COMPARISON OF OPEN AND LAPAROSCOPIC ANTIREFLUX SURGERY FOR THE TREATMENT OF GASTROESOPHAGEAL REFLUX DISEASE IN TAIWANESE

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Background and Purpose: Laparoscopic antireflux surgery has recently been introduced as an alternative to laparotomy for the treatment of gastroesophageal reflux disease (GERD) at National Taiwan University Hospital. This study compared the results of traditional open and laparoscopic fundoplication for the treatment of GERD.

Materials and Methods: The surgical records and medical charts of 29 adult patients who were surgically treated for GERD between 1980 and 2001 were retrospectively reviewed. The clinical characteristics, indications for surgery, and surgical findings and procedures were analyzed.

Results: Laparotomy and Nissen fundoplication were carried out on 20 of the patients between 1985 and 2000. Laparoscopic Nissen or Toupet fundoplication was performed on nine patients between 1997 and 2001. Patients in the laparoscopic group were younger than those in the laparotomy group (46.7 ± 15.9 vs 58.3 ± 18.5 yr). The incidence of associated prominent hiatal hernia was significantly higher in the laparotomy group (60 vs 33%). The mean operation time was 164.5 ± 25.5 minutes in the laparotomy group and 182.2 ± 52.2 minutes in the laparoscopy group (p = 0.6129). The mean hospital stay in the laparotomy group was significantly longer than that in the laparoscopy group (8.7 vs 3.4 days). Postoperative complications included three ventral hernias and one ileus in the laparotomy group. Results were good or excellent in 78.9% (15/19) of patients undergoing laparotomy (one patient was lost to follow-up 2 months later), and in 77.7% (7/9) of those undergoing laparoscopy. Symptomatic and endoscopic recurrence was recorded in two patients in the laparotomy group and one in the laparoscopy group.

Conclusion: Laparoscopic fundoplication is as effective as traditional laparotomy for treating GERD. More GERD patients in Taiwan, even the young and those without associated hiatal hernia, would rather undergo the less invasive and cosmetically better laparoscopic surgery than require medication throughout their lives.

The incidence of gastroesophageal reflux disease (GERD) in Taiwan has been increasing. According to endoscopic surveillance reports, the rate of erosive esophagitis in Taiwan increased from 2.4% in 1979 to 14.5% in 1997 [1, 2]. Management options for GERD include lifestyle and diet adjustment, drugs that inhibit gastric acid output, and surgical fundoplication. Indications for surgery include unresponsiveness to or drug-dependence on acid inhibitors, associated prominent hiatal hernia, and complications of GERD (pulmonary complication, esophageal strictures, esophageal shortening, Barrett’s esophagus, etc).

In 1951, Allison pointed out the association of hiatal hernia with GERD [3]; since then, surgeons have noticed the importance of the lower esophageal sphincter in controlling acid regurgitation. Many antireflux procedures have been proposed, including Nissen fundoplication [4], Hills procedure [5], Belsey Mark IV procedure [6], anterior fundoplication (Dor procedure), and partial posterior fundoplication (e.g.,

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Toupet procedure. Studies investigating open antireflux surgery reported 87.5 to 91% long-term success rates for Nissen fundoplication carried out by laparotomy [7, 8]. Nissen fundoplication was superior to the Belsey procedure carried out by thoracotomy in terms of shortened hospital stay and fewer postoperative complications [7]. However, one randomized trial showed that postoperative dysphagia was more common in patients undergoing Nissen fundoplication than in patients undergoing partial fundoplication [9]. In the laparoscopic era, recent systemic reviews have shown that the long-term satisfaction rate for minimally invasive antireflux procedures is about 90% [10, 11]. The antireflux procedures included Nissen fundoplication (74.8%) and Toupet fundoplication (23.8%) [10]. In randomized studies, the laparoscopic approach was shown to be as effective as the open method, and reduces the morbidity rate and hospital stay [12, 13]. The effectiveness of the less invasive laparoscopic fundoplication offers physicians an alternative to refer symptomatic GERD patients who have failed to respond to medical treatment for surgery.

However, the experience of surgically treating GERD patients is limited in Taiwan. This study compared the results of open and laparoscopic antireflux surgery for GERD at National Taiwan University Hospital over the past 20 years.

Materials and Methods

The surgical records and medical charts of patients treated for GERD using a primary antireflux surgical procedure at National Taiwan University Hospital from 1980 to 2001 were included in this study. The diagnosis of GERD was made on the basis of clinical symptoms, endoscopic evidence of esophagitis, and esophagograms. Reflux-induced esophagitis at endoscopy was graded according to the Savary-Miller classification [14]. Manometry and 24-hour pH monitoring were reserved for patients with an atypical presentation of GERD. Hiatal hernia was documented by preoperative esophagogram, and endoscopic and intraoperative findings. The size of the hernia was defined as the axial length of the hiatal hernia relative to the superior margin of the diaphragm at mid-swallow on esophagography [15]. The hiatal hernia was recorded as prominent if it was larger than 2 cm or identified as a paraesophageal hernia.

Operative technique

Open Nissen fundoplication was carried out via an upper midline laparotomy. The gastric fundus was wrapped 360° around the distal 2 cm of the lower esophagus. A Mallory tube (42–48 Fr) was placed in the esophagus as a stent when the wrap was constructed. Laparoscopic fundoplication was performed via five abdominal trocar sites as previously described [16]. Briefly, the procedure was performed with the patient in the modified lithotomy position. Pneumoperitoneum was established via the supraumbilical port. The other four working ports were placed at the subxiphoid, bilateral subcostal in the midclavicular line, and left lower quadrant of the abdomen along the anterior axillary line. The gastrohepatic omentum was opened and the right crus was identified and dissected. The esophagus was mobilized by dissecting the margin of the left crus, and a window was created between the posterior wall of the esophagus and the left crus. The esophagus was then looped and pulled by a silk tape. The posterior vagus nerve was preserved, the hiatus was closed with interrupted sutures, and the fundus was mobilized by dividing the short gastric vessels. The posterior wall of the fundus was passed behind the previously made window. The Mallory tube (42–48 Fr) was placed in the esophagus as an adjustable temporary stent when Nissen fundoplication was performed. The anterior and posterior walls of the fundus were sutured with interrupted sutures of about 2 cm in length. When Toupet partial fundoplication was performed, no stent was placed in the esophagus except for a 14-Fr nasogastric tube. The mobilized posterior fundic wall of the stomach was passed behind the window and sutured to the right side of the lower esophagus and the preaortic fascia. The mobilized anterior fundic wall of the stomach was sutured to the left side of the lower esophagus from the front, creating a 270° posterior wrap of the lower esophagus. The abdomen was closed after adequate hemostasis.

Data on three major symptoms of GERD during clinical follow-up were analyzed: acid regurgitation, heartburn and dysphagia. Data on the presence or absence of each of the following symptoms were also collected: epigastric pain, early satiety, inability to belch, epigastric bloating, anorexia, vomiting, nocturnal coughing and wheezing. Patients were asked to rank the outcome of surgery after 2 months as excellent if they had complete recovery, good if they had major improvement but still had minor complaints, fair if they had major problems (e.g., dysphagia) as well as major improvement, and poor if they had no improvement, deterioration or recurrence of symptoms [17, 18]. Recurrence of GERD was documented by symptomatic (graded poor) and endoscopic assessment. The differences in patient characteristics, surgical indications, surgical procedures, perioperative complications and surgical results of patients with GERD were compared between groups. Student’s t-test was used to assess the significance of continuous data.
sets. When cells had expected values of less than 5, Fisher’s exact test was used. Statistical significance was accepted at p less than 0.05.

**Results**

Thirty-six patients underwent surgery for proven GERD at National Taiwan University Hospital in the past 20 years. All 29 adult patients treated during the study period were included in the analysis. Another seven infant cases, most with complex heart disease, were excluded. Nissen fundoplication was performed via laparotomy in 20 patients between 1980 and 2000. Nissen (5 patients) or Toupet (4 patients) fundoplication was carried out by laparoscopy in nine patients between 1997 and 2001. The demographic characteristics and surgical results of patients are listed in the Table. There was a predominance of men in both groups. Patients in the open group were older than those in the laparoscopy group. A higher proportion of the laparotomy group had associated prominent hiatal hernia. There was no difference between the two groups in mean operation time (p = 0.6129). The hospital stay of the laparoscopy group was significantly shorter than that of the laparotomy group (p = 0.0002). Ventral hernias complicated the postoperative course of three patients in the laparotomy group. Two patients in the laparotomy group and one patient in the laparoscopy group who underwent Nissen fundoplication had temporary, self-limited dysphagia. Otherwise, there was no mortality or morbidity in either group. The mean follow-up time was 27.3 months (range, 2–73 mo) in the laparotomy group and 22 months (3–51 mo) in the laparoscopy group. One patient in the laparotomy group was lost to follow-up 2 months after surgery. Symptomatic assessment was ranked as good (12) or excellent (3) in 15 of 19 patients (78.9%) in the laparotomy group, and as good (6) or excellent (1) in seven of nine patients (77.7%) in the laparoscopy group. Two patients in the laparotomy group and one in the laparoscopy group had symptomatic and endoscopic recurrence of esophagitis (all underwent Nissen fundoplication). These patients did not undergo post-operative 24-hour pH monitoring or reoperation, but took an H₂ blocker or proton pump inhibitor for symptom control.

**Discussion**

H₂ blockers and proton pump inhibitors can effectively decrease acid reflux, but fundoplication is the only known way to restore the function of the incompetent lower esophageal sphincter. Fundoplication can also limit both acid and bile reflux. Barrett’s esophagus, the most severe form of esophagitis, is also a precancerous lesion. Studies show that antireflux surgery can prevent the progression of Barrett’s esophagus to dysplasia and cancer [19, 20]. Nissen first reported his fundoplication procedure for the treatment of GERD in 1956 [21]. In 1991, laparoscopic Nissen fundoplication was first described by Dallemagne et al [22]. Laparoscopic management offers the same treatment effects and substantially more postoperative comfort than conventional laparotomy. Although the number of cases in this study was small, this is the first report comparing results from open and laparoscopic antireflux surgery in Taiwan. In our series, satisfaction rates were similar in both groups of patients, and there were no differences in the rate of dysphagia or recurrence of esophagitis.

**Table.** Demography of 29 patients undergoing laparotomy and laparoscopic antireflux surgery

<table>
<thead>
<tr>
<th></th>
<th>Laparotomy</th>
<th>Laparoscopy</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>M:F</td>
<td>11:9</td>
<td>6:3</td>
<td>0.271</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>58.3 ± 18.5</td>
<td>46.7 ± 15.9</td>
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<tr>
<td>Hiatal hernia</td>
<td>60% (12/20)</td>
<td>33% (3/9)</td>
<td>0.015*</td>
</tr>
<tr>
<td>Operation time (min)</td>
<td>164.5 ± 25.5</td>
<td>182.2 ± 52.2</td>
<td>0.6129</td>
</tr>
<tr>
<td>Hospital stay (days)</td>
<td>10.4 ± 4.9</td>
<td>3.4 ± 1.1</td>
<td>0.0002*</td>
</tr>
<tr>
<td>Result</td>
<td></td>
<td></td>
<td>0.3703</td>
</tr>
<tr>
<td>Excellent</td>
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<td>2/19</td>
<td>1/9</td>
<td></td>
</tr>
<tr>
<td>Complications</td>
<td>2 Dysphagia, 3 ventral hernia, 1 ileus</td>
<td>1 Dysphagia</td>
<td></td>
</tr>
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</table>

*Significant difference between laparotomy and laparoscopy groups (p < 0.05). The ratio of excellent or good among the results was compared in both groups.
Although the operation times of the two groups were not significantly different, the variation in operation time was greater in the laparoscopy group. This finding suggests that laparoscopic fundoplication was not more time-consuming once surgeons learned the technique. The hospital stay was significantly shorter in the laparoscopy group, reflecting the decreased invasiveness of laparoscopic surgery. Two changes in the characteristics of GERD management were noted in our series. First, patients who underwent laparoscopic surgery were younger, which might suggest that lifelong medication is no longer the only option, and that more physicians are willing to recommend an effective, minimally invasive surgery. Second, the proportion of GERD patients with associated hiatal hernia was lower in the laparoscopy group. It is conceivable that, in the past, patients with large hiatal hernias had more severe esophagitis [15] and were more willing to undergo surgery when symptoms became obvious and medical treatment failed. The decline in the association between GERD and hiatal hernia might also suggest that physicians today are more alert to GERD, and more able to make a diagnosis in the absence of an obvious associated anatomic defect.

Four patients in the laparoscopy group underwent posterior partial fundoplication (Toupet) rather than Nissen fundoplication. Although the long-term effect of partial fundoplication against reflux is still debated [23], this procedure is suitable for patients with impaired esophageal motility [24, 25] and can prevent the occurrence of iatrogenic esophageal perforation as resulting from the stent modifications (manipulations) required by the Nissen procedure. The short-term results in our series were satisfactory and no dysphagia was reported. Three patients who underwent Nissen fundoplication had clinical and endoscopic recurrence of esophagitis (two in the laparotomy group and one in the laparoscopy group). The reported causes of failure included loosening or intrathoracic migration of the wrap. However, postoperative endoscopy confirmed that the wraps were intact in all three patients. None of these patients underwent postoperative 24-hour pH monitoring to document their acid reflux, and the exact causes of recurrence remain to be elucidated.

In summary, antireflux surgery performed via laparotomy or laparoscopy had similar effectiveness, although laparoscopy patients had a shorter hospital stay. The laparoscopic approach provides a safe, less invasive, and cosmetically superior alternative. With the introduction of effective laparoscopic antireflux procedures, younger GERD patients or those who do not have associated hiatal hernia in Taiwan may be more willing to undergo surgery rather than require medication throughout their lives.

References