



# An original procedure for orbitonasal cutaneous infiltrative tumor repair, using combined forehead and melolabial propeller flaps

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## Abstract

**Introduction** Resections of cutaneous tumors in the medial orbitonasal region can be transfixing. Repairs using a single local flap run the risk of failure and that of secondary sinonasal fistula, especially in cases of surgery on a radiated field. We propose an original and reliable repair procedure using two pedicled regional flaps vascularized by two distinct arterial systems clinched together to reconstruct the mucosal and cutaneous planes.

**Materials and methods** A first melolabial propeller flap (MPF) with a superior perforating pedicle was elevated and the cutaneous side was sutured to the deep plane of the loss of substance (mucosal lining). A second homolateral or contralateral paramedian forehead flap (PFF) was then lifted and sutured over the first flap (superficial plane). The forehead pedicle flap was divided at 1 month.

**Results** No trophic complication or failure was recorded on two patients. The 7-year carcinologic, aesthetic, and functional results were satisfying.

**Conclusion** This technique involving the superimposition of two local flaps, vascularized by two different arterial systems, appears to offer a simple and reliable repair technique for transfixing cutaneous losses of substance in the medial orbitonasal region. It could be used in the first-line treatment, particularly if an additional radiotherapy is to be performed.

**Keywords** Nasocutaneous fistula · Medial canthus · Paramedian forehead flap · Melolabial propeller flap

## Introduction

Excision of cutaneous tumors in the medial and paralatero-nasal canthal region sometimes requires osseocutaneous transfixing resection given the thinness of the sub-cutaneous tissue in this anatomic area. A possible immediate consequence in this area of the need for adequate carcinologic margins can be the development of a sinocutaneous fistula. Whether perioperative or cicatricial, such fistulas can have major functional repercussions (chronic fistula oozing, cacosmia, epiphora, nasal breathing difficulties, nasal speech, and aesthetic discomfort) giving rise to impaired

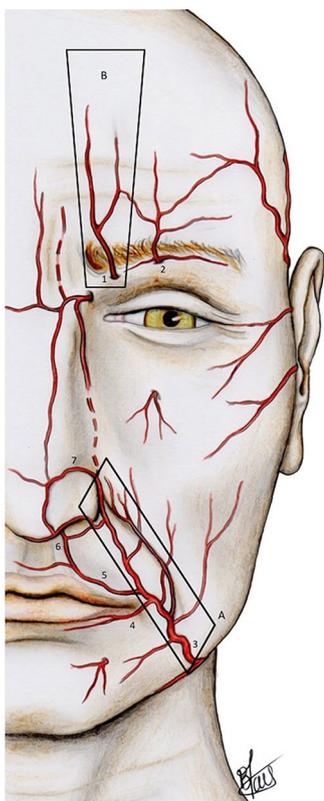
quality of life. When the fistulas are millimetric, guided healing [1] can suffice. Alternatively, multilayer surgical reconstruction can be considered given that the risk of development of a nasocutaneous fistula due to partial or total necrosis of isolated superficial local flaps ranges between 5 and 23% at 5 years [1, 2], and particularly in post-operative radiotherapy cases. It would appear reasonable, even in cases involving orbital exenteration in advanced tumors and even more so when adjuvant radiotherapy is being considered, to combine several local–regional flaps before resorting to microanastomosed free flaps.

The aim of this study is to propose an original surgical technique to repair nasocutaneous fistulas extending superficially from the medial ocular canthus to the homolateral lateral nasal region, and in depth to the nasosinusal cavities (nasal and ethmoid fossae). The technique combines two pediculated regional flaps vascularized by internal and external carotid arteries (Fig. 1). These are the paramedian forehead flap (PFF) and the melolabial propeller flap (MPF). The flaps are lifted at two opposing sites and are superimposed

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**Fig. 1** Superficial arterial vascularization of the face. A—Melolabial propeller flap; B—paramedian forehead flap; 1—supra-trochlear artery; 2—supra-orbital artery; 3—facial artery; 4—inferior labial artery; 5—superior labial artery; 6—nasal septal branch; 7—superior alar branch

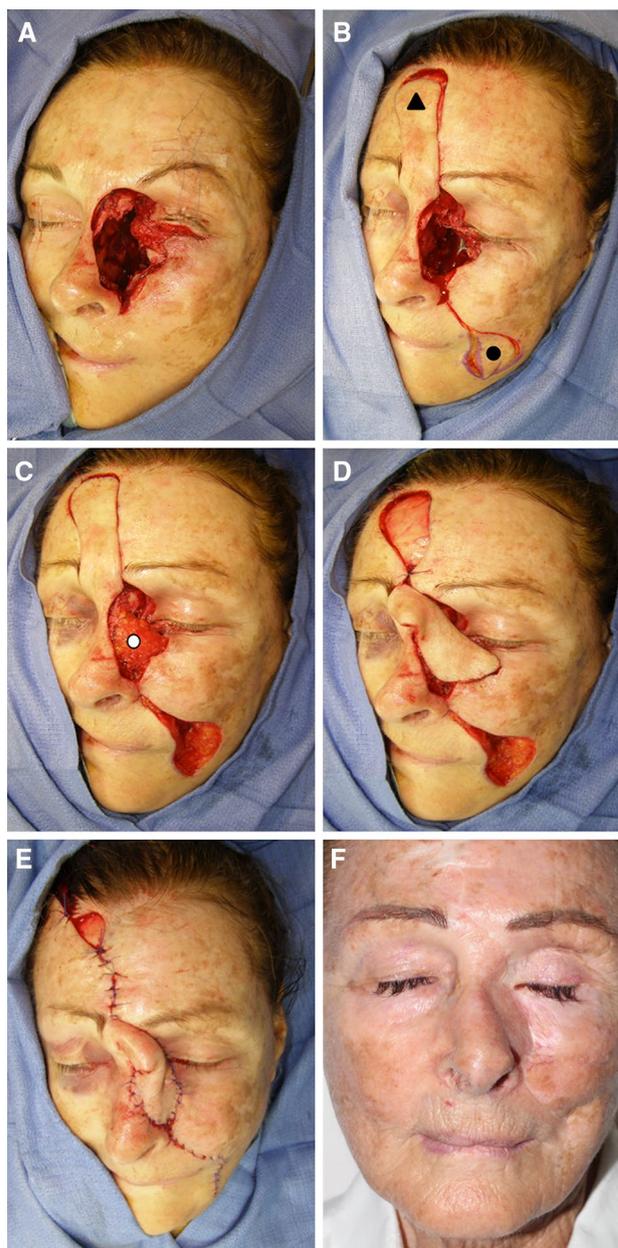
and gathered in a handshake-type formation (two opposing cutaneous surfaces). We report below on our clinical experience performing this double-flap procedure.

## Materials and methods

### Underlying repair principles

The principles underlying this repair technique are shown in Fig. 2. Once the nasocutaneous transfixing resection has been performed, the tear ducts are individualized and either preserved or sacrificed (with repermeabilization using a siliconized catheter) according to the surgeon's carcinologic approach.

In a first stage, a perforator MPF is lifted by designing a tapered flap, the lower margin of which is located in the melolabial fold. The size of the distal cutaneous paddle (excluding the pedicle) is adapted to the dimensions of the lost substance. The size of the cutaneous portion approximates a maximum of 50 mm in the long axis and 30 mm in width. It can be extended by 35–40 mm towards the



**Fig. 2** Example of performing our double flap: **a** first step: tumor resection; **b** harvesting the melolabial propeller flap (black circle) and the frontal forehead flap (black triangle); **c** flipping and stitching the melolabial flap to the bone resection margins providing the trophic support for the second flap; **d** flipping the paramedian forehead flap (cutaneous layer); **e** closing every incisions (the frontal unclosed area was skin grafted). The frontal flap pedicle separation is not shown here; **f** 7 years later result

substance loss while preserving the nasojugal fold. The inferior incision (buccal margin) is made first, beginning at the facial artery, to identify and isolate one, two, or three perforating arteries in the peri-alar region [3]. The MPF is then incised circumferentially. The arteriovenous vascularized pedicle is dissected while preserving sufficient peri-arterial

material to ensure venous vascularization and limit the risk of torsion during manipulations. The MPF is then turned 180° around its vascular hinge. The lower extremity is fixed with resorbable thread to a bone resection margin of the medial canthus, with the cutaneous paddle forming the intrasinus lining and the sub-cutaneous layer providing the trophic support for the second flap. The cheek margin of the flap is then sutured to the superior bony maxillary margins and the labial rim to the lateronasal sub-cutaneous tissues with resorbable thread. A two-plane direct suture maintains the closure of the harvesting site.

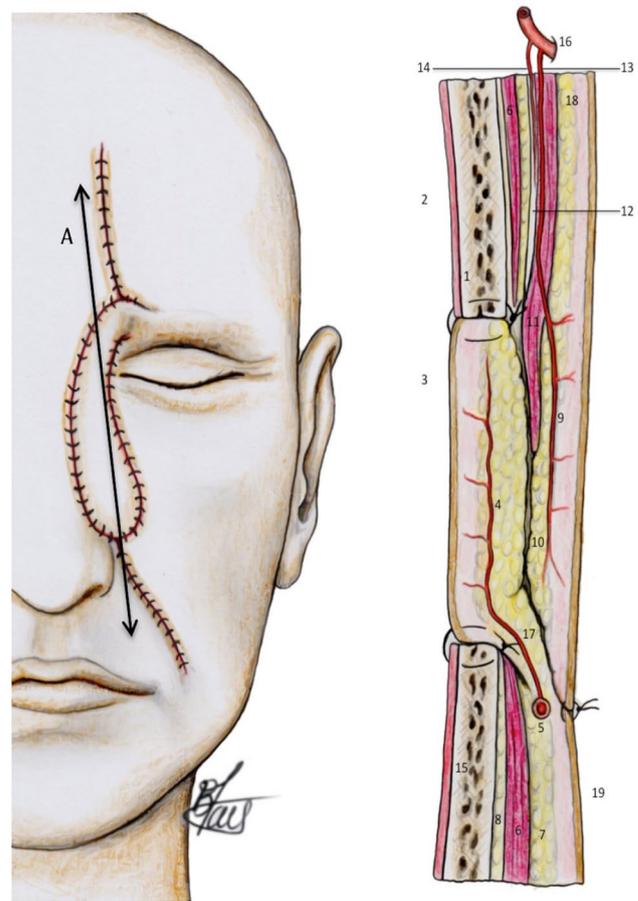
The second repair stage entails harvesting a PFF homolateral or contralateral tailored at the substance loss. The PFF pedicle (supra-trochlear artery) is systematically located via the pulse, or alternatively, when in doubt, using a portable Doppler. The PFF is then positioned with the cutaneous side outwards, sutured to the margins of the substance loss. The cross section in Fig. 3 illustrates the superimposition of the two flaps sutured one on top of the other.

Viability of the MPF is checked by nasofibroscope during the week following the procedure. Pedicle separation of the PFF can be done in two- or three-step procedure if an intermediary modeling before separation is required.

### Clinical cases

**Case N 1—Mrs B, 61 years (Fig. 2),** presented post-radiation relapse of an epidermoid carcinoma of the left medial canthus. The locoregional imaging work-up (MRI and cervicofacial CT scan) identified a left-side naso-orbital isolated tumor lesion on the lateral aspect of the nasal wing (18×11 mm) with rupture of the external ethmoidal wall and invasion of the anterior ethmoidal cells. No orbital, ocular, or muscular invasion was observed. Treatment of this patient entailed in block carcinologic excision of the tumor by transfacial approach [4] via an ethmoid-nasal bone flap combined with dual-path (external and endonasal) ethmoidectomy removing the entire ethmoidal content, the inter-nasosinus septum, and a portion of the middle turbinate and of the nasal bone itself. The substance loss was repaired with our double flap (contralateral PFF—Fig. 3). Canthopexy was performed with catheterization of the tear duct using a siliconized probe (left in place for 6 months).

**Case N 2—Mrs V, 58 years,** presented a cystic adenoid carcinoma of the right medial canthus. The locoregional imaging work-up (MRI and cervicofacial CT scan) revealed an isolated tumor lesion measuring 19×33 mm which was lysing the lower section of the nasal bones and which extended internally to the nasal cavity and the homolateral lacrymonasal duct. No intra-orbital invasion was found. Total carcinologic excision of the tumor was performed involving the internal orbital wall, the internal third of the infraorbital margin, the intersinus wall, the middle turbinate, the right ethmoid bone, and a



**Fig. 3** Schematic illustration of the post-operative appearance of the double flap. Sagittal cross section along the A axis. 1—Nasal bone (NB); 2—nasal side of the NB; 3—cutaneous side of the melolabial propeller flap turned over in the nasal fossa; 4—sub-dermal arterial network of the melolabial propeller flap; 5—facial artery; 6—muscles of the face in the plane of the superficial musculo-aponeurotic system (SMAS); 7—sub-cutaneous facial fat; 8—sub-SMAS fat; 9—sub-cutaneous path of the supra-trochlear artery; 10—sub-cutaneous tissue at the extremity of the paramedian forehead flap; 11—frontal muscle; 12—periosteum of the frontal flap; 13—trunk of the supra-trochlear artery; 14—periosteal section of the supra-trochlear artery; 15—superior maxillary bone; 16—ophthalmic artery; 17—pedicle of the melolabial flap; 18—pedicle of the frontal flap; 19—cutaneous surface of the face

portion of the nasal septum, and leaving a major substance loss in the right lateronasal area. A second repair procedure was carried out following a final histologic analysis of the excision margins. During the second surgical intervention (double flap—homolateral PFF), canthopexy was performed.

## Results

No post-operative complication was observed in either. Concerning decisions taken at radiotherapy and multidisciplinary meetings, no additional re-radiation was deemed necessary in the first case (total excision), while external re-radiation was delivered in the second case after the final histological margins. Both patients are still being followed up 7 years after showing a perfect cosmetic and functional stability of the flap assembly with no recurrence, breathing difficulties, olfactory disorders, or epiphora. Furthermore, for both patients, thickness gradually thinned.

## Discussion

Reconstruction of transfixing internal, primary, or secondary transfixing canthal substance loss is justified by virtue of the major functional and aesthetic impact of the resulting sinocutaneous fistulas. Using an isolated local flap (glabellar, cheek or pseudo-Mustardé technique, and nasal mucosa flap) entails the risk of cicatricial failure and of sequellary nasofacial fistulas. These risks are even greater when the patient has undergone radiotherapy. Regional flaps harvested at a distance from the operative field (already radiated in certain cases) limit the risk of fistula, especially when complementary radiation therapy is scheduled. The originality of this procedure lies in the combination of two “classic” flaps.

The MPF is rarely used to reconstruct the nasal cavities. It can be pedicled (superior or inferior pedicle [5, 6]) or harvested as an island flap and given a propeller form up to 4 cm in length and tunneled sub-cutaneously, when necessary [7]. It is cutaneous and, unlike the forehead flap, spares the facial muscles. Vascularization supplied by musculocutaneous arteries [8] originates from the facial artery which terminates most often in the lateronasal region [3], thus, almost systematically ensuring vascularization of the peri-alar area. Venous drainage, in parallel with the arterial drainage [3, 9], flows through the facial vein located deeper and more laterally [10]. A recent anatomical study on 20 hemifaces identified an average of three arterial perforators originating from the facial artery in the lateronasal region and two in the nasogenian region [3] measuring an average 18 mm. The authors claim that this study justifies skeletonizing the arteriovenous pedicle of the so-called perforating MPFs, the width of which can be reduced to roughly 1 cm without jeopardizing vascularization [10]. When upturned at depth, the pedicle effectively occludes the sinocutaneous fistula and provides an intranasal lining which is sutured directly to the bone

resection margins so as to accommodate another superficial flap and permit reconstruction of the superficial cutaneous plane. As previously described in anterior mouth floor reconstruction or in the PERS technique, the MPF can withstand both septic environment and plication [11, 12]. Disfigurement at the harvesting site is reduced if the lower flap margin is incised in the nasogenian fold [13].

The PFF is a reliable reconstruction technique for facial defects [14–17]. Its axial vascularization ensures good cicatricial trophism, good tolerance to post-operative radiotherapy, and, consequently, high reliability. Currently, PFF harvesting is well codified in three thicknesses [18] with the pedicle width reduced to between 0.8 and 1.2 cm. In the current practice, the pedicle contains only the supra-trochlear artery [15, 19, 20], which is detected by palpating the pulse before mapping out the flap or using a vascular Doppler blood flow detector [21]. The thickness, texture, and color of the pedicle are perfectly suited to pre-orbital and nasal reconstructions. The length of the PFF pedicle is generally sufficient to repair the internal orbitonasal region but can be augmented if necessary [16]. Although most often used in its paramedian homolateral form [14, 15, 17, 22–24], the contralateral PFF can always be used in the event of carcinologic need. In elderly patients, closure of forehead defects can be achieved directly.

Other surgical procedures have been used to repair these sinocutaneous fistulas. Several authors have used a bicoronal approach to perform a tunneled galeoperiosteal flap under the glabella associated with a cutaneous local advancement flap [25] (two cases) or a thin skin graft [26] (21 cases), or a contralateral frontal–periosteal–galeal island flap tunneled beneath the glabella (four cases), or, finally, a PFF combined with a free osteosynthesized calvaria bone graft [27] (18 cases) for wider defects (> 3 cm). When a skin graft was not used for superficial reconstruction, no fistula recurrence was reported by these authors who, nevertheless, reported a 30% rate of lacrimal or palpebral mechanical or infectious complications. Conversely, skin graft gave rise to partial (25%) or complete (10%) flap necrosis requiring revision surgery in 10% of cases [27]. Concerning depth reconstruction, even if an osseous segment is removed during the resection, it appears unnecessary to reinforce the assembly with a piece of cartilage between flap layers, since the MPF edges are stitched to the bone circumferentially, preventing the assembly from collapsing into the nasal fossa.

A *fascia temporalis superficialis* flap procedure has been described [28] for orbital reconstructions. However, tension-free advancement to an internal or lateronasal position is limited with considerable cicatricial damage. Finally, a combination of two opposing forehead flaps can be used with the same procedure that we have described to reconstruct the deep and superficial planes, but with more significant scarring.

In our view, this double MPF and PFF technique is reliable and can be used to close sinocutaneous fistulas exceeding 3 cm in the long axis in the medial region or paralateronasal region. A composite flap can be considered for larger losses of substance or in the event of failure by adopting a bicoronal route, but with the drawbacks inherent to this approach pathway. This technique has already been used successfully in the medial canthus region (three cases) but not on a wide substance loss in the lateronasal area [29]. Scarring damage is offset by the functional benefit and by the reliability of the reconstruction, and even more so if the tumor reconstruction margins are located within the area of the nasal aesthetic sub-units [20]. In the event of failure, microanastomosed free flaps can be used [30].

As with any procedure involving regional cutaneous-subcutaneous flaps, preoperative clinical assessment is essential [17]. This will eliminate any relative or absolute contraindication to their adoption which might compromise their viability. The evaluation should include the assessment of the patient's general condition, vascular status, facial radiation history, and tumoral scars and lesions in the harvesting region. The multi-stage procedure needs to be explained and discussed with the patient, who must be made fully aware of the risk/benefit ratio of these operations, of the scarring on the forehead and cheeks, and of the risk of iterative corrective procedures over time.

## Conclusion

Repair of cutaneous-nasal fistulas in the secondary medial orbitonasal region secondary to infiltrative cutaneous tumors poses a surgical challenge, particularly in cases of post-operative and/or post-radiation tumor recurrence. The most frequently used repair procedures (single, superficial, and local flaps) most often end in functional failure and consequent recurrence of the sinocutaneous fistula. We propose the association of superimposed local flaps, vascularized via two distinct pedicles, to obtain a thick, multi-layered, reliable, radiation-resistant structure using a propeller melolabial flap combined with a paramedian forehead flap. Performance of this technique on two patients has shown satisfactory results.

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## Compliance with ethical standards

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

**Ethical approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the insti-

tutional 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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