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Case Series

Lateral Arm Free Flap: A Useful Flap in the Maxillo-Facial Surgeon's Therapeutic Armory

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Abstract

Background: Reconstruction of maxillofacial defects using free flaps is considered standard treatment. An alternative to the radial forearm or lateral tight free flap is the lateral arm free flap, which offers many advantages.

Methods: Operative technique for lateral arm free flap is described and illustrated by history, surgical treatment and outcomes of 8 patients in head and neck oncologic reconstruction.

Results: During the years 2021 and 2022 8 patients (1 woman and 7 men) underwent reconstruction with a lateral arm free flap at University Hospital of Lausanne in Switzerland. The age rages from 52 to 87 years with mean age of 65.25 years. Reconstruction site variated from orbita, internal cheek, retromolar mandibula, palate, mouth floor and frontotemporal area. There was no perioperative complication. Six patients did not encounter any postoperative complications. Two patients presented with superficial flap skin loss due to venous congestion. All donor sites were closed primarily with one drainage and presented no postoperative complication.

Conclusions: the lateral arm free flap is an underused in head and neck reconstructive surgery. It presents valuable versatile characteristics which makes it a valuable substitute to other fascio-cutaneous free flaps.

Keywords: Free tissue flaps; Maxillofacial surgery; Microsurgery; Reconstructive surgery; Soft tissue injuries

Introduction

The gold standard of reconstruction in maxillofacial surgery is local flaps or free flaps, depending on the localization, size of the defect, and the patient's history. If bone replacement is required, fibula, iliac crest or scapula free flaps are the major workhorses. Radial forearm free flaps or lateral tight free flaps are the most commonly used flaps in soft tissue reconstruction, including tongue, palate, inner cheek, mouth floor or skin [1]. Reconstruction of these facial defects is very demanding as it must be functional as well as esthetic. Criteria for the ideal flap are to be reliable, versatile, pliable, easy to harvest and with low donor site morbidity. One valuable free flap presenting these advantages is the lateral arm free flap. It has been used for decades now and various modifications have been described [1] but it is still less in literature reported as the radial forearm or lateral tight free flap. In this study, we present a case series of 8 patients operated for a maxillo-facial defect with a lateral arm free flap and discuss the indications, the main advantages and drawbacks as well as surgical keys.

Materials and Methods

Ethical vote was obtained for this retrospective case review by the Institutional Ethical Committee.

Patient Selection and Data Collection

The reported patients were treated during the years 2021 and 2022 at the Department of oral and maxillofacial surgery, University

Hospital in Lausanne, Switzerland. All data were retrieved from patient's charts. Inclusion criteria were patients treated for oncologic defects involving the face with a lateral arm free flap. Minimal follow- up length was 3 months. Concerning main outcome measures data were collected concerning flap survival, complication rates and length of hospital stay.

Operative Technique

On all patients two surgical teams operate simultaneous. One team is preparing the reconstruction site and the recipient vessels, the other team is harvesting the free flap. The patient is positioned in a supine position, the palm of the hand on the abdomen, the arm rotated internally. We do not use a tourniquet nor Doppler ultrasonography. Landmarks such as the deltoid muscle and lateral epicondyle are drawn as well as the planned skin paddle (Figure 1A) which is centered 1 cm posteriorly to the line between the deltoid insertion and the lateral epicondyle of the humerus. If the deltoid muscle is not palpable another landmark might be the acromioclavicular joint. For usual small skin paddles we start 5 cm above the lateral epicondyle, but it can be extended up to 10 cm below [2,3] or even to the forearm. The lateral side of the paddle is incised as well as the muscular fascia of the lateral head of the triceps and dissection continues down towards the intermuscular septum. The posterior radial collateral artery is identified, sectioned distally and the dissection proceeds superiorly. Two sensory nerves can be associated with the harvesting: the posterior cutaneous nerve of the arm pierces the fascia of the lateral arm flap and can be used to provide sensory innervation of the flap. The posterior cutaneous nerve of the forearm does not supply sensation to the flap. It travels along the axis of the pedicle and might be used as vascularized nerve graft. These two nerves are branches of the radial nerve. The radial nerve must be preserved and separated from the vascular pedicle after being identified between the brachialis and brachioradialis muscle (Figure 1B). To obtain as much as possible pedicle length, one must proceed between the lateral arm of the triceps and the deltoid muscle which might be the tedious part of harvesting. Radial collateral vessels can be followed up to the brachial artery and vein.

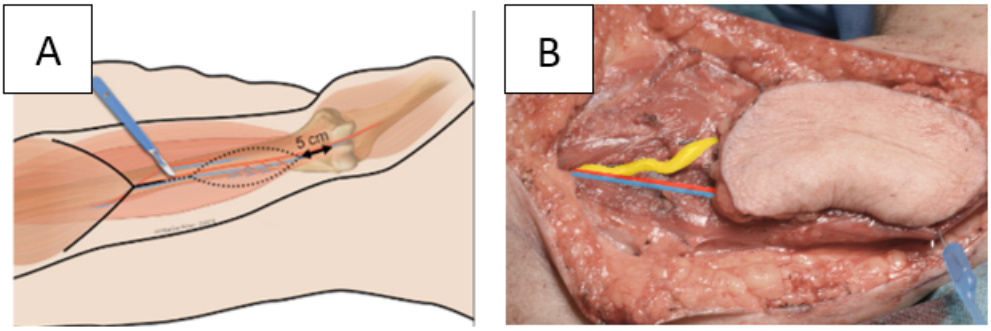

Figure 1: Schematic images of lateral arm harvesting. **A:** Landmarks such as the deltoid muscle and lateral epicondyle are drawn as well as the planned skin paddle **B:** The radial nerve (yellow) must be preserved and separated from the vascular pedicle (artery in red, vein in blue).

After harvesting the artery and the two collateral veins are rinsed with heparinized saline solution. The pedicle is oriented through a subcutaneous tunnel into the neck or preauricular area. Microvascular anastomoses are performed and the flap is sutured to the defect site. Concerning defects on the upper or middle third of the face, temporal vessels are preferred as recipient vessels. If the defect is located in the lower third of the face, we prefer using the facial vessel for the microvascular anastomosis. All anastomoses were performed in end-to-end fashion.

Donor side is closed primarily after insertion of a drainage tube.

Patient's aftercare

After the operation patients are admitted in intermediate care unit for cardiovascular and flap surveillance. Color, temperature, and softness of the free flap are appreciated every hour for one day, every two hours from day two to four, every 4 hours from day four on. From this time on the patient can be admitted into regular station. Home departure is considered between seven and fourteen days depending on the site of reconstruction and patient's general health condition. Intraoral reconstructions need weaning of nasogastric tube which requires a few more days of hospital stay than extraoral reconstruction. Nasogastric tube is inserted during the operation. Drinking water is allowed since one postoperative day. Eating is started at fifth postoperative day for maxillary defect and seventh postoperative day for mandibular defect. Texture is gradually improved from liquid to smooth food the following days to allow removal of nasogastric tube during the second week. Considering medications patients benefit from

prophylactic heparin subcutaneous injections one day preoperative and once a day during their hospital stay, starting six hours after the operation. Antibiotics (penicillin if no allergy documented) as well as intravenous corticoids are given during operation and for three days postoperatively. Intraoral flap care is done with teeth brushing and mouth rinsing 3 times a day and extraoral flap care with ointment appliance on the sutures 3 times a day for two weeks.

Results

Between 2021 and 2022, 8 patients (1 woman and 7 men) underwent reconstruction with a lateral arm free flap at the University Hospital of Lausanne in Switzerland. Their ages ranged from 52 to 87 years, with a mean age of 65.25 years. The reconstruction site varied from the exenterated orbita for two patients, internal cheek for two patients, retromolar mandible, palate, mouth floor and frontotemporal each for one patient. Reconstruction was done in all patients for oncologic reason. Six patients received primary reconstruction during the same surgery as the tumorectomy and for two patients' reconstruction was done in a second surgery. Anastomoses have been done on temporal vessels in five cases and on facial vessels in three cases. Length of hospital stay was shortest of 6 days and longest of 16 days with a mean of 10.3 days**.** Considering resumption of oral food intake for intraoral reconstructions mean was 8 days after surgery with shortest time 2 days and longest 20 days. This long waiting for oral food intake was due to venous congestion of the flap at one postoperative day with loss of the superficial skin of the lateral arm flap. Since the reconstruction was on the internal cheek, we preferred waiting for full intraoral healing before allowing oral food. There were no perioperative complications. Six patients did not encounter any postoperative complications. Two patients presented with superficial flap skin loss. This was due to venous congestion. In one of these patients' revision of the cervical access was done and venous pedicle compression due to malposition of the pedicle loop was found. It could be repositioned without the need of redoing the anastomosis. The other patient presented slight venous congestions over the second recovery week possible due to tiny venous vessels with insufficient venous drainage. No revision was done in this case. Superficial debridement was done in these two patients with surgical wound dressings. The same patient with cervical revision presented cervical access and pulmonary infection during his hospital stay that resumed with cervical surgical drainage and antibiotic switch.

Donor site was the left arm for two patients and right arm for six patients. There was no need in any case to harvest additional pedicle length by placing the flap lower on the forearm or arm. All donor sites were closed primarily with one drainage. No donor site presented any complication.

Discussion

The first description of lateral arm flap has been done in 1982 by Song et al [2]. It has been used for a lot of different indications, mostly on traumatic wounds. Sullivan et al were the first to focus on this technique in head and neck reconstruction in 1992 [3]. Lateral arm for maxillofacial reconstruction is to be considered as a valuable alternative to radial forearm flap or anterolateral thigh free flap. One must consider its numerous advantages for the recipient as well as for the donor site. As described by Civantos et al [4] and Eun et al [5] this free flap is one of the most versatile flaps for head and neck reconstruction. Skin flap can be harvested from the thinner skin of proximal forearm [6] or thicker portion of the upper arm. Considering the tissue bulk it is in between of radial forearm free flap and anterolateral thigh free flap which is a real advantage in midfacial or scalp reconstruction especially since the fat in the lateral arm resists to ptosis since it is well compartmentalized. The thicker portion of the flap may be used for tongue base reconstruction allowing better swallowing functions whereas the thinner distal flap is ideal for the floor of mouth reconstruction without excessive bulk. Skin paddle size may range from 3x5 cm to 17x7 cm [7]. Useful modifications [8,9] have been described such as simple fascio-cutaneous flap or Musculo-tendo-fascio-cutaneous flap. Reinnervation can be done using the posterior cutaneous nerve of the forearm or arm, depending on the chosen skin flap [4]. The posterior cutaneous nerve of the arm provides an excellent branching pattern as vascularized nerve graft for cable grafting as for example in facial nerve sacrifice. A small, vascularized bone flap with the distal humerus may also be harvested if needed [10].

Advantages of this flap is also low donor-site morbidity: the posterior radial collateral artery is a nonessential arm vessel with constant anatomy. Harvesting can be done without using an Allan test and there has to be no concern about the perfusion of the hand. Donor site can be closed primarily with low aesthetic repercussion. If a skin graft might be necessary, it is a favorable recipient site because of the underlying muscle without risk of tendon exposition and healing problems. Harvesting is also done in supine position without intraoperative postural change need during the different steps of reconstructive surgery. Closure of the harvesting site can be done simultaneously with the insetting and anastomoses.

Disadvantages is mainly the vascular pedicle which can be short and tiny. Average of pedicle length is 5.58 cm but it can be harvested up to 10 cm and mean arterial diameter is 1.55 mm and mean venous diameter is 2.5mm [11]. This is why we privilege, if possible, from the proximity of the reconstruction site, to perform the anastomoses on the temporal superficial vessels since they

offer a good match of the diameter. Occipital and superior thyroid vessels offer an alternative with excellent size match. Anastomoses on facial vessels or if needed with vein grafts are a valuable alternative if one lacks pedicle length. However, discrepancy of vessel diameter in these cases might be challenging for the anastomosis performance. Recipient vessel choice depends also if the patient needs neck dissection. In this case facial or superior thyroid vessels are exposed and should be used.

Disadvantage of short and tiny vessels is the risk of compression of the venous anastomoses or insufficient venous drainage. This has been observed in two of our patients with subsequent superficial skin loss. A solution to this is the possibility to do two venous anastomosis and ameliorate flap venous return.

Female patients present often thicker subcutaneous tissue in the lateral portion of the arm which makes thicker skin paddles than in men. Lateral arm free flap can be used for the reconstruction of various sites in head and neck (Figure 2). It might be used for intra-oral mucosal as well as extraoral skin replacement. For maxillary intraoral reconstruction one can proceed to removable dental rehabilitation the days after the surgery since the dental appliance helps to flatten and reshape the flap against the residual palate. Mandibular intraoral reconstruction often needs more time before dental rehabilitation to allow skin paddle to reduce and adapt itself to its new environment. If dental prosthesis is done too early in these cases it will need more further tailoring than if one waits for a more stable, less swollen skin paddle. Extraoral reconstruction shows a good skin integration few weeks after surgery. Color skin match for the face is considered to be better than with radial forearm or lateral tight free flap reconstructions. The compartmentalized fat makes it a good tool for parotid reconstruction as well as external face and neck resurfacing.

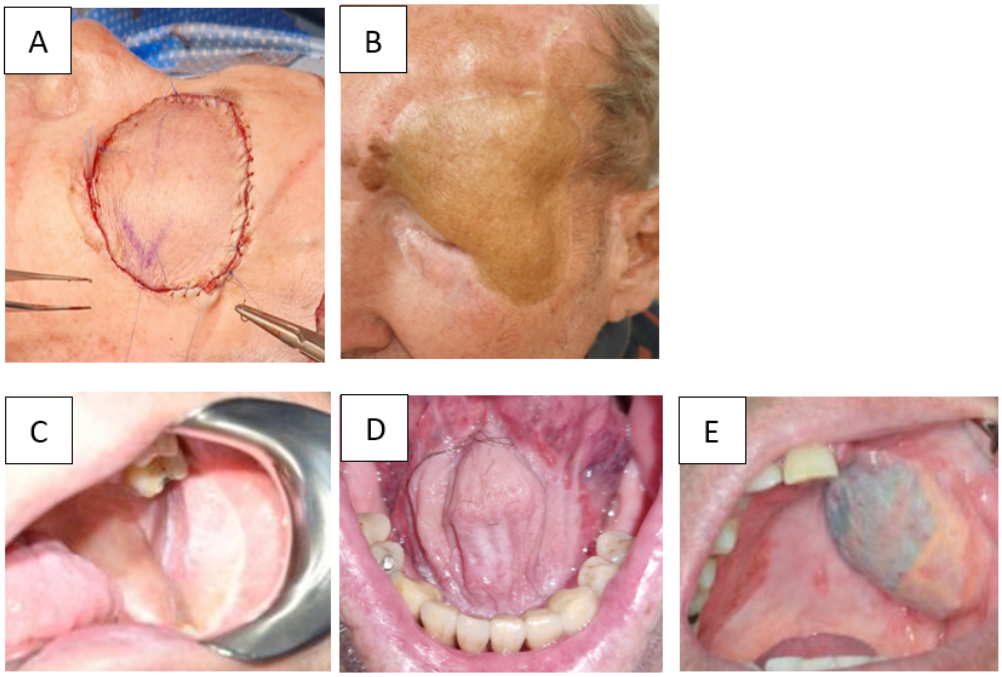

Figure 2: Extraoral and intraoral reconstruction sites. **A:** Exenterated orbita; **B:** Frontotemporal skin area; **C:** Internal cheek; **D:** Mouth floor; **E:** Palate.

Donor site heals as fast as 10 days and shows a very discreet thin scar (Figure 3). There is no functional or sensitive sequela for the patient. They can resume their manual professional or leisure occupation as soon as the surgical access is healed. No load restrictions are applied postoperatively.

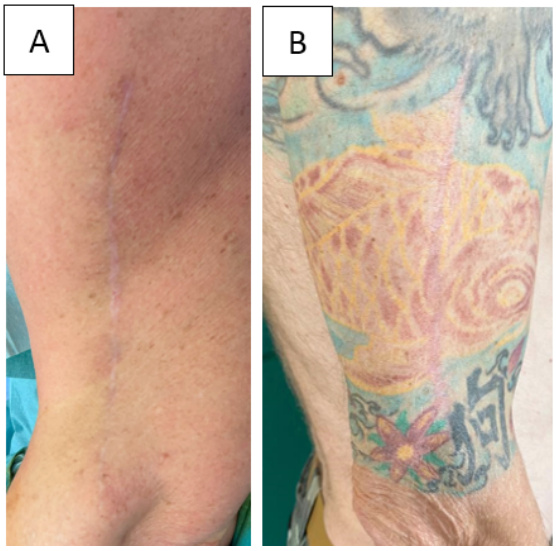

Figure 3: Donor site scar after few months **A:** left arm; **B:** Right tattooed arm.

Conclusion

The lateral arm free flap harvesting has been well described, it however remains underused compared to other free flaps such as radial forearm and anterolateral thigh free flap in head and neck reconstruction surgery. It is easy to harvest and shows low donor-side morbidity. The fat content, skin color and pliability make it ideal and it should be considered more often as valuable reconstruction option in head and neck defect. Temporal vessels offer a good match for microvascular anastomoses and should be considered as recipient vessels as often as possible.

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