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Reconstruction of skin defects using deltopectoral flap in laryngeal carcinoma underwent total laryngectomy

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Abstract

Laryngeal carcinoma can infiltrate the skin, creating a defect during a total laryngectomy, extending beyond the infiltrated skin. The size, thickness, and location of the defect vary, leading to different closure procedures. It is important to understand how to select the appropriate closure technique to minimize potential complications. To describe the appropriate flap type for closing skin defects in laryngeal carcinoma undergoing total laryngectomy. A 47-year-old man suffered from T4aN1M0 laryngeal carcinoma with skin infiltration. Treatment included a total laryngectomy, total thyroidectomy, Modified Radical Neck Dissection (MRND) type 3 on the right and left, closure of the neck region defect with a deltopectoral flap, and secondary closure of the defect with a split-thickness skin graft. No complications were observed. A literature search was conducted in PubMed using the keywords "head and neck defect" and "deltopectoral flap. Four case reports relevant to the topic and available in full text were retrieved from a total of six search results. Closure of anterior neck defects measuring 6-7 cm can be performed with a regional flap or free tissue transfer. The choice of flap is based on the patient's limitations, the surgeon's expertise, and the anatomical structure. Closure of large neck defects with a deltopectoral flap has good results and no complications.

Keywords: Flap, Deltopectoral, Skin defect

Introduction

Laryngeal carcinoma is a malignancy of the larynx that can affect the glottis, supraglottis, and subglottis.[1] The incidence of laryngeal cancer in Indonesia is estimated at 0.9% of all cancer cases. According to Globocan data, there were approximately 3,663 new cases of laryngeal cancer in 2020.[2] Laryngeal cancer is more common in men than in women, with a ratio of 6:1. This carcinoma often occurs in people over 35 years of age.[1] According to WHO data and statistics, an average of 1.2 deaths per 100,000 people are due to laryngeal carcinoma.[3]

One of the treatments for laryngeal carcinoma is a surgical procedure called a total laryngectomy. A total laryngectomy is performed in advanced stages (T3, T4), when chemotherapy and radiotherapy have failed, or when conservative laryngeal surgery has failed.[1] Tumor infiltration into the skin in laryngeal cancer is a rare condition. Managing laryngeal cancer patients with skin infiltration presents a challenge for head and neck surgeons. A total laryngectomy extending to the skin is necessary, followed by reconstruction to repair the skin defect. [4,5]

One method of reconstructing skin defects is grafting. A graft is a unit of tissue transferred from one area (donor site) to another (recipient site) while maintaining its own blood flow. The various types of grafts and their classifications can be characterized by their component parts, the location of the defect, the nature of the blood supply, or the graft's movement to fill the defect.[6]

Reconstruction of skin defects in head and neck cancer often requires regional flaps, including the deltopectoral flap. The deltopectoral flap is used as the primary technique for reconstructing large defects in the head and neck region.[7] Other regional flap techniques include the pectoralis major flap and vascularized free flaps. The advantages of using the deltopectoral flap include a simpler technique, elimination of the need for microanastomosis, shorter surgical duration, and fewer donor-site complications. However, a disadvantage of the deltopectoral flap is that it is performed in two stages, thereby prolonging the treatment time.[8,14]

The purpose of this case report is to describe the type of flap that is suitable for closing skin defects in laryngeal carcinoma undergoing total laryngectomy.

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Case report

Mr. P, a 47-year-old man, presented to the ENT-KL Outpatient Unit (URJ) of Dr. Soetomo General Hospital on June 3, 2022. The patient's primary complaint was hoarseness for three months. The hoarseness worsened and the voice gradually faded, accompanied by shortness of breath. A lump was found on the skin of his neck for one month. The shortness of breath resolved after a tracheotomy was performed in May 2022. There were no complaints of coughing up blood or difficulty eating or drinking. The patient had a history of smoking one pack per day for 20 years. A physical examination revealed a good general condition, with a blood pressure of 110/70 mmHg, respiratory rate of 18 breaths per minute, pulse rate of 82 beats per minute, and a temperature of 36.7°C.

A local examination of the ears, nose, and throat was within normal limits. A neck mass infiltrating the skin at the tracheotomy site was found, measuring approximately 2x1x0.5 cm, with well-defined borders (Figure 1). Histopathological examination revealed well-differentiated squamous cell carcinoma.

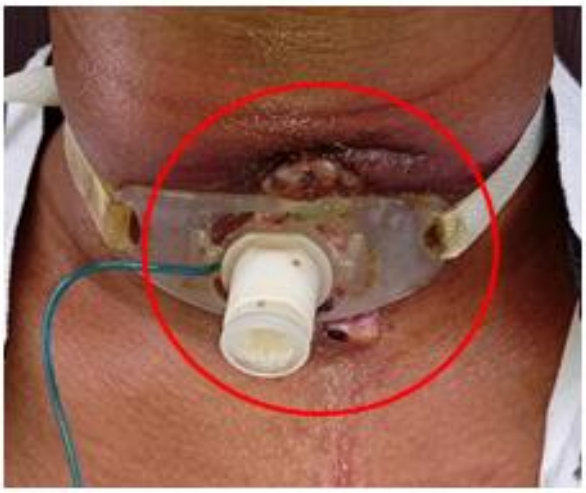

Figure 1. Clinical presentation of the patient upon arrival at the ENT-KL URJ of Dr. Soetomo Regional Hospital. A mass was seen infiltrating the skin around the tracheocanth

A head and neck Computed Tomography (CT) scan of the larynx with contrast showed a solid mass in the glottis-subglottic with contrast administration. Contrast enhancement was observed, 79 Hounsfield Units (HU). The mass completely obstructed the airway, following a tracheotomy. The mass infiltrated the right and left true vocal cords, extended to the posterior choroidal area, the pre-epiglottic space, and adhered to the inner cortex of the thyroid gland. Subcentimeter lymph nodes were seen in the right and left submandibular and left upper paratracheal nodes. This image corresponds to T3N1Mx, based on the AJCC TNM Staging 8th Edition 2017 (Figure 2).

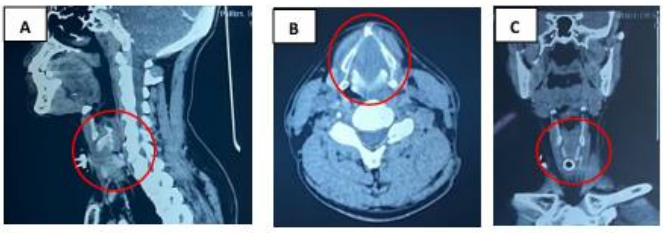

Figure 2. Head and neck ct scan results with and without contrast: a. sagittal section: mass extending from the glottis to the subglottic at the level of VC 4-5 (red circle); B. Axial Section: Mass completely obstructs the airway, extending into the pre-epiglottic space and attaching to the inner cortex of the thyroid (red circle); C. Coronal Section: Tracheocannula inserted at the level of VC 4-5 (red circle)

The assessment of T4aN1M0 laryngeal carcinoma with skin infiltration involved a total laryngectomy, total thyroidectomy, modified radical neck dissection (MRND) on the right and left sides of the neck region, closure of the neck region defect with a deltopectoral flap, and closure of the secondary defect with a split-thickness skin graft. The surgery began with a total laryngectomy, with a Y-shaped incision at the level of the hyoid bone from right to left across the bottom of the tracheotomy opening. A two-centimeter skin margin was left around the infiltrated tracheotomy opening. The surgery continued with the removal of the larynx and thyroid gland, followed by the suturing of the esophagus and trachea to the skin. A 7 x 4 cm skin defect was created. The surgery was then continued by a consultant plastic surgeon with a deltopectoral flap, which was then sutured to the recipient's neck region. Next, a split-thickness skin graft was performed from the right femur to close the secondary defect in the right thorax.

Post-surgery, the patient was hospitalized for eleven days before finally being discharged. Upon discharge,

the patient was able to eat and drink orally, and there were no fluid leaks or fistulas in the neck area. The patient was discharged on his regular medication regimen of Euthyrox 100 mcg every 24 hours and calcium lactate 500 mg every 8 hours orally. The flap removal was scheduled for 21 days after surgery.

Figure 3. Post-operative closure of the neck region defect with a deltopectoral flap

The patient was seen at the BP-RE Clinic at Dr. Soetomo General Hospital in Surabaya 14 days after surgery. The surgical wound was treated and the sutures in the submandibular region were removed. The patient was scheduled for flap removal 21 days after surgery. The patient was seen at the One-Stop Oncology Clinic (POSA) ENT-BKL at Dr. Soetomo General Hospital, Surabaya, 18 days after surgery, reporting fluid discharge from the upper neck with each meal and drink. An examination revealed an esophagocutaneous fistula (Figure 4). The patient was scheduled for fistula repair surgery, which was performed simultaneously with the flap-removal surgery by a BP-RE consultant.

Figure 4. Control 18 days post-operatively, esophagocutaneous fistula was found

Twenty-one days after the first operation, an esophageal fistula was excised and repaired. The operation began with fistula exploration. An esophageal fistula was found in the esophagus-hypopharynx area, measuring 0.3 centimeters in diameter. The fistula was cauterized with TCA, and sutures were placed around the fistula. The operation was continued by a BP-RE consultant. The deltopectoral flap was excised, and the remaining flaps in the pectoral and neck regions were sutured to the surrounding skin. A nasogastric tube (NGT) was inserted during the operation. Postoperatively, the patient was not allowed to swallow. He was fed and hydrated via the NGT. One day after surgery, the patient was discharged home with the NGT still in place.

Clinical questions

What type of flap is suitable for closing skin defects in laryngeal carcinoma undergoing total laryngectomy?

Methods

A literature search was conducted in November 2023 in PubMed using the keywords "head and neck defect" and "deltopectoral flap" for the past five years. Four case reports relevant to the topic, available in full text, were identified across six literature searches.

Result

Closure of malignant head and neck defects with a deltopectoral flap demonstrates a relatively good postoperative prognosis. Outcomes for patients undergoing deltopectoral flap reconstruction include short operating times, minimal intensive monitoring, and minimal postoperative complications.

Discussions

Many treatment options are available for malignant laryngeal tumors, depending on the tumor's stage, location, and spread, as well as the patient's condition. This patient was diagnosed with advanced stage T4aN1M0 infiltrating laryngeal carcinoma, requiring a total laryngectomy and removal of all involved skin, followed by reconstruction to close the skin defect. The choice of defect closure method is depicted as a reconstruction ladder (Figure 6), beginning with primary suture closure and culminating in the use of a free flap. [9]

The reason for choosing a graft to cover the defect in this patient over a graft is the poor vascularization of the recipient area, which is unable to provide

nutrition to the graft that will be placed in the recipient area. In this patient's case, the recipient area's vascularization was poor due to a history of smoking and malignancy. High blood viscosity slows blood flow and impairs vascularization. Flap is composed predominantly of grafts, consisting of skin, subcutaneous tissue, muscle, and bone.[6,10]

After tumor resection, the flap composition can be adjusted to match that of the defect. Furthermore, considerations include the risk of tumor recurrence in the recipient area and a history of radiotherapy. The flap also yields better cosmetic results than skin grafts due to color matching between the donor and recipient and its favorable texture.[11] Of the various types of regional flaps, the deltopectoral flap was chosen because it can cover large defects in the neck. Technically, the deltopectoral flap is easier and requires simpler instruments compared to microvascular techniques.[5,6] In cases of poor vascularization, such as in this patient, the use of the deltopectoral flap is more feasible than the use of a free flap.[11]

The deltopectoral flap was first described by Aymard in 1917 for nasal reconstruction. The history of the deltopectoral flap is so ancient that it was considered a prime candidate for head and neck reconstruction in the 1960s. Myocutaneous and vascularized flaps have become increasingly common in recent years. However, the deltopectoral flap is the first choice for reconstructing neck skin defects due to its thin, flexible nature and its ability to match the colour and texture of the surrounding neck area. The deltopectoral flap procedure is relatively easy and safe to perform. A disadvantage of the deltopectoral flap is the need to process the pedicle 2 or 3 weeks after the primary surgery. [6,7] Skin grafting at the donor site is usually required to close the secondary defect.

The deltopectoral flap zone covers the area between the sternum and the anterior axillary line and can extend to the clavicle and the fourth and fifth intercostal spaces. The extended deltopectoral flap extends beyond the deltoid muscle. The deltopectoral flap has a pedicle at the sternal line, with the upper border at the infraclavicular line of the deltopectoral groove, and the distal border at the nipple area, ending in the deltoid region.[5,12] The deltopectoral flap receives its primary vascular supply from the first four perforator branches of the internal mammary artery, located 3-4 cm from the midsternal line.[5] Secondary vascular supply originates from the thoracoacromial and thoracolateral arteries distally, although these are often severed during elevation and thus cannot provide vascular supply to the flap. [5,6,7]

The advantages of the deltopectoral flap include simple reconstruction, good donor skin color and texture, and lack of effect from prior radiation therapy.[7] One significant drawback of the deltopectoral flap is that the reconstruction procedure is performed in two stages, with the flap pedicle resected in the second stage. Lash, as cited in Moretensen,[8] introduced the one-stage deltopectoral flap procedure, a variation of the deltopectoral flap involving deepithelialization of the skin bridge and the formation of a subcutaneous fascial pedicle. This method provides better results and a thinner flap.[8]

Indications for the use of deltopectoral flaps include (1) reconstruction of facial and neck defects associated with severe infection, chronic fistulas, and radiotherapy interventions, (2) reconstruction of defects in the oral region, and (3) reconstruction of partial or complete defects of the pharynx and cervical esophagus.[13] Deltopectoral flaps cannot be used in the following conditions: (1) a history of surgery that damaged the intercostal perforator vessels, (2) a history of thoracic surgery involving the internal mammary artery, and (3) severe deformity in the donor area.[13]

Gilas et al., as cited in Chen et al., reported that more than 5% of flaps failed in delayed procedures. Bakamjian et al., as cited in Feng et al., improved the dectopectoral flap procedure by delaying it in patients with advanced age, malnutrition, diabetes mellitus, arteriosclerosis, lupus erythematosus, and anemia. Bakamjian et al., as cited in Feng et al., emphasized the importance of fasciocutaneous access to maintain the distal flap's blood supply. Necrosis of the flap primarily occurs in the distal flap due to insufficient blood supply to that area. The viability of the flap can be restored with two stages of elevation (delayed). After the initial elevation, the flap is sutured back together to form a bipedicle flap. Once the flap becomes bipedicle, its vascularity can

be maintained. When the flap is returned to a unipedicle, vasoconstriction does not occur.[7,11]

Esophagocutaneal fistule complications occur in patients. Goepfert et al. reported complications and length of hospital stay in 245 patients after total laryngectomy. The incidence of postoperative complications was 58.77%. Pharyngocutaneal fistule and wound-healing complications were the most common. The extent of surgical resection affected the success of wound healing in patients[5.] Esophagocutaneal fistule repair was performed in patients with no fistula after the repair.

Conclusions

In this case, T4aN1M0 laryngeal carcinoma infiltrating the skin was treated with a total laryngectomy, total thyroidectomy, Modified Radical Neck Dissection (MRND) type 3 on the right and left sides, closure of the neck region defect with a deltopectoral flap, and closure of the secondary defect with a split-thickness skin graft. Extensive defect closure with the deltopectoral flap yielded good results, and no complications were observed.

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