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Les lambeaux libres revascularisés de scapulaire dans les reconstructions mandibulaires. A propos de 93 cas (Avril 1997 - Octobre 2009)

Revascularized free scapular flaps in mandibular reconstruction. About 93 cases (April 1997 – October 2009)

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Résumé

Objectif *: le but de cet article est de préciser la place du lambeau libre revascularisé de scapulaire dans la reconstruction mandibulaire en chirurgie cervico-faciale oncologique réparatrice. Nous discuterons des avantages et des inconvénients, des indications et des contre indications, ainsi que des éventuelles complications et séquelles de ce lambeau.* ***Matériels et méthodes*** *: il s'agit d'une étude rétrospective portant sur 93 lambeaux libres revascularisés de scapulaire pour reconstruire une perte de substance interruptrice de la mandibule entre Avril1997 et Octobre 2009 (chez 91 patients). Tous les patients ont été suivis avec un recul de 10 mois à 12 ans. Sur le site receveur : l'évaluation fonctionnelle a porté sur la qualité de l'alimentation, et de la déglutition.* ***Résultats*** *: le taux de succès était 94,63 % (5 nécroses sur 93 lambeaux). Sur le site receveur : les résultats ont été considérés comme bons (fonction normale ou quasi normale concernant l'alimentation et la déglutition), 83 % à 6 mois, 91 % à 18 mois. Sur le site donneur : les séquelles fonctionnelles ou douloureuses sont inexistantes (la rééducation post-opératoire a bien été menée chez tous les patients).* ***Conclusion*** *: le transplant scapulaire composite avec os, revascularisé par micro-anastomoses, présente un immense intérêt pour les pertes de substance interruptrices de la mandibule, osseuses pures (ne dépassant pas 13 cm), ou composites (pluri-tissulaires), secondaires à des résections carcinologiques ou ostéo-radionécrose.*

Mots-clés : Mandibule, reconstruction, scapula, microchirurgie, lambeau libre, tête et cou, cancer.

Summary

Objective*: The aim of the present article is to demonstrate the relevance of revascularized free scapular flap in mandibular reconstruction in oncological cervicofacial salvage surgery. We will discuss the advantages and the disadvantages, indications and contraindications, together with possible complications and sequelae for this type of surgical flap.* ***Materials and methods****: Retrospective study of 93 revascularized free scapular flaps used to reconstruct segmental substance defects in the mandible from April 1997 to October 2009 (in 91 patients). All patients benefited from 10 months to 12 years follow-up surgical and functional results. Functional assessment following anatomic site restoration focused on the quality of feeding and deglutition.* ***Results****: The anatomical success rate was 94.63% (5 complete necroses out of 93 flaps). Results were considered to be good (normal or close to normal function for feeding and deglutition) in the majority of patients (83% at 6 months, 91% at 18 months). On the donor site: Functional sequelae were moderate when post-operative reeducation was correctly performed.* ***Conclusion****: Vascularized free scapular flap bone graft is very interesting for the reconstruction of mandibular discontinuity, composite (soft tissue and cutaneous resection) or exclusively osseous defects (not in excess of 13 cm), secondary to oncologic or osteoradionecrotic resections.*

Key-words: Mandible, reconstruction, scapular, microsurgery, free flap, head and neck, cancer.

INTRODUCTION

The reconstruction of segmental substance loss in the mandible, composite or exclusively osseous defects secondary to oncologic resection or osteoradionecrosis is problematic. Composite bone graft, revascularized via microanastomosis, offers a single-stage procedure.

Today, the absence of mandibular reconstruction is barely acceptable due to the functional and cosmetic deficiency it implies. Mandibular reconstruction is essential to acceptable deglutition, phonation, cosmetic appearance and quality of life.

The surgical act must take into account: Bone resection (size, site); soft tissue loss for the restoration of

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mucosal and cutaneous volume and cover; cervical surgical history (neck dissection); arterial disease of the lower limbs.

Several donor sites have been proposed (fibula, scapular bone, iliac crest, radius…) for mandibular reconstruction. We concurrently use fibula and scapular flaps. The latter appeared to be particularly appropriate to our study population, due to the absence of arteritis on this donor site, and thanks to the wealth of multi-paddle compositions on several planes and to its reliability.

Scapular harvesting was considered for the very first time in 1978, by Saijo (1).

Then in 1981, Teot et al published the first results of scapular crest bone grafts (2). In 1984, Dos Santos improved our anatomic knowledge of this site and of this free flap (3). The same year, Batchelor and Sully were the first to associate the latissimus dorsi muscle with scapular paddles (4). In 1986, Granick et al reported the association of the latissimus dorsi with osteocutaneous scapular graft (5) and Swartz et al illustrated the mandibular applications of such scapular grafting on a series of 26 patients (6). In 1988, Deraemaecher et al were the first to propose the thoracodorsal axis via the angular branch as an exclusive source of vascularization of the inferior angle of the free edge of the scapula (7). This was confirmed by Coleman and Sultan in 1991 (8). Finally, in 1991, Aviv et al published a series of 6 cases of combined subscapular transfer (9).

Since the 1990s, applications of this type of transfer have been continuously developed. Several authors began successfully applying it to facial reconstruction; our own study focuses on the application of the free scapular flap in oncological mandibular salvage reconstruction (on a series of 93 cases) including advantages and indications, but also disadvantages, sequelae and contraindications.

MATERIALS AND METHODS

Our work integrated the retrospective study of 93 free scapular flaps performed on 91 patients following mandibulectomy from april 1997 to october 2009 at the François Baclesse Cancer Center in Caen (a homogeneous series and one unique team).

Among the 91 patients: 89 benefited from free scapular flap transfer; 1 patient benefited from two free scapular flap transfers secondary to resection for osteoradionecrosis of both mandibular angles, at a 6-month interval; 1 patient benefited from two free scapular flaps at a 2-year interval; the first was secondary to oncological resection and the second was secondary to osteonecrosis on the contralateral mandibular angle.

The median age at surgery was 55 years, with extremes ranging from 27 to 84 years.

Surgery was performed 78 times on male subjects (93.9%) and 15 times (16.1%) on female subjects, i.e. an M/F sex ratio of 5.2.

81 patients were alcohol and tobacco dependant,

5 patients had cirrhosis and 5 others had diabetes.

Patient medical histories at the time of surgery included: 35 having undergone cervical radiotherapy (35 flaps were therefore performed on irradiated tissue), 23 having undergone cervicofacial surgery and 17 having undergone both (table I).

TABLE I: Patient medical history.

	No surgery	Surgery	Total
Cervical radiotherapy	18	17	35
No radiotherapy	52	6	58
Total	70	23	93

All patients benefited from 10 months to 12 years follow-up.

The indications of the 93 surgical flaps were divided into two groups: 26 cases (28%) of osseous resection for osteoradionecrosis; 67 cases (72%) of oncological resection and reconstruction in a single-stage procedure (64 malpighian carcinomas, 2 adenoid cystic carcinomas, 1 osteosarcoma).

Among these 67 patients:

➢ 47 underwent postoperative cervicofacial radiotherapy (50 to 70 Gy). after a 6-week postoperative interval (2 received 50 Gy, 21 received 60 Gy and 24 received 70 Gy).

➢ 20 did not undergo postoperative radiotherapy because they did not need [11] or were irradiated earlier [9].

We performed 80 left scapular bone grafts (86%) and 13 right scapular bone grafts (14%).

The median length of bone used was 62 mm, with extremes ranging from 38 to 130 mm.

One osteotomy was performed in fourteen cases (none in 79 cases), in order to avoid bone fragments measuring less than 3 cm.

Reconstruction was:

• Exclusively osseous in 54 cases.

• Composite (osseous + soft tissue and/or cutaneous) in 39 cases: 15 double-paddle transfers: osseous and muscular (9 serratus anterior, 3 latissimus dorsi and 3 teres major); 3 double-paddle transfers: osseous and myocutaneous (serratus anterior); 20 double-paddle transfers: osseous and cutaneous; 1 triple-paddle transfer: osseous and 2 cutaneous.

According to the site and the extent of bone loss, we have summarized our excisions in figure 1.

These surgical procedures require three distinct operating stages and two position changes: a cervico-

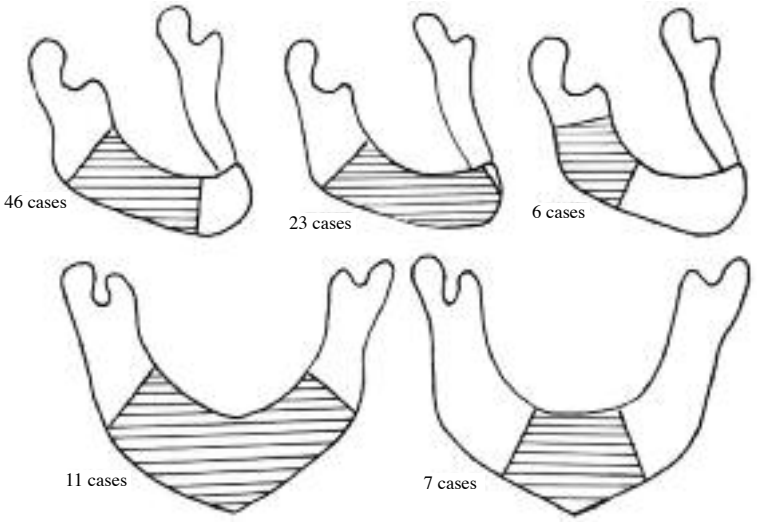


Fig. 1: Site and extent of mandibular bone loss in the 93 resections.

facial stage in supine position for resection, neck dissection, preparation of receiving vessels, a second stage in lateral decubitus for flap harvest, then a third stage, again in supine position for microsurgical anastomosis, adaptation of the flap and closure.

Initially, flap harvesting was performed on the contro-lateral side of the dominant hand, later it was performed on the contralateral side of tumour (and vascular anastomosis) in order to preserve the homolateral latissimus dorsi flap and to take full advantage of the natural curvature of the bone. Several muscular and/or myocutaneous paddles may be associated with bone harvest. In such cases, initial pedicle dissection allows to compensate for the frequently observed anatomic variations.

Functional results were assessed by the feeding type per os, tube and mixed. On the donor site, the abduction and antepulsion of the shoulder was studied.

RESULTS

The mean duration of the surgical procedure was 11h30 min, for a minimum of 9h and a maximum of 15h.

Mean duration of hospital stay was 23 days (range 13-62).

Immediate complications

5 complete necroses, none of patient with diabetes, none of patient with cirrhosis.

➢ 1 peroperative necrosis (non viable flap following 3 repeated anastomotic suture revisions, prior irradiated patient).

➢ - 3 complete postoperative necroses: Two necroses due to thrombosis of the arterial anastomosis (one patient irradiated, one non irradiated), and one necrosis due to thrombosis of the internal jugular vein following a cervical abscess (non irradiated patient).

➢ 1 partial cutaneous necrosis requiring complete flap removal (non irradiated patient).

There is no statistical difference for total flap failure between irradiated and non-irradiated patients, nor between patients with [2] or without [3] arteritis.

1 surgical revision (eighth day) with success for insufficient veinous return

1 partial cutaneous necrosis "saved" by leeches.

5 hemorrhages on the receiving site: 1 sudden death following carotid rupture; 4 surgical revisions (the flaps remained viable).

16 local dehiscences: 8 mucosal dehiscences, 6 cutaneous dehiscences and 2 salivary fistulae. These local complications occurred more often in previous irradiated patients (10/35 versus 6/58). Among the aforementioned complications, 13 were treated locally and 3 required surgical revision (all flaps remained viable).

5 postoperative deaths of cardiac origin (infarcts, rhythmic disorders).

Late complications

1 dissection of the carotid sinus with hemiplegia, 6 months after surgery (previous irradiated patient).

1 lymphorrhea on the donor site lasting several weeks and treated by puncture.

7 osseous complications assessed at 12 months:

➢ 5 patients presenting with lysis around the osteosynthetic material, 4 of them required ablation of the material.

➢ 1 osteosynthesis plate fracture discovered accidentally on x-ray but with no functional consequence.

➢ 1 pseudoarthrosis without functional disease.

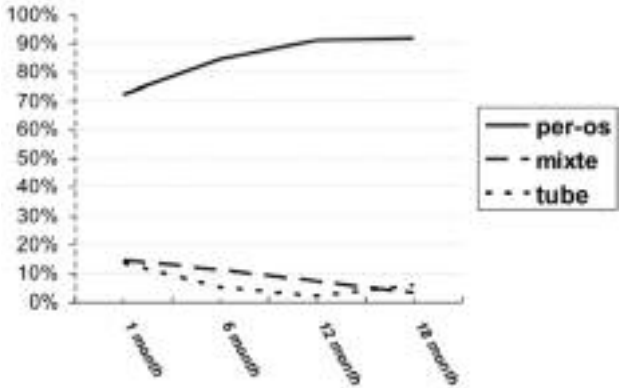
Bone lysis at 18 months in 1 patient did not require surgical revision.

We observed no partial nor total necrosis of flaps during or after radiotherapy.

Functional results

Deglutition was assessed in all evaluable patients (patients still alive, viable flap, no local recurrence) at 1, 6, 12 and 18 months from date of surgery, i.e. including the postoperative period and radiotherapy. Persistent feeding difficulties were observed when resection involved large amount of soft tissue.

The graph (1) represents the percentage of patients by feeding type: Per os, tube and mixed (per os + tube) during the postoperative period. At 18 months 91% of the patients were feeding normally.



Graph. 1: Evolution of deglutition at 1, 6, 12 and 18 months after surgery.

Fig. 2: Donor site (1 year after surgery).

On the axillary donor site:

Patients who correctly pursued their scapular reeducation recovered normal abduction and antepulsion of the shoulder; however, less motivated patients had persistent reduced shoulder mobility (fig. 2). Resulting scarring was acceptable.

DISCUSSION

Several exclusively osseous or pluritissular donor sites have already been described for mandibular reconstruction:

- Osteocutaneous radial forearm flap (10-11),
- Metatarsal bone grafts (12),
- Osteocutaneous outer arm flap (13),
- Clavicular osteocutaneous flap described by Reid et al in 1986 (14).
- Transplant of the internal femoral condyle (15).

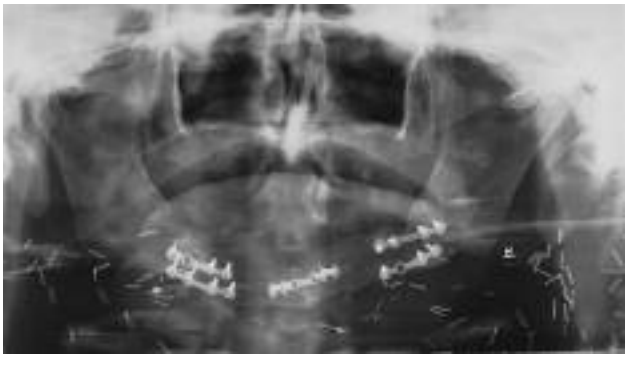


Fig. 3: Orthopantomogram (1 year after surgery).

These flaps are not routinely used for mandibular reconstruction.

Nevertheless, in our opinion three flaps appear to be the most appropriate: The iliac crest (16), the fibula (17) and the scapular bone (18). We have no experience with the iliac crest. We regularly use fibula flaps (the first used by our team) and scapular flaps.

Fibula harvesting (19) is simpler and can be performed concomitantly to resection. Long lengths of bone can be harvested (over 20 cm) and the quality of transferred bone is excellent, hence allowing reliable implantation. It is the reference free flap for pelvi-mandibular reconstruction. However, its skin paddle offers minimal mobility and precludes the restoration of important loss of substance, in particular lingual or oropharyngeal, occasionally requiring for a further flap to be harvested. This option constitutes for us an increasingly major and less satisfactory surgical procedure. Furthermore, the use of this free flap presents a risk among patients presenting with arteritis of the lower limbs. In our department, around 42% of patients requiring mandibular reconstruction (49 out of 117 scheduled mandibular reconstructions) presented with clinical and/or iconographic signs of arteritis, hence our preference for the scapular free flap.

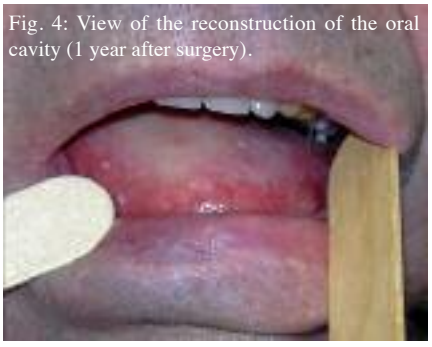


Fig. 4: View of the reconstruction of the oral cavity (1 year after surgery).

The scapular free flap: The absence of negative outcome of obliterating artery disease on the pedicle of this flap remains in our opinion, a major advantage (20).

The subscapular vascular axis is a reference axis. Blood vessel caliber can reach 2 to 2.5 mm at the origin of the circumflex scapular artery, giving this pedicle high reliability from a microsurgical point of view (fig. 5).

Blood vessel caliber can reach 2 to 2.5 mm at the origin of the circumflex scapular artery (repetition du paragraphe precedent). Vascular pedicle length is limited to 6 cm.

This free flap is of great value since a wide range of harvests are possible thanks to the subscapular axis' vast topographical potential.

- A strip of bone on the lateral edge of the scapula, of a length of 11 to 13 cm.

- Two skin paddles: one parascapular and/or one orthoscapular.

- Several muscular or myocutaneous flaps from the latissimus dorsi and/or serratus anterior, and/or muscular from the teres major.

Fig. 5: The subscapular vascular axis.

Fig. 6: A complex pluritissular oral reconstruction using a revascularized free scapular flap.

The spatial independence of the bone and myocutaneous paddles allows for complex pluritissular reconstructions (21) (fig. 6).

The mechanical characteristics of transferred scapular bone are close to those of the mandible. The external edge of the scapula, with its three cortical bones, is similar to the basilar edge of the mandible. The bone is solid at the top and more cancellous towards the tip.

The scapular bone is corticocancellous, therefore adapted to endosseous implant insertion conditions. The human body offers very few vascularized flat bones: the scapula is one of them (23). However, although the thickness of the free edge of the scapula is often compatible with the use of osteointegrated implants in men, careful consideration should be given to its use in women, as demonstrated by Frodel et al in their anatomic study (24).

In our own series, only one patient benefited from dental implants.

As in all free flaps, the scapula also presents a number of disadvantages. The drawbacks of this type of flap are (21):

• Harvesting is performed in lateral decubitus, which makes a two-team procedure extremely difficult, hence imposing three distinct surgical stages.

• Dissection remains a delicate procedure within a highly vascularized zone, with an often inconsistent anatomy. The dissection of the vascular pedicle can be a laborious task. It requires perfect knowledge of the anatomy of the region in question. Dissection time is relatively short for an experienced team familiar with the regional anatomy (from 1h30 to 2h30 depending on skin paddles).

• The quantity of available bone is limited compared to the fibula. The scapular free flap is essentially indicated in cases of major defect of substance requiring extensive soft tissue replacement, be it cutaneous and/or muscular. The entire harvested free edge measures, on average, 11 cm in women and 13 cm in men, to which 3 further centimeters can be added, if we include the contour of the tip of the bone (25). Discontinuity defect of mandibular bone substance of more than 14 to 15 cm is, in our opinion, incompatible with the use of the scapular bone. In these cases, we prefer the revascularized fibula free flap, whenever available.

• Defects can be exclusively osseous or associated with soft tissue (composite flaps). Skin paddle plasticity is good in slim patients, however it is of poorer quality in the case of thick adipose tissue.

• Vascular pedicle length is limited to around 6 cm and this should be kept in mind when considering indication based on the patient's cervical history and on the mandibular sector to be reconstructed.

Harvesting of the revascularized free scapular flap involves a number of contraindications resulting from patient history of:

• Axillary surgery having damaged the pedicle.

• Axillary and/or scapular scarring in case of associated cutaneous harvest.

Furthermore this flap can be used in old patient as the oldest patient was 84 and was successfully treated as it was pointed out by other authors (26).

CONCLUSION

Composite scapular bone graft, revascularized via microanastomosis, is a reliable free flap. The success rate in our series was 94.62% (5 complete necroses from 93 harvests).

It is of great relevance for the repair of segmental substance defect in the mandible in oncology, be it composite (pluritissular) or exclusively osseous, and not in excess of 13 cm. It offers an excellent complement to the free fibular flap in complex mandibular and facial reconstructions, especially for patients with peripheral vascular disease.

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