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HEAD & NECK

Clinical application of supraclavicular flap for head and neck reconstruction

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Abstract

Purpose To assess the efficacy and clinical application of a supraclavicular flap for head and neck reconstruction.

Method A pedicled supraclavicular flap was used on 26 patients at Sun Yat-Sen University Cancer Center between July 2017 and November 2018, including 16 cases with oral cancer defects, 7 cases with laryngeal cancer and hypopharyngeal carcinoma defects, 1 case with parotid gland cancer defects, 1 case with external auditory canal cancer defects, and 1 case with tracheal esophageal fistula. The time required to harvest the flap, the amount of intraoperative blood loss, the duration of postoperative drainage tube placement, the outcome of the flap, and the healing observed at the donor site are reported.

Result The sizes of the flaps were 6–20 × 4–6.5 cm. The time required to harvest the supraclavicular flap ranged from 25 to 35 min and averaged 30 min. The amount of intraoperative blood loss ranged from 20 to 100 ml and averaged 58.8 ml. The duration of postoperative drainage tube placement ranged from 3 to 8 days and averaged 5.9 days. A total of 23 flaps survived. In two cases, the distal blood supply of the flaps was poor, but the flaps survived after debridement and suturing. One flap had partial necrosis, but survived after conservative treatment. All donor area defects were directly sewed and stitched without complications.

Conclusion There are multiple advantages of the supraclavicular flap, including simple preparation technique, reliable repair of the defects, and without the need for performing microvascular anastomosis. It can be safely used in head and neck reconstruction after surgery.

Keywords Supraclavicular flap · Head and neck reconstruction · Reconstructive surgery

Introduction

Due to the complex anatomy of the head and neck, the repair of postoperative defects following head and neck surgery has been a hurdle [1]. The free flap is the main method for defect repair after head and neck surgery worldwide [2]. However, it requires microvascular anastomosis technology, which is a time consuming and high-risk strategy that is difficult to perform extensively in primary hospitals.

The main blood vessels of the supraclavicular region are the transverse carotid arteries, which have an average of four perforators, with 75% from the superficial branch, 15% from the deep branch, and 25% directly from the transverse artery of the neck [3]. The supraclavicular flap is moderately thick, its color and texture are similar to that of the head and neck area, and its blood supply is clear and constant. The preparation of the flap is simple, and the operation time is relatively short. It can be used for various types of defects in the head, neck, and face [4]. With the continuing development of plastic surgery, the application of the supraclavicular flap is currently receiving increasing attention. In the present study, a pedicled supraclavicular flap was used to repair defects following head and neck surgeries. Its preparation technique, effect, and complications are discussed.

Yin Li and Zheng Zhao contributed equally to this work and should be considered co-first authors.

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Materials and methods

Case data

A pedicled supraclavicular flap was used in 26 patients at Sun Yat-Sen University Cancer Center between July 2017 and November 2018 (RDDA2019001077). The cases included 16 with oral cancer defects, 7 with laryngeal cancer and hypopharyngeal carcinoma defects, 1 with parotid gland cancer defects, 1 with external auditory canal cancer defects, and 1 with tracheal esophageal fistula. Twenty males and 6 females took part in this study, with an average age of 59.3 years (41–76 years). This study was approved by the Sun Yat-Sen University Cancer Center Institutional Review Board and all participants provided signed informed consent agreement.

Surgical technique

The patient is placed in the supine position, with the head turned towards the side opposite the donor site. A bolster is placed beneath the shoulder to expose the supraclavicular area. First, the primary tumor is completely resected. Second, with the use of preoperative imaging results, supraomohyoid or functional neck dissection is then performed. Third, great care is undertaken to protect the transverse cervical artery during the level IV neck dissection. Based on the size and position of the defect, the fusiform flap, which is 6–20 × 4–6.5 cm in size, is designed on the clavicle and the rotator cuff.

An incision is made in the skin, subcutaneous tissue, and deltoid fascia from the distal end to the proximal end of the flap, forward to the clavicle, backward to the trapezius muscle, and lateral to the deltoid muscle; the flap is then flipped as a whole. The external jugular vein is maintained, the pedicle is dissected to the starting point of the traversing vein of the neck, and the flap is rotated. The flap is then tunneled under the skin of the neck to reach the defect to be repaired and tension-free sutured.

Before suturing, the excess epidermis at the distal end of the flap can be cut to observe whether the bleeding of the flap is normal. If the blood supply is poor, the distal flap is cut until the observed blood supply is deemed satisfactory. The shoulder donor area is directly sutured by freely loosening the subcutaneous tissue, and a negative pressure drainage tube is placed. The head median is kept slightly angled to the operation area to avoid local compression after the operation. Vasodilator drugs are routinely used postoperatively to improve the microcirculation. The drainage tube is removed when the daily drainage volume is less than 30 ml.

Results

In our procedure, the time required to harvest the supraclavicular flap ranged from 25 to 35 min and averaged 30 min. The intraoperative blood loss ranged from 20 to 100 ml and averaged 58.8 ml. The postoperative drainage tube remained in place from 3 to 8 days (average, 5.9 days). The supraclavicular flaps of all 26 patients survived, and none were completely necrotic. In total, 23 flaps survived with good color, texture, elasticity, and appearance. In two cases, the distal blood supply of the flap was poor and partially split, but the flap survived after debridement and suturing. One patient's flap developed distal necrosis. On the first postoperative day, the proximal flap was found to be transported well and survived after conservative treatment. All donor area defects were directly restitched without complications such as wound infection and effusion. However, the postoperative scars were obvious at the donor site. The patient status list is shown in Table 1.

Typical case

A 65-year-old male patient was admitted to our hospital because of a "mass in the left tongue for one month". On physical examination, an exogenous ulcer-like mass, size of 3 × 2 cm, on the left side of the tongue was found. It was hard, with clear demarcating boundary and invaded the left side of the buccal floor. The lymph node on level Ib of the left neck was 2 × 1 cm in size, slightly hard and with clear boundary. The patient underwent a left tongue cancer radical resection, left mandibular partial resection, titanium plate internal fixation, bilateral supraomohyoid neck dissection, left supraclavicular flap reconstruction, and tracheotomy under general anesthesia. The follow-up time lasted for 2 months. The flap survived and healed well. The patient's shoulder function was normal, and demonstrated satisfactory activity. (Fig. 1).

Discussion

The supraclavicular flap procedure was first described by Lamberty [5], but was not reported in the literature for nearly 20 years due to the high incidence of complications arising from its underlying unfamiliar anatomy. In 1997, Pallua et al. [6] improved this technique and demonstrated its clinical safety, and the flap was then mainly used for the repair of burn scars. Afterward, in 2009, Chiu et al. [7] proposed that the flap was versatile and reliable for the repair of postoperative head and neck tumor defects.

The supraclavicular flap has then been used for the repair of head and neck defects of the mouth, tongue,

Table 1 Status list of the 26 enrolled patients

Patient number	Gender	Age	Diagnosis	Intraoperative blood loss (ml)	Postoperative drainage tube (day)	Flap size (cm)	Flap outcome
1	Male	59	Pharyngeal fistula after comprehensive treatment for laryngeal cancer	50	6	6×4	Survived
2	Male	54	Flap necrosis after comprehensive treatment for right tongue squamous cell carcinoma	50	5	19×6	Partial split, survived after debridement and suturing
3	Female	69	Tracheal esophageal fistula	50	5	19×6	Survived
4	Male	52	Recurrence after comprehensive treatment for right tongue cancer	50	4	19×6	Survived
5	Male	54	Titanium plate exposed after comprehensive treatment for left tongue cancer	30	3	19×5	Survived
6	Male	59	Titanium plate exposure after laryngeal cancer surgery	30	7	15×6	Survived
7	Male	41	Incisional infection of right acinic cell carcinoma of the parotid	50	4	18×5	Survived
8	Female	58	Uncontrolled adenoid cystic carcinoma of the external auditory canal	20	4	20×6.5	Partial necrosis, survived after conservative treatment
9	Male	54	Left tongue squamous cell carcinoma	50	6	20×6	Partial split, survived after debridement and suturing
10	Male	65	Left tongue squamous cell carcinoma	50	4	15×5	Survived
11	Male	60	Recurrence after laryngeal cancer surgery	50	7	15×6	Survived
12	Female	65	Right tongue poorly differentiated squamous cell carcinoma	50	7	15×5	Survived
13	Male	48	Right tongue squamous cell carcinoma	50	8	19×6	Survived
14	Male	66	Lower pharyngeal esophageal cancer	80	5	20×5	Survived
15	Male	55	Squamous cell carcinoma of right floor of mouth	100	7	16×6	Survived
16	Male	50	Recurrence after comprehensive treatment for left oropharyngeal cancer	50	7	20×6	Survived
17	Female	76	Left tongue squamous cell carcinoma	50	4	21×5	Survived
18	Male	65	Titanium plate exposure after laryngeal cancer surgery	20	5	20×5	Survived
19	Female	64	Left tongue squamous cell carcinoma	50	8	20×5	Survived
20	Male	59	Right tongue squamous cell carcinoma	100	7	20×6	Survived
21	Male	64	Laryngeal cancer	50	5	20×6	Survived
22	Male	62	Right tongue squamous cell carcinoma	100	7	20×5	Survived
23	Male	62	Left tongue squamous cell carcinoma	100	7	20×5	Survived
24	Male	59	Right tongue squamous cell carcinoma	100	8	19×6	Survived

Table 1 (continued)

Patient number	Gender	Age	Diagnosis	Intraoperative blood loss (ml)	Postoperative drainage tube (day)	Flap size (cm)	Flap outcome
25	Male	53	Pharyngeal fistula after laryngeal cancer surgery	50	7	14×4.5	Survived
26	Female	69	Left tongue squamous cell carcinoma	100	7	17×6	Survived

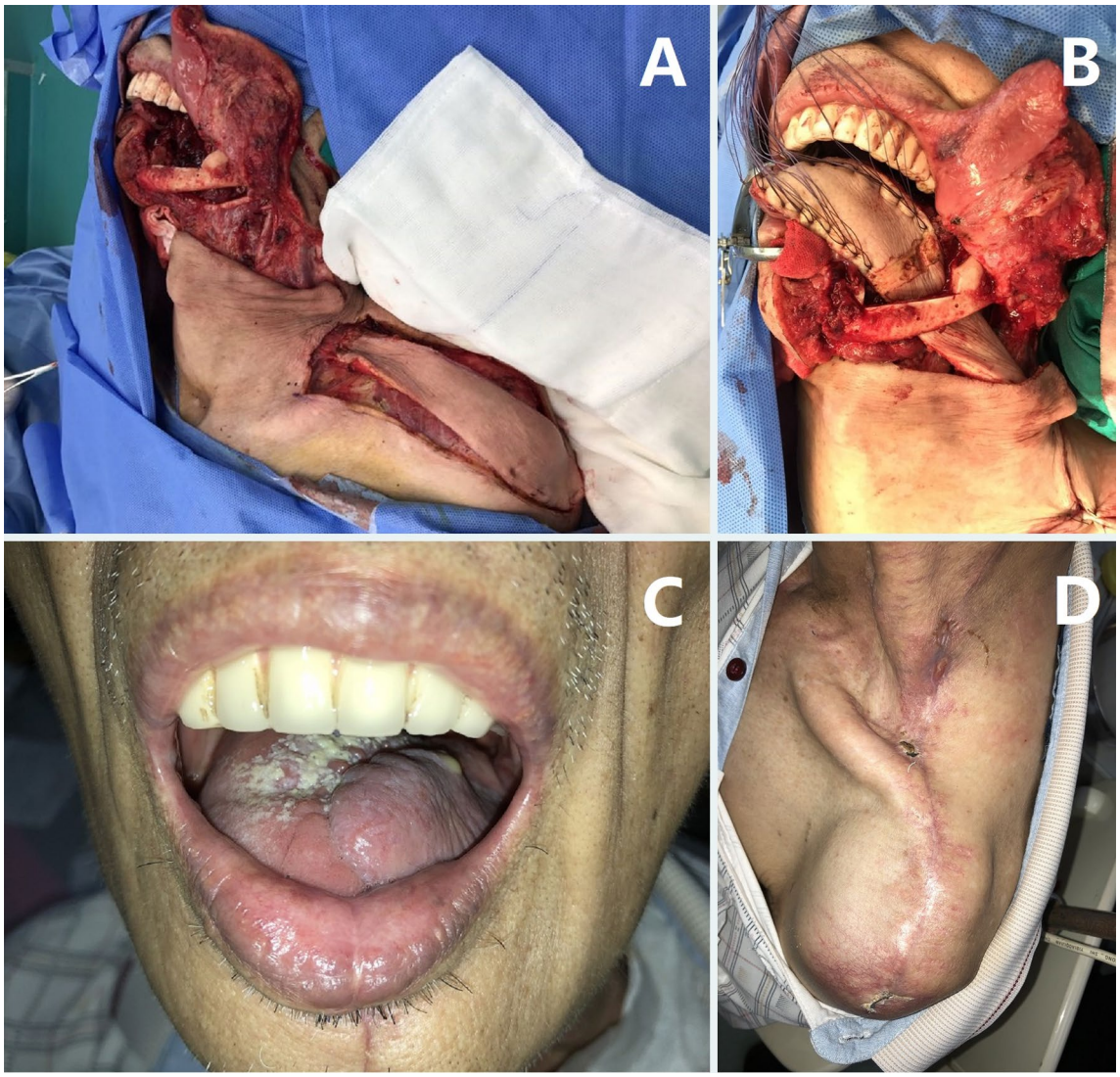

Fig. 1 Typical case of supraclavicular flap reconstruction. **a** Harvesting of the flap during the operation; **b** rotation of the flap to reach the defect; **c**, **d** satisfactory appearance of the scar of the tongue and left shoulder at 2-month postoperative

oropharynx, hypopharynx, cervical esophagus, and facial and neck skin [8–12]. The main postoperative complications observed have been partial or total necrosis of the flap, infection, rupture of the wound, sputum, pharyngeal fistula, and esophageal stricture [10, 13–15]. Kokot et al. [13] reported 45 cases of supraclavicular flap repair of the oral cavity, oropharynx, hypopharynx, esophagus, trachea, tibia, and neck skin, of which two and eight cases had complete and partial necrosis, respectively. Sandu et al. [4] reported 50 cases of neck skin defect, oral or oropharynx

lining mucosal defect restoration, of which they found that there were 2 and 4 cases of complete and partial necrosis, respectively.

In the present study, one case of partial necrosis of the distal end of the flap was observed and it was considered to be related to injury to the transverse carotid artery and vein due to radical radiotherapy. Therefore, for patients who have undergone radical radiotherapy, ipsilateral level IV or V neck dissection, the cervical transverse and external jugular veins should be elaborately evaluated by ultrasound before a supraclavicular flap is performed.

During neck dissection, the traversing vein and external jugular vein of the neck should be protected, or the contralateral neck without lymph node metastasis should be used to prepare the flap. Care must be taken to avoid damage to the pedicle. Two patients had poor blood flow and partial rupture at the distal end of the flaps, which were considered to be related to the length of the flap. Long flaps (> 22 cm) were found to be more prone to distal necrosis [11]. Flap delay, in which flap removal is completed 10 days before the repair operation, has been recommended to reduce complications; this procedure can also increase the length of the flap to 3–4 cm [4]. However, for the repair of large area of defects of the head and neck, the flap is still insufficient.

The donor skin can be directly sewn after free release. Harvesting a very large flap may require a skin graft to the donor site. In all 26 patients in this study, the size of the donor flap was within this range (< 22 cm), but with the risk of having an obvious shoulder scar. Herr et al. [16] used the Penn shoulder and the constant shoulder joint scoring system to evaluate patients undergoing supraclavicular flap reconstruction, while a physiotherapist measured shoulder muscle strength and mobility. While the muscle strength of the shoulder joint is not affected by this operation, there can be an effect on joint mobility in one or more directions. Due to the short follow-up period, long-term shoulder joint activity could not be fully evaluated in this group of patients.

In summary, the supraclavicular flap was found to be an ideal tissue flap for head and neck surgery. It has the advantages of being a simple preparation technique, demonstrating reliable repair defect, with less local functional damage, and without the need for microvascular anastomosis. It can be further safely used for the postoperative head and neck defect repair in primary hospitals.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Sponsorships None.

Research involving human participants and/or animals All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

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