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CASE REPORT

Reconstructive

Iliocostalis Muscle Rotational Flap: A Novel Flap for Esophagopleural Fistula Repair

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Summary: Intrathoracic fistulas present major challenges to reconstructive surgeons. Reconstruction with muscle flaps have been shown to improve patient outcomes; however, there are patients for whom one or more of the commonly used muscle flaps is not available for several reasons. We describe the use of an iliocostalis muscle rotational flap for the repair of a caudally located esophagopleural fistula in the setting of definitive chemoradiotherapy for treatment of nonsmall-cell lung cancer and reirradiation with photons for local recurrence 5 years later. Our repair remained intact through the nearly 12-month follow-up period during which the patient tolerated a regular diet. This report demonstrates that the iliocostalis lumborum muscle is a viable option for repair of intrathoracic fistulas that are located in the distal esophagus, even in the setting of previous thoracotomy and radiation, and should be part of the reconstructive surgeon's armamentarium in the management of intrathoracic fistulas. *(Plast Reconstr Surg Glob Open 2022;10:e4007; doi: 10.1097/GOX.0000000000004007; Published online 5 January 2022.)*

Intrathoracic fistulas (eg, esophageal, bronchopleural) are very challenging defects for thoracic and reconstructive surgeons.[1,2] Extra-thoracic muscle flaps such as the serratus anterior, latissimus dorsi, and pectoralis major are primarily utilized for repair.[3] Recently, perforator-based intercostal artery muscle flaps have also been utilized.[4] However, there are patients for whom commonly utilized regional muscle flaps are not available, for reasons including prior thoracotomy and radiation fibrosis.

We report here the novel use of the iliocostalis, which is the most lateral component of the erector spinae muscle group for the repair of an esophagopleural fistula in a patient in whom the conventional flap options were not available. The pedicled iliocostalis muscle flap provided successful repair, confirmed by esophagoscopy and esophogram. The patient resumed a regular diet for the full extent of his follow-up.

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CASE REPORT

Ipsilateral iliocostalis muscle rotational flap was used to treat a 60-year-old man with a radiation-induced right-sided esophagopleural fistula. In 2013, the patient underwent definitive chemoradiotherapy consisting of carboplatin, taxol, and 66 Gy for squamous cell carcinoma of the lung that was judged unresectable at thoracotomy. Biopsy proved that recurrence occurred in 2018, and he underwent immunotherapy and additional radiotherapy with protons to a total dose of 61.2 Gy. He presented 1 year later with empyema and required a Clagett procedure, at which time he was found to have esophagopleural fistula at the level of the T8. Esophageal stenting, endoluminal suturing, esophageal vacuum therapy, and conservative measures all failed to close the fistula, and the fistula/chest cavity was being managed with dressing changes and vacuum-assisted wound devices.[5] The fistula (2 × 3 cm) was surrounded by radiation-induced fibrotic tissue and located 6 cm superior to the diaphragm (Fig. 1). Numerous biopsies did not demonstrate any malignancy. The latissimus dorsi and serratus anterior muscles were not available as donor reconstructive options due to prior exploratory thoracotomy, and local intercostal/diaphragm areas were severely fibrosed due to prolonged wound care. In addition, the patient had a previous laparotomy to treat ballistic intraabdominal injuries. An esophageal stent was replaced across the fistula to divert the intraluminal

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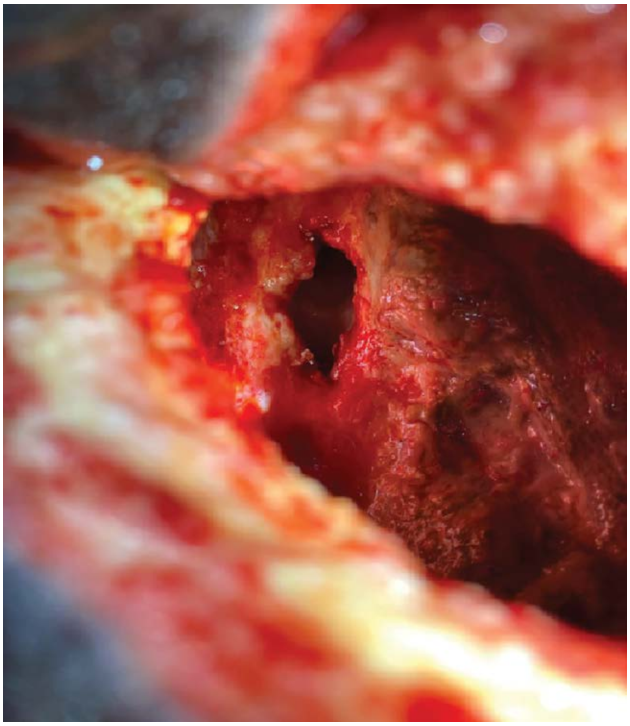

Fig. 1. A 2 × 3 cm hole in the esophagus seen through the Clagett window. The fistula is surrounded by dense fibrous tissue from radiation and serial VAC dressing changes.

contents. A vastus lateralis myocutaneous free tissue transfer was initially attempted. However, this failed due to technical difficulties, and the patient refused another free tissue transfer. We evaluated all other regional options for repair, and ultimately decided to use the iliocostalis muscle as a pedicled flap. Review of the patient's chest CT with contrast revealed that the iliocostalis muscle was well perfused, and that when pedicled and rotated akin to a propeller flap, the mid to inferior aspect of the muscle would reach the defect. As such, the patient consented, and in concert with the thoracic surgeons, we took the patient to the operating room for the procedure.

The iliocostalis muscle flap was designed to be based on the perforators from T10 and T11 intercostal vessels. A paramedian back approach was used, incising skin, subcutaneous tissue, and the latissimus dorsi muscle, and then exposing the iliocostalis muscle. The muscle was raised from lateral to medial direction to identify the T10–T12 intercostal perforators. The iliocostalis was dissected off the longissimus and divided distally from the posterior iliac crest and proximally cephalad to the T10 intercostal vessels. Segmental lumbar and sacral vessels supplying the distal portion of the flap, as well as the T12 intercostal perforator were divided. Resection of posterior segments of ribs 9–11 created a window to the chest cavity, and T10–11 intercostal vessels lateral to the perforators were divided (Fig. 2). Indocyanine green angiography confirmed good perfusion of all but the inferior tip of the muscle which was resected (not shown). The mobilized iliocostalis muscle was rotated into intrathoracic space, then the caudal end of the flap was internally rotated (with the T10–11 pedicle

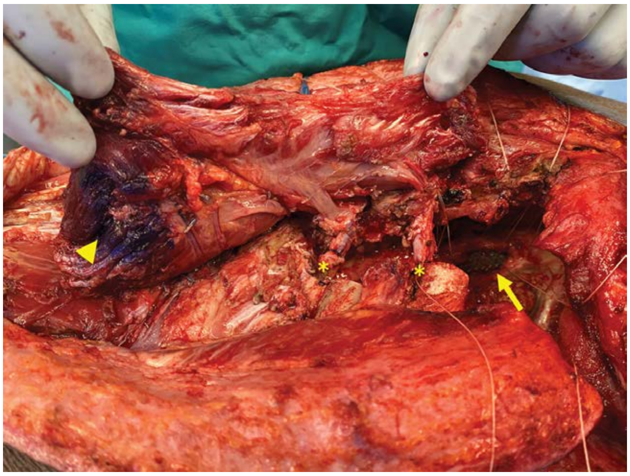

Fig. 2. Elevation of iliocostalis lumborum muscle flap based on T10 and T11 intercostal perforators. Ribs 9–11 are segmentally resected, and T10–11 intercostal vessels are divided laterally (*). Esophageal stent through the defect (arrow) is visible and numerous sutures are placed around the defect for parachuting the flap. The blue area (arrowhead) outlines the area that will seal the esophageal defect once rotated into intrathoracic space.

as pivot point) and advanced cephalad to cover the esophageal defect (Fig. 3). The muscle was sutured directly onto the defect to seal the fistula with an absorbable suture and reinforced with a second layer of absorbable suture. An esophageal stent was placed across the defect before the iliocostalis muscle flap to divert the saliva to allow healing. Four weeks after the surgery, a small leak at the anastomosis was identified on esophogram. The stent was replaced and re-evaluation 5 weeks later demonstrated complete

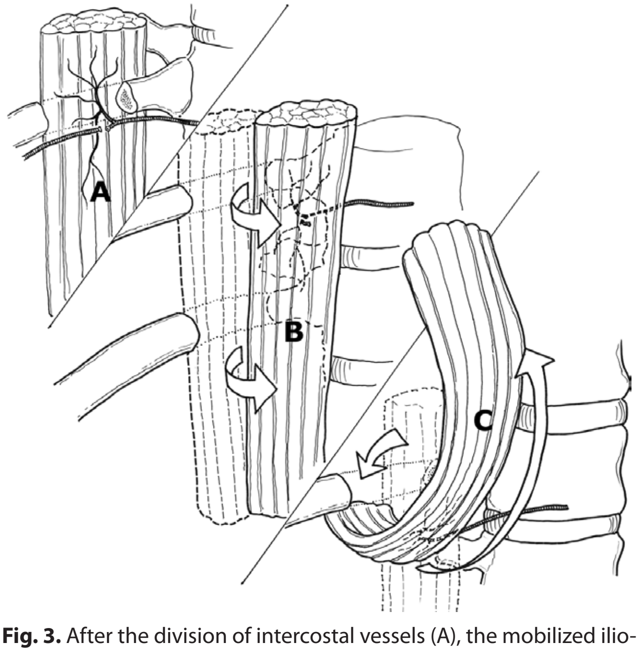

Fig. 3. After the division of intercostal vessels (A), the mobilized iliocostalis muscle is rotated into intrathoracic space (B), then the caudal end of the flap is internally rotated (the pedicle as pivot point), (C) and advanced cephalad to cover the esophageal defect.

healing. The stent was removed and the patient was started on and tolerated a regular diet. Unfortunately, 12 months after iliocostalis flap reconstruction, the patient developed a leak at the anastomosis that was subsequently diagnosed as primary esophageal cancer. Esophageal stent and gastrostomy tube were placed, and he is currently undergoing chemotherapy.

DISCUSSION

We present the first detailed report of successfully treating a radiation-induced intrathoracic fistula using an iliocostalis muscle rotational flap. Our patient's esophagopleural fistula likely was the result of treatment of his lung cancer, as it was located on the lower third of the mediastinum at the level of T8. A robust, well-vascularized flap is required to provide an airtight layer to close the defect, as they have been shown to improve rates of infection, morbidity, and mortality and minimize fistula recurrence.[3,6–8] Commonly used extrathoracic muscles were compromised in the previous surgical and radiation field, and thus not available as reconstructive options. History of exploratory laparotomy also precluded the use of omentum. Here we offer a novel method that uses the iliocostalis muscle to manage intrathoracic fistulas after failure of all gastroenterological procedures.[5]

The iliocostalis muscle is the most lateral of the erector spinae muscles (Fig. 4). One can appreciate the proximity of the iliocostalis muscle to the esophagus: the two structures are separated by the posterior chest wall. The iliocostalis originates in the lateral sacral crest, and medial iliac crest, and inserts in the angles of ribs 5–12, transverse processes of the L1–L4 vertebrae, and the adjacent thoracolumbar fascia. The caudal portion has the most muscular bulk and length, which are essential for reach and obliteration of dead space. Perfusion is via segmental branches from the lumbar intercostal vessels and lateral sacral vessels, and would be categorized as Mathes and Nahai type IV.[9] This segmental vascular pattern potentially limits the flap length and excursion when using this flap for defects within the chest but will reach below the carina as it was in our case.

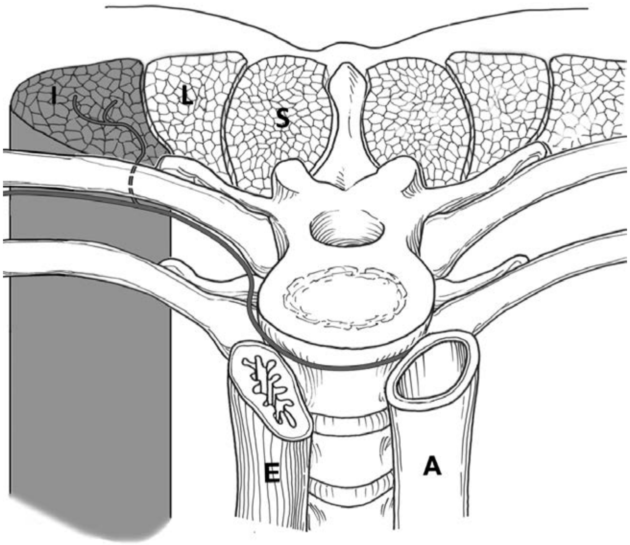

Fig. 4. The iliocostalis muscle is the most lateral of the erector spinae muscles. Once can appreciate the proximity of the muscle to the esophagus. For illustration purposes, only one intercostal vessel and associated perforator to the muscle are shown. I, iliocostalis; L, longissimus; S, spinalis; E, esophagus; A, aorta.

Given the depth and the paraspinal location in the lumbar region, the iliocostalis muscle is rarely compromised by thoracic pathology/procedures. In addition, the use of the iliocostalis lumborum presents minimal functional deficiencies because it is a singular component of the larger collection of the erector spinae muscle group.

CONCLUSIONS

The iliocostalis muscle has the bulk, vascularity, and length to be an effective flap option to treat caudally located intrathoracic fistulas. The iliocostalis muscle flap should be part of the reconstructive surgeon's armamentarium to provide optimal treatment for recovery in these patients.

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