

Double-island anterolateral thigh free flap used in reconstruction for salvage surgery for locally recurrent head and neck carcinoma

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Abstract

Salvage surgery is usually the only treatment for recurrent head and neck tumors but often poses a challenge to surgeons due to post-resected defects at 2 or more sites. Here we present the outcomes and rationale for reconstruction by a double-island anterolateral thigh (ALT) free flap following the salvage surgery.

Patients treated with double-island ALT free flaps in salvage surgery between September 2012 and January 2017 at West China Hospital, Sichuan University were retrospectively viewed.

A total of 18 patients (15 males) underwent reconstruction with double-island ALT free flaps (range from 40 to 77 years old). All patients had recurrent tumors after surgery and/or chemoradiotherapy and were selected for salvage surgery by a multidisciplinary team. The flaps were initially harvested as 7 cm × 7 cm to 16 cm × 10 cm single blocks and then divided into double-island flaps with each individual paddle ranging from 5 cm × 3 cm to 10 cm × 8 cm. The average flap thickness was 3.5 cm (range from 2 to 6 cm), and the average pedicle length was 8 cm (range from 6 to 10 cm). A total of 18 arteries and 32 veins were anastomosed. Three patients developed fistula, 1 developed flap failure due to thrombosis and was re-operated with a pedicle flap. One patient died of pulmonary infection 6 months after the operation.

Flap reconstruction for complex head and neck defects after salvage surgery remains challenging, but double-island ALT free flap reconstruction conducted by a multidisciplinary team and experienced surgeons would have a role in this setting.

Abbreviations: ALT = anterolateral thigh, HNSCC = head and neck squamous cell carcinoma, MRA = magnetic resonance angiography, PCF = pharyngocutaneous fistula.

Keywords: double-island anterolateral thigh free flap, head and neck carcinoma, multidisciplinary team, reconstruction, salvage surgery

1. Introduction

Head and neck cancers are major malignancies and account for approximate 3% of all cancers.^[1] Most of them are squamous cell carcinomas^[2] associated with aggressive behaviors and metastasis.^[3] They are usually treated with radiotherapy, chemotherapy, surgery and comprehensive treatment. However, patients with head and neck squamous cell carcinoma (HNSCC)

are at risk of post-treatment recurrence and progression, resulting in frequent regional recurrences in previously irradiated areas. A recurrence of advanced tumor at the primary sites occurs in 20% to 30% of patients and occurs in 10% to 15% patients in the neck.^[4] It is well-known that such regional recurrence poses great therapeutical challenges to head and neck surgeons and oncologists. Previous reports suggest that salvage surgery provides better overall survival and tumor control than chemoradiotherapy for resectable recurrences.^[5] However, it is important to note that reconstructions of post-resection defects in these patients are very difficult.

Defects after resection of recurrent head and neck carcinomas are complex and usually involve 2 or more sites. In this case, the anterolateral thigh (ALT) free flap is widely preferred among commonly used simultaneous free and pedicle flap, 2 free flaps, and double-island folded free flap.

Such flap, first described by Song et al in 1984,^[6] is a piece of large skin based on musculocutaneous or fasciocutaneous perforators that can be harvested safely and provide enough tissue to fill large defects.^[7] Their versatility, sufficient vessel length and minimal donor site damage have ensured their success in many fields, such as vulvar cancer, limbs repair, autologous breast,^[8–10] and especially reconstruction in head and neck involving scalp, parotid area, eyes and skull base.^[11–14] A double-island ALT flap is composed of 2 skin paddles and/or muscular components that allow simultaneous reconstruction of 2 defects. This study will evaluate the outcome of head and neck reconstruction by double-island ALT flaps in locally recurrent HNSCC patients following comprehensive therapies including chemoradiotherapy and surgery.

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2. Patients and methods

2.1. Patients

From September 2012 to January 2017, 18 patients with recurrent head and neck carcinoma received salvage surgery with double-island ALT free flap reconstruction at West China Hospital, Sichuan University. This retrospective review was approved by the Institutional Review Board of the West China Hospital (Cheng Du, Sichuan Province, China). All patients underwent blood test, electrocardiogram examination, chest X-ray or CT, laryngoscope, Doppler or magnetic resonance angiography (MRA) of their thighs. Their defect types, flap conditions, complications, and perioperative nutritional status were recorded.

Inclusion criteria were:

- 1) recurrent tumors;
- 2) no distant metastases;
- 3) carcinoma that can be completely or safely excised;
- 4) multiple defects after excision;
- 5) blood vessels available at the recipient sites;
- 6) or more perforators available at the donor sites;
- 7) no vascular disease in lower limbs;
- 8) no severe hypoalbuminemia (serum albumin > 35 g/L);
- 9) well-controlled hypertension, diabetes and pulmonary infection;
- 10) salvage surgery considered as the best choice by a multidisciplinary team including radiologists, oncologists and surgeons.

2.2. Surgical method

Tumor removal and subsequent evaluation of surgery-related defects and adjacent blood vessels were conducted by the same group. The flap harvesting technique has been described previously.^[15] Steps are as follows:

- 1) find the middle point of the line drawn between the anterior superior iliac spine and superolateral border of the patella, design the flap around the perforators identified on Doppler or MRA, make sure that the flap is big enough for head and neck defects;
- 2) incise the flap medially to the deep fascia of rectus femoris muscle;
- 3) identify suitable perforators from the descending branch of lateral femoral artery in intermuscular septum between the rectus femoris and vastus lateralis muscles;
- 4) isolated the chosen perforators in a retrograde fashion to the descending branch of lateral circumflex femoral artery.

After harvesting, the flap was split into 2 paddles according to the cutaneous, pharyngeal or oral defects and based on the perforators, and applied to the defects with vessel anastomosis. The distal paddle was used for replacing mucosal lining in oral cavity or throat while the proximal paddle covering the external defect. Careful hemostasis and drainage were carried out during the surgery (Fig. 1). These flaps were monitored during the early postoperative period.

2.3. Postoperative treatment

All patients were maintained on nasogastric feeding tube as per nutrition plans made by a professional dietitian, and also received wound care, airway management, acid-suppressive drugs and

anti-inflammatory drugs. Their flaps were monitored by electronic fiber laryngoscopy postoperatively.

3. Results

3.1. Patient demographics

In the 18 patients, 1 had maxillary sinus carcinoma, 5 had oral cavity cancer, 3 had oropharyngeal cancer and 9 had laryngocarcinoma. Seven patients had different levels of osteomyelitis and 16 had dermatitis. Demographic characteristics and prior therapy methods are summarized in Table 1. The mean interval between initial treatment and salvage resection was 50 months (12–250 months).

3.2. Surgery and flap information

All surgeries were performed by the same team. All patients had various degrees of adhesion (Fig. 2C–H) and 2 defects: oral and cutaneous defects in 9 (9/18), tracheal and cutaneous defects in 7 (7/18), and tracheal and esophageal defects in 2 (2/18). A total of 18 arteries and 32 veins were anastomosed (1 vein in 4 patients each and 2 veins in 14 patients each). During anastomosis, recipient blood vessels were at the contralateral sides of defects in 5 patients, and from the faces at the ipsilateral sides in 2 patients with neck defects. (Fig. 2 A and B). One patient received vein graft (Table 2). The flaps were initially harvested as 7 cm × 7 cm to 16 cm × 10 cm single blocks and then divided into double-island flaps with each individual paddle ranging from 5 cm × 3 cm to 10 cm × 8 cm. The average flap thickness was 3.5 cm (range from 2 to 6 cm), and the average pedicle length was 8 cm (range from 6 to 10 cm).

3.3. Complications

Four patients developed recipient site infection, and 3 of them developed fistula. Their infections were controlled by enhancing anti-infection treatment, wound care, nutritional status, and so on. One patient developed flap failure due to thrombosis and was re-operated with a pedicle flap which successfully survived (Table 3). No trismus/shoulder dysfunction/lymphedema/oral infections occurred. No infection or hematoma occurred at the donor sites.

3.4. Long-term assessment

All patients were closely followed after surgery for a mean period of 36 months (6–72 months). Only 1 died of pulmonary infection 6 months after the surgery. [http://dict.youdao.com/javascript:void\(0\);](http://dict.youdao.com/javascript:void(0);) No tumor recurrence or distant metastasis occurred. All other patients were capable of oral feeding, but 2 had the symptom of coughing. None of dysphagia, sleep disturbance/sleep apnea, xerostomia osteonecrosis or dyskinesia, and paresthesia at the donor site occurred. All flaps survived. Eight patients received 60Gy radiotherapy after surgery without ensuing flap necrosis.

4. Discussion

Non-surgical treatment strategies are more acceptable for head and neck cancer. However, tumor recurrences are frequent, and resectable recurrences are usually best treated with salvage surgery as they may achieve long-term control in up to 80% of early recurrences and up to 45% of advanced recurrences.^[4,16]

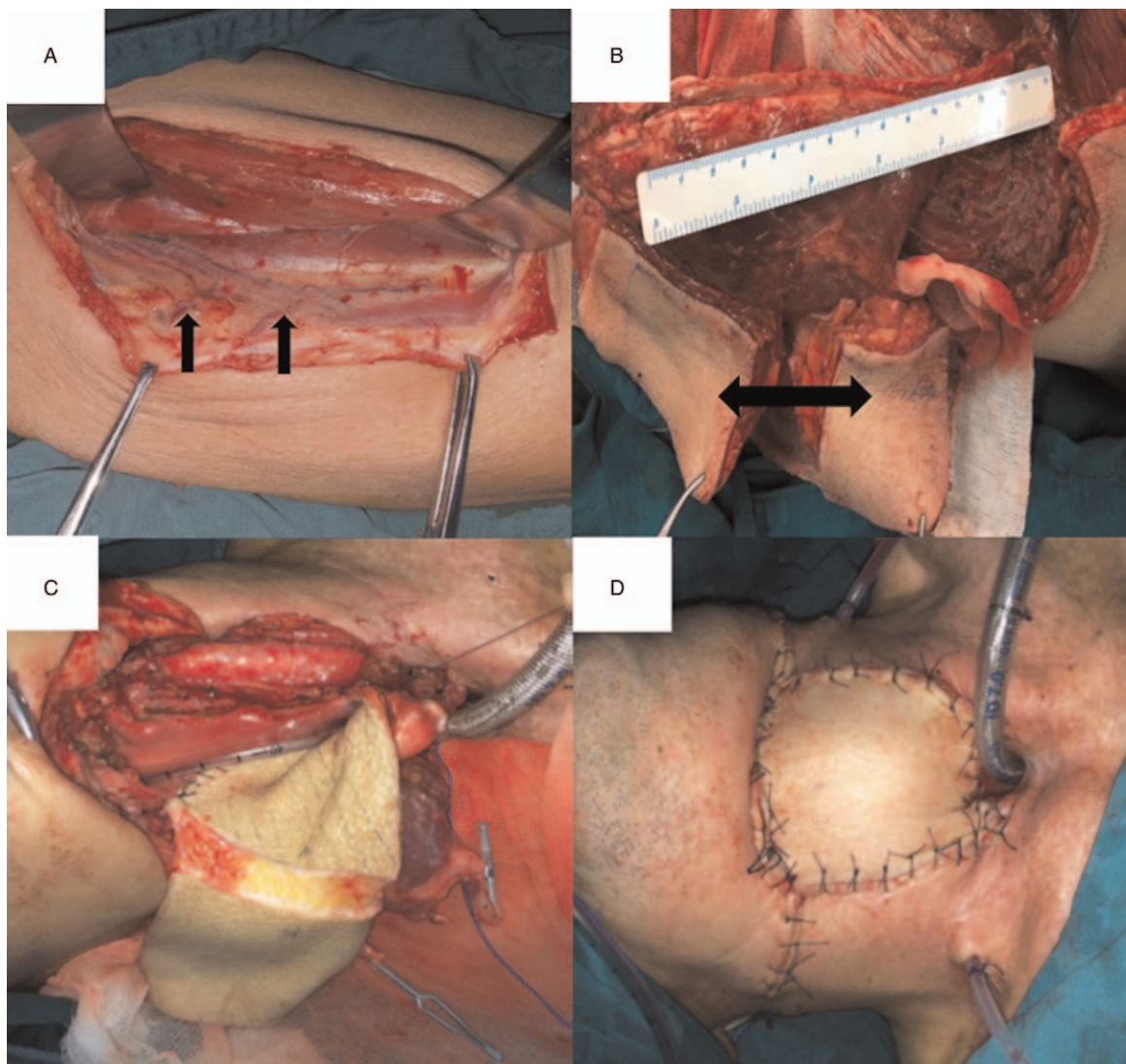


Figure 1. (A): double-island flap with multiple cutaneous perforators (black arrows). (B): A long vascular pedicle may allow anastomosis with blood vessel far away. And double-island (black arrows) is made. (C) The esophagus and skin were reconstructed by the flap. (D) After flap transplantation.

But salvage surgery requires wide excision to ensure negative margins and removes damaged skin or osteonecrosis related to previous chemoradiotherapy, thus results in complex defects because it removes. In this setting, simultaneous flap reconstruction is required to deal with the aesthetic and functional problems. The ALT flap can preserve at least 2 cutaneous perforators originated from the descending branch of lateral circumflex femoral artery,^[17] and is suitable for reconstruction of complex defects in head and neck after salvage surgery.

We prefer double-island ALT free flap because:

- 1) the flap has at least 2 paddles with multiple perforators to repair complex defects;
- 2) they have long vascular pedicle that may allow anastomosis with vessels far away;
- 3) musculocutaneous, subcutaneous, fasciocutaneous, or adipofascial flaps can be harvested for different defects;^[17]
- 4) complications are only rarely seen at the donor sites; and
- 5) the flap provides adequate healthy tissue to obliterate the dead space and cover the carotid artery, which is helpful in

Table 1

Patient details.

	No. of patients (%)
Age (yrs)	
Range	40–77
Mean (SD)	58.1
Gender	
Male	15 (83%)
Female	3 (17%)
Defect Location*	
Mid face	1 (6%)
Lower face	8 (44%)
Neck	9 (50%)
History of neck dissection	
yes	14 (78%)
no	4 (22%)

SD = standard deviation.

* Midface defects included defects after maxillectomy. Lower facial defects included skin defects and various intraoral structures such as the floor of the mouth and mandible. Neck defects included pharyngoesophageal or tracheal defects with neck skin defects.

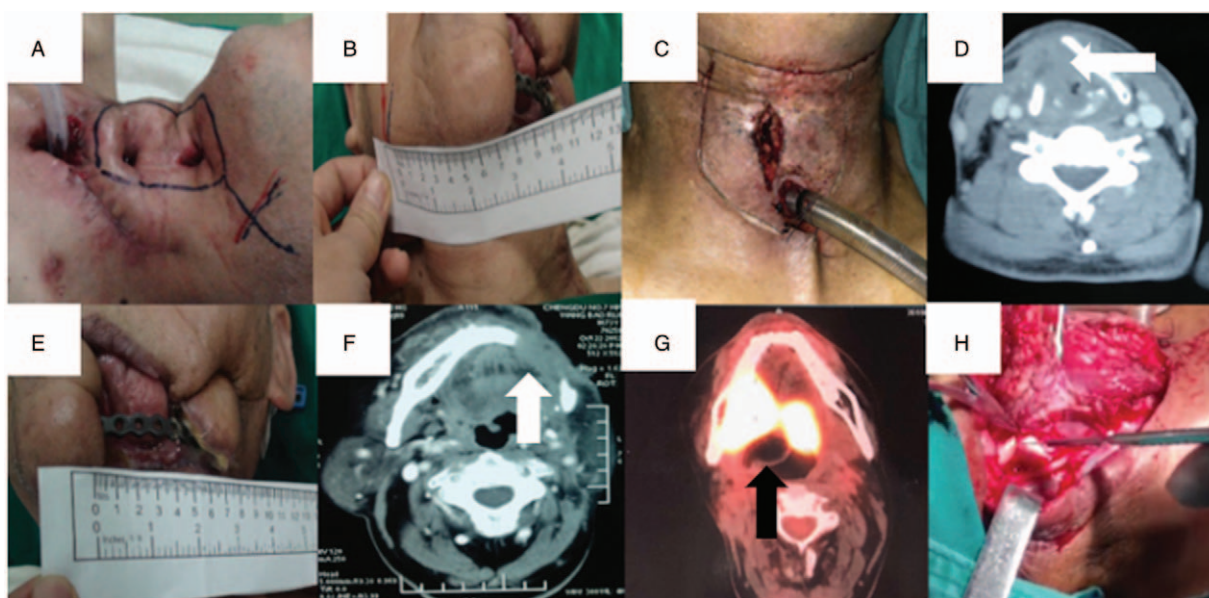


Figure 2. (A) and (B): Suitable vessels at the recipient site were far away from the defects. (C) and (D): skin and throat were involved by the recurrent tumor, and 2 defects required reconstruction (white arrow in D). (E) and (F): The defect measured 7 cm at maximum diameter and associated with osteomyelitis (white arrow in F). (G): The recurrent tumor (high signal) and flap (black arrow) from the last surgery on positron emission tomography. (H): The scar from the last surgery adhered to arteria carotis communis.

preventing the complications, such as infections, fistula and rupture of the carotid artery.^[18,19]

Patients requiring salvage surgery often have failed previous chemoradiotherapy or/and surgery which would adversely impact free flap availability, especially blood vessels.^[20,21] Blood vessels at the recipient sites may complicate the surgery because:

- 1) adhesion to surrounding tissue and susceptibility to bleeding may have increased the risk of vascular injury;
- 2) some vessels may be compromised or excised during the previous surgery, especially during the neck dissection; and
- 3) previous radiation leads to intimal fibrosis and early arteriosclerosis.^[22] In addition, patients were in poor conditions after the comprehensive treatment and had

increased morbidity due to diseases such as hypoalbuminemia. Radiation therapy also increases the risk of local skin infection and poor wound healing.

To deal with vessel damages of the recipient sites caused by previous comprehensive treatment, we must replace them with healthy blood vessels at proper locations. For each patient, anastomosis with 1 well-functioning artery and 2 veins was attempted as much as possible. In 4 patients, through only had 1 vein anastomosed, the flap survived well after surgery, indicating that anastomosis of 1 vein may be acceptable. Similar results have also been reported in other studies.^[23,24]

Seven patients required anastomosis outside their defects while recipient vessels far away from the defects are usually problematic in anastomosis. However, ALT flaps with long vascular pedicles may allow anastomosis to contralateral vessels or vessels far away, even cephalic veins as Jacobson et al reported.^[25] Vein graft is an alternative when no vein is available at the recipient site.

Other factors related to successful salvage surgery with flap reconstruction include:

- 1) strict selection criteria to exclude patients with hypoalbuminemia, distant metastases or tumor that cannot be completely or safely excised;

Table 2

Vessels anastomosis.

Vessel	Number of case
Arteries	
Superior thyroid artery	8
Lingual artery	3
Facial artery	3
arteria transversa faciei	4
Veins	
common facial vein	11
posterior facial vein	3
anterior facial vein	4
external jugular vein	9
Internal jugular vein	5
Far vessels	
On the contralateral side	5
Outside the defect on the ipsilateral side	2
vein graft	1

Table 3

Complication.

Recipient site complications	Number
Infection	4/18
Fistula	3/18
Flap thrombosis	1/18
Donor site complications	
Wound dehiscence	0/18

- 2) Adequate preoperative preparation in all patients, especially examination of perforator vessels by MRA or Doppler of the thigh and thorough risk evaluation of vascular anastomosis by computed tomography of the neck,
- 3) surgeons highly experienced in microsurgical techniques and familiar with anatomy to properly handle intraoperative problems.

But pharyngocutaneous fistula (PCF) has always been a frequent and feared complication in salvage surgery, especially salvage laryngectomies with neck dissections.^[26] In a meta-analysis performed by Sayles and Grant,^[27] the incidence of PCF was 14.3% in primary laryngectomy, 27.6% in salvage laryngectomy, and 10.3% in salvage laryngectomy with flap reconstruction. Chemotherapy also increases the risk of fistula.^[28] When treating PCF, improvement of nutritional status, treatment of infection, active wound care and control of underlying diseases are indispensable. Prevention of PCF requires multidisciplinary cooperation among endocrinologists and dieticians.

There are still some limitations:

- 1) the ALT flap is usually too thick,^[29]
- 2) male patients often have hairy thighs; and
- 3) vascular pedicles might be difficult to identify. In addition, the small number of patients and strict criteria in our study may lead to bias. Therefore, the results should be further verified by prospective studies with a larger sample size.

5. Conclusion

Double-island ALT free flap may have a role in reconstruction of composite head and neck defects during salvage surgery. They can fix aesthetic and functional problems with few complications. Experienced head and neck group, multidisciplinary cooperation, strict selection criteria and adequate preoperative examination are also necessary.

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