

Esophageal Manometry and 24-Hour pH Monitoring to Evaluate Laparoscopic Lind Fundoplication in Gastroesophageal Reflux Disease

Pablo Roberto Miguel, MD, André Luiz Moreira da Rosa, MD,
Marcus Reusch, MD, Marcos Aguzzoli, MD

ABSTRACT

Laparoscopic and thoracoscopic techniques have provided a new dimension in the correction of functional disorders of the esophagus. Therapeutic success, however, depends on the confirmation of esophageal disease as a cause of the symptoms, on understanding the basic cause of dysfunction and on identifying the surgical patient. This study is a retrospective study of patients submitted to surgery using the Lind procedure for gastroesophageal reflux disease (GERD). The purpose of this study is to establish the value of the routine use of esophageal manometry and 24-hour pH monitoring in order to select patients and perform pre and postoperative functional evaluation. Forty-one patients (68.3%) had a hypotonic lower esophageal sphincter. The average pressure was 9.2 mm Hg preoperatively and 15.2 mm Hg postoperatively, with an increase of 6.0 mm Hg. This increase was 8.8 mm Hg in hypotonics and 4.3 mm Hg in the normotonics. There was a certain degree of hypomotility of the esophageal body in 14 patients (23.3%) and, of this group, 4 (28.5%) improved postoperatively. Pathological acid reflux was found in 51 cases (85.0%) by pH monitoring. The mean of the preoperative DeMeester score was 31.4, later dropping to 3.2. Esophageal manometry and 24-hour pH monitoring are effective methods for revealing the level of functional modification established by anti-reflux surgery and for helping to objectively perform the selection.

Key Words: Gastroesophageal reflux, Antireflux surgery, Digestive motility.

INTRODUCTION

Laparoscopic and thoracoscopic techniques developed recently have provided a new dimension for performing surgical correction of functional disorders of the esophagus. These new approaches have changed the attitudes of physicians and patients in regard to the treatment of esophageal dysfunction, but have also increased the risk of superficial and inappropriate choices of candidates for surgery. A precise diagnosis must be performed before any therapy. Therapeutic success depends on the confirmation of the esophageal disease as the cause of the symptoms, on understanding the basic cause of dysfunction and on identifying the patient to be treated surgically.¹ The surgeon must perform the right procedure for the right disease on the right patient. This work shows a retrospective study involving surgical treatment of gastroesophageal reflux disease (GERD) laparoscopically. The purpose is to establish the value of the systematic use of esophageal manometry and 24-hour pH monitoring in selecting surgical patients and in performing the functional evaluation of the esophagus during the pre and postoperative period. In order to do so, we analyze and compare the results of the two periods.

MATERIALS AND METHODS

The addition of esophageal manometry and 24-hour pH monitoring to the tests performed in order to select surgical cases of GERD began in September 1995. In June 1997, 60 patients had undergone a partial videolaparoscopic fundoplication at 270 degrees (Lind procedure).² Upper digestive endoscopy, contrast radiography and functional evaluation were used in order to select the patients systematically.

In the group of patients submitted to surgery, 40 (66.6%) were male and 20 (33.3%) were female. The mean age was 45 years-old, with ages ranging from 12 years to 79 years. The indication for surgery was based on symptoms refractory to medical treatment in 58 cases (96.6%) and paraesophageal hernia in 2 cases (3.3%). All presented hiatal hernia at radiography and some degree of endoscopic esophagitis. According to the modified classification of Savary-Miller, 3 had grade I esophagitis

Service of Laparoscopic Surgery, Hospital Mãe de Deus (Drs. Miguel, Moreira da Rosa, and Reusch).

Service of Anesthesiology, Hospital Mãe de Deus (Dr. Aguzzoli).

Address reprint request to: Pablo Roberto Miguel, Rua Costa, 30 -conj. 502, CEP 90110-270, Porto Alegre-RS, Brazil. Telephone: 00 55 51 2314407, Fax: 00 55 51 2317821

Table 1.
DeMeester Score – Components.

- Number of reflux episodes with a pH lower than 4.
- Number of refluxes longer than 5 minutes.
- Longest reflux in minutes.
- Percentage of total reflux time.
- Percentage of reflux time in upright position.
- Percentage of reflux time in supine position.

(1.8%), 26 grade II (43.3%), 24 grade III (40.0%) and 7 grade IV (11.6%).

Esophageal manometry (**Figure 1**) was performed using a perfusion system and computer program for automated digital analysis. The following information resulting from manometry was evaluated in this study: mean pressure of the lower esophageal sphincter (normal ranging from 8 mm Hg to 26 mm Hg) with DeMeester method³ and the presence of any degree of hypomotility in the body of the esophagus. Dysmotility was measured using the parameters of amplitude, duration and progression (peristaltism or simultaneity) of the swallowing contractions. The 24-hour pH monitoring was measured with a single sensor located 5 cm above the lower esophageal sphincter (LES) (**Figure 2**). The results were evaluated by the DeMeester score,⁴ taking as a maximum limit of normality the 95 percentile, whose value is 14.72. The said score includes the variables shown in **Table 1**. The postoperative measures were obtained 45 days after fundoplication.

RESULTS

Before surgery, LES proved hypotonic in 41 patients (68.3%) and normal in 19 (31.67%). The pressure of the LES was on the average 9.2 mm Hg during the preoperative period and 15.2 mm Hg during the postoperative period, with a calculated rise of 6.0 mm Hg. This rise in pressure, however, was higher in the group of hypotonic patients and significantly lower in the group of patients with normal pressure of the LES (**Table 2**). Hypomotility of the body of the esophagus appeared in 14 patients (23.3%). After surgical correction, the 46 cases of normal motility (76.6%) remained normal, except for 2 patients

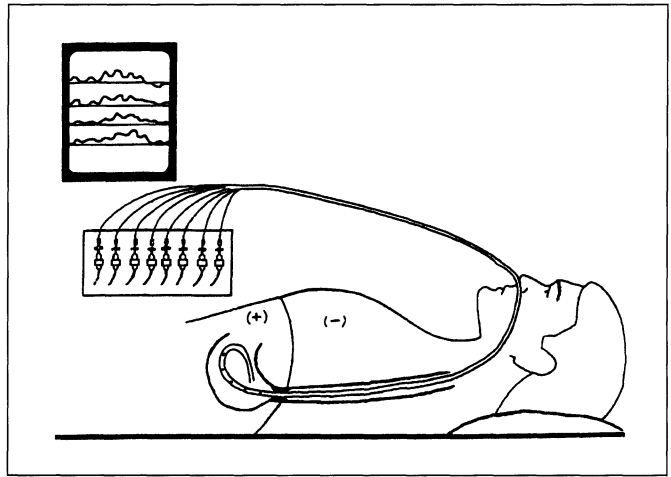


Figure 1. Patient in supine position with perfusion catheter to the stomach before the traction, which allows the evaluation of LES. The pressure transducers are connected to the polygraph, which emits a trace for subsequent computer analysis.

(4.3%) who had an increased amplitude of the peristaltic contractions. Among the 14 cases of hypomotility, 4 patients (28.5%) had a postoperative improvement expressed in the increased amplitude and duration of the contractions that had been reduced or were absent in the lower third of the esophagus. Six patients (10%) presented early dysphagia with a resolution in less than two months. A total of 51 cases (85.0%) had pathological acid reflux found by pH monitoring before surgery. There was a combination of normal pH and esophagitis in nine cases (15%). The DeMeester score of the group of patients in the postoperative period was 31.4. After the procedure, it went down to an average of 3.2. Forty-eight patients (80.0%) did not present any reflux episodes at any time during the 24-hour pH monitoring during the postoperative period.

Table 2.
Lower Esophageal Sphincter Pressure.

Pressure of LES	Preoperative	Postoperative	Difference
Hypotonics (n=41)	5.89 mm Hg	14.6 mm Hg	8.8 mm Hg
Normotonics (n=19)	12.3 mm Hg	16.6 mm Hg	4.3 mm Hg

DISCUSSION

The choice of patients with GERD who will benefit most from surgical correction depends on a careful evaluation covering several aspects: the presence of symptoms, degree of esophagitis, size and type of hiatal hernia, esophageal motility, LES pressure, presence and intensity of reflux and response to medications. These aspects, to be taken into account when deciding to submit the patient to surgery, are obtained, respectively, from the anamnesis, endoscopy, contrast radiography, esophageal manometry, 24-hour pH monitoring and therapeutic test with acid secretion inhibitors. All the data together will allow the definition of the best treatment. Using isolated data cannot help select the best case for laparoscopic fundoplication, and adequate selection is one of reason for the good results shown in specialized literature.⁵

It is essential to know whether the patient has relief from his or her symptoms while using medication to predict symptom regression after making a valve, which will prevent gastroesophageal reflux.⁶

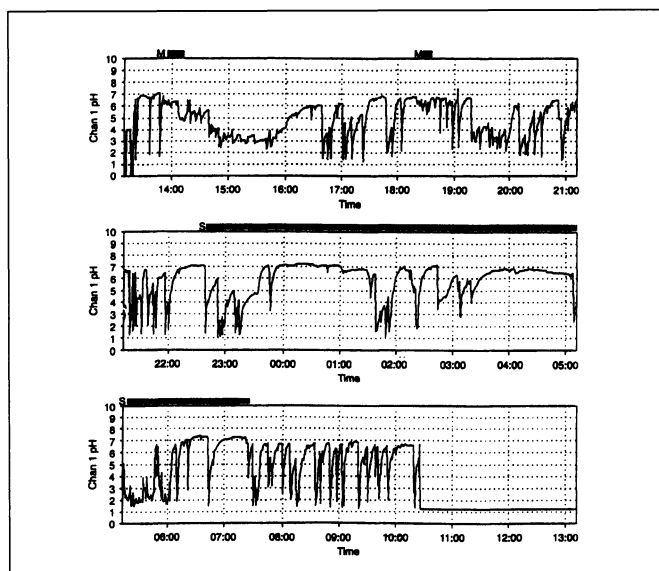


Figure 2. 24-hour pH monitoring of a patient with reflux in the supine and orthostatic positions. M is the period corresponding to eating and S to the supine position. Observe the frequency and duration of pH falling below 4.

A mechanical defect in the LES can be found in 60% to 70% of the patients with GERD.⁷ The mean pressure of LES below the normal values is predictive of a bad prognosis for drug therapy⁸ and good prognosis for surgical treatment.⁹ Multifactorial analysis performed in selecting our cases and understanding the pathophysiology of gastroesophageal reflux are essential in order to best deal with medical situations that are sometimes confusing, such as when we find normal pressures in the LES. Measuring sphincter pressure using what is called “volume vector” is considered one of the most effective ways of detecting mechanical deficiency, as well as the only form of achieving postoperative control of the surgical correction.³ However, the transient relaxation of the LES, besides being one of the most important areas of study in esophageal physiology, is currently considered to be closely related to GERD.¹⁰ In 1964, McNally et al¹¹ presented a study that discussed the mechanism of eructation based on the transient relaxations of the LES, caused not by swallowing but by the distension of the stomach with air. Curiously, the relationship between this phenomenon and GERD was only suggested later, explaining the association of GERD and normal LES pressure at stationary manometry. Most studies on transient relaxations show that the participation of this mechanism in GERD is on the order of 63 to 74%.^{12,13} Considering the comments on LES function, we see that marked hypotonia leads to a high probability of dependence on prolonged medical control and, consequently, surgery. On the other hand, the certain finding of normal mean pressure in the LES does not rule against a fundoplication. Making an antireflux valve will naturally raise the pressure of a hypotonic LES, but this is not its main function. Fundoplication should aim to prevent the transient relaxations not induced by swallowing, maintaining a pressure close to the normal average of 13.8 mm Hg.¹⁴

The main objective of manometry of the esophageal body during the preoperative period is to detect changes in motility, which will prevent fundoplication or require some adaptation of the technique to be used. Some authors advocate rendering the type of valve adequate to the function of the esophageal body, suggesting partial fundoplications when hypomotility is present.¹⁵ Around 7% of the patients with GERD present some degree of primary disease of motility¹⁶ and, besides this, 20% present an acquired or secondary disorder, like those caused by medication, trauma or lesion due to reflux itself.¹⁷ Esophageal manometry easily diagnoses “nutcracker”

esophagus, diffuse spasm and achalasia. Improvement is expected in the cases of hypomotility caused by pathological reflux itself, predominantly in the lower third of the organ, as long as fibrosis has not yet been established. Ottigmon et al,¹⁸ after a 28-month follow-up, showed that dysphagia was present in 39% of the patients submitted to surgery using Nissen's technique, and in 13% of the Toupet group (partial valve). There was no change in esophageal motility in the Nissen group, whereas, in the Toupet group, a rise in peristaltic velocity occurred from 3.2 cm/s before surgery to 4.4 cm/s after the procedure. In our present paper, improved peristalsis occurred in 28.5% of the patients with deficiency.

The DeMeester scoring system for 24-hour pH monitoring, according to authors Johnson and DeMeester, supplies a 90.3% sensitivity and 90.0% specificity to diagnose GERD.¹⁹ However, pH monitoring is not useful in diagnosing reflux esophagitis and, therefore, does not replace the endoscopic study. In patients with a clinical suspicion of GERD, in whom no esophagitis is detected, the indication for esophageal pH monitoring is essential and irreplaceable in order to perform the diagnosis of the clinical form of "pathological reflux without esophagitis."²⁰ When the diagnosis of esophagitis is established endoscopically in patients with suggestive symptoms, pH monitoring could be considered unnecessary.²¹ There was a significant percentage (around 25%) of the patients who, despite presenting esophagitis, had a normal pH in a single 24-hour period studied.^{22,23} The result of the pH monitoring by itself also does not define the therapy to be applied, even though Jamieson et al²⁴ mention prolonged 24-hour pH monitoring as the most sensitive and specific examination for the diagnosis of GERD. In our study, the nine patients (15.0%) who had a normal pH showed erosive esophagitis at endoscopy, symptoms refractory to medical treatment, and a large hiatal hernia. It is essential to understand, however, that this exam makes it possible to assess the evolution of reflux with a given surgical technique even with some limitations, controlling the postoperative result at a recent or late stage. Its function is also to diagnose absence of reflux in patients who still present some symptom after the fundoplication.

The goals of preoperative evaluation are to confirm the disease, find the difficulties in clinical management, relate the disease to symptoms (typical or atypical) and make sure of the functional condition of the esophagus, which will allow it to adapt to a valve. The goals of postoper-

ative evaluation are to verify raised LES pressure in the hypotonic cases, evaluate the presence of residual relaxation at swallowing, locate the LES and prove the absence of gastroesophageal reflux.

The results of esophageal manometries and 24-hour pH monitoring before and after antireflux surgery show that these methods are effective in revealing the level of functional modification established by the corrective procedure and also in helping select the surgical cases, using objective data. The findings of the present study were similar to those obtained at centers that use the same technology. The comparisons reinforce the fact that a standard profile should be sought in evaluation and preoperative control and another standard profile should be expected in postoperative follow-up.

References:

1. Constantini M, DeMeester TR. Preoperative assesment of esophageal function. In Bremner RM, ed. *Modern Approach to Benign Esophageal Disease*. Philadelphia: Lippincot-Raven; 1997:45-55.
2. Lind JF, Duthie HL, Schleger JF, et al. Motility of the gastric fundus. *Am J Physiol*. 1961;201:197-199.
3. Crookes PF, Peters JH, DeMeester TR. Physiology of the antireflux barrier and diagnostic tests of foregut function. *Sem Laparosc Surg*. 1995;2:10-26.
4. Johnson LF, DeMeester TR. Development of 24-hour pH monitoring of the distal esophagus. *Am J Gastroenterol*. 1974;61:325-330.
5. Rafferty MD, Rattner DW. Gastroesophageal reflux disease: indications for surgery, preoperative evaluation, and choice of operation. *Problems Gen Surg*. 1996;13:29-37.
6. Traube M. The spectrum of symptoms and presentations of gastroesophageal reflux disease. *Gastroenterol Clin North Am*. 1990;19:609-616.
7. Zaninotto RK, DeMeester TR, Schwizer W, et al. The lower esophageal sphincter and health disease. *Am J Surg*. 1988;155:104-111.
8. Kuster E, Ros D, Toledo-Pimental V, et al. Predictive factors of the long-term outcome in gastroesophageal reflux disease: six-year follow-up of 107 patients. *Gut*. 1994;35:8-14.
9. DeMeester TR, Bonavina L, Albertucci M. Nissen fundoplication for gastroesophageal reflux disease — evaluation of primary repair in 100 consecutive patients. *Ann Surg*. 1986;204:9-20.
10. Mittal RK, Holloway RH, Penagini R, et al. Transient lower sphincter relaxation. *Gastroenterology*. 1995;109:601-610.

11. McNally EF, Kelly JF, Ingelfinger FJ. Mechanisms of belching: effects of gastric distension with air. *Gastroenterology*. 1964;46:254-259.
12. Dodds WJ, Dent J, Hogan WJ, et al. Mechanisms of gastroesophageal reflux in patients with reflux esophagitis. *N Engl J Med*. 1982;307:1547-1552.
13. Mittal RK, McCallum RW. Characteristics and frequency of transient relaxations of the lower esophageal sphincter in patients with reflux esophagitis. *Gastroenterology*. 1988;95:593-599.
14. Karim SS, Panton ON, Finley RJ, et al. Comparison of total vs. partial laparoscopic fundoplication in the management of gastroesophageal reflux disease. *Am J Surg*. 1997;173:375-378.
15. Thor KBA, Silander TA. A long-term randomized prospective trial of the Nissen procedure vs a modified Toupet technique. *Ann Surg*. 1989;210-719.
16. Constantini M, Crookes PF, Bremner RM, et al. Value of physiologic assesment of foregut symptoms in a surgical practice. *Surgery*. 1993;114:780-786.
17. Kahrilas PJ, Dodds WJ, Hogan WJ, et al. Esophageal peristaltic dysfunction in peptic esophagitis. *Gastroenterology*. 1986;91:897-904.
18. Ottigmon Y, Pelissier EP, Maution G, et al. Reflux gastro-oesophagien. Comparison des resultats cliniques pH-metriques et manometriques des proceds de Nissen et de Toupet. *Gastroenterol Clin Biol*. 1994;18:920-926.
19. Johnson LF, DeMeester TR. Development of the 24-hour intraesophageal pH monitoring composite score system. *J Clin Gastroenterol*. 1986;8:52-58.
20. Kasapidis P, Xynos E, Mantides A, et al. Differences in manometry and 24-h ambulatory pH-metry between patients with and without endoscopic or histological esophagitis in gastroesophageal reflux disease. *Am J Gastroenterol*. 1993;88:1893-1899.
21. DeMeester TR, Wang CL, Wermly JA, et al. Technique, indications an clinical use of 24-hour esophageal pH monitoring. *J Thorac Cardiovasc Surg*. 1980;79:656-670.
22. DeMeester TR, Johnson LF. The evaluation of objective measurements of gastroesophageal reflux and their contribution to patient management. *Surg Clin North Am*. 1976;56:39-53.
23. Masclee AAM, De Best ACA, De Graf R, et al. Ambulatory 24-hour pH-metry in the diagnosis of gastroesophageal reflux disease. *Scand J Gastroenterol*. 1990;25:225-230.
24. Jamieson JR, Stein HJ, DeMeester TR, et al. Ambulatory 24-hour esophageal pH monitoring: normal values, optimal thresholds, specificity and reproducibility. *Am J Gastroenterol*. 1992;87:1102-1111.

This study was performed in the Laboratório Bioclínico Mãe de Deus, Unidade de Motilidade Digestiva, Hospital Mãe de Deus – Porto Alegre, RS, Brazil.