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Pharynx and Trachea Reconstruction with Pedicle and Fasciocutaneous Flap: A Clinical Case

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Abstract: Objective: This study aims to present a clinical case requiring pharynx and trachea reconstruction using a transverse cervical artery-based perforator flap, and an internal mammary perforators-based fasciocutaneous flap, for managing complex post-laryngectomy fistula. Clinical case: The case we describe is of a 62-year-old patient with squamous cell carcinoma of the glottic larynx, who after radiotherapy and total laryngectomy presented a pharynx-to-skin and pharynx-to-trachea fistula--. He underwent surgery with a perforated flap based on a branch of the transverse cervical artery and another fasciocutaneous flap based on internal mammary perforators. Conclusion: Pedicled perforated flaps are quick to dissect, safe, thin, versatile, and offer a functional reconstruction similar to a microsurgical flap. Head and neck reconstruction can be challenging due to comorbidities and previous radiotherapy. A notable advantage is that tissue harvested from an area near the defect is generally more similar than tissue harvested from another donor site. Dissection of the cervix or microsurgical anastomoses are not required.

Key words: carcinoma; squamous cell; fistula; larynx; trachea; flaps

1. Introduction

According to the MPPS Mortality Yearbook, in 2008, 318 men and 55 women died from laryngeal cancer in Venezuela [1]. In 2018, it was estimated that approximately 13,150 new cases of laryngeal cancer would be diagnosed in the US, representing 0.8% of all new cancers. Mortality rate estimates vary, depending on the site and stage of the primary tumor [2]. Squamous cells constitute the epithelium lining the upper aerodigestive tract; therefore, squamous cell carcinoma accounts for 90%–95%. Laryngeal and hypopharyngeal cancer are common malignant tumors of the head and neck region. Recently, a combination of surgery, radiation therapy, and chemotherapy has been used for the treatment of laryngeal and hypopharyngeal cancer. Total laryngectomy is considered a surgical option for advanced laryngeal cancer [2].

Pharyngocutaneous fistula is a serious and difficult complication after total laryngectomy. Failure to provide timely treatment can delay healing of the surgical incision, affect postoperative functional recovery and quality of life, and increase hospital stay and cost. It also affects the recovery of the patient's speech and swallowing function. The incidence of pharyngeal fistula ranges from 3% to 65%, and most occur between the seventh and tenth day after surgery [3].

Currently, perforated flaps have become the main reconstructive technique, offering reduced donor site morbidity,

easier recipient site coverage, an adequate pedicle, and greater possibility of pedicle orientation, in addition to satisfactory cosmetic results [4]. Perforating vessels are classified into three groups: direct perforators, which after originating from their source artery only cross the deep fascia and then distribute into the subcutaneous cellular tissue and the skin; septal perforators, which cross only one septum before reaching the skin; and muscular perforators, which cross muscle before reaching the overlying skin. The blood flow velocity in the skin, in a perforating artery, is lower than in its corresponding source artery [5].

Pedicled myocutaneous flaps are those that consist of a blood vessel. The point where the vessel enters the tissue is the flap's rotation point. Both its artery and vein are part of this pedicle. The classic example is the pectoralis major myocutaneous flap, used for certain head and neck reconstructions. This flap consists of sufficient tissue but produces a large bulk and requires a large dissection area. Another type of flap is the microsurgical or free flap, for example, the rectus abdominis flap, which is voluminous, or the radial forearm flap. Both require special instruments and a surgeon skilled in microsurgery and longer surgical time, dissecting the neck in search of receptors [5].

Thin flaps, with axial blood supply via a small-diameter perforator vessel (1 mm), located using Doppler ultrasound and dissected close to the defect with the aid of magnifying glasses, have the advantage of not creating a bulk and providing secure, non-random axial blood supply. Thin microsurgical perforated flaps are also available, but they also require microsurgical techniques. Low donor site morbidity often leads to faster recovery and less postoperative pain [5].

The purpose of this article is to demonstrate that pedicled perforated flaps are quick to dissect, safe, thin, and versatile, offering functional reconstruction similar to a microsurgical flap and more similar to the recipient site than other donor sites.

2. Clinical Case

This is a 62-year-old male patient, a smoker with a history of high blood pressure, diagnosed with ST II glottic laryngeal squamous cell carcinoma in April 2021. He required a hemilaryngectomy and received adjuvant radiotherapy in July 2021. During radiation treatment, he presented with COVID-19 and was admitted to the ICU. Subsequent follow-up examinations revealed a subglottic lesion, the biopsy of which reported squamous cell carcinoma. Therefore, surgery was proposed in November 2021, performing a total laryngectomy. On the 10th day, he began to experience discharge through the wound, and a physical examination revealed communication between the pharynx and the skin and the pharynx and the trachea (Figure 1).

Surgery was performed on April 20, 2022, with an axial pedicle flap based on a branch of the left transverse cervical artery. On the 10th postoperative day, the patient began to experience discharge again through the upper edge of the anterior flap, and a fistula was identified from the pharynx to the skin. Therefore, a new surgical intervention was proposed for April 27, 2022, where a right axial fasciocutaneous deltopectoral flap was performed based on the perforating branches of the internal mammary artery.

Figure 1. Pharyngocutaneous and pharyngotracheal fistula.

2.1 Surgical procedure

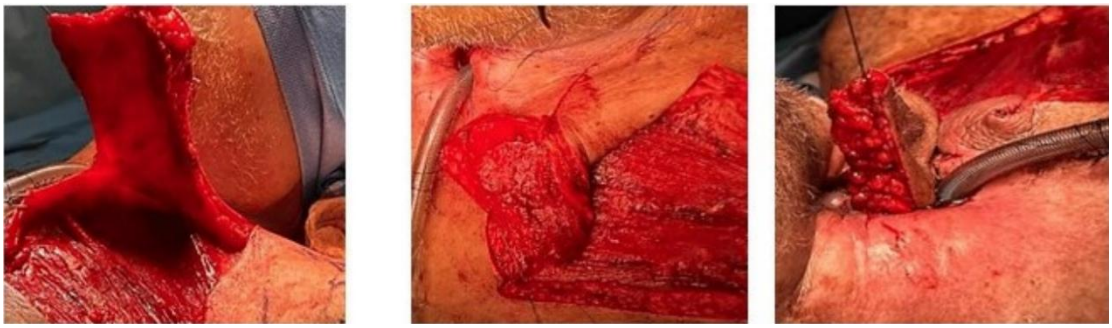
For both surgical interventions, ultrasound demarcation and location of the anterior perforator, which originates from the transverse cervical artery and perforating branches of the internal mammary artery, were performed. The transverse cervical artery is located within the midsupraclavicular region, 6 cm lateral to the external clavicular joint and 2 cm above the clavicle (Figures 2, 3 and 4.)

Figures 2, 3 and 4. Location and demarcation of perforators.

The required flap length was measured from the top of the neck defect. The rotation point was located. The flap was designed. An incision was made following the classic pectoralis major flap approach and the prepectoral subfascial dissection, maintaining the pectoralis major insertions. The expected angle of rotation relative to the defect was calculated (Figures 5, 6 and 7).

Figures 5, 6 and 7. Flap design from the first surgical procedure.

The flap was lifted and rotated toward the defect, the upper angle of the defect directed toward the defect between the pharynx and skin, and the lower angle toward the posterior wall of the trachea. The space to be reconstructed consisted of two defects, one in the trachea and the other in the pharynx. A thin flap with axial irrigation was needed, without having to dissect or approach the neck for a microsurgical anastomosis. Despite the plastic surgeon's training, it was not possible to propose this due to the patient's comorbidities and the prolonged surgical time (Figures 8, 9, and 10).



Figures 8, 9 and 10. Flap design for the first surgical procedure.

Peripheral skin de-epithelialization was performed to seed the flap and advancement was performed to close the donor site defect (Figure 11).

Figure 11. Final result of the first surgical intervention.

In the second surgical intervention, the defect was delimited again, which on this occasion was only pharyngeal-cutaneous, and the flap was designed, lifted, and the defect was closed with a fasciocutaneous flap based on internal mammary perforators (Figure 12, 13, 14 and 15).

Figures 12, 13 and 14. Flap design for the second surgical procedure.

Figure 15. Final result of the second surgical intervention.

The patient was evaluated 1 month after surgery and showed tolerance to the full diet and good healing of the flaps (Figures 16 and 17).

Figures 16, 17. Final result of the two surgical interventions.

3. Discussion

Pharyngocutaneous fistula is a common complication after total laryngectomy, with a reported incidence between 3% and 65%. This event significantly increases hospital stay and costs, can delay the start of postoperative radiotherapy (RT), and greatly affects the patient's psychological status. It is generally diagnosed on the seventh to tenth postoperative day, and although there is still no gold standard test (e.g., blue dye test, etc.) for early diagnosis, fever in the early postoperative period represents an excellent predictor of its development [6]. The patient presented two postoperative events, both of which revealed a fistulous tract from the pharynx to the skin and from the pharynx to the trachea after RT and total laryngectomy.

Once a fistula is diagnosed, standard wound care is generally implemented, including pressure dressings, antibiotic coverage, and artificial nutrition [6]. These techniques were used in the patient, but they failed. Closure can be accelerated by invasive/surgical approaches (use of pedicled or free flaps, endoscopic repair) or by nonsurgical strategies, such as hyperbaric oxygen therapy, botulinum toxin injection, or negative pressure (or vacuum-assisted) therapy [6].

Age, smoking, T stage, prior RT, preoperative albumin, hemoglobin, tumor site, and treatment method are risk factors for pharyngocutaneous fistula [3]. The popular "workhorse" free flaps for soft tissue defects in the head and neck are the radial forearm flap and the anterolateral thigh flap. Fasciocutaneous free flaps, such as the radial forearm flap, the deep inferior epigastric artery perforator flap, and the anterolateral thigh flap, have also been used. Although free flap reconstruction is routinely performed in many medical centers and hospitals, there are numerous barriers and potential problems associated with these procedures. These problems include the surgeon's need for training in microsurgical techniques, increased operating times, surgical options, and outcomes may depend on the availability or suitability of recipient and donor vessels, and postoperative flap monitoring is required [7].

The patient presented here had a history of heavy smoking and was hypertensive. He received RT. He developed COVID-19 during radiation treatment and required ICU. In addition to low socioeconomic status, he required an axial flap that did not require neck dissection. Therefore, a thin, adjacent flap was proposed that would allow reconstruction of both defects, with low volume, versatility, and speed. Local flaps that can be dissected include the submental island flap, the supraclavicular artery island flap, the pectoralis major myocutaneous flap, and the deltopectoral flap. The supraclavicular region and anterior chest wall are considered good donor sites for head and neck reconstruction due to the close overlap between the face and neck skin. This has led to an ongoing effort to identify a flap in this region that is reliable, easy to dissect, and associated with low morbidity.

The anterior perforator flap of the transverse cervical artery is harvested from the anterior thoracic wall and was first described by Chen for the repair of facial and cervical scar contractures, severe burns, and trauma [7]. This flap is useful, versatile, thin, and safe. Reconstruction of the alimentary tract is challenging. The goal of reconstruction should be a single-stage operation with low morbidity and mortality, shorter hospital stay, and rapid restoration of oral feeding [8, 9]. In this case, two flaps were created: one based on the anterior perforator of the transverse cervical artery and a right axial fasciocutaneous deltopectoral flap based on the perforating branches of the internal mammary artery. Both flaps allowed coverage of the defects, also allowing primary closure of the donor sites, reducing hospital stay, and enabling functional reconstruction of the pharynx and alimentary tract.

We conclude that pedicled perforated flaps are quick to dissect, safe, thin, versatile, and offer functional reconstruction similar to a microsurgical flap. Head and neck reconstruction can be challenging due to comorbidities and RT. A notable advantage is that tissue harvested from an area near the defect is generally more similar than that from another donor site. Neck dissection and microsurgical anastomoses are not required.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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