Distally Based Dorsal Nasal Flap in Nasal Ala Reconstruction: Anatomic Study and Clinical Experience

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BACKGROUND The nasal dorsum is a good skin flap donor site for alar reconstructions because of its qualities: appropriate color, texture, and thickness.

OBJECTIVE An anatomic vascular study on cadaver and the clinical use of the dorsal nasal skin flap, inferiorly based on the nasal septal branches, is reported.

MATERIALS AND METHODS Vascular anatomy of the nasal dorsum was demonstrated in five fresh-frozen latex-injected heads. Fourteen patients were operated of reconstruction of the nasal ala using an inferiorly based dorsal nasal flap.

RESULTS Nasal septal branches, from the superior labial arteries, give vascular supply to the nasal tip. Connections of these arteries with lateral nasal branches (facial system) and dorsal nasal arteries (ophthalmic system) form a consistent vascular network in the dorsal nasal superficial muscular aponeurotic system and allow to safely raise cutaneous flaps distally based. No total or partial loss of the flaps was observed in clinical use. The donor site was sutured directly in 13 patients and with a skin graft in one.

CONCLUSION The inferiorly based dorsal nasal flap provides very good cosmetic and functional results and could be considered an additional adequate surgical option for nasal ala reconstruction, especially when skin from the nasolabial fold, upper lip, and cheek is not available.

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Nasal ala defects have always been a reconstructive and aesthetic problem. Various methods of repair have been described.[1–6] Full-thickness small defects may be repaired using a composite chondrocutaneous ear graft and larger ones using pedicle flaps.

Partial-thickness defects can be repaired using skin grafts or pedicle flaps. Flap donor sites include the nasolabial region, nose, upper lip, forehead, and less frequently, distant areas.

Vascularization of the nasal skin depends on three main arteries on each side:[7–11] the dorsal nasal or external nasal artery from the ophthalmic artery, the lateral nasal branch from the facial artery, and the nasal septal branch, usually called the columellar artery, from the superior labial artery (Figure 1). Anastomoses of the dorsal nasal artery with the lateral nasal branch and anastomoses between the two contralateral lateral nasal branches have been already described.[7] However, the connections of the nasal septal branches with the other vessels that nourish this region have been neither mentioned nor clearly demonstrated in previous anatomic studies. Thus, over the years, facial surgeons have used the whole nasal skin as a local flap also distally pedicled, due to the vascularization supplied by the nasal septal branches.

We report the results of a nasal vascular anatomic study in cadavers and describe our experience in nasal ala reconstruction using the inferiorly based dorsal nasal flap nourished using the nasal septal branches.

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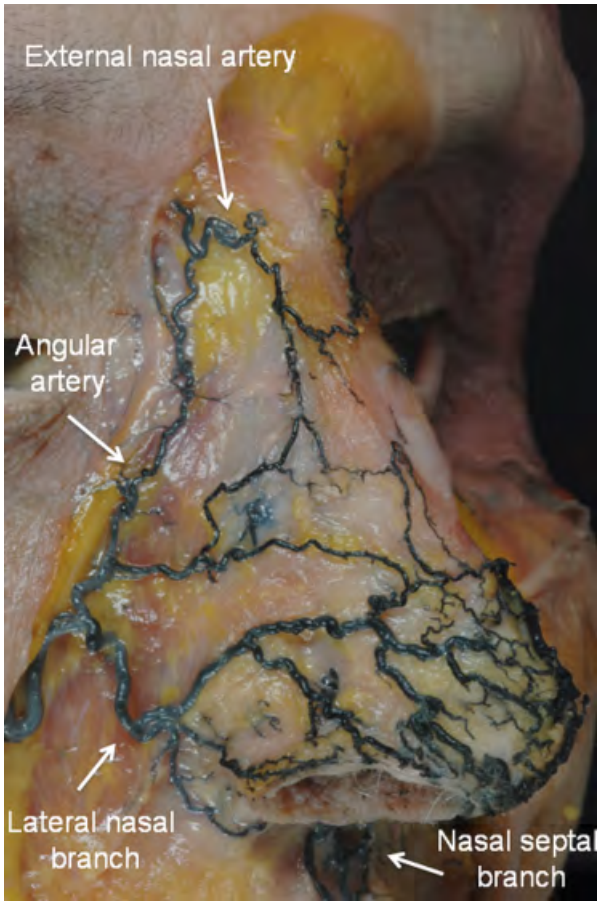

Figure 1. Vascular supply of external nose. Angular artery, external nasal artery, and lateral nasal branch are shown.

Materials and Methods

Anatomic Study

Five fresh-frozen, latex-injected heads were studied. The skin of the nasal dorsum, glabella, upper lip (superior to the vermilion), and nasolabial fold was removed. The vessels that nourish the nasal dorsum and the nasal tip were carefully identified and dissected. The orientation and location of the vessels and connections between them were observed.

Clinical Study

Fourteen patients, eight women and six men, underwent left or right nasal ala reconstruction with an inferiorly based dorsal nasal flap from June 2005 to January 2008. Nine had a basal cell carcinoma (BCC) of the right nasal ala. Four had a BCC on the left nasal ala, and in a 68-year-old female patient, the BCC involved the left nasolabial fold, the left nasal ala, the cheek, and the upper lip. A full-thickness alar defect occurred in six patients and a partial-thickness defect in eight. The average age was 69 (Table 1).

Surgical Technique

Every tumor was excised with safety margins. The inferiorly based dorsal nasal flap was planned by measuring the distance between the lateral margin of the defect and the nasal midline. This length was transferred to the nasal dorsum, starting from the interdomal point, to obtain the whole flap length (Figure 2). The flap was raised in a supraperiosteal-perichondral plane until it reached the domal area and was turned down to repair the alar defect (Figure 3). It is possible to find two dissecting planes during the harvesting of the flap: subcutaneous and supraperiosteal-perichondral. The second one includes the superficial muscular aponeurotic system (SMAS) in the flap, converting the vascular supply in a safer axial pattern instead of random (Figure 4).

The tip of the flap was anchored to the periosteum of the maxillary bone or to a cartilaginous remnant using an absorbable suture. The pivot point "dog ear" was corrected, when needed, by de-epithelization and suture of the skin (Figure 5).

The subcutaneous dissection allows the raising of a random vascular flap that, when rotated, can give a kinking of the flap. In a subcutaneous flap, a de-epithelization of the "dog ear" in the area of the pedicle may be a high-risk procedure because of a potential interruption of the subcutaneous vascular supply. When dissection is made in the supra-periosteal-perichondral plane, the main vascular supply of the flap becomes deeper and makes de-epithelization a safe procedure.

TABLE 1. Clinical Study

Sex	*Age*	*Tumor Location*	*Defect Thickness*	*Flap Donor Site Closure*	*Complication or Secondary Procedure*
F	68	Left nasal ala, nasolabial fold, cheek and upper lip	Full	Skin graft	Partial loss of a skin graft in the upper lip with scar retraction
F	72	Right nasal ala	Full	Direct suture	—
F	74	Right nasal ala	Partial	Direct suture	—
M	77	Right nasal ala	Partial	Direct suture	—
F	67	Right nasal ala	Partial	Direct suture	—
F	77	Left nasal ala	Partial	Direct suture	—
F	71	Right nasal ala	Full	Direct suture	—
M	69	Right nasal ala	Partial	Direct suture	Widening of a skin margin and dog ear correction
M	75	Left nasal ala	Partial	Direct suture	—
M	73	Right nasal ala	Full	Direct suture	—
F	62	Right nasal ala	Full	Direct suture	—
F	42	Left nasal ala	Partial	Direct suture	—
M	69	Right nasal ala	Partial	Direct suture	—
M	79	Left nasal ala	Full	Direct suture	—

With the full-thickness defects, the inner aspect of the flaps were covered using retroauricular skin grafts. The donor areas were closed directly or, in one patient, using a full-thickness skin graft.

Results

Anatomic Study

Soft tissue in the nose comprises subcutaneous tissue and SMAS. The nasal SMAS is located immediately

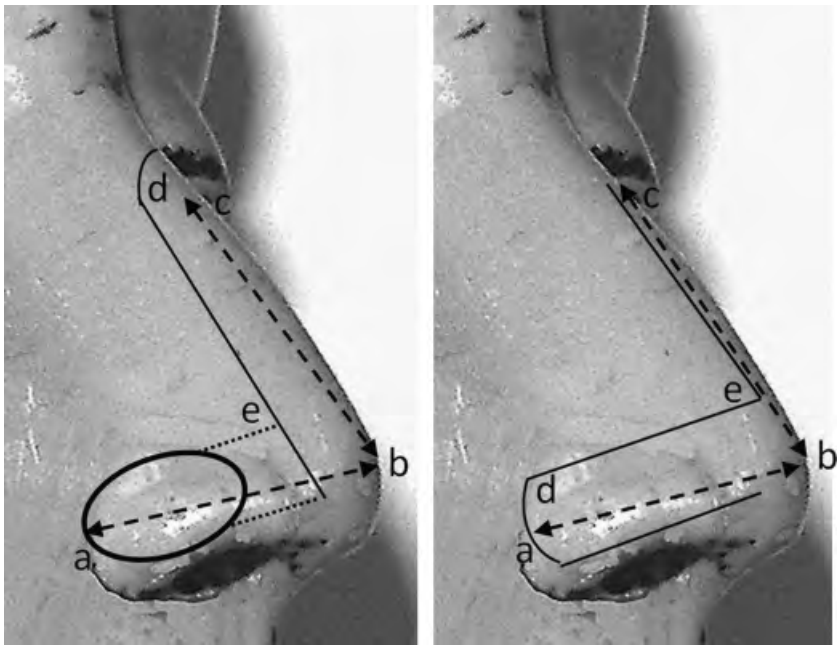

Figure 2. Schematic surgical planning. The distances a–b and b–c must be the same. In a lateral defect, dotted lines include an area that can be raised with the lateral flap.

Figure 3. Surgical procedure. The skin lesion with safety margins and the flap design were marked preoperatively. The skin tumor was excised. A retroauricular skin graft was sutured into the inner part of the defect. The dorsal nasal flap was harvested and rotated into the defect. Immediate postoperative result is shown.

superficial to the periosteum and perichondrium and encompasses the nasal musculature (procerus, levator labii, alaeque nasi, anomalous nasi, alar nasalis, depressor septi nasi, transverse nasalis, compressor narium minor, dilator narii anterior).

In the dorsal nasal SMAS, a consistent vascular network was observed, formed by connections between the main arteries that supply this region: the dorsal nasal artery, the lateral nasal branch, and the nasal septal branch. In the dorsal aspect of the nose, these connections were longitudinally oriented (Figure 6) and mainly formed, on each side, between the dorsal nasal artery and the lateral nasal branch. In the tip of the nose, important connections were found between the lateral nasal branch and the nasal septal branch. Connections of all these vessels were observed through the midline, especially at the tip of the nose.

Other vessels observed supplying this region and connecting with the network mentioned were small nasal branches from the angular artery and infraorbital artery (nourishing the adjacent lateral nasal skin), small branches from the anterior septal branches coming from the anterior ethmoidal artery (and entering the midline dorsal skin deeply), and an inferior branch from the lateral nasal branch. This last vessel was found deep in the nasolabial fold, running medially toward the midline and then ascending to the tip of the nose (Figure 7).

Clinical Study

No total or partial flap loss occurred. The donor site was closed directly in 13 patients (Figures 8 and 9), and in one case, a skin graft was needed. In this case, the take of a skin graft in the upper lip was incomplete and healed spontaneously, causing a scar

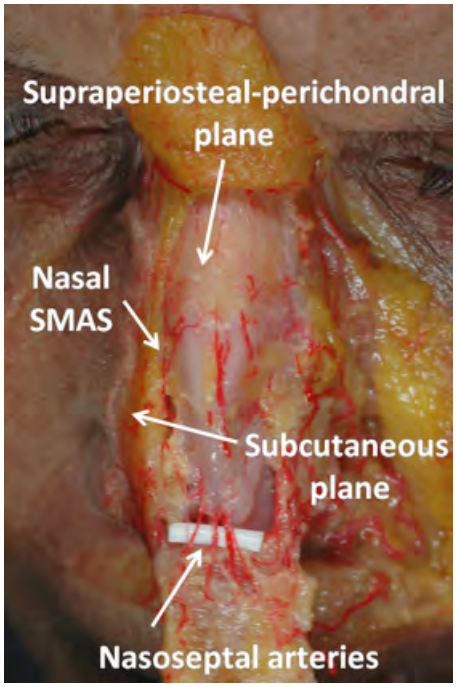

Figure 4. In the specimen, the skin was removed and the nasal superficial muscular aponeurotic system was harvested in a supraperiosteal-perichondral plane like a distally based dorsal nasal flap. The photograph shows the two dissecting planes: subcutaneous and supraperiosteal-perichondral.

retraction with lip distortion that the patient did not want to correct. One patient was reoperated on because of a widening of a skin margin caused by tumor infiltration in the biopsy. In this case, the flap was re-elevated and used to cover the new defect, but a secondary revision of the pivot point dog ear was needed.

Direct suture of the donor site in all patients resulted in a light flattening of the dorsum in its caudal portion, with a slight incisure between the tip and the dorsum in the lateral view. No patients complained about or asked for a revision of this light profile irregularity.

Discussion

The SMAS in the nasal dorsum has a consistent vascular network that interconnects all the branches that supply this skin. In clinical applications, this means that it is possible to raise, in a supraperiosteal-perichondral plane, the whole nasal dorsum skin based on each of the vessels that connect with the nasal SMAS. This vascular network has allowed surgeons to create reliable superiorly,[12] laterally,[2] and inferiorly[6] based flaps. Furthermore, according to our observations, it is possible to safely raise the whole nasal dorsal flap also inferiorly based on the nasal septal branches.

Edgerton and colleagues[13] first described the use of dorsal nasal skin flaps based on the nasal septal branches for columellar lengthening.

Orticochea[14] proposed the alar rim reconstruction using a compound flap, based on the nasal septal branches, from the nasal tip and the opposite ala. The length of this flap did not exceed the nasal tip and interrupted the residual nasal cartilaginous structures, often distorting the original shape of the nose. Our surgical experience and anatomical findings suggest that the length of a flap inferiorly based on the nasoseptal vessels can safely exceed the nasal tip and can include almost the whole dorsal nasal skin, to the glabellar area. Furthermore, whenever possible, it is preferable to avoid interrupting the residual cartilaginous structures to achieve a better cosmetic result.

Pontes and colleagues[6] described a nasal dorsum transposition flap for closure of an alar rim defect. The authors used a template to improve the flap design and make the reconstruction perfect. In their patient, the authors dissected the flap in two different planes: subcutaneous in the distal part of the flap and supraperichondrial in the proximal part. The portion of the flap that was dissected in a subcutaneous plane showed a clear pallor in the immediate postoperative photograph, due in part to epinephrine injection with local anesthetic. There was no tissue loss in the flap. In our flaps, most of which were longer than those of Pontes, we have always included the deeper plane of the SMAS in the whole length of the flap; consequently, we have never seen this pallor. We believe that, when the SMAS is included

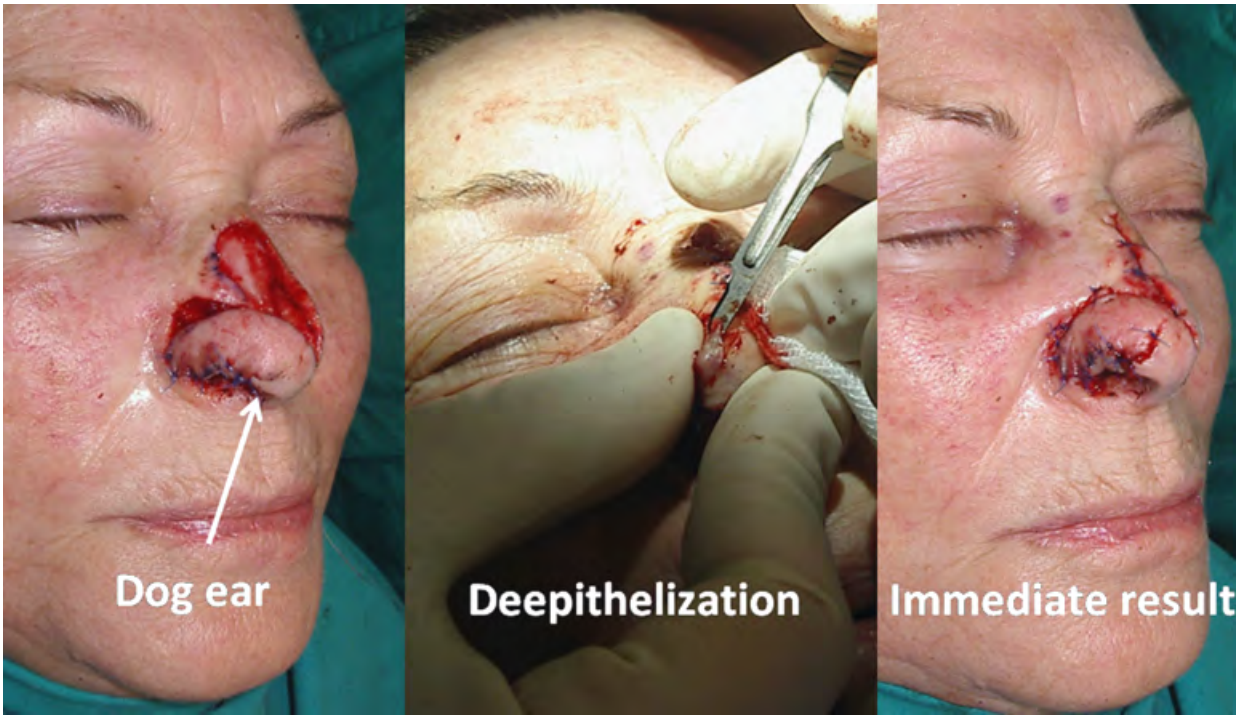

Figure 5. Dog ear de-epithelization is shown. When the distally based dorsal nasal flap is harvested in the supraperiosteal-perichondral plane, the superficial muscular aponeurotic system guarantees the main vascular supply, and this procedure can be safely performed.

Figure 6. Longitudinally oriented vascular pattern of the dorsal nasal superficial muscular aponeurotic system.

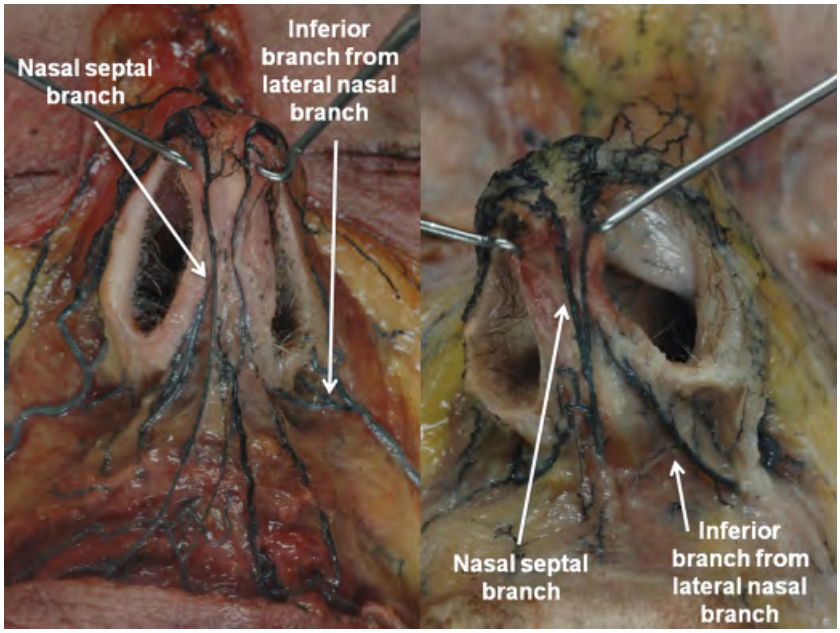

Figure 7. The nasal septal arteries and the left inferior branch from the lateral nasal artery are shown.

in the whole length of the flap, the vascular supply is converted in a safer axial pattern. Conversely, we consider interesting and ingenious the removal of the dog ear in the contour of the nasal orifice.

Some authors, such as Guerrerosantos and Dicksheet,[15] propose the use of a simultaneous insertion of a cartilage graft to better repair a full-thickness alar defect, but others, such as Gliosci and colleagues,[16] did not find it indispensable in all patients. In our experience, it is important to evaluate the residual cartilaginous structures at two critical points, the domus and the caudal part of the superior lateral cartilage. In full-thickness reconstructions, the risk of alar notching and the need for a cartilage graft will depend on the integrity of these structures. Furthermore, in the distally based dorsal nasal flap, the rotation of the tissue gives the flap a structural rigidity in the domal area (its pivot point) that allows the skin to fall into the defect as an arch, recreating a natural nasal ala.

The application of a skin graft on the inner surface of the flap in full-thickness defects was effective to avoid a thick nasal ala resulting in reconstruction with other flaps.

The inferiorly based dorsal nasal flap avoids deforming the alar facial groove. This deformation is experienced in many cases of melolabial transposition flaps.

The donor site was closed primarily except in one patient because of the lack of skin in the lateral nasal wall.

Although it is a narrow finger-like flap, we have not seen a "trap door." In all patients, during the first 6 to 8 months, edema is seen on the caudal part of the flap. This inflammation disappears with time.

The scar on the nasal dorsum also becomes inconspicuous with time. The dorsal nasal flap width is limited because of the need to directly close the donor site. A skin graft to repair the nasal dorsum is a procedure that should always be avoided when possible, and limitation in flap width allows its use only in alar defects that do not exceed alar edges.

Figure 8. A 77-year-old man with an infiltrating basocellular carcinoma of the left nasal ala. The full-thickness defect was reconstructed using an inferiorly based dorsal nasal flap. The inner part of the flap was covered using a retroauricular skin graft (preoperative and 15-month postoperative views).

Larger defects must be repaired with alternative flaps.

To avoid rim asymmetry and nasal tip distortions, it is advisable first to close the donor area and then inset and suture the flap.

In our series, no patients had a history of cigarette smoking, making the vascular supply of this flap safe. Cigarette smoking can negatively influence the healing process, including a graft take, but not flap survival.

Thick and sebaceous skin is not a contraindication to the safety of the flap, although it can produce a bulbous tip. In these cases, a better aesthetic result might be achieved with an alternative surgical option such as a melolabial flap.

With this one-step procedure, minimal morbidity of the donor area (with a linear scar in the nasal dorsum), a good amount of tissue available, and similar features of the skin to repair make the distally based dorsal nasal flap an interesting additional surgical option in nasal alar reconstruction.

Figure 9. A 42-year-old woman with a basal cell carcinoma of the left nasal ala. Preoperative views are shown. Skin tumor with safety margins and flap design were marked preoperatively. The defect was reconstructed using a distally based dorsal nasal flap. One-year postoperative results.

Conclusions

In our opinion, the dorsal nasal flap based on the nasoseptal arteries is a safe additional surgical option for nasal ala reconstruction.

Advantages of this flap are that the skin has similar texture and color, the defect and flap donor site is limited to a single anatomic structure, it is not bulky, it does not modify the alar facial groove as a lot of melolabial flaps do, the execution is simple, the operation can be performed under local anaesthesia, and good cosmetic result can be achieved.

The disadvantages of the flap can include a slight scar on the nasal dorsum that usually heals well, a light incisure above the nasal tip in the lateral view, and a bulbous tip in thick and sebaceous skin.

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