ABSTRACT

Objective: The purpose of this study was to evaluate the changes in esophageal physiology that are produced after laparoscopic surgery in patients with gastroesophageal reflux disease (GERD).

Methods: From May 1996 until January 2000, 13 patients with GERD underwent antireflux laparoscopic surgery. In 8 patients, preoperative manometric studies showed motility disorders characterized by a decrease in the percentage of primary peristaltic waves (32% average), a reduction in the pressure of the waves (40 mm Hg average), and a decrease in the percentage of the physiological waves (7.4% average). Laparoscopic Toupet fundoplication was the surgical procedure used in all cases, without complications and with a good postoperative course. Esophageal manometry was performed 8 weeks after the operation in 7 patients.

Results: The results revealed an increase in the percentage of primary peristaltic waves (76.4% average) \((P = 0.05906 \text{ Wilcoxon Test})\); an increase in the wave pressure (57 mm Hg average) \((P = 0.1056)\); and an increase in the percentage of the physiological waves (45.8% average) \((P = 0.05906)\).

Conclusion: Our final conclusion was that antireflux laparoscopic surgery, in this specific case the Toupet (partial) fundoplication, induced recovery in esophageal motility in those patients with peristaltic alterations due to reflux. This plays an important role in disease control because the recovery of esophageal peristalsis allows an increase in its emptying and reduces the possibility of esophageal damage by reflux episodes that could persist even though a fundoplication was constructed.

Key Words: Gastroesophageal reflux disease (GERD), Esophageal manometry, Fundoplication, Laparoscopy.

INTRODUCTION

Gastroesophageal reflux disease (GERD) represents a common clinical problem. Between 36% and 44% of the adult population show signs of pyrosis once a month and 18% take antacids to control the symptoms.\(^1,2\) Although open surgery is effective in controlling reflux, it was not until the advent of esophageal manometry studies and minimally invasive surgery techniques that the surgical treatment of GERD became popular.

These therapeutics have focused mainly on augmenting the lower esophageal sphincter (LES) and by paying less attention to the role of other physio-pathological factors that intervene in this pathology.\(^3\) The objective of this project was to evaluate the physiological alterations produced after laparoscopic surgery for GERD and its possible clinical implications.

METHODS

From May 1996 until January 2000, 13 patients diagnosed with GERD were treated surgically. Six were men and 7 were women with an average age of 37.76 years (range 16 to 64). The duration of symptoms varied between 1 and 6 years. All of the patients in this series experienced thoracic pain, 11 had pyrosis as a dominant symptom (84.6%), and one had signs of nocturnal coughing as a cardinal symptom (7.69%). The diagnosis was confirmed with upper endoscopy and esophageal biopsy, high quality radiological series with contrast and 24-hour pH monitoring for all of the patients.

A Synectics\textsuperscript{\textregistered} 4-channel polygraph, connected to 4 pressure transducers connected to an Nº 12 Fr 4-channel catheter, which used Polygram Software for Windows\textsuperscript{\textregistered} for the esophageal manometry analysis, was also used.
The pH studies were performed with a Synectics Digitrapper Mk III® apparatus, which was connected to a Synectics® multi-purpose anti-ammonium catheter with 1 electrode, along with a module for analyzing the esophagram of the reflux that was included in the Polygram program for Windows®.

All of the above required a monitor with a resolution of 800*600 and an MMX 32Mb RAM Pentium processor with a Windows 95® program.

Second-degree esophagitis was diagnosed in 5 patients, and third-degree esophagitis was diagnosed in 5 patients. The 3 remaining patients had Barrett’s esophagus (23.07%). Of the 13 patients, a sliding hiatal hernia was diagnosed in 10 cases (76.9%). In 2 patients, the DeMeester test was normal, and in the 11 remaining ones, the test score was above 14 points with an average of 113.3 points (17 to 200 points).

From the manometric point of view, 8 patients had damage to the esophageal pump that was expressed as abnormal values in motility, characterized by alterations in the primary peristaltic waves. These patients were the focus of this study.

The percentage of primary peristaltic waves in these 8 patients was 39.2%, with a range from 10% to 78% (normal value > 60%) with an average pressure per wave of 40 mm Hg, with a range from 24.6 mm Hg to 55 mm Hg (normal value: 60 to 140 mm Hg), and a normal wave morphology of 7.4% with a range from 0% to 10%. The average pressure for the LES was 6.9 mm Hg (normal value: 14 mm Hg).

A complete fundoplication of the Nissen-Rossetti type was performed by laparoscopic means in the 5 patients with a normal esophageal pump, and in the 8 remaining patients who had damage to the esophageal pump, a partial fundoplication of the Toupet type was performed by means of a laparoscopy.

With the patient in a gynecological position, the surgeon placed himself between the patient’s legs with his first assistant to his left and the second assistant to his right. The abdominal cavity was initially entered in all cases by the Hasson technique,4 inserting the trocar and cannula in the midline, 1/3 of the distance between the umbilicus and xyphoid process. Pneumoperitoneum was created with CO₂ insufflation and a 30° laparoscope was introduced by the first assistant. Immediately afterwards and under direct vision, two 10-mm trocars were introduced at the clavicular midlines, parallel to the first portal, which were handled by the surgeon. A fourth 10-mm trocar was introduced into the left anterior axillary line, parallel to the previous ones. The fourth port, which was managed by the second assistant, permitted the gastric fundus to be retracted during dissection of the hiatus and allowed for esophageal traction after the esophagus was encircled with a latex drain. A fifth trocar, in the subxiphoid position, was manned by the second assistant who retracted the left lobe of the liver and exposed the phrenoesophageal membrane.

In all of the patients, the fundoplication was performed over a Nº 51 Fr esophageal bougie, and included a diaphragmatic cruroraphy. Under no circumstances was sectioning of the short gastric vessels required.

For the patients with Toupet fundoplication, 6 stitches with Ethibond® 2-0 were made on the right side including 3 stitches on the esophagus-stomach-right abutment of the diaphragm and 3 stitches on the left side from the stomach to the esophagus. The posterior esophageal channel was left free, and a 270°-posterior fundoplication with gastropexy was performed. In 3 patients, an additional gastropexy stitch was placed on the left abutment of the diaphragm.

A nasogastric tube was inserted in all patients. After 24 hours, an esophagram was performed with an iodine water soluble contrast to evaluate the esophagus, the gastric-esophageal junction, and the gastric fundus for possible perforation. If the esophagram was interpreted as normal, liquids were given and the nasogastric probe was retrieved. In 7 of these 8 patients, a postoperative esophageal manometry was performed 8 weeks later. In all cases, upper endoscopy was performed 3 months after the operation.

RESULTS

Six men and 2 women, average age 32.3 years (range 16 to 64 years), were operated on with the Toupet technique. In all cases, the procedure was completed with laparoscopy without intraoperative complications. One patient experienced left basal atelectasis that was resolved without any consequences. The average stay in the hospital was 2.25 days. No conversions to open surgery were necessary. No mortalities occurred.
The average postoperative manometric results from the series were as follows: primary peristalsis 76.4% (45% to 100%); length of the wave 57 mm Hg (27.4 to 68.8 mm Hg); percentage of normal waves (morphology) 45.8% (10% to 75%); and LES pressure 18.8 mm Hg.

These results were evaluated by using a nonparametric test (Wilcoxon test), $P = 0.05906$ for both primary peristalsis and the percentage of normality of the wave. For the length of the wave $P = 0.1056$. Manometric values are shown in Table 1.

All of the patients have satisfactory control of GERD without the need for antireflux medication. In no case was dysphagia or “gas bloat syndrome” present. All of the patients indicated that they could burp, and 2 of them had an episode of vomiting which they did without difficulty.

Postoperative upper endoscopic studies confirmed that the patients were cured in 100% of the cases.

**DISCUSSION**

Laparoscopic procedures have proven the efficiency and certainty of GERD surgical management. In the current study, age distribution was similar to that of other series but with a lower average age.

The choice of patients who will benefit from the surgical treatment for GERD as well as the selection for the type of procedure to be performed depends on a careful preoperative evaluation in which esophageal manometry studies are fundamental.

A complete study of esophageal motility must include evaluation of the superior and inferior esophageal sphincters as well as an evaluation of the esophageal body (esophageal pump). For this, the following parameters must be considered: the length of the contractions, the morphology of the wave (wave length and velocity), and the primary esophageal peristalsis (morphology and number of contractions).

Seven of the 13 (53.8%) patients in our study had alterations in the esophageal pump. This advanced condition can be attributed to the fact that in our area, surgical intervention for patients with GERD is delayed due to the opposition of gastroenterologists to surgical procedures. For this reason, patients reach the surgeon with more esophageal damage due to reflux that has lasted for a longer period of time.

In our series of patients with esophageal pump alterations, we elected to perform a partial Toupet fundoplication. Our objective was to improve LES pressure as much as possible to prevent reflux without creating an obstruction to esophageal emptying.

We cannot define the parameters, which precisely determine when the esophageal pump is considered inadequate. The normal values of the manometry equipment are considered a reference point and when 2 or more of the parameters to be evaluated are below the normal values, the possibility of esophageal emptying (clearance) is considered deficient. Thus, we selected the 270° posterior fundoplication of the Toupet type.

Although our series was small, in studies with a higher number of patients, it has been established that posterior partial fundoplications are sufficient to treat GERD. For this reason, our postoperative findings, in which significant improvement in esophageal physiology was obtained with an improved efficiency in the esophageal pump and with adequate LES pressure, correlated clinically and endoscopically with 100% control.

| Manometric Values                  | Preoperative Manometry | Postoperative Manometry | $P$  |
|-----------------------------------|------------------------|-------------------------|------|
| Primary peristalsis               | 39.2% (10% to 78%)     | 76.4% (45% to 100%)     | 0.05906 |
| Length of the wave                | 40 mm Hg (24.6 to 55 mm Hg) | 57 mm Hg (27.4 to 68.8 mm Hg) | 0.1056 |
| Normal morphology of the wave     | 7.4% (0% a 10%)        | 45.8% (10% a 75%)       | 0.05906 |
| LES pressure                      | 6.9 mm Hg              | 18.8 mm Hg              |      |
of the disease without any need for medication. This leads us to question whether Nissen fundoplication which can lead to dysphagia and the “gas bloat syndrome,”9-13 is justified in patients with an adequate esophageal pump.

CONCLUSION

These results indicate that good esophageal clearance along with sufficient LES pressure can be obtained after Toupet fundoplication and physiological reflux episodes can be easily controlled. Esophageal physiology is more efficient after Toupet fundoplication. We suggest that patients with a good esophageal pump are candidates for a 270°-posterior-partial fundoplication, which avoids the inconveniences produced by the 360° fundoplication of a Nissen type.

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