# Surgical Adjuncts During Esophagectomy

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**KEYWORDS**

• Esophagectomy complications • Pyloric drainage • Feeding tube • Enteral access
• Anastomotic buttressing • Omentum

**KEY POINTS**

- During esophagectomy, several intraoperative maneuvers classically thought to mitigate postoperative complications may be indicated.
- Enteral access via jejunostomy tube placement provides reliable enteral nutrition and can prevent malnourishment. Selected patients who exhibit evidence of malnourishment should have enteral access placed before surgery.
- Nasogastric tube decompression at the time of esophagectomy should be used and removed by postoperative day 2 if possible.
- Evidence for pyloric drainage or pyloroplasty is limited. No specific recommendation can be made at this time, but chemical pyloroplasty with botulinum toxin is an option for a temporary pyloric drainage procedure without the long-term side effects associated with pyloromyotomy or surgical pyloroplasty.
- Anastomosis may be buttressed with surrounding tissue. Ideally omentum should be used if available.

## INTRODUCTION

Esophagectomy is used for benign and malignant esophageal disease. Although outcomes following esophagectomy have improved over the years, the operation still portends significant morbidity.[1] Herein, the authors critically examine data available for adjunctive surgical procedures, including enteral access, pyloric drainage procedures, nasogastric decompression, and anastomotic buttressing during esophagectomy.

### *Feeding Tubes*

It is common for patients with esophageal cancer to lose up to 15% of their body weight from time of diagnosis to 6 months postoperatively.[3] Randomized clinical trials have shown that early feeding is associated with decreased complications during major gastrointestinal operations.[4–6] There are also some data indicating that length of stay may be shorter and quality of life improved with early feeding.[5,7] Current Enhanced Recovery After Surgery (ERAS) Society guidelines recommend early feeding on days 3 to 6 following esophagectomy.[1] Depending on the patient's clinical status, early feeding may only be possible with tube feeds.

The ERAS Society recommends the use of enteral access via nasoduodenal/nasojejunal tubes (NJ tubes) or jejunostomy feeding tube in patients who are at high risk of malnourishment (**Box 1**).[1] This nutritional assessment should be done at the time of diagnosis or multidisciplinary intervention, ideally with the involvement of a qualified dietitian. Patients should have a feeding tube placed preoperatively or before induction therapy

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**Box 1**
**High-risk indicators for nutritional deficiency[2]**

Severe dysphagia: able to tolerate puree/fluids only

Unintentional weight loss greater than 10%

Body mass index less than 18 kg/m$^2$

Serum albumin less than 3 g/dL

if there are concerns for malnourishment substantiated by the aforementioned criterion. Interruption of induction therapy for enteral access because of worsening of dysphagia or weight loss should be avoided if possible by preemptively placing feeding tubes in high-risk patients. Intraoperative placement of a feeding tube at time of esophagectomy may have less benefit.[8] The authors favor selective preoperative placement of laparoscopic jejunostomy tubes when needed because jejunostomy tubes are not without their own complications. Although most of these complications are minor, major tube-related complications are associated with morbidity as high as 46% and can require laparotomy in up to 16.7% of patients.[5,8–10]

Other options for enteric access include a nasogastric tube (NG tube), NJ tube, and gastrostomy tube (g-tube; via open or percutaneous technique). A subset of patients may not tolerate preoperative endoscopic placement of a feeding tube and may require operative gastrotomy or jejunostomy placement for reliable enteric access. Feeding tubes traversing the nasopharynx are less comfortable for the patient and have been associated with dislodgement and aspiration.[11] Although rare, there have been some case reports of gastric vasculature compromise following percutaneous gastrotomy (PEG) tube placement.[12] Gastrotomy site metastasis following PEG tube placement has also been reported in individual cases.[13,14] A larger single-center retrospective analysis of patients who underwent gastric tube placement did not find any incidence of these complications.[15] Utilization of the "push" method of PEG placement avoids passing instruments through malignancies and then into healthy tissue, which likely lowers the risk of seeding as compared with the "pull" method of PEG placement.[15] Current National Comprehensive Cancer Network (NCCN) guidelines recommend that gastrotomy placement is more suitable for patients with cervical esophageal cancer who are receiving definitive chemoradiation or for patients with marginally resectable disease.[16] However, data available indicate that g-tube placement, particularly open g-tube or "push" technique PEG placement, is likely a safe alternative for carefully selected patients with resectable esophageal cancer as an alternative to jejunostomy tube or NG-/NJ-tube placement.

### *Nasogastric Decompression*

ERAS Society guidelines strongly recommend intraoperative NG tube placement for postoperative decompression with the caveat that early removal (postoperative day 2) be pursued when appropriate.[1] Two randomized control trials have assessed the use of postoperative NG tube decompression.[17,18] Shackcloth and colleagues[17] compared standard NG tube decompression with early removal (on postoperative day 2) versus no NG tube decompression. Higher pulmonary complications were seen in the group without NG tube decompression.[17] Mistry and colleagues[18] compared early (postoperative day 2) versus delayed NG tube removal and found no difference in pulmonary or other complications. As expected, patients had less pain complaints about the NG tube when it was removed early. However, the group with early NG tube removal had higher reinsertion rates as compared with the group that underwent delayed removal.[18] A recent metaanalysis confirmed early removal of NG tubes is not associated with increased rates of anastomotic leak, pulmonary complications, or mortality. Notably, this study also found no difference in pulmonary or anastomotic complications whether nasogastric decompression was omitted, although analysis included retrospective data.[11]

### *Pyloric Drainage Procedures*

Delayed gastric emptying occurs in up to 50% of patients following esophagectomy because of the truncal vagotomy that is part of resection, tubularization of the stomach, and gastric pull-up.[3,19] It is impossible to determine which patients will develop gastric outlet obstruction and benefit from pyloric drainage. Four options exist to address this problem at the time of surgery: no intervention, pyloroplasty, pyloromyotomy, or chemical pyloroplasty. Although pyloromyotomy and pyloroplasty were historically well accepted, there is now considerable debate about their efficacy.[20] Advocates of the drainage procedures cite the low morbidity and potential to minimize postoperative conduit dilation, which may lead to anastomotic leak. Those critical of these interventions espouse the long-term benefits of an intact pylorus. In addition, delayed gastric outlet obstruction has been shown to be effectively treated with endoscopic measures, including

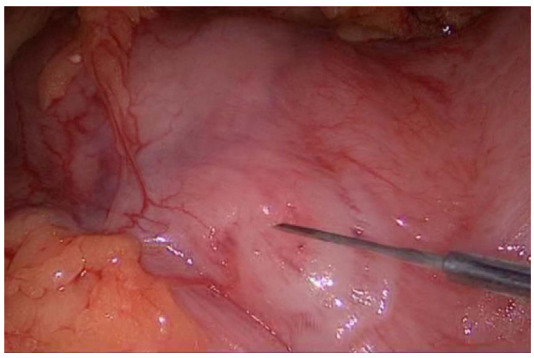

**Fig. 1.** Botulinum toxin injection into pylorus.

balloon dilation, botulinum toxin injection, and endoscopic per-oral pyloromyotomy.[21]

In summary, the data surrounding pyloric drainage procedures are mixed and limited. There are insufficient data to recommend drainage procedures over not performing pyloric drainage. Several retrospective series have found no difference in rates of delayed gastric outlet obstruction after pyloromyotomy or pyloroplasty.[22–24] A prospective study of 242 patients undergoing esophagectomy with a gastric conduit found no difference in rates of gastric outlet obstruction among patients who did and did not receive a pyloromyotomy.[25] In contrast, a metaanalysis of 9 trials and 553 esophagectomy patients randomized to pyloromyotomy versus no pyloric drainage procedure found a lower risk of gastric outlet obstruction for patients treated with pyloromyotomy (odds ratio: 0.18, 95% confidence interval [CI]: 0.03–0.97, $P<.046$).[26] However, this metaanalysis found no difference in operative mortality, anastomotic leaks, or pulmonary complications.[26] A more recent systematic review did find nonstatistically significant trends toward decreased gastric outlet obstruction and lower anastomotic leaks.[27]

Given the inconclusive data available, current ERAS guidelines do not make a recommendation on the role of pyloric drainage.[1] The authors selectively use chemical pyloroplasty with 200 units of botulinum toxin injected on the anterior surface of the pylorus (Fig. 1); this can alternatively be done in 4 quadrants. Although expensive, botulinum chemical pyloroplasty is a simple, safe, and temporary gastric outlet procedure that provides

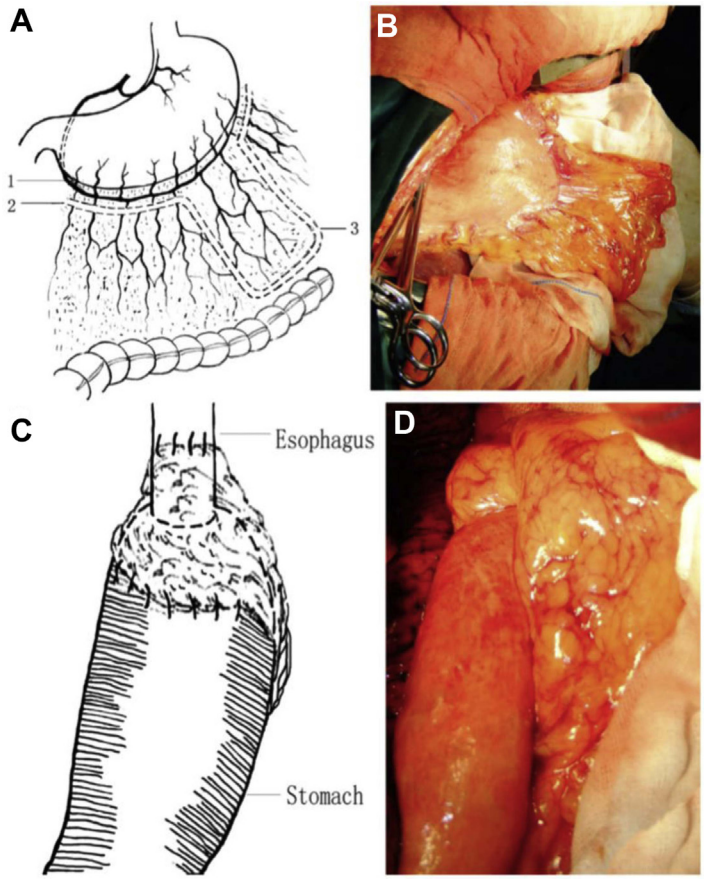


**Fig. 2.** Technique for omental flap construction. (*A*) Technique for harvesting the omental graft: (*1*) right gastroepiploic artery; (*2*) mobilized site of omentum for harvesting the pedicle omental flap; (*3*) pedicle omental flap. (*B*) Harvesting a pedicle omental flap during an operation. (*C*) The method for wrapping of the pedicle omental flap around the esophagogastric anastomotic site after esophagectomy. (*D*) Wrapping of the pedicle omental flap around the esophagogastric anastomotic site after esophagectomy during an operation. (*From* Dai et al. with permission.[33])

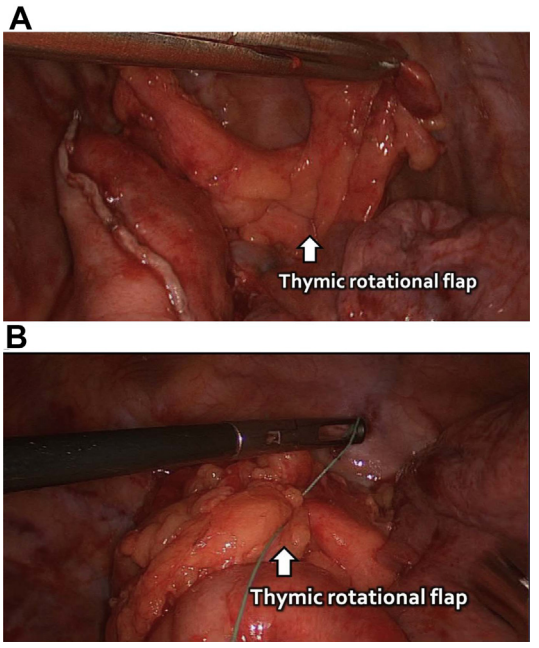


**Fig. 3.** Thymic rotational flap. (*A*) Fully mobilized thymic rotational flap elevated by instrument. Esophageal anastomosis staple line is visible. (*B*) Circumferential tension-free rotational flap around esophageal anastomosis.

the early benefit of a gastric outlet procedure and avoids long-term complications, including biliary reflux and dumping syndrome.[28] In 1 retrospective analysis, however, intraoperative botulinum injection was associated with more acid reflux than pyloromyotomy and pyloroplasty at the time of 6-month follow-up.[29] If chemical pyloroplasty is inadequate in the long term with recurrent symptoms of delayed gastric emptying, then endoscopic or laparoscopic drainage procedures may be offered to the patient.

### *Anastomotic Buttressing*

Despite improvements in surgical techniques, esophageal leak rates remain significant at 12% for cervical anastomoses and 9% for intrathoracic anastomoses.[30] Buttress of an intrathoracic anastomosis using a pedicled omental flap has demonstrated decreased leak and stricture rates in large retrospective series and 2 prospective randomized control trials.[31–34] Typically, the omental pedicle is created by preserving 2 to 4 perforating arteries from the right gastroepiploic artery (**Fig. 2**),[33] and this is transposed into the chest and wrapped around the anastomosis medial to lateral like a scarf. The omentum pedicle surrounds the entire anastomosis and lies along the gastric conduit lesser curvature staple line. Intercostal muscle or thymus may also be used, although existing published data are limited to the use in airway and pulmonary operations.[35,36] Thymus is relatively easy to harvest with minimal added morbidity or operative time (**Fig. 3**).

Although the literature supports omental wrapping, it is not yet routine practice, and current

**Table 1**
**Summary of Enhanced Recovery After Surgery Society recommendations for operative adjuncts to esophagectomy**

| Element | Recommendation | Level of Evidence | Recommendation Grade |
|---|---|---|---|
| Enteric feeding tube | Early enteral feeding should be used. If a patient is high risk for malnutrition, a feeding tube should be placed preoperatively. Feeding jejunostomy or NG/NJ tubes are preferred | Moderate | Moderate |
| Nasogastric decompression | Should be used postoperatively but with early discontinuation (postoperative day 2) | Moderate | Strong |
| Pyloric drainage procedure | No specific recommendation can be made given the limited data available | Low | Strong |
| Anastomotic buttress | Not addressed in ERAS Society recommendations | | |

*Adapted from* Low DE, Alderson D, Cecconello I, et al. International consensus on standardization of data collection for complications associated with esophagectomy: Esophagectomy Complications Consensus Group (ECCG). Ann Surg 2015;262:286–94; with permission.

ERAS guidelines do not include any discussion on anastomotic buttressing.[1,35,37] Arguments against routine omental wrapping include potential obstruction at the diaphragm by the omentum and omental bleeding secondary to traction. In addition, a wrap may contribute to a complex phlegmon should there be an anastomotic leak, potentially complicating the leak management. In fact, the authors' group selectively used a thymic rotational flap to buttress the anastomosis for minimally invasive Ivor-Lewis esophagectomy until they encountered a complex postoperative leak with a large phlegmon component that was difficult to manage. Nevertheless, omental wrapping may be a useful addition, not a substitution, to a well-perfused conduit and technically optimized anastomosis. Surgeons may consider adding the buttress to their esophagectomy technique.

## SUMMARY

Esophagectomy is a complex operation fraught with numerous potential complications. **Table 1** summarizes available adjuncts to surgery and their ERAS Society recommendations with level of evidence. In sum, enteral access should be pursued preoperatively for patients at high risk for malnutrition. NG tube drainage should be used with the caveat of early discontinuation when feasible. All available pyloric drainage procedures have mixed and limited data; these maneuvers should be used selectively. Although not addressed by the ERAS Society, anastomotic buttressing with omentum should be considered because data indicate it may reduce the incidence and severity of anastomotic leaks.

## DISCLOSURE

The authors have no disclosures or conflicts of interest to report.

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