

# Role of the Pectoralis Major Muscle Flap in the Multidisciplinary Treatment of Esophageal Cancer

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**Background:** Management of esophageal cancer is complex. Esophagectomy is associated with risk of significant complications. In this case series, we share the experience of our multidisciplinary team of thoracic surgeons and otolaryngologists in managing complications arising in the surgical treatment of esophageal cancer with the assistance of regional tissue transfer in the form of the pectoralis major flap.

**Methods:** We present a case series highlighting 3 patients who underwent esophagectomy who experienced significant anastomotic or conduit complications which were managed with a pectoralis muscle flap.

**Results:** Complications included tracheoesophageal fistula, refractory stenosis, and gastric conduit necrosis. Using a pectoralis major muscle flap with both myocutaneous and myofascial transfers was key to successful management. In the first patient, esophageal stent erosion after posterior tracheal wall dissection resulted in a tracheoesophageal fistula reconstructed through interposition of a myofascial flap. In the second patient, a tubed myocutaneous flap was interposed between the remnant gastric conduit and cervical esophagus to manage a posttreatment stenosis following resection of the stenosed segment. Finally, a myofascial flap was utilized to bolster a colonic interposition flap after initial necrosis of a gastric conduit that necessitated the creation of a temporary pharyngocutaneous fistula and subsequent colon interposition.

**Conclusions:** Multidisciplinary care and collaboration are integral components for optimization of patient outcomes. In this case series, otolaryngology and thoracic surgery utilized multiple tools within their armamentarium to manage complications associated with the surgical management of esophageal cancer. (*Plast Reconstr Surg Glob Open* 2024; 12:e6290; doi: [10.1097/GOX.00000000000006290](https://doi.org/10.1097/GOX.00000000000006290); Published online 8 November 2024.)

## INTRODUCTION

Reconstruction after esophagectomy is commonly performed with a gastric conduit that depends on a potentially tenuous blood supply.<sup>1</sup> Distal flap ischemia can result in anastomotic complications, including anastomotic dehiscence and subsequent stenosis. Significant compromise of

the vascular supply may lead to conduit necrosis, necessitating removal of the conduit, creation of a cervical esophagostomy, and delayed reconstruction. A multidisciplinary treatment strategy is beneficial when difficulties arise. This review summarizes recent progress toward interdisciplinary treatment of esophageal cancer and provides an overview of the multidisciplinary approach to esophagectomy complications that led to the use of regional tissue transfer from the pectoralis major muscle.

## CASE 1

A 58-year-old man with a history of smoking and alcohol use presented with squamous cell carcinoma within the cervical esophagus. He was initially treated with definitive chemoradiation, but the tumor subsequently recurred. McKeown esophagectomy was performed, revealing that

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the tumor was adherent to the posterior membranous trachea; thus, a portion of the common wall was resected. The resulting defect was reconstructed with a serratus anterior muscle flap and a gastric conduit. Persistent anastomotic leak developed that was initially managed with a proximal salivary stent and a mid-esophageal stent; however, these eroded into the patient's airway, causing a tracheogastric fistula. Subsequently, a large cavity and infection within the right apex of the chest resulted in sepsis, and a thoracic window was created (Fig. 1A).

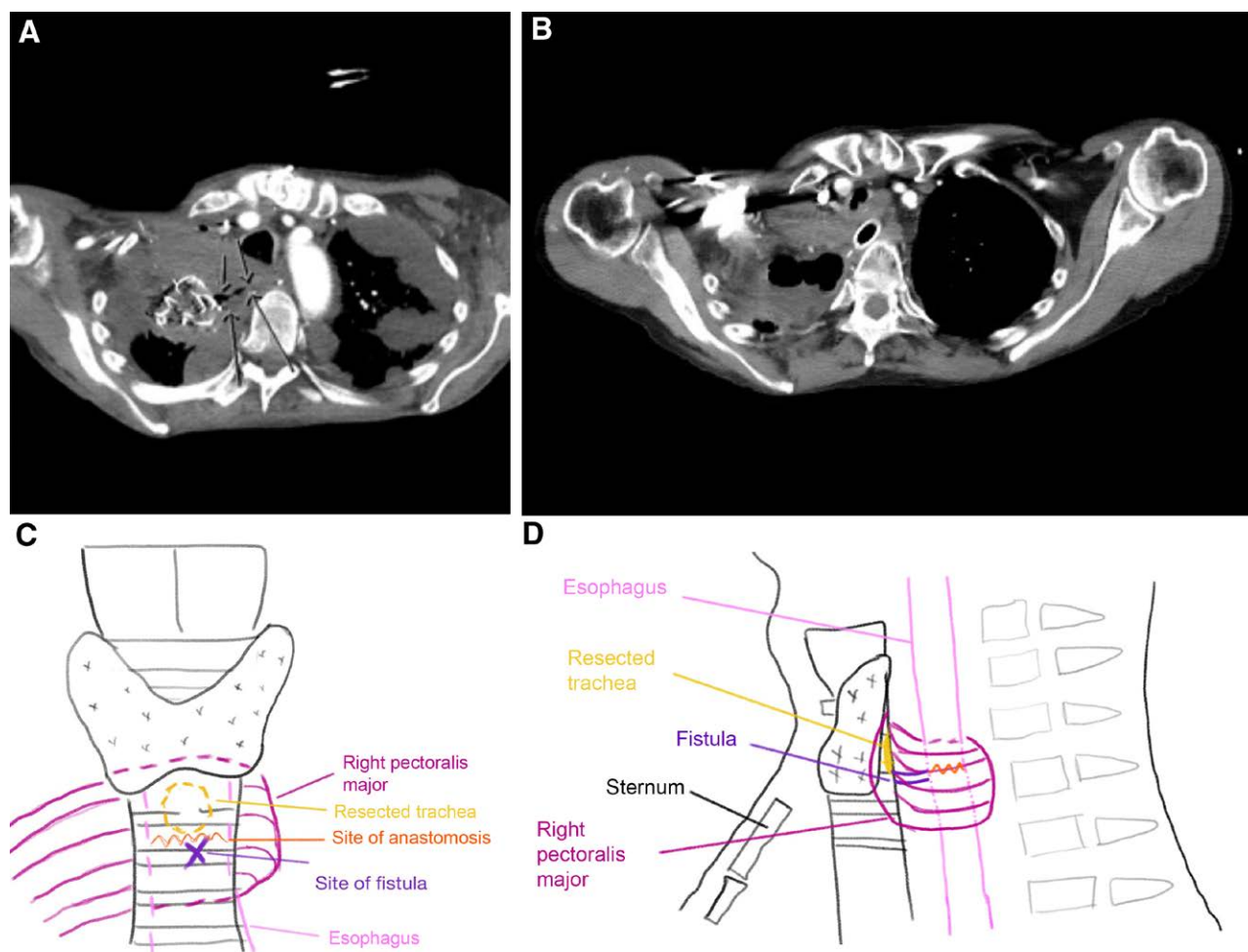
The stent was removed, and a defect in the esophago-gastric anastomosis was identified. A Montgomery salivary stent was advanced to bridge the gap. The right pectoralis major myofascial flap was harvested, pedicled superiorly on the thoracoacromial artery in the standard manner, rotated, and transposed through the thoracic window into

### Takeaways

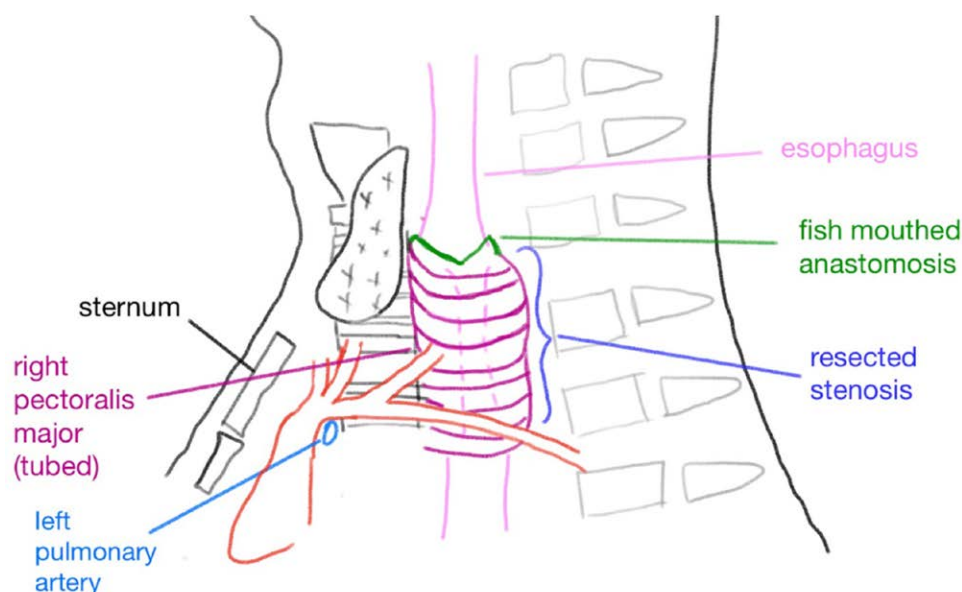
**Question:** Are regional flaps of the pectoralis major effective for the management of postesophagectomy complications, and what is the significance of multidisciplinary care in the improvement of surgical management?

**Findings:** In cases where a multitude of complications arise postesophagectomy, using a pectoralis major flap proved successful in the study group due to the collaborative work between thoracic and head and neck surgeons.

**Meaning:** The use of a pectoralis major flap is a beneficial treatment in the prevention of postoperative complications due to the collaborative work between thoracic and head and neck surgeons.



**Fig. 1.** Pectoralis major myofascial flap as patch and bolster to tracheo-conduit fistula. A, A photograph of computerized tomography postesophagectomy with gastric pull-up, Clagett window in right upper hemithorax and arrows indicating persistent continuity between the upper aspect of the gastric conduit and the Clagett window. B, A photograph of computerized tomography postesophagectomy with gastric pull-up, tracheoesophageal fistula repair with serratus and pectoralis major muscle flaps. Previous connection between the gastric conduit and Clagett window has been repaired following reconstruction with the right pectoralis major flap. C, Drawing of an anterior view of the cervical esophagus and upper thorax illustrating the use of the pectoralis major flap to buttress the anastomosis, repair the resected trachea, and repair the fistula. D, Drawing of a sagittal view of the cervical esophagus and upper thorax depicting the use of the pectoralis major flap to buttress the anastomosis, repair the resected trachea, and repair the fistula.



**Fig. 2.** Tubed pectoralis major myocutaneous flap to reconstruct defect after anastomotic stricture resection. Illustration of the cervical esophagus and upper thorax sagittally demonstrating the use of the major flap of the pectoralis to bridge the proximal esophagus and the conduit.

the thoracic inlet. Sutures were placed at the superior and inferior aspects of the flap to allow transposition of the flap behind the trachea between the esophageal conduit and the trachea toward the contralateral side, successfully separating the trachea from the conduit, thus repairing the fistula. The sutures were then tied down to the strap muscles overlying the larynx on the contralateral side to the flap harvest to secure the flap anteriorly and prevent it retracting proximally away from the site of repair. Given its bulk, it was felt adequate to provide sufficient tissue between the trachea and the esophagus at the level of the anastomosis (Fig. 1B–D).

Accumulation of granulation tissue of the pectoralis muscle within the tracheal lumen required ablation. (See figure, **Supplemental Digital Content 1**, which displays photographs from esophagogastroduodenoscopy showing stricture, healthy conduit, and pectoralis flap, <http://links.lww.com/PRSGO/D601>.) Reconstruction and obliteration of the thoracic window were accomplished with a regional tissue transfer via a pedicled latissimus dorsi musculocutaneous flap. After these procedures, the patient recovered and was discharged from the hospital.

### CASE 2

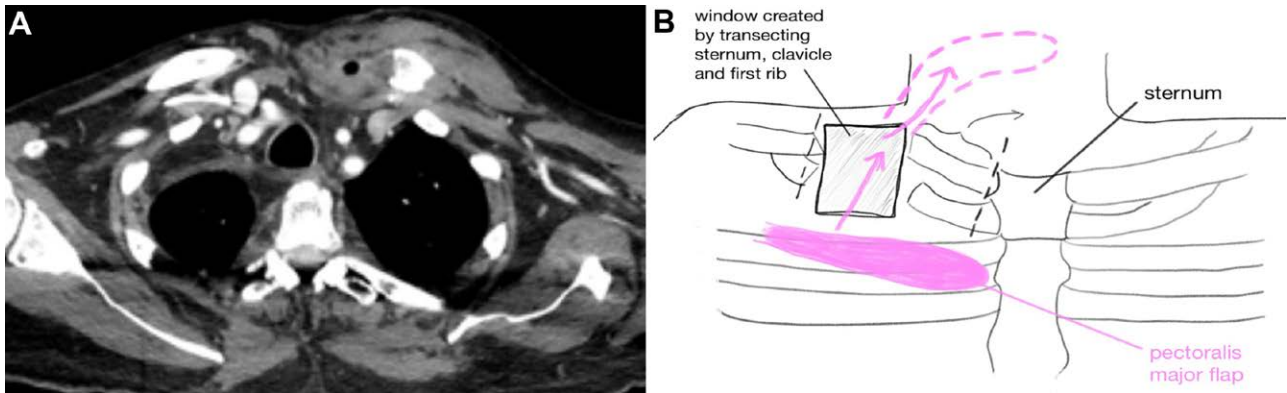
A 69-year-old woman who had received induction chemoradiotherapy followed by esophagectomy at an outside institution had developed a refractory stricture located at the junction of the gastric conduit with the cervical esophagus and was jejunostomy tube dependent.

The stricture was resected, and a tubed myocutaneous pectoralis major flap was used to bridge a 10-cm circumferential gap between the cervical esophagus and remaining distal conduit. An inadvertent tracheotomy resulted, and the muscle of a myocutaneous pectoralis major flap was utilized

for onlay closure. The myocutaneous pectoralis major flap was harvested from the anterior chest wall in a standard manner, incorporating a 12 cm × 6 cm skin paddle. The cutaneous portion of the flap was tubed, taking care to invert the epithelium in to the lumen of the neoesophagus. The flap was inset between the remnant proximal esophagus and the remaining conduit, with a fish-mouth anastomosis to further widen the anastomosis to the remnant cervical esophagus. Distal anastomosis of the flap was performed through the chest inferior to the pulmonary artery (Fig. 2). Postoperatively, she developed an air collection in the right chest. Placement of a drain revealed bilious fluid. Bronchoscopy revealed no fistula between the airway and the conduit despite bile within her trachea. This was managed expectantly without a stent and resolved. She was discharged, and at 16 months follow-up, she was tolerating oral intake.

### CASE 3

A 64-year-old man with alcohol and tobacco exposure was diagnosed with adenocarcinoma of the distal esophagus and completed induction chemoradiotherapy followed by an esophagectomy. Proximal gastric conduit necrosis resulted in conduit failure, necessitating the creation of a spit fistula. Gastric conduit loss and resection resulted in discontinuity, requiring an isoperistaltic colonic interposition based on the middle colic artery with a gastrocolic anastomosis. The esophagocolic anastomosis was completely buttressed with a pectoralis major myofascial flap posterior and anterior to the anastomosis to increase the likelihood of success, which required transection of the clavicle and first rib laterally (Fig. 3). Bolstering of the anastomosis was successful, with no evidence of leak throughout the remainder of the patient's convalescence. Postoperatively, he required balloon dilation of a stricture at the anastomosis. (See figure, **Supplemental Digital Content 2**, which displays photographs



**Fig. 3.** Pectoralis major myofascial flap as buttress to esophagocolic anastomosis. A, Photograph of computerized tomography of pectoralis major flap rotation and bolstering of conduit. B, Illustration of the window created on the anterior thoracic wall to allow the pectoralis flap to be rotated around the anastomosis.

of esophagogastroduodenoscopy of balloon dilation of stricture, <http://links.lww.com/PRSGO/D602>.)

## DISCUSSION

Esophageal cancer requires a multidisciplinary approach for optimal patient outcomes. Multidisciplinary consultation allows the integration of various skill sets to address complications with innovative strategies. Our study sheds light on the implications of multidisciplinary collaboration in managing esophageal cancer complications. The observed heterogeneity in referral patterns for technically intricate procedures underscores the importance of tailored approaches to patient care. This variability, observed across various healthcare facilities and geographical regions, highlights the need for adaptable strategies to optimize patient outcomes.

In Canada, thoracic surgeons play a significant role in performing esophageal surgery, reflecting a specific referral pattern within the healthcare system. Moreover, our center benefits from the expertise of head and neck surgeons who demonstrate a remarkable level of experience in performing myocutaneous flaps for reconstruction. This specialized skill set enables our multidisciplinary team to address complex cases with a comprehensive approach. Within other settings, general surgery and plastic and reconstructive surgery may play more substantial roles in the management of these patients.

The collaboration between thoracic and head and neck surgeons exemplifies the diverse expertise within multidisciplinary teams. By leveraging this collective proficiency, we can effectively manage complications arising from esophageal cancer treatment, thereby optimizing resource allocation and patient outcomes.

Several techniques have been developed to restore gastrointestinal continuity after esophagectomy.<sup>2</sup> We report the successful use of the pedicled pectoralis major flap to address intraoperative and postoperative complications.

For anticipated complicated esophageal reconstruction, preoperative planning should include integrating a surgeon with experience reconstructing the aerodigestive tract with muscular flaps. In this series, adding

a reconstructive otolaryngologist—head and neck surgeon—helped manage intraoperative and postoperative complications in reconstruction of the esophagus.

## Role of Otolaryngology—Head and Neck Surgeons

Reconstruction in this series was accomplished using pedicled regional flaps. Reconstructive options for complex defects typically include pedicled flaps and free tissue transfers. The latter, which offers unparalleled reconstructive flexibility, requires longer operative times and microsurgical expertise. In postradiotherapy postesophagectomy patients with complications including leaks and infection, eliminating the need for recipient vessels is a significant advantage of pedicled regional flaps.<sup>3</sup>

The pectoralis major flap is an ideal option for reconstruction within the thoracic cavity and neck, given its proximity. The flap can be harvested with the patient remaining supine, resulting in little donor site morbidity, including primary donor site closure. Myofascial flaps are a reliable technique in reconstructive surgery that involves including both the muscle and its fascial layer to ensure adequate vascularity and tissue viability at the recipient site. This technique offers a versatile option for addressing tissue defects and optimizing patient outcomes. The myofascial component of the flap can be utilized to bolster anastomoses and overlaid on luminal defects, as shown in case 2. For large circumferential defects, the cutaneous paddle can be incorporated as a patch or tubed, such as in the cases presented here. The muscle provides well-vascularized tissue to prevent anastomotic leakage. Harvest of the pectoralis major flap is straightforward and expedient and has been well described previously.<sup>4–6</sup> In brief, the skin of the anterior chest wall may be incorporated for the myocutaneous flap or left in situ for the myofascial flap. Incisions are carried down to the pectoralis major muscle, ensuring the pectoral fascia is left on the muscle. Laterally, the border of the pectoralis major is identified and the plane between the pectoralis major and the pectoralis minor is developed. The inferior attachments of the pectoralis major to the ribs are divided, as are the medial attachments to the sternum. The pedicle is identified superiorly, and the lateral attachments to the humerus



can be divided to allow additional rotation. The medial and lateral pectoral nerves are divided. The flap is then rotated to its recipient site.

Our research expands on existing literature by examining the management of specific complications related to esophagectomy using the pectoralis major flap. It is worth noting that other studies have also explored the usefulness of this flap in similar contexts. Examples include Siu et al (1985), Alemar and Anand (1997), Lifei et al (2022), and Heitmiller et al (1998), who have all documented the effectiveness of the pectoralis major flap in various esophageal reconstructions and complication management. Our study adds to this body of literature by offering additional insights into the efficacy of the pectoralis major flap in addressing complications following esophagectomy.

Although this series reports on the management of specific esophagectomy-related complications managed with the use of the pectoralis major flap, others have reported on the use of another commonly utilized myocutaneous flap, the latissimus dorsi flap. Based on the thoracodorsal artery, the flap has been used to manage persistent intrathoracic esophageal anastomosis leakage,<sup>7</sup> but it typically requires a lazy lateral decubitus position for harvest or repositioning of the patient, and the harvest site can be within the thoracotomy incision lines, limiting flap availability.<sup>8</sup>

#### Role of Thoracic Surgeon

If an additional intra-abdominal procedure is needed to manage postesophagectomy complications, the stomach or colon can be mobilized to provide a tension-free anastomosis. Partial resections of the thoracic cage can provide access to the chest for flap inseting, improving the arc of rotation for inseting the pectoralis major flap.

At our institution, the thoracic surgeon typically performs the proximal esophagojejunal or esophagocolonic anastomoses in the neck. If an intestinal reconstruction is used, the thoracic surgeon also performs the necessary bypasses for the remaining bowel.

#### COMPLICATIONS

Several donor site complications can arise when a pectoralis major muscle flap is harvested and used for reconstruction. Any pedicled flap poses a risk of partial necrosis of the distal tip,<sup>6</sup> which can be mitigated using a more proximal and superior skin paddle. A comparative study described the use of a supercharged gastric conduit for cervical anastomosis, suggesting that this technique improves perfusion to the conduit and reduces

anastomotic leak.<sup>9</sup> Fistulas, dehiscence, hematomas, infections, and flap failure are possible but uncommon.<sup>10,11</sup>

#### CONCLUSIONS

A multidisciplinary approach is vital for managing esophageal cancer complications. The pectoralis major flap is a valuable tool in addressing diverse challenges, offering a promising option for aggressive radical surgery in challenging cases.

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#### DISCLOSURE

*The authors have no financial interest to declare in relation to the content of this article.*

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