversion to open surgery was needed (0.5%). In one of the cases an esophageal perforation occurred after a bougie was introduced in the esophagus (in a patient with an esophageal stricture previously treated with dilatations), so we had to perform a thoracotomy to suture the perforation. Even so, fortunately, this complication was no cause of mortality, but it did increase morbidity and postoperative hospital stay.

Other frequent complication in laparoscopic surgery was the accidental perforation of the gastric cavity, generally secondary to the manipulation of the stomach with Babcock forceps. In our experience, it occurred in 15 cases, but it was laparoscopically solved in 11 cases, so we had to convert only 4 patients (0.6%).

Finally, pleural injury during esophageal dissection occurred in 6 patients (1%), and was more frequent in paraesophageal and giant hernias with a big hernial sac. However, a thorax tube was needed in no cases.

In conclusion, we think that the laparoscopic approach is presently the gold standard for reflux and hiatus hernia. The incidence of intraoperative complications in our series has been low and basically occurred during the initial decade (learning curve). The rate of conversion, despite the fact that this surgery was performed by many non-specialized surgeons, falls within the acceptable limits and has decreased with growing experience.

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