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ORIGINAL ARTICLE

"C-shaped" anterolateral thigh flap for stomal repair due to recurrence in patients with total laryngectomy

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ABSTRACT

Background: Stomal recurrence after total laryngectomy is one of the most challenging problems in head and neck surgery due to the complexity of its management. The tracheal opening remains deep and caudal after resection, creating a neo stoma that presenting a significant challenge for reconstructive surgery. With this study, we aimed to describe the design of the C-shaped ALT flap to show that it is the ideal design in such a difficult reconstruction.

Methods: Five patients who underwent a free ALT flap for defects in the anterior neck wall and airway after resection due to tumor recurrence adjacent to a permanent stoma between 2018-2020 were included in the study. Tumor resection was performed by the Otolaryngology team in all cases. Age, gender, cause of defect, ALT flap size, donor site closure method, number of perforators, ischemia time, flap survival, early complications, and postoperative tracheostomy use and postoperative quality of life assessment were reviewed.

Results: 5 male patients were included in the study and the mean age was 63.8. The mean duration between admission and recurrence after laryngectomy was 11.2 months. Flap survival was noted in all patients. The patients did not encounter complications such as tracheostomy-related dehiscence, discharge, fistula, cannulation difficulties due to flap collapse, and mediastinitis during their lifetime. In the follow-ups, one still alive, the mean survival time of the other three patients was four months. We found an average high score in our patients regarding functional scales in QLQ-H&N35 module.

Conclusions: The C-shaped ALT flap design provides ease of insertion into a tension-free tracheal-skin suture line and helps to reduce the rates of stoma-related complications and increase the quality of life of the patients.

Keywords: ALT flap, C- shaped, stoma recurrence, tracheostomy.

INTRODUCTION

Stomal recurrence after total laryngectomy is one of the most challenging problems in head and neck surgery due to the complexity of its management [1]. Patients with stomal recurrence have a poor prognosis and a short life expectancy. The prognosis of most patients who face this serious complication is poor with a mortality rate of 98 percent [2].

The limited number of cases results in less surgical experience and limited information in the literature. The tracheal opening remains deep and caudal after resection, creating a neo stoma that presenting a significant challenge for reconstructive surgery.

Before the discovery of free tissue transfers, mediastinal tracheostomy was the preferred method in these patients. This method led to very serious vascular complications [3]. Later; local flaps, deltopectoral flap [4], thoracoacromial flap, pectoralis major myocutaneous flap[5,6], inframammary artery perforator flap (IMAP) [7], latissimus dorsi myocutaneous flap [8], bipediculated chest flaps were attempted. With the increasing popularity of free tissue transfers, these options were replaced by radial forearm flap (RFFF) [9] and anterolateral thigh flap (ALT) [10]. Free tissue transfer offers many additional flap options and may therefore address reconstruction needs more specifically. For example, they can be easily manipulated and adapted to complex defects. Moreover, they provide a large, well-vascularized and pliable skin area. The Flaps used in this type of defect have some basic problems. Firstly, most patients receive adjuvant radiotherapy treatment after total laryngectomy. This may lead to flap-related postoperative complications due to issues regarding recipient vessel. Secondly, the deep and caudal placement of the tracheal stump flap design requires keeping the vertical height long. If the vertical length of the flap not maintained, it may cause tension in the tracheal-skin suture line, thus dehiscence. Thirdly, the very deep and caudal location of the defect increases its distance to the neck and thus to the recipient vessel. Therefore, the flap pedicle should be kept long. Another problem is that patients use a tracheal cannula in the postoperative period, which may result in collapsing the flap and cannulation problems. For this reasons, aforementioned problems should be taken into consideration when designing the flap. The ideal reconstructive method should provide vascularized soft tissue that can close the defect after resection, allow the tracheal opening to be sutured to the skin edges without tension, and stand against collapsing to avoid obstructing the airway. We believe the C-shaped design of the ALT flap addresses all these problems, which makes this specific design of ALT flap the ideal reconstruction for this challenging area.

In this study, we aimed to describe the C-shaped design, advantages of the free anterolateral thigh (ALT) flap and observe the effect of the neo stoma on patients' quality of life.

MATERIALS and METHODS

Patients who underwent a free ALT flap for defects in the anterior neck wall and airway after resection due to tumor recurrence adjacent to a permanent stoma between 2018-2020 were included in the study. The study was approved by the Institutional Review Board/Ethics Committee and written consents were obtained. Resection, as well as flap design and reconstruction surgery, were performed by the same otolaryngology and reconstructive surgery team in all cases.The free flap used in accordance with the defect was designed in a C shape (Figure 1).

Age, gender, etiology of defect, ALT flap size, donor site closure method, number of perforators, ischemia time, flap survival, early complications, and postoperative tracheostomy use were reviewed. (Table 1) We used the QLQ-H&N35 module designed for patients with head and neck tumors to evaluate patients' quality of life. Except for the patient who died in the early postoperative period, 4 patients completed the QLQ-H&N35 module on the 20th postoperative day.

RESULTS

5 male patients were included in the study and the mean age was 63.8.(range 39 to 87) The mean duration between admission and recurrence after laryngectomy was 11.2 months (range 6 to 20 months); The mean duration of hospitalization in the intensive care unit after surgery was 6 days (range 2 to 15 days), and the mean duration of

Figure 1. Preoperative planning

Table 1. Case series

	Age	Sex	Co-Morbidities	Time to Recurrence After Surgery	Postoperative Intensive Care Stay	Post Operative Hospital Stay	Post Operative Lifetime	Complications	Flap Size	Number of Perforators	Ischemia Time	Tumor Stage	Kt/Rt	Anastomosis
Patient 1	39	M	None	10 Months	2 Days	12 Days	7 Months	None	8X7 cm	2	55 Min	pT4aN0M0	Preop RT	Fasial a./v.
Patient 2	66	M	None	10 Months	3 Days	18 Days	1 Month	Dehiscence around the flap	15x10 cm	2	54 Min	pT3N0M0	Preop RT	Tca. / Ejv.
Patient 3	65	M	COPD	6 Months	3 Days	7 Days	Alive since 2020	Healing problem in the donor area	10x12 cm	1	40 Min	pT1N2aM0	Adjuvant KT+RT	Tca. / Ejv.
Patient 4	87	M	COPD, ICD, DM	20 Months	15 Days	15 Days	15 Days	Major bleeding	14x15 cm	2	91 Min	pT4aNXM0	Preop RT	Ima/Imv
Patient 5	62	M	CAD, DM, HT, Right Knee Amputation, Hypothyroidism	10 Months	7 Days	21 Days	4 Months	Dehiscence around the flap	19x9 cm	2	91 Min	pT4aNXM0	Preop RT	Tca. / Ejv.

COPD, Chronic Obstructive Pulmonary Disease; DM, Diabetes Mellitus; ICD, Ischemic Cerebrovascular Disease; HT , Hypertension; CAD, Coroner Artery Disease; Tca, Transverse Cervical Artery; Ejv, External juguler vein.

hospitalization was 14 days(range 4 to 21 days). Defect dimensions were measured as 13.2 x 10.6 cm on average (defect range 9X5 cm to 19x9 cm) in the intraoperative period. In one patient, the flap was harvested over a single perforator, while the flap was harvested over 2 perforators in other patients. Tumor invasion was observed in the innominate artery in the intraoperative period in one patient. The innominate artery was cleared of tumor by the department of Cardiovascular Surgery, but major bleeding occurred in the innominate artery within the first 24 hours after surgery. Later, the patient died as a result of complications related to major bleeding. In the follow-ups, one still alive, the mean survival time of the other three patients was four months.

Flap survival was noted in all patients. However, one patient died due to major bleeding in the early postoperative period. Minor dehiscence was detected at the flap margin in two patients in the postoperative period, probably due to radiotherapy damage in the native tissue, yet improvement was achieved with conservative follow-up within 6 weeks. Healing problem due to granulation tissue was observed in 1 patient in the donor area, and recovery was achieved with silver nitrate treatment. The patients did not encounter complications such as tracheostomy-related dehiscence, discharge, fistula, cannulation difficulties due to flap collapse, and mediastinitis during their lifetime.

Case report (Patient II):

A 66-year-old male patient was seen with a recurrent supraglottic squamous cell carcinoma after radiotherapy. The patient did not have any co-morbidities. He underwent total laryngectomy. A "C shape" ALT flap was used to reconstruct the anterior neck skin defect and the tracheostoma. The flap was based on two perforators and measured 15x10 cm. The flap was well perfused throughout. One week after surgery a small dehiscence appeared around the flap and healed very well with conservative treatment (Figure 2.,3.,4.).

In the postoperative EORTC QLQ - H&N35 module evaluation of the patient, functional scales were noted as role (42.36), emotional (50.64) and social (52.83).

The patient died of metastatic disease 1 months later.

Figure 2. Preoperative photograph; Stoma recurrence after total laryngectomy

Figure 3. Intraoperative photograph; "C-shaped" ALT flap

DISCUSSION

In our series, the patients reconstructed with a C-shaped ALT flap due to stomal recurrence after laryngectomy, did not have tracheostomy-related problems in the postoperative period. None of our patients died due to reconstruction-related complications. Our patients were able to receive their treatment for their systemic metastases on time. Although the mortality was high, one of our patients continues to live in a healthy way. It was ensured that in such a mortal disease, patients' treatment for their malignancies was not delayed,

Figure 4. Postoperative photograph; "C-shaped" ALT flap for stoma repair after resection

and they did not suffer from tracheostomy-related problems with low quality of life in their probable short postoperative life. Our patients were discharged from the hospital in a short time and were able to continue their ordinary lives.

We think that the most important reason for our good reconstructive result is that our C-shaped flap is optimal for such defects. With the design of the C-shaped ALT flap, we adapt the inferior flap of the flap to the trachea after resection without tension. It can be adapted in a way that does not leave dead space for the defect by providing sufficient tissue volume at the superior of the flap. Thus, the irritation can be prevented by minimizing the contact of the postoperative tracheostomy cannula with the flap. The collapsed appearance can be avoided by providing sufficient volume of tissue. No matter how short the tracheal remnant is, the pedicle tension can be minimized by preferring the transverse cervical artery/vein anastomosis, which we used in most of our patients, while flap adaptation is performed without tension. In our view, design with 2 perforators, we prevented flap circulation disorders that may have occurred due to flap size. Concerning the difficult problem of reconstruction after resection of stomal recurrence after total laryngectomy, Caliceti et al. [10]

published a case report on the use of ALT flaps for this application. We argue that this flap, which is designed in the form of a tube, causes collapse over time and causes various cannulation difficulties. A brief comparison of flaps designed for stomal repair after resection due to recurrence in patients with total laryngectomy is provided. (Table 2).

We strongly believe that a C-shaped ALT is more suitable flap design than a tube-shaped ALT. In our experience, the tracheal mouth was easily adapted to the flap without tension thanks to the C-shaped design, and there was no collapsed appearance. We believe that the freedom in planning the dimensions of the part to be adapted to the tracheal residue, regardless of the extent of excision from the skin outside the stoma, provides a significant advantage in the design of this flap. The patients in our case series did not experience neo stoma-related complications during their lifetime.

The QLQ-H& N35incorporates seven multi-item scales that assess pain, swallowing, senses (taste and smell), speech, social eating, social contact, and sexuality. In addition, eleven single item assess problems with teeth, opening the mouth, dry mouth, sticky saliva, coughing, feeling ill, use of pain killers, nutritional supplements, or a feeding tube, weight loss and weight gain [11]. The functional scale scores are inverse: i.e., the higher the score, the better the function; on the symptom scales and independent items, the higher the score, the greater the difficulties or symptoms. It is found out that an average high score in our patients regarding functional scales: role (48.43), emotional (54.64) and social (57.43) and a low score on insomnia (15.64) and financial difficulties (25.76). In the study of Dinescu et al. [12] using the EORTC QLQ - H&N35 module for patients with total laryngectomy; they found that patients received low functional scores and a high score on the symptom scales and independent items.

Stomal recurrence is considered the most serious and fatal complication of laryngeal cancer. The highest cure rate in stomal recurrence after laryngectomy is achieved with aggressive radical surgery. In many series, the incidence of stoma recurrence ranges from 1.7% to 25%. However, since many articles count this complication among local complications, it is not possible to know the true value [13,14]. Stomal recurrence is commonly considered to be incurable. Even with aggressive surgical therapy and radio- therapy, these patients

Table 2. Comparison with other studies

	Flap Type	Survival After Surgery	Advantages	Disadvantages	Number of Cases
Withers EH et al.[6]	Pec. Major Flap	6 months	Easy to harvest; decrease the incidence of great vessel rupture, good option for salvage	Too bulky; 10% to 20% skin paddle necrosis; donor site contour deformity	1
Shinoda M et al.[8]	L. Dorsi Flap	3 years	Abundant vascularity, wide mobility, provides bulk to fill the dead space, easy to harvest	Not a first choice because of its more distant location	1
Yu P et al.[7]	IMAP	Mean 3.5 months	Thin and well- vascularized tissue; less bulky	Small size, unable to prevent vascular accidents	2
Cordeiro et al.[9]	RFFF	Not mentioned	Provides a large area of well-vascularized, pliable skin	Tension on the trachea–skin suture line because of limited size, unable to fill the dead space	1
Caliceti et al.[10]	Tubed ALT	22 months postoperatively alive	Low donor site morbidity, long and reliable pedicle. Possible chimeric design to fill dead space	Steep learning curve of perforator flaps; significant hair regrowth, low secretion clearance, collapsed appearance	1
Our Study	C-shaped ALT	Mean 4 months / 1 patient still alive since 2020	In addition to advantages of tubed ALT; no collapsed appearance, no neo stoma-related complications, tension free trachea-skin suture line	No additional disadvantages compared to the above tubed ALT (with no collapsed appearance)	5

Pec.Major Flap, Pectoralis Major Flap; L.Dorsi Flap, Latissimus Dorsi Flap ; IMAP , Internal Mammary Arter Perforator Flap ; RFFF , Radial Forearm Free Flap ; ALT , Anterolateral Thigh Flap.

usually succumb to respiratory obstruction or massive hemorrhage. Before the discovery of free tissue transfer, mediastinal tracheostomy was used as the standard reconstructive procedure after resection due to recurrence in patients with total laryngectomy. It was reported that wound dehiscence, mediastinitis, innominate artery erosion and vascular complications was not uncommon in patients after mediastinal tracheostomy also patient comfort is extremely poor [15]. Sisson (13) used mediastinal tracheostomy for reconstruction and achieved one of the best survival rates, with a 35% survival rate at 42 months for 75 stomal recurrences over 30-year period. Chemoradiotherapy protocols have not been shown to offer curative or palliative results to this extent. The mean survival time was calculated as 8.9 months in patients with stomal recurrence [16]. The mean survival time of 4 patients in our study was determined as 4 months and 1 patient is still alive, which is comparable with the literature. We think that inadequate resection margins due to proximity of the innominate artery in three of our patients resulted in close or positive surgical margins in the postoperative pathologic assessment, which we believe was the cause of such a high mortality rate in our series. All of the patients died due to the complications of metastatic disease. As the literature shows, we are aware of that the surgery performed on these patients was more palliative than cure. We found that these patients were protected from complications around the stoma in their short life span, thanks to this design, and their treatment is aimed at systemic disease.

Local flaps help to close defects of limited size. Thoracoacromial and deltopectoral flaps can be used for small defects, but distal parts may have circulation problems and have insufficient maneuverability. The pectoralis myocutaneous flap defined for this type of defects by Withers et al.6 provides substantial vascularized skin and muscle flaps and has been shown to reduce the incidence of vascular complications. We do not prefer the latissimus dorsi myocutaneous flap for such defects as described by Shinoda M et al. [8] due to its distant location. We believe that the internal mammary artery perforator flap (IMAP) for such defects as described by Yu P et al. [7] is thinner than other regional options, thus providing better aesthetic results than deltopectoral and pectoralis myocutaneous flaps. However, the size limits for safe removal of the IMAP flap have not been defined. Hence, it may be a better choice for small defects.

Cordeiro et al. [9] favored the radial forearm free flap (RFFF) for reconstruction in such patients because of its advantages such as flexibility, thinness, and long pedicle. Here, a repair was made for the skin defect and a hole was made in the middle of the flap and the trachea was placed. However, if the skin defect is large and/or the tracheal remnant is short, we believe that would result in tension in the trachea-skin suture line.

Wheatley et al. [17] later designed a tubular radial forearm flap mostly for tracheal reconstruction to reduce this suture tension. While the entire flap is used for tracheal reconstruction, the remaining skin defect is closed with the help of local myocutaneous flaps.

Low number of cases is the main limitation of our study. We attribute this to the fact that patients with stoma recurrence are generally deemed inoperative for various reasons by the oncology team, and the patients are referred directly to palliative treatment centers.

CONCLUSION

The ALT flap is a reliable and safe flap with a long pedicle, and the C-shaped design provides ease of insertion into a tension-free tracheal-skin suture line. Although the survival of patients with stomal recurrence after laryngectomy is very low due to metastatic disease, reconstruction with a C-shaped free ALT flap helps to reduce the rates of stoma-related complications and increase the quality of life of the patients. Future studies with larger patient cohorts and longer survival times are needed.

Author contribution

Study conception and design: BS, AHS, ÖS ; data collection: AHS, ÖS analysis and interpretation of results: BS, ZDA; draft manuscript preparation: AHS, ÖS All authors reviewed the results and approved the final version of the manuscript.

Ethical approval

The study was approved by the Clinical Research Ethic Committee of Marmara University Facult of Medicine (Protocol no. 09.2024.922).

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Conflict of interest

The authors declare that there is no conflict of interest.

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