Chimeric Anterolateral Thigh Flap for One-stage Reconstruction after Cervical Exenteration with Anterior Mediastinal Tracheostomy

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Summary: Cervical exenteration with anterior mediastinal tracheostomy is rarely performed for extensive cervicothoracic malignancies. Although it provides effective palliation and occasional cure, reconstruction remains a formidable challenge owing to its complexity and high mortality. The resultant defects usually require an intestinal flap or tubed skin flap to restore the alimentary tract, soft-tissue interposition to separate the relocated trachea from the innominate artery, and another tubed or fenestrated skin flap to create a tension-free tracheocutaneous anastomosis and provide coverage for the exposed vessels, hopefully in one stage. We report a case involving a 60-year-old woman with recurrent medullary thyroid cancer who developed dyspnea and dysphagia. Salvage cervical exenteration and anterior mediastinal tracheostomy were complicated by tissue fibrosis caused by previous surgical and radiation therapies, resulting in complex defects with segmental loss of the esophagus, a short stump of trachea incapable of tracheocutaneous anastomosis, and great-vessel exposure. We used a chimeric anterolateral thigh flap consisting of a tubed skin flap for pharyngoesophageal reconstruction, a fenestrated skin flap for tracheostomy and neck coverage, and a vastus lateralis muscle bulk to separate the innominate artery from the relocated trachea. To our knowledge, this is the first report describing the reconstruction of such a complex defect with a single skin flap in a single stage. *(Plast Reconstr Surg Glob Open 2022;10:e4444; doi: 10.1097/GOX.0000000000004444; Published online 20 July 2022.)*

INTRODUCTION

Cervical exenteration with anterior mediastinal tracheostomy is considered to be a therapeutic challenge for advanced cervicothoracic malignancies. Although it may facilitate cure or palliation in patients with extensive cervicothoracic malignancies, such extensive resection usually yields segmental loss of the alimentary tract, a short stump of the trachea, and great-vessel exposure, which can be further complicated by previous surgery or radiotherapy and cause lethal consequences without prompt reconstruction.

The goals of reconstruction include restoration of the alimentary tract, creation of a secured airway, and provision of soft tissue to cover the exposed great vessels and separate the innominate artery from the relocated trachea.[1] Such reconstruction usually requires a combination of intestinal flaps and/or skin flaps.[1,2] Typically, the alimentary tract is restored with an intestinal flap, while the tracheostomy is reconstructed with a pectoralis major or deltopectoral flap.[1,3,4]

To our knowledge, no study has reported one-stage pharyngoesophageal and anterior mediastinal tracheostomy reconstruction using a single skin flap. Here, we present the first case involving the use of a chimeric anterolateral thigh flap.

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CASE REPORT

A 60-year-old woman presented with life-threatening dyspnea and dysphagia due to recurrent medullary thyroid cancer with invasion of the trachea and esophagus extending superiorly to the larynx and inferiorly to the cervicothoracic region. Cervical exenteration with an anterior mediastinal tracheostomy was performed, and the remaining trachea was relocated to the inferior and right of the innominate artery to prevent attrition rupture. Direct tracheocutaneous anastomosis was infeasible due to the short stump of the trachea and radiation-associated tissue fibrosis, leaving a defect requiring reconstruction of the cervical esophagus, creation of an anterior mediastinal tracheostomy, and coverage of the great vessels (Fig. 1).

The left anterolateral thigh flap was dissected without preoperative perforator mapping, and three cutaneous perforators originating from the descending branch of the lateral circumflex femoral artery were identified. A chimeric flap was designed, bearing two separate skin flaps and one bulk vastus lateralis muscle (Fig. 2 and SDC 1). (**See figure, Supplemental Digital Content 1,** which displays flap design, **http://links.lww.com/PRSGO/C115.**) The 12 (top line) × 9.5 (baseline) × 8 cm (height) trapezoid proximal skin flap based on the proximal cutaneous perforator was tubed for the pharyngoesophageal reconstruction. The 16 (diagonal length) × 8 cm (diagonal width) rhomboid distal skin flap based on the two distal cutaneous perforators was fenestrated for anterior mediastinal tracheostomal creation and neck coverage. An 8 (length) × 4 (width) × 2 cm (thickness) section of the vastus lateralis muscle based on the distal runoff was interposed between the innominate artery and the relocated trachea. The pedicle vessels were anastomosed to the left transverse cervical vessel (Fig. 3).

Flap necrosis, tracheostomal dehiscence, or esophageal anastomotic leakage were not observed postoperatively, and the patient was discharged on postoperative day 50. At the 6-month follow-up, she could breathe smoothly through a nonstenotic anterior mediastinal tracheostomy (Fig. 4). Although esophagography revealed a stricture at
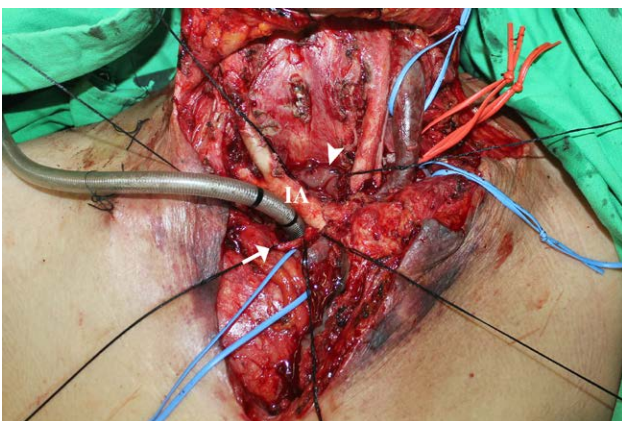
Takeaways

Question: Reconstruction after cervical exenteration with anterior mediastinal tracheostomy remains a formidable challenge owing to its complexity and high mortality and usually requires a combination of intestinal flaps and/or skin flaps.

Findings: We used a chimeric anterolateral thigh flap consisting of a tubed skin flap for pharyngoesophageal reconstruction, a fenestrated skin flap for tracheostomy and neck coverage, and a vastus lateralis muscle bulk to separate the innominate artery from the relocated trachea.

Meaning: No study has reported one-stage pharyngoesophageal and anterior mediastinal tracheostomy reconstruction using a single skin flap. Here, we present the first case involving the use of a chimeric anterolateral thigh flap.
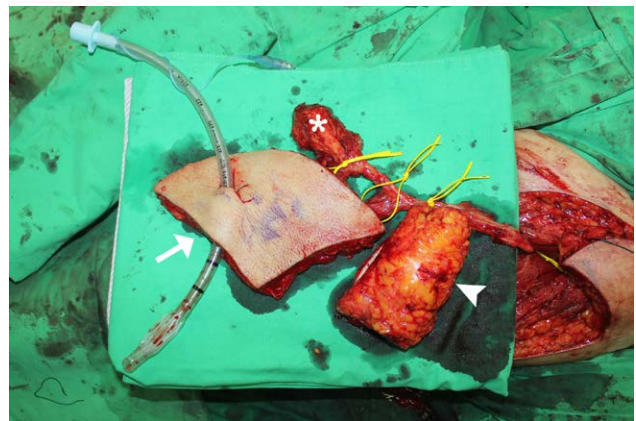
Fig. 2. A chimeric anterolateral thigh-vastus lateralis flap with two skin paddles and one muscle bulk was harvested from the left thigh. The proximal skin paddle (arrowhead) based on a cutaneous perforator was tubed for pharyngoesophageal reconstruction. The distal skin paddle (arrow) based on two cutaneous perforators was fenestrated for anterior mediastinal tracheostomy and neck coverage. The vastus lateralis muscle bulk (asterisk) supplied by the vascular pedicle runoff was used to separate the innominate artery from the trachea.

Fig. 1. The defect showed a segmental circumferential loss of the cervical esophagus (arrowhead), a short stump of trachea (arrow) relocated inferiorly to the IA, exposed great vessels, and deficiency of cervicothoracic skin. IA indicates innominate artery.
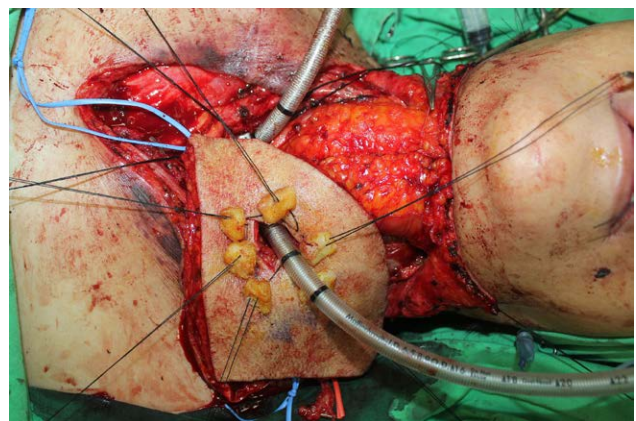

Fig. 3. After the inset of the tubed flap for the pharyngoesophageal reconstruction, the fenestrated flap was then insetted for the anterior mediastinal tracheostomy using the parachute technique.

Fig. 4. At the 6-month follow-up, the patient could breathe normally from the nonstenotic tracheostomy.

the distal esophageal anastomosis, she could still tolerate a regular diet. (**See Video [online],** which shows that at the 6-month follow-up, the patient could tolerate a regular diet despite the distal esophageal anastomosis stricture observed during esophagography.)

DISCUSSION

Malignancies involving both the esophagus and trachea were previously considered unresectable owing to difficulties in reconstruction. However, advancements in reconstruction techniques have made cervical exenteration with anterior mediastinal tracheostomy a feasible option. Successful reconstruction usually requires more than one flap to restore the alimentary tract, create a tension-free tracheostoma, and provide coverage of exposed vessels. Moreover, to prevent innominate artery rupture, additional soft-tissue interposition between the innominate artery and relocated trachea is also recommended.

For alimentary tract reconstruction in such defects, gastric pull-up or free jejunal transfer has been widely used as a conduit flap.[1] The omentum carried with the intestinal flap can be used to separate the relocated trachea from the innominate artery.[5] A tubed skin flap may also be introduced to restore the alimentary tract. Nisa et al[2] reported the use of a tubed antebrachial flap. Unlike intestinal flaps, which may result in higher morbidity and longer recovery times and necessitate laparotomy and additional intestinal anastomosis, skin flaps can preclude the associated donor-site morbidities. Because of increasing familiarity with anterolateral thigh flaps and their success in complex pharyngoesophageal reconstruction, we chose this flap to reconstruct the alimentary tract in our case.[6]

In anterior mediastinal tracheostomy, the key points to success are reducing the skin suture tension of the tracheostoma, preventing apposition of the trachea to the great vessels, and filling the dead space.[7] In 1966, Grillo[8] first reported the use of a bipedicle upper thoracic flap with a central fenestration to obtain skin coverage for the anterior mediastinal tracheostomy. Deltopectoral and pectoralis major myocutaneous flaps were introduced

subsequently and became widespread.[3,7] The tracheal stump can be anastomosed with the flap edge or a fenestrated hole on the skin flap. However, the usage of free skin flaps is limited. Only a few cases using free radial forearm and anterolateral thigh flaps have been reported.[1,9]

To our knowledge, one-stage pharyngoesophageal and anterior mediastinal tracheostomy reconstruction with a single skin flap has not been reported to date, and this is the first study to use a chimeric-designed anterolateral thigh flap. However, our method is only feasible when the anterolateral thigh flap has multiple cutaneous perforators that allow for splitting of the skin flap into two skin paddles. If not, an alternative is creating two skin paddles by bridging de-epithelialization, with one nourished by the direct cutaneous perforator and the other by the preserved fascial and subcutaneous vascular branches.[10] Otherwise, an additional locoregional flap, such as a pectoralis major myocutaneous flap, would inevitably be required.

In summary, cervical exenteration with anterior mediastinal tracheostomy for cervicothoracic malignancy can cause life-threatening defects. Simultaneous reconstruction of the alimentary tract and anterior mediastinal tracheostoma along with provision of soft tissues to separate the relocated trachea from the innominate artery and cover the exposed great vessels is mandatory, usually necessitating a combination of various flaps. Improvements in the application of anterolateral thigh flaps in head and neck reconstruction will facilitate one-stage, single-flap reconstruction using chimeric-designed anterolateral thigh flaps consisting of a tubed skin flap for pharyngoesophageal reconstruction, a fenestrated skin flap for anterior mediastinal tracheostomy, and a vastus lateralis muscle bulk for separating the relocated trachea and innominate artery.

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