Minimally invasive surgery of the esophagus

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SUMMARY

The laparoscopic antireflux procedure, especially Nissen fundoplication, has evolved into the surgical treatment of choice for gastroesophageal reflux disease. The goal of laparoscopic operation is to duplicate the technique and result of open operation. Paraeosophageal hernia also may be treated with a laparoscopic approach. Minimally invasive Heller myotomy is the procedure of choice for achalasia. Minimally invasive esophageal tumor resection is not far past the case report stage.

REVIEW

Treatment of gastroesophageal reflux disease. Laparoscopic Nissen fundoplication was first reported in 1991.11,17 It has evolved into the procedure of choice in most centers when operative treatment of gastroesophageal reflux disease (GERD) is elected. This change has occurred without the benefit of controlled trials, similar to the change which occurred in the treatment of symptomatic cholelithiasis. The improvement in patient related factors has been such (see below) that a controlled trial probably will not be performed. Laparoscopic Nissen fundoplication will be the main topic in this review.

Indications. The indications for open operative treatment of GERD have been complicated disease (ulcer, bleeding, stricture, dysplasia), and noncompliance with or refractoriness to medication. The indications for minimally invasive treatment of GERD are in evolution and are not standardized, but in general more patients are choosing operative treatment now that laparoscopic surgery is available. Many uncomplicated GERD patients who have their symptoms controlled by but are
dissatisfied with taking medication undergo laparoscopic intervention. The synergistic effect of duodenogastroesophageal reflux on epithelial dysplasia of the esophagus, though still under investigation, may be another indication for early operation on GERD.\textsuperscript{5,40}

**Contraindications.** The relative contraindications to both an open and laparoscopic Nissen fundoplication include previous gastric surgery (including proximal gastric vagotomy\textsuperscript{21}), esophageal shortening, esophageal motor disorder, and severe epithelial dysplasia. Additional relative contraindications to laparoscopic Nissen include those common to other laparoscopic procedures such as portal hypertension, bleeding disorders, and intraabdominal adhesions.

**Preoperative evaluation.** The preoperative evaluation\textsuperscript{18,20,28,41} for Nissen fundoplication is the same as it is for open fundoplication and should include: esophagogram (to evaluate for stricture, shortened esophagus and hiatal hernia); endoscopy (to evaluate the esophageal epithelium and to rule out concomitant gastroduodenal lesions); and manometry (to evaluate for motor disorder). Ambulatory pH monitoring may be performed if the diagnosis of acid reflux is in question.\textsuperscript{41}

**Operative technique.** The objective in performing laparoscopic Nissen fundoplication is duplication of the open operation. The goal of the open operation, which has evolved over the past 40 years, is to create a short (3 cm), loose fundal wrap around well-mobilized intraabdominal length (5 cm) of esophagus inside of which a large (50-60 Fr) bougie has been placed.\textsuperscript{14} Often a hiatal hernia is present, requiring reduction of the stomach and lower esophagus into the abdomen. The esophageal hiatus of the diaphragm is narrowed with interrupted sutures to prevent herniation of the wrap into the chest. Most authors divide the proximal short gastric vessels which mobilizes the fundus so a loose wrap may be created (which lessens the chance for postoperative dysphagia).\textsuperscript{2,7,16,19,25} Some authors suture the wrap to the esophagus (to prevent slippage);\textsuperscript{7,14,25} others suture the wrap to the diaphragm (to prevent herniation).\textsuperscript{16}

**Other procedures.** Other antireflux procedures which have been performed with a minimally invasive approach include the Hill,\textsuperscript{1} Toupet,\textsuperscript{8,25} Collis-Nissen,\textsuperscript{38} Rossetti,\textsuperscript{4,28} and other procedures. The laparoscopic Collis-Nissen, indicated for shortened esophagus, has been performed by placing the laparoscopic stapler-cutter transorally across the fundus.

**Results.** There are no controlled trials comparing open versus laparoscopic Nissen fundoplication. In most uncontrolled comparisons patients undergoing the laparoscopic procedure have quicker resumption of alimentation, less postoperative pain, a shorter hospitalization, and a quicker return to full activity compared to patients having the open procedure.\textsuperscript{2,7,16,34} It is these advantages which have allowed the laparoscopic operation to replace the open operation. Operative time initially is longer with the former, but the time shortens as the "learning curve" is surmounted.

The available reports of laparoscopic Nissen fundoplication contain short term follow up.\textsuperscript{1a,2,7,16,19,28,39,43} It has been shown with long term (10-20 years) follow up of open Nissen fundoplication that a good to excellent result (Visick I-II) persists in about 80-90% of patients.\textsuperscript{12,24} It seems that the short term result with laparoscopic Nissen fundoplication (80-95% Visick I-II) will approximate the result obtained with open operation. An excellent (Visick I) result is absence of reflux symptoms with no dysphagia, bloating, or diarrhea. A good (Visick II) result is improvement in condition but with mild reflux, dysphagia or other symptom present but not severe enough to be treated.

**Complications.** Complications related to the performance of the fundoplication include pleural injury with pneumothorax,\textsuperscript{8,19} esophageal perforation (0.5-1%),\textsuperscript{4,8,19} esophageal stenosis,\textsuperscript{20,32,42} and gastric necrosis.\textsuperscript{2} Splenic injury is
rare. A general consensus is that the laparoscopic view of the hiatus is better than the open view; this may make injury such as splenic laceration less common compared with laparoscopic operation. Other complications include pneumonia, trocar site hernia, and pulmonary embolism. Conversion, although not a complication, occurs in less than 5% of patients and usually is do to bleeding or technical difficulties.

Failure. A poor (Visick III-IV) result has been noted in less than 10% of patients. Operative failure implies recurrent reflux, bloating, or dysphagia which severely impacts on the patient's lifestyle. Recurrent reflux may be secondary to breakdown of the wrap or recurrence of the hialt hernia. The integrity of the fundoplication may be protected by using nonabsorbable suture, anchoring the wrap to the diaphragm, and performing posterior cruroplasty. Dysphagia usually is secondary to a tight fundoplication; this may be prevented by creating a floppy fundoplication around the esophagus (not the stomach body).

Treatment of paraesophageal hernia. Most surgeons would agree that paraesophageal hernia should be repaired promptly after diagnosis, because even the asymptomatic hernia can present with strangulated gastric volvulus. Elective laparoscopic paraesophageal herniorrhaphy is safe and feasible. The hernia may be repaired with posterior cruroplasty (simple sutures); prosthetic mesh repair of the hernia also has been described. It is controversial whether or not to perform an antireflux procedure in conjunction with the herniorrhaphy. Paraesophageal hernia repair requires extensive dissection at the esophageal hiatus which can destroy the physiologic antireflux mechanism; an intraabdominal fundoplication prevents reflux and also may be a buttress against recurrent hernia.

Treatment of achalasia. Minimally invasive operation is now the preferred operative approach for achalasia. Heller myotomy may be performed either laparoscopically or thoracoscopically with excellent results. There is a tendency to perform an antireflux procedure in addition to the myotomy if done laparoscopically, because the dissection at the esophageal hiatus necessitated by this approach may ablate the physiologic antireflux mechanism.

Treatment of esophageal tumors. Thoracoscopic enucleation of benign esophageal tumors has been described, and appears to be a logical treatment for this type of lesion. Thoracoscopic and laparoscopic transhiatal esophagectomy for malignancy has been performed in small numbers. This procedure should be considered experimental.

REFERENCES

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