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The pedicled levator labii superioris alaeque nasi flap: A durable single-stage option for reconstruction of full-thickness nasal defects

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A B S T R A C T

Importance: Repair of full-thickness nasal defects can often be associated with multi-stage operations that can result in significant physical and psychological morbidity for patients. We present a single-stage option for reconstruction of these defects.
Objective: Demonstrate the utility of the pedicled levator labii superioris alaeque nasi flap and consistency of its vascular pedicle.
Design: Anatomical study using fresh cadavers.
Setting: Academic medical center.
Main outcome and measures: Evaluation of vascular anatomy of pedicled flap and measurements of distances with relationship to facial anatomic landmarks.
Results: With few noted anatomic variations, the vascular pedicle of the pedicled levator labii superioris alaeque nasi flap arises from the superior labial artery and is reliably located within 1 cm lateral and inferior of the nasal sill.
Conclusions and relevance: As a robust single-stage option, the pedicled levator labii superioris alaeque nasi flap can serve as a powerful option in the arsenal of the reconstructive surgeon. The technique for harvest is simple with attention to a few anatomic variations as described herein, and excellent results can be obtained with proper application.

1. Introduction

The nose is the most prominent feature in the human face. The characteristics of the nose play an important role in an individual's aesthetic appearance, as well as his or her cultural and overall identity. It is well-established that facial appearance is an important aspect of social interactions. The nose also has a vital functional role as a part of the upper airway, responsible for humidification and warming of air prior to its passage into the larynx.

To describe the anatomy of the nose as complex is an understatement. A three-dimensional construct involving skin, cartilage, intricate fascial connections, muscle, mucosa and bone, the human nose is one of the most difficult anatomic areas to reconstruct in an aesthetically and functionally sound manner. Unfortunately, due to its location and prominence, it is also a common location affected by cutaneous malignancy and facial trauma (12% of skin malignancies overall occur on the nose [1]). The defects created by trauma and resection of cutaneous malignancies can often leave patients with full-thickness nasal defects. Reconstruction of these defects has traditionally been thought to require attention to all elements of the nose, including the skin/soft tissue envelope, cartilaginous framework, and inner mucosal lining. Recently, however, successful use of regional flaps that omit the cartilaginous aspect has been described [2].

There are many options with which to accomplish this goal, including combinations of local or regional flaps (such as the paramedian forehead flap) with mucosal flaps and/or cartilage grafts, as well as microvascular free flaps. Many of these reconstructive options are associated with both physical morbidity (such as pain and/or functional deficits at a free flap donor site) and psychological morbidity (such as dealing with the time between the harvest of the paramedian forehead flap and the flap takedown). The reaction of an observer to a patient with nasal deformity – whether this deformity consists of the malignancy itself or, for example, a patient with an intact paramedian forehead flap pedicle – can have a significant negative impact on the patients' self-esteem and self-image. Patients can experience feelings of anxiety and depression due to this, and it can result in social isolation [1].

We describe a novel reconstructive option for full-thickness nasal defects that can easily be accomplished in a single stage, while still attaining excellent aesthetic and functional results. The pedicled levator labii superioris alaeque nasi (PLLAN) flap provides a durable reconstructive option that only involves a single stage of reconstruction and simplifies reconstruction further by obviating the need for a separate mucosal flap.

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1.1. Anatomy

The levator labii superioris alaeque nasi (AN) muscle originates superolaterally with an oblique orientation from the infraorbital rim and is closely associated with the zygomaticus minor muscle inferolaterally. In one anatomic study, if was found to be in continuity with the zygomaticus minor muscle in some specimens [3]. Its medial aspect insets into the frontal process of the maxilla and continues past this to join the nasal musculature. Deep to the AN muscle lies the sublevator space, which contains the vascular pedicle as well as a fat pad described in one anatomic study as the sublevator extension of the buccal fat pad [3]. The function of the muscle is to elevate the upper lip and nasal ala.

2. Methods

2.1. Harvest technique

For the purposes of this study, we used a V-shaped incision, with the medial aspect extending from the nasal sidewall down the melolabial fold to about 1 cm below the level of the nasal sill, and the lateral aspect extending to the same level superiorly as the medial aspect and terminating in the mid-cheek. In clinical practice, the incision can of course be tailored to fit the individual's defect. Next, extend the incision through the level of the dermis and the AN muscle, taking care to watch for the pedicle as it is sometimes just deep to the muscle (Fig. 1). Careful dissection in the sub-levator space will lead to identification of the pedicle. Once the pedicle is identified, divide the flap from the remainder of the muscle and elevated the flap from the subcutaneous fat and fascial connections laterally (Figs. 2 and 3). If further mobility of the flap is necessary, it can easily be used as an island flap (Fig. 4). Repair of the donor site typically results in the line of closure falling within the melolabial fold and nasofacial junction.

2.2. Measurements

With assistance from the Department of Cellular Biology and Anatomy, fresh cadavers of individuals who were enrolled in Louisiana State University Health's Willed Body Program, we performed dissections of the PLLAN flap bilaterally in order to identify the vascular pedicle. Using a V-shaped incision as described above, the flap was elevated. On each side, measurements were taken to the nearest millimeter of the relationship of the vascular pedicle (at the location it was first encountered during dissection) to the nasal sill, as well as the length of the pedicle itself from its origin at the superior labial artery.

Fig. 1. The vascular pedicle is often found just deep to the AN muscle.

Fig. 2. Flap has been divided from fat and fascial connections laterally, and now may be mobilized to the area of the defect.

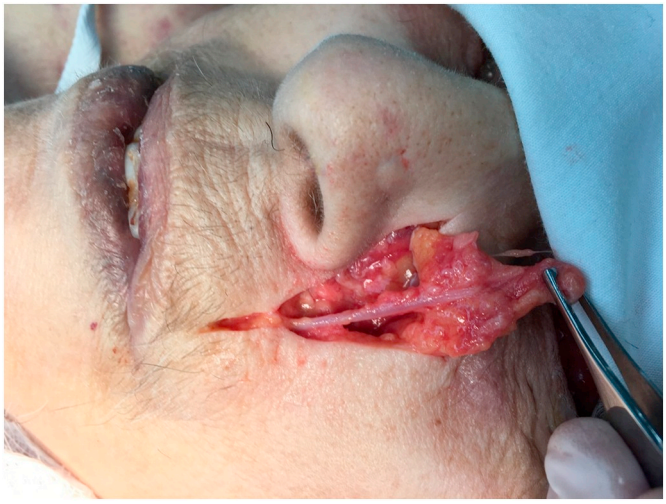

Fig. 3. The pedicle enters the deep surface of the muscle.

Fig. 4. Creation of island flap allows for greater mobility.

Measurements were taken of the distance to the vascular pedicle inferiorly and laterally from the edge of the nasal sill, as this was thought to be a readily identifiable and stable landmark. Any anatomic

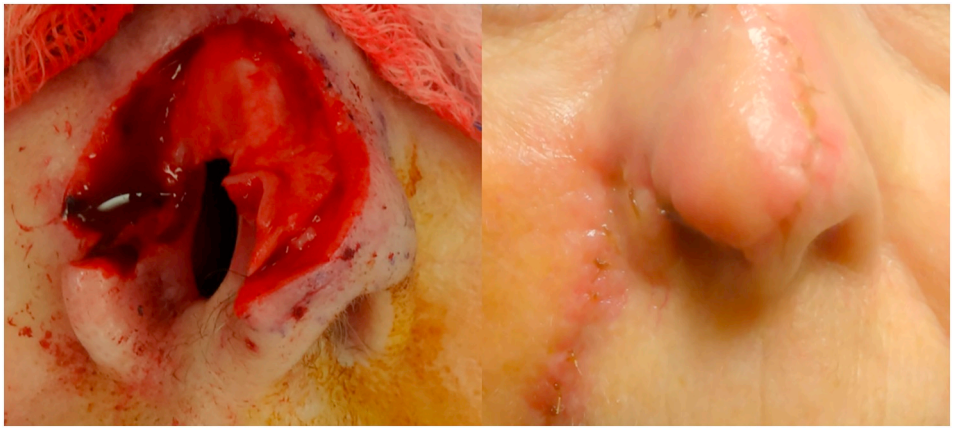

Fig. 5. On the left: post-excision defect of nasal tip, dorsum, sidewall, and majority of ala. On the right: 1-month post-operative appearance after reconstruction with pedicled levator labii superioris alaeque nasi flap. Note donor site defect hidden in melolabial fold.

Table 1
Pedicle location in relation to nasal sill.

	Distance from lateral border of sill inferiorly to pedicle	Distance from lateral border of sill laterally to pedicle	Pedicle length from sup. labial
Average	2.7	6.3	39.4
Range	−7 to 10	0 to 12	21 to 55
Median	3	5	39
St dev	3.23	3.00	8.41

variations were also recorded, and are described in the Results section.

3. Results

Average distances were determined using a total of 16 cadavers, with 27 facial halves total being used ($n = 27$). The unused facial halves were the result of the investigator being called to an emergency and unable to return prior to the designated embalming time of the cadaver. The measurements are noted in Table 1. 100% of pedicles were located within 1 cm inferiorly and 96% were within 1 cm laterally of the nasal sill (see Table 1). The depth of the pedicle varied somewhat, with some dissection inferiorly to the muscle needed at times to find the pedicle. The source of the pedicle was invariably the superior labial artery, and in all but one case it terminated in the (AN) muscle. Other anatomic variations were encountered as well. In two of the specimens, one on both sides and one only on the right (11%), dual pedicles were encountered. In only one specimen, the pedicle originated more medially, but still from the superior labial artery. The primary variation noted in the specimens was the depth at which the artery was identified; in some it was just deep to the AN muscle itself, but many times the artery was found somewhere in the sublevator space in the fat pad extension described above. In one of the cadavers with significant cachexia and atrophy of the muscle itself, a pedicle was not identifiable.

4. Discussion

There are numerous options for reconstruction of full-thickness nasal defects. When choosing a reconstructive option, the surgeon should take into account factors such as the patient's grasp of reasonable expectations post-operatively, overall physical and mental health, and reliability of the patient for follow-up. Use of multi-stage options such as a paramedian forehead flap and mucosal re-arrangements can produce excellent results cosmetically, but are associated with physical and psychological morbidity, which can lead to unsatisfactory outcomes. As in any case, extensive patient counseling on expectations and the reconstructive process is of the utmost importance. The pedicled levator labii superioris alaeque nasi flap's ability to serve as a single-stage reconstruction arises from the addition of the pedicled alaeque nasi muscle layer, which not only provides additional structural support but also mucosalizes over time. This mucosalization eliminates the need for a separate mucosal lining flap, further simplifying the reconstructive process. Described above, the technique for harvest is similar to the commonly-used melolabial transpositional flap, with the addition of muscle and pedicle identification. Once the flap is inset, the donor site can easily be closed with minimal morbidity. Thus far the authors have used the flap mainly for defects of the nasal alae, tip, and sidewall (see Fig. 5), however depending on pedicle length the flap could potentially be used for malar, lip, or other defects as well, especially if used as an island or tunneled flap.

As a robust single-stage option, the pedicled levator labii superioris alaeque nasi flap can serve as a powerful option in the arsenal of the reconstructive surgeon. The technique for harvest is simple with attention to a few anatomic variations as described herein, and excellent results can be obtained with proper application.

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