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Laparoscopic repair of large hiatal hernia with polytetrafluoroethylene

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Abstract
Background: Several studies have shown that large hiatal hernias are associated with a high recurrence rate. Despite the problem of recurrence, the technique of hiatal herniorrhaphy has not changed appreciably since its inception. In this 3-year study we have evaluated laparoscopic hiatal hernia repair in individuals with a hernia defect greater than 8 cm in diameter.
Methods: A series of 35 patients with sliding or paraesophageal hiatal hernias was prospectively randomized to hiatal hernia repair with ($n = 17$) or without ($n = 18$) polytetrafluoroethylene (PTFE). All patients had an endoscopic and radiographic diagnosis of large hiatal hernia. Both repairs were performed by using interrupted stitches to approximate the crurae. In the group randomized to repair with prosthesis, PTFE mesh with a 3-cm "keyhole" was positioned around the gastroesophageal junction with the esophagus through the keyhole. The PTFE was stapled to the diaphragm and crura with a hernia stapler.
Results: Patients were followed with EGD and esophagogram at 3 months postoperatively, and with esophagogram every 6 months thereafter. Individuals with PTFE had a longer operation time, but the 2-day hospital stay was the same in both groups. The cost of the repair was \$1050 ± \$135 more in the group with the prosthesis. There were two complications (1 pneumonia, 1 urinary retention) in the group repaired with PTFE and one complication (pneumothorax) in the group without prosthesis. The group without PTFE was notable for three (16.7%) recurrences within the first 6 months of surgery.
Conclusion: On the basis of these preliminary results it appears that repair with PTFE may confer an advantage, with lower rates of recurrence in patients with large hiatal hernia defects.

Key words: Laparoscopy — Hiatal hernia — Gastroesophageal reflux — Laparoscopic Nissen fundoplication — Polytetrafluoroethylene — Prosthetic

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An enlarged hiatus traditionally is closed with interrupted large-gauge sutures (primary closure or repair) [9]. However, this closure method is prone to disruption, resulting in reherniation. It has been shown that in patients who experience failure of their antireflux procedure, more than half of these failures are caused by breakdown of the hiatal hernia repair, with reherniation of the stomach [10]. There is no clear data examining rates of hiatal hernia recurrence in laparoscopic operations, particularly in relation to the size of the hiatal hernia defect.

It appears that diaphragmatic repair is prone to disruption from the repetitive stresses of coughing, straining, sneezing, and laughing. Primary closure of large fascial defects elsewhere in the body (e.g., inguinal or ventral hernia) often results in a recurrence of the defect because of a disrupted suture line. A remedy for this problem is the use of prostheses such as polypropylene mesh or polytetrafluoroethylene (PTFE) in the repair of inguinal [7] and ventral [2] hernias.

As a carryingover from experience with body wall hernias, a 5-year prospective randomized study was undertaken to examine the use of PTFE prosthetic repair as compared with primary repair in patients with large esophageal hiatal defects. Here we present our 3-year preliminary results.

Patients and methods

Thirty five patients with hiatal defects greater than 8 cm were enrolled in the study, and an informed consent was obtained. The study was approved by the institutional review board. Hiatal hernia (either sliding or paraesophageal) was determined by barium contrast study and esophagogastroduodenoscopy (EGD). If the patient had symptoms of dysphagia or odynophagia, or there was evidence of dysmotility on the esophagogram, manometry was obtained. The decision to enroll a patient in the study was made intraoperatively on visualization and measurement of the esophageal hiatus. The length of the hiatal defect was measured using the Patch

Spreader (Circon, Santa Barbara, CA) and all patients with a hiatal defect larger than 8 cm were enrolled. Seventeen patients with a mean age of 53 years (range, 36–68 years) were randomized to repair with PTFE, and 18 patients with a mean age of 55 years (range, 42–55 years) to a primary repair without prosthesis.

Technique

The technique of laparoscopic hiatal hernia repair follows our previous description [4–6]. Cefazolin (2 gms IV) is given with induction of anesthesia. The patient is placed in a modified lithotomy position, and the abdomen is prepped and draped in the usual sterile manner. A 1-cm incision is made below the left costal margin at the midclavicular line, and the 12-mm Optiview trocar (Ethicon-EndoSurgery, Cincinnati, OH, USA) is used to enter the abdominal cavity. Carbon dioxide (CO_2) pneumoperitoneum then is established and maintained at 15 mmHg. Four additional 10- to 11-mm trocars are placed: one in the right quadrant, one on the subcostal left anterior axillary line, one about 3 cm above the umbilicus in the midline, and one in the subxiphoid area. All trocars are placed under direct view and by transillumination of the abdominal wall. The laparoscope is introduced through the supraumbilical port.

The left lobe of the liver is retracted cephalically and to the right with an inflatable balloon retractor (Soft Wand Retractor, Circon, Santa Barbara, CA, USA) introduced through the subxiphoid port. A Babcock forceps with atraumatic inserts (Pilling Weck, Inc., Research Triangle Park, NC, USA) is used through the left lateral port to retract the stomach caudally and to the left. The herniated stomach, and at times the omentum, are reduced into the abdomen by gentle traction using atraumatic Babcock forceps.

Once the stomach is reduced into the abdomen, the hernia sac is identified and with the use of grasping forceps is gradually detached from the mediastinum and brought into the abdomen. Detachment of the hernia sac begins first anteriorly and then at the right side of the esophagus. With the use of hook electrocautery and hook scissors, the hernia sac is divided and removed through one of the lateral ports. The esophagus then is identified visually with the use of a lighted bougie introduced into the esophagus by the anesthesiologist, and by palpation with a blunt palpation probe. With large hiatal hernias, the esophagus lies posteriorly, and mobilization is performed by blunt dissection.

Once the esophagus is mobilized from the right, a Babcock forceps is introduced through the right lateral port and placed posteriorly to the esophagus to exert anterior and caudal traction. This maneuver facilitates further mobilization of the posterior aspect of the esophagus.

The hernia sac on the left side of the esophagus then is reduced and divided. With the hernia sac completely removed, the right and left bundles of the right crus are seen clearly, and the hiatal defect is appreciated. The size of the hiatal defect then is measured, and the patient is randomized.

The next step of the procedure is to divide the short gastric vessels. The lesser sac is entered through an opening on the gastrosplenic omentum using hook electrocautery. The harmonic scalpel (Ethicon-EndoSurgery, Cincinnati, OH, USA) is used to divide the short gastric vessels, beginning at a point high on the greater curvature and extending up to the gastroesophageal junction. The fundus of the stomach then is mobilized posteriorly out of the retroperitoneum, and the left bundle of the right crus is cleared of any adhesions.

A 30° laparoscope then is brought to the right of the esophagus with the angle facing to the left, and a Babcock forceps is passed posteriorly to the esophagus creating the posterior window. We prefer to leave the posterior vagus attached to the esophagus so injury to the nerve can be avoided during cruroplasty. The posterior cruroplasty then is carried out with the placement of four interrupted nonabsorbable sutures (#2-0 polyester) incorporating both muscle and fascia.

Before the crural sutures are placed, the 50 Fr dilator is passed into the stomach. The sutures are placed from caudad to cephalad so the hiatus is snug around the esophagus containing the dilator. An oval sheet (15 × 10 × 0.1 cm) of fenestrated PTFE (MycroMesh Gore-Tex, W. L. Gore & Associates, Phoenix, AZ, USA) is used as an onlay to reinforce the cruroplasty. A radial slot with a 3-cm defect in the center of the oval (keyhole) is cut into the PTFE. The prosthesis is pushed through the left midclavicular line (12-mm trocar) into the peritoneal cavity and placed around the gastroesophageal junction, with the esophagus coming through the 3-cm defect and the keyhole slot oriented anteriorly. The PTFE is stapled to the diaphragm and the crura with a straight hernia stapler (Ethicon-EndoSurgery, Cincinnati, OH, USA), and the two leaves of the keyhole are stapled to each other.

In both groups, after repair of the hiatal defect, a three-stitch Nissen fundoplication is performed. The most cephalad stitch of the fundoplication incorporates either the anterior arch of the right crus, or in the group repaired with PTFE, the prosthesis and the anterior arch of the right crus. In our animal laboratory, this has been shown to prevent a "slipped Nissen" and is an alternative to incorporating the delicate tissues of the esophagus.

Each patient was seen in the clinic at 1 week, 2 weeks, 1 month, 3 months, and then yearly. This data represents the 3-year follow-up in a planned 5-year study. At 3 months each patient had an EGD and barium contrast study of the upper gastrointestinal tract, then an esophagogram every 6 months thereafter. Complaints of persistent chest pain or heartburn prompted evaluation with a barium contrast study and a clinic visit.

Results

Hospitalization time for the two groups was identical (2 days). The duration of surgery, however, was longer in the group repaired with prosthesis (3.2 ± 0.3 h vs. 2.5 ± 0.2 h). The rate of complications was 5.5% for the group without prosthesis (one pneumothorax) compared with 13.3% for the group with prosthesis (one pneumonia, one urinary retention). Because of the small number of subjects involved in this study, our results are not statistically significant.

There were no recurrences in the group repaired with prosthesis. In contrast, there were three recurrences (16.6%) in the group repaired without prosthesis. Two patients who had recurrence underwent reoperation. By request, one procedure was performed laparoscopically with PTFE, whereas the other patient underwent an open procedure. All three recurrences were recognized within 6 months after surgery.

The cost with Gore-Tex was $1,050 ± $135, more than without prosthesis. The difference included not only the cost of the prosthesis, but the operating room costs as well.

Discussion

There is little precedent for the use of PTFE for repair of hiatal hernia, either open or laparoscopic. Edelman [3] reported a series of five patients with paraesophageal hernia who were treated with laparoscopic hiatal herniorrhaphy using polypropylene mesh, gastropexy, and gastrostomy. Pitcher et al. [8] reported a series of 12 patients with paraesophageal hernia who underwent laparoscopic repair. Two of these patients required polypropylene mesh to close a large hiatus.

We have a series of 44 patients from the prelaparoscopic era with large hiatal hernia who were treated with open hiatal herniorrhaphy using polypropylene mesh [1]. All but two of these patients have had a good to excellent result. We also have performed a pilot study of three patients with gastroesophageal reflux disease (GERD) who had a large hiatal hernia, and who underwent a laparoscopic Nissen fundoplication with PTFE hiatal herniorrhaphy [5].

We feel that PTFE onlay for repair of large hiatal defect provides a buttress where healing tissue is subjected to stress from coughing, straining, retching, or obesity. Other surgeons have opted for pledgeted sutures. The utility of this technique was not examined in the current study. The rate of recurrence in the current study was lower in the group of patients repaired with PTFE than in the group with primary repair alone.

Determining the efficacy and safety of PTFE reinforcement of posterior cruroplasty for large hiatal defects will require a larger number of patients (i.e., 50–75) observed over 10 to 15 years. On the basis of our 3-year preliminary results, it appears that the use of PTFE reinforcement may result in a lower rate of recurrent herniation than with primary repair alone.

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