The American Journal of Surgery (2010) xx, xxx

The American Journal of Surgery®

Laparoscopic transgastric esophageal mucosal resection: 4-year minimum follow-up

Constantine T. Frantzides, M.D., Ph.D., F.A.C.S.[a,*], Mark A. Carlson, M.D., F.A.C.S.[b,c], Ali Keshavarzian, M.D.[d], Jacob E. Roberts, D.O.[a,e]

[a]Chicago Institute of Minimally Invasive Surgery, 4905 Old Orchard Center, Skokie, IL 60077; [b]Department of Surgery, University of Nebraska Medical Center, Omaha, NE; [c]Department of Surgery, VA Medical Center, Omaha, NE; [d]Department of Gastroenterology, Rush University, Chicago, IL; [e]Department of Surgery, St Mary Mercy Hospital, Livonia, MI, USA

KEYWORDS:
Barrett's esophagus;
High-grade esophageal dysplasia;
Gastroesophageal reflux disease;
Esophageal adenocarcinoma;
Minimally invasive surgery;
Mucosal ablation

Abstract

BACKGROUND: The management of high-grade esophageal dysplasia has included surveillance, endoscopic ablative techniques, and esophagectomy. Herein we describe an alternative treatment, laparoscopic transgastric esophageal mucosal resection.

METHODS: Laparoscopic transgastric esophageal mucosal resection was accomplished through an anterior gastrotomy. The mucosa was stripped from the Z-line to the proximal extent of the abnormal epithelium. The gastrotomy then was closed with a linear stapler, and a Nissen fundoplication was performed.

RESULTS: Six patients with high-grade dysplasia of the distal esophagus underwent mucosal resection. After 4 to 7 years of endoscopic surveillance, all patients have regenerated squamous epithelium. One patient developed nondysplastic Barrett's esophagus after 2 years and was treated medically. Two strictures were treated successfully with dilatation.

CONCLUSIONS: Laparoscopic transgastric esophageal mucosal resection was a reasonable treatment for high-grade dysplasia in this small sample of patients. This technique is a potential alternative treatment for high-grade dysplasia of the esophagus.

The risk of adenocarcinoma developing in a patient with uncomplicated Barrett's esophagus (intestinal metaplasia of the esophagus) has been estimated to be about 4 per 1,000 patient-years.[1] If the Barrett's esophagus is complicated by high-grade dysplasia, then the risk of cancer increases about 10-fold to about 6 per 100 patient-years.[2] The preferred management of Barrett's esophagus with high-grade dysplasia is controversial; current modalities include surveillance, esophagectomy, and a variety of mucosal ablative techniques.[3,4] None of these modalities has attained a clear superiority over the others in both efficacy (ie, prevention of cancer) and procedure-related morbidity. In this brief report, we present follow-up data on a newer approach to Barrett's esophagus with high-grade dysplasia: laparoscopic transgastric esophageal mucosal resection.

The technique follows a previous description.[5] Briefly, circumferential esophageal mobilization is performed, and any associated hiatal defect is repaired. A 5-cm transverse

Presented at the American College of Surgeons Clinical Congress, October 11–15, 2009, Chicago, IL.

The authors have no financial disclosures.

* Corresponding author. Tel.: +01-847-676-2200; fax: +01-847-676-1813.

E-mail address: cfrantzides@cimis.info

Manuscript received August 21, 2009; revised manuscript October 13, 2009

0002-9610/$ - see front matter © 2010 Elsevier Inc. All rights reserved.
doi:10.1016/j.amjsurg.2009.10.011

gastrotomy then is made 4 cm below the gastroesophageal junction. Epinephrine in normal saline (1:100,000 or .01 mg/mL) is injected from the Z-line to the proximal extent of the abnormal mucosa. The abnormal mucosa is dissected from the submucosa using scissors and hook electrocautery. The specimen is removed intact and oriented for pathology. The gastrotomy is closed with a linear stapler-cutter, and a floppy Nissen fundoplication is performed.

Laparoscopic transgastric esophageal mucosal resection was performed in 6 patients (all male; median age, 53.5 y; range, 44–68 y). All patients had high-grade dysplasia on preoperative biopsy. The median length of Barrett's esophagus was 4.0 cm (range, .5–8.0 cm). In the patient with the longest (8.0 cm) segment of Barrett's esophagus, the proximal extent of abnormal epithelium could not be reached with the laparoscopic approach. This patient had a complete endoscopic mucosal resection in the early postoperative period. There was no 30-day mortality or morbidity in any patient. Five patients had high-grade dysplasia on pathologic examination; 1 patient had a small region that was read as carcinoma in situ. The latter patient was offered an esophagectomy, but he elected to undergo surveillance.

The patients have been followed up for a median of 6.3 years (range, 4.5–7.5 y). Upper endoscopy was performed at 3, 6, and 12 months, and then yearly. Multiple mucosal biopsies and methylene blue staining was performed at each endoscopy. All the patients regenerated squamous epithelium at the site of the mucosal resection. One patient developed a recurrence of nondysplastic Barrett's epithelium (several small islands) 2 years after resection; he is being managed with surveillance and a proton-pump inhibitor. The patient with the completion endoscopic resection has been without recurrence for 6 years. Two patients developed an esophageal stricture; both were treated successfully with endoscopic balloon dilatation and have suffered no further sequelae.

High-grade dysplasia of the esophagus is a premalignant condition formerly managed with either surveillance or esophagectomy. Endoscopic mucosal ablative therapies[6] are now popular, including cryotherapy, radiofrequency energy, photodynamic therapy, and laser. One controlled trial of 127 patients with dysplasia comparing radiofrequency ablation with a sham procedure showed that the 12-month rate of complete eradication of intestinal metaplasia was 77% versus 2%, with progression to cancer in 1% versus 9%, respectively.[7] Beyond this study, there are not enough controlled data to make firm conclusions on these newer therapies. A systematic review of uncontrolled data in this area suggested that the incidence of cancer after endoscopic ablation of high-grade dysplasia (all techniques) was about 2 per 100 patient-years or about one third of the incidence in untreated patients.[8]

Given the proliferation of new techniques to treat esophageal dysplasia, it may seem odd that yet another technique is being described in the present report. The rationale for treating high-grade dysplasia of the esophagus with laparoscopic transgastric mucosal resection has 3 main components: (1) en bloc resection of the complete segment of abnormal esophageal mucosa (limited to the lower 5 cm of esophagus); (2) repair of any coexisting hiatal hernia; and (3) concomitant performance of an antireflux procedure. The first component is possible with some endoscopic resection methods, but the second and third components are not possible with present technology. Laparoscopic transgastric mucosal resection yields an intact segment of esophageal mucosa, which can be oriented anatomically for pathologic examination (although the need for an en bloc specimen has not been shown).

Laparoscopic transgastric mucosal resection treats 2 underlying conditions associated with high-grade dysplasia: hiatal hernia and gastroesophageal reflux. Endoscopic ablative therapies, however, are not intended to reduce reflux. Endoscopically treated patients will need to stay on lifelong acid suppression.[6] Reflux of gastroduodenal contents (including bile in some patients) presumably will continue. The hiatal herniorrhaphy and the Nissen wrap that is performed with laparoscopic transgastric mucosal resection address the primary problem that these patients have: reflux of gastroduodenal contents.

A drawback of this procedure is that laparoscopic resection can reach only about 5 cm proximal to the Z-line. With current laparoscopic instrumentation, the patient with a longer segment of Barrett's might not be resected completely with this technique. Laparoscopic transgastric mucosal resection requires general anesthesia, port insertion, mediastinal dissection, fundal mobilization, and a gastrotomy. Two of 6 patients (33%) in our series developed strictures after laparoscopic transgastric mucosal resection. The rate of stricture formation with endoscopic ablation has ranged up to 30%,[6] depending on the energy type and quantity. Stricture formation after mucosal ablation (both in the present report and historically) has been amenable to endoscopic dilatation.

Laparoscopic transgastric esophageal mucosal resection was completed in 6 patients with no progression of disease and one limited recurrence. Morbidity was limited to 2 strictures, both dilated. Further study will be required for determination of the comparative efficacy and safety of laparoscopic transgastric mucosal resection for treatment of high-grade dysplasia. Given its minimally invasive approach to treating both the pathology and the underlying cause of high-grade dysplasia, laparoscopic transgastric mucosal resection might be a reasonable treatment to evaluate in future trials of dysplasia therapy.

References

1. Yousef F, Cardwell C, Cantwell MM, et al. The incidence of esophageal cancer and high-grade dysplasia in Barrett's esophagus: a systematic review and meta-analysis. Am J Epidemiol 2008;168:237–49.
2. Rastogi A, Puli S, El-Serag HB, et al. Incidence of esophageal adenocarcinoma in patients with Barrett's esophagus and high-grade dysplasia: a meta-analysis. Gastrointest Endosc 2008;67:394–8.

3. Wang KK, Sampliner RE. Updated guidelines 2008 for the diagnosis, surveillance and therapy of Barrett's esophagus. Am J Gastroenterol 2008;103:788–97.
4. Zhang HY, Spechler SJ, Souza RF. Esophageal adenocarcinoma arising in Barrett esophagus. Cancer Lett 2009;275:170–7.
5. Frantzides CT, Madan AK, Moore RE, et al. Laparoscopic transgastric esophageal mucosal resection for high-grade dysplasia. J Laparoendosc Adv Surg Tech A 2004;14:261–5.
6. Waxman I, Konda VJ. Mucosal ablation of Barrett esophagus. Nat Rev 2009;6:393–401.
7. Shaheen NJ, Sharma P, Overholt BF, et al. Radiofrequency ablation in Barrett's esophagus with dysplasia. N Engl J Med 2009;360: 2277–88.
8. Wani S, Puli SR, Shaheen NJ, et al. Esophageal adenocarcinoma in Barrett's esophagus after endoscopic ablative therapy: a meta-analysis and systematic review. Am J Gastroenterol 2009;104:502–13.