

Original Research Article

Experience of 10 years in routine trans operative endoscopy and calibration in fundoplication due to gastroesophageal reflux disease

César Manuel Vargas Sahagún¹, Jorge Alejandro Ortiz De La Peña Rodríguez¹, Enrique Jean Silver^{1*}, Martín Vega De Jesús¹, Antonio Giovanni Spaventa Ibarrola¹, Cuauhtémoc Morfín Vela¹, Tomás Benavides Zavala¹, Elsa Paulina Alonso Lopez²

¹Department of Endoscopic Surgery, American British Cowdray Medical Center, Mexico City, Mexico

²Department of Gastrointestinal Surgery, UMAE Hospital de Especialidades CMN Siglo XXI, Mexican Institute of Social Security. Mexico City, Mexico

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*Correspondence:

Dr. Enrique Jean Silver,

E-mail: drenriquejean@gmail.com

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ABSTRACT

Background: Endoscopy and intraoperative calibration in fundoplication for gastroesophageal reflux disease (GERD), confirm an adequate technique avoiding postoperative failure. Intraoperative changes and morbidity in routine use are unknown.

Methods: Retrospective study in a single center, data were taken primarily from electronic archive medical records. A total of 899 who underwent fundoplication surgery with endoscopy and/or routine intraoperative calibration due to GERD met the required criteria between 1 January 2010 and 31 December 2020. The primary objective was to identify the number of calibration and intraoperative endoscopy findings. Also, the morbidity associated with its routine use was analyzed.

Results: Over a 10-year study period, the most frequent calibration in the Nissen Fundoplication was 60Fr in 472 cases (61.4 %). The most used calibration in Toupet Fundoplication was 60Fr in 26 cases (21.1%). Endoscopy was performed in 786 patients (71.38%), of which; 3 patients (0.3%) required changes, secondary to fundoplication rotation in 2 patients (0.2%) and redundant gastric fundus in 1 patient (0.1%).

Conclusions: Routine intraoperative calibration and endoscopy achieved excellent results in 96.8% of fundoplication's, ensuring adequate esophageal position and corroborating an adequate intraoperative technique; decreasing the rate of failures and immediate postoperative dysphagia.

Keywords: Fundoplication, Gastroesophageal reflux, Intraoperative endoscopy, Endoscopy control

INTRODUCTION

Gastroesophageal reflux disease (GERD) has notably changed its management in recent years. Its current prevalence is 10 to 20% of the population. The long-term side effects of proton pump inhibitors (PPIs) and the failure of medical treatment have sparked interest in the treatment and safety of surgical procedures for GERD.^{1,2}

The current surgical treatment of choice for GERD is laparoscopic fundoplication. Regardless of the type of fundoplication, it is important to restore the antireflux mechanism of action by repairing any hiatal hernia, to have adequate intra-abdominal esophageal length and a fundoplication correctly around the distal esophagus over the lower esophageal sphincter (LES).²

The results of the surgical procedure have achieved high long-term success rates of up to 90-95%, following a standardized technique that includes dissection of the distal esophagus, dissection and closure of pillars, identification and integrity of the vagus nerve, ligation of short gastric vessels, esophageal calibration (56-60FR) and fundoplication of 2 cm in length.^{2,3} When dissecting the esophagus, intraoperative calibration is recommended to identify an adequate position of the esophagus and reduce dysphagia in the immediate postoperative period. However, its introduction must be performed by an anesthesiologist or an experienced surgical team member, to avoid a complication such as esophageal perforation.^{3,4} Intraoperative endoscopy is useful to avoid failures in the fundoplication technique. In some centers it is used routinely, however, others indicate it in cases of revision surgery, since it is considered costly and increases intraoperative morbidity.⁴ Almost all the reported studies recommend a type of calibration and intraoperative endoscopic findings that help to identify possible technical defects in the fundoplication, however there is a lack of detailed information on the subject in the different types of fundoplication. The objective of this study was to characterize the number of calibrations and describe the findings in intraoperative endoscopy, as well as the morbidity associated with its routine use in fundoplication for GERD.

METHODS

This was a retrospective, descriptive analytical study and data were taken primarily from electronic archive medical records. This study conducted from January 2010 and December 2020, with a follow-up of up to 2 years through the electronic archive at the Department of Endoscopic Surgery at the American British Cowdray Medical Center Mexico City, Mexico with a total of 899 patients who met the inclusion and exclusion criteria.

The inclusion criteria were patients older than 18 years of age with a clinical diagnosis of GERD corroborated by pH monitoring and/or preoperative endoscopy, who underwent fundoplication with endoscopic control and/or calibration (Hurst, Savary and/or Maloney).

All patients undergoing revision fundoplication surgery and with preoperative dysphagia (atypical symptoms) were excluded.

We documented calibration characteristics, transoperative endoscopic findings, changes in surgical technique in response to endoscopic findings, surgery performed, and postoperative evolution. Proper ethical consent was taken from the respective concerns.

Data were expressed as mean (\pm SD) for quantitative variables, frequencies and percentages for qualitative variables. All patients had an electronic clinical file and those that did not have the data required for the study

were eliminated. All analyzes were performed using SPSS 25 for Mac (Chicago, IL, USA).

RESULTS

In a period of 10 years, 1,243 patients underwent fundoplication due to GERD, of which 344 patients (27.7%) were excluded because they did not have the data required for the study. Including a total of 899 patients who underwent fundoplication with endoscopy and/or intraoperative calibration due to GERD. 478 patients were men (53.2%) and 421 women (46.8%). The average age of the sample was 46.23 (\pm 14 years).

The most frequent surgical approach was laparoscopy in 885 patients (98.5%), of which 3 patients (0.3%) required conversion to open surgery. 12 patients (1.2%) underwent robotic surgery, of which 1 patient (8.3%) required conversion to laparoscopic surgery and 2 patients (0.2%) initially underwent open surgery. The most frequent type of fundoplication was Nissen in 769 patients (85.5%), Toupet in 123 patients (13.7%), Dor in 4 patients (0.4%) and Collis Nissen in 3 patients (0.3%) (Table 1).

Table 1: Characteristics of the patients included in the study.

Patients (n=899)	N (%)
Age	46.23 (\pm 14)
Gender (M/F)	478 (53.2)/421 (46.8)
Surgical approach	
Laparoscopic	885 (98.5)
Open conversion	3 (0.3)
Robot	12 (1.2)
Laparoscopic conversion	1 (8.3)
Open	2 (0.2)
Fundoplication type	
Nissen	769 (85.5)
Toupet	123 (13.7)
Dor	4 (0.4)
Collis Nissen	3 (0.3)

The most frequent intraoperative calibration in the Nissen Fundoplication was 60Fr in 472 patients (61.4%), 56Fr in 136 patients (17.6%), 58Fr in 56 patients (7.2%), 52Fr in 11 patients (1.4%), 54Fr in 9 patients (1.1%), 50Fr in 7 patients (0.9%), 42Fr in 5 patients (0.6%), 48Fr in 4 patients (0.5%), 40Fr in 4 patients (0.5%), 32Fr in 3 patients (0.3%), 46Fr in 1 patient (0.1%), 35Fr in 1 patient (0.1%), 30Fr in 1 patient (0.1%) and in 59 patients (7.67%) the calibrator number is not specified. Only 1 patient (0.1%) had difficulty passing the calibrator, changing for a lower Fr. In the Toupet Fundoplication, the most used calibrator was 60Fr in 26 patients (21.1%), 48Fr in 21 patients (17%), 50Fr in 19 patients (15.5%), 44Fr in 7 patients (5.6%), 52Fr in 3 patients, 56Fr in 2 patients (2.4%), 42Fr in 2 patients (2.4%), 58Fr in 1 patient (0.8%), 54Fr in 1 patient (0.8%), 46Fr in 1 patient (0.8%) and 40 patients (32.5%) the calibrator number is

not specified. Only 2 patients (1.6%) had difficulty passing the calibrator, changing for a lower Fr, and 1 patient (0.8%) required revision with intraoperative endoscopy to rule out esophageal perforation. In the Dor

Fundoplication, 56Fr was used in 3 patients (75%) and only 1 patient (25%) the calibrator number is not specified. Collis Nissen fundoplication, 58Fr was used in 1 patient (50%) and 56Fr in 1 patient (50%).

Table 2: Characteristics of patients with alterations in intraoperative endoscopy.

Patients	Age	Gender	Surgical approach	Fundoplication type	Fr calibration	Intraoperative endoscopy
1	37	Female	Laparoscopy	Nissen	Unknown	Redundant gastric fundus
2	55	Male	Laparoscopy	Nissen	56Fr	Fundoplication rotation
3	25	Female	Laparoscopy	Nissen	56Fr	Fundoplication rotation
4	78	Female	Laparoscopy	Toupet	42Fr	Esophageal and gastric perforation

Intraoperative endoscopy was performed in 786 patients (71.38%), of which Nissen was performed in 662 patients (84.2%), finding abnormalities in 3 patients (0.3%), a rotated fundoplication in 2 patients (0.2%) and redundant gastric fundus in 1 patient (0.1%), performing the fundoplication again. The Toupet fundoplication was performed on 114 patients (14.5%) and only 1 patient (0.1%) had perforation of the distal esophagus and perforation of the gastric fundus due to manipulation and difficult dissection, converting to open surgery for repair. Dor fundoplication was performed in 4 patients (0.5%) and Collis Nissen in 3 patients (0.38%), who did not find alterations in the transoperative endoscopy (Table 2).

The most frequent transoperative complications were; gastric serosal laceration in 3 patients (0.3%), gastric perforation and esophageal perforation in 1 patient (0.1%) and gastric perforation in 1 patient (0.1%). The most frequent medical postoperative complication was; immediate dysphagia in 30 patients (3.9%), of which 29 patients (3.3%) underwent Nissen fundoplication and 1 patient (0.8%) Toupet fundoplication.

Postoperative complications related to surgery; no complications were found in the immediate postoperative period (the first 24 hours after surgery). In the immediate postoperative period (24 hours-7 days postoperatively) were: reintervention of the fundoplication in 4 patients (0.4%), migration of the fundoplication towards the chest in 3 patients (0.3%) and stenosis of the fundoplication in 3 patients (0.3%). In the late postoperative period (7 days-2 years) were: dysfunctional fundoplication in 13 patients (1.6%) and fundoplication migration in 9 patients (1.1%) (Table 3).

DISCUSSION

Gastroesophageal reflux disease has notably changed its management in recent years, promoting new minimally invasive surgical options for the treatment of antireflux surgery such as laparoscopic surgery and robotic surgery, achieving excellent long-term results in 90-95%.⁴ Different measures have been used to objectively evaluate intraoperative fundoplication, such as:

calibration and intraoperative endoscopy.⁵ The use of an intraoperative esophageal calibration, has demonstrated its usefulness in identifying the position of the esophagus, guaranteeing that the fundoplication has the appropriate width.⁶ In our study, the most frequent calibration in the Nissen fundoplication was 60Fr, 58Fr and 56Fr, this is similar to the recommendations in the literature. Calibration number and type (Savary, Maloney and/or Hurst) should be individualized to the patient, as well as the decision and experience of the surgeon.⁷ In partial fundoplication there is no recommendation in the literature regarding the number of esophageal calibrators, in our experience the most used was 60Fr, 48Fr and 50Fr. The calibrator can be safely and easily placed into the esophagus in all patients due to its shape and composition of the sizer, however the introduction should be performed by an experienced anesthesiologist or senior member of the surgical team (Endoscopist) to avoid complications. In our study, only 0.3% required modifying the calibrator number due to difficulty in placing it, therefore, it is important not to force its insertion and reduce the Fr, thus avoiding the morbidity associated with calibration placement. as reported in the literature with an index of up to 1.2% of esophageal perforation.⁸

Intraoperative endoscopy evaluates the width, length, tension and geometry of the fundoplication, even with a distended stomach, confirming that the fundoplication has an adequate technique avoiding failures during the fundoplication. Some hospitals recommend its use in cases of revision surgery and to avoid the possibility of increasing morbidity due to the endoscopic procedure.¹⁰ In our hospital, intraoperative endoscopy is performed in up to 71.38% of fundoplications; its routine use has also been shown that prevents potential complications; identifying the esophageal lumen by transillumination, facilitating dissection in the correct plane.¹¹ In our study, it was shown that only 0.4% of the patients required changes during the intraoperative endoscopy, compared to what is reported in the literature that up to 27.7% require a correction in the technique by rotation of the fundoplication, redundant gastric fundus, esophageal perforation and gastroesophageal junction laceration.

Table 3: Relationship of complications with type of fundoplication and transoperative endoscopy with/or calibration.

Variables	Nissen; (N=769)	Toupet; (N=123)
Intraoperative complications		
	2 (0.2)	1 (0.1)
Laceration of serosa gastric (N=3); Frequency (%)	Calibration	
	60 Fr=2 (0.2)	40 Fr=1 (0.1)
	Intraoperative endoscopy	
	Without modifications: 2 (0.2)	Without modifications
Gastric and esophageal perforation (N=1); Frequency (%)	-	1 (0.1)
		Calibration
		42 Fr=1 (0.1)
		Intraoperative endoscopy
		Gastric & esophageal perforation: 1 (0.8)
Gastric perforation (N=1); Frequency (%)	-	1 (0.1)
		Calibration
		50 Fr=1 (0.1)
		Intraoperative endoscopy
		Without modifications
Post-surgical medical complications		
Dysphagia (N=30); Frequency (%)	29 (3.7)	1 (0.8)
	Calibration	
	60 Fr=18 (2.3), 58Fr=3 (0.3), 56Fr=6 (0.7), 52Fr=1 (0.1), Unk Fr=2 (0.2)	Unk Fr= 1 (0.8)
	Intraoperative endoscopy	
	Without modifications: 25 (3.2), Not performed: 5 (0.5)	Without modifications: 1 (0.8)
Early post-surgical complications		
Reintervention (N=4); Frequency (%)	4 (0.4)	-
	Calibration	
	60Fr=3 (0.3), Unk=1 (0.1)	
	Intraoperative endoscopy	
	Without modifications: 4 (0.4)	
Fundoplication migration (N=3); Frequency (%)	3 (0.3)	-
	Calibration	
	60Fr=1 (0.1), 56Fr=1 (0.1) Unk=1 (0.1)	
	Intraoperative endoscopy	
	Without modifications: 3 (0.3)	
Fundoplication stenosis (N=3); Frequency (%)	3 (0.3)	-
	Calibration	
	60Fr=2 (0.2), Unk=1 (0.1)	
	Intraoperative endoscopy	
	Without modifications: 3 (0.3)	
Late post-surgical complications		
Disfuncional fundoplication (N=13); Frequency (%)	13 (1.6)	-
	Calibration	
	60Fr=10 (1.3), 56Fr=2 (0.2) Unk=1 (0.1)	
	Intraoperative endoscopy	
	Without modifications: 12 (1.5)	
	Fundoplication rotation: 1 (0.1)	
Fundoplication migration (N=9); Frequency (%)	9 (1.1)	-
	Calibration	
	60Fr=6 (0.7), 56Fr=2 (0.2) Unk=1 (0.1)	
	Intraoperative endoscopy	
	Without modifications: 9 (1.1)	

This is due to the proper standardization of the fundoplication technique and the experience of the surgeon, reducing failures in the technique. Small perforations that are not always evident on direct vision can be detected by intraoperative endoscopy and repaired more precisely; for all these purposes, the intraoperative endoscopy is currently the most accurate tool.¹²

The most frequent immediate postoperative complication in our study was immediate dysphagia in 3.3%. Therefore, the calibration of 56-60Fr in the Nissen fundoplication was associated with a significantly reduced incidence of temporary dysphagia than reported in the literature by not using intraoperative calibration. Persistent dysphagia is related to a very tight or long fundoplication, very tight pillar closure, and excessive angulation of the gastroesophageal junction.¹³⁻¹⁵ In our study, despite routine intraoperative endoscopy, the fundoplication may fail in 0.4% of patients due to migration of the fundoplication into the thorax, which is related to laxity of the diaphragmatic pillars, fundoplication stenosis, which is related to a fundoplication tight and in some cases torsion. The fundoplication can fail despite intraoperative endoscopy in up to 2.5% reported in the literature and in some cases requiring reintervention to undo the fundoplication.^{16,17}

Endoscopy after fundoplication is indicated only if the patient presents symptoms after the procedure. In our study, only 0.1% required endoscopic dilation due to fundoplication stenosis, which is reported in the literature in up to 12% due to fibrosis.^{17,18} Late complications in our patients, such as fundoplication dysfunction reported in 1.4% and fundoplication migration in 0.9%, were lower than those reported in the literature in up to 17% without performing transoperative endoscopy and/or calibration. Fundoplication failure is most often related to hiatal hernia recurrence, which was also present in up to 45.4% of our patients with fundoplication failure, similar to reported in up to 51%. This is due to poor positioning of the fundoplication and/or slippage of the fundoplication through the diaphragm. The presence of persistent symptoms of GERD after fundoplication is bound to rule out ineffective surgery or an incorrect diagnosis.¹⁹

Limitations

The study design constitutes a major limitation of the study. The study was retrospective in a single center hospital of Mexico City and might not reflect the trends and the situation in other facilities.

CONCLUSION

At our hospital, because our surgeons perform a high volume of these procedures following a standardized surgical technique with routine intraoperative endoscopy and calibration, they have ensured that this procedure is safe, effective, and has excellent short- and long-term

results. Routine transoperative calibration and endoscopy in fundoplication for GERD has its benefit in corroborating an adequate technique during the transoperative period, ensuring successful surgery in up to 99.4% and avoiding immediate postoperative dysphagia in up to 96.7% of patients.

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