

Nasolabial Flap in Nasal Reconstruction: A Comprehensive Review

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ABSTRACT

The nasolabial flap (NLF) is one of the most versatile and frequently employed local flaps in nasal reconstruction, offering excellent tissue compatibility, reliable vascular supply, and the ability to conceal donor-site scars within the natural nasolabial crease. This review provides plastic surgery residents with a comprehensive and clinically applicable overview of the NLF, covering its anatomical basis, classification, indications, surgical technique, and outcomes in the context of nasal reconstruction following excision of non-melanoma skin cancers (NMSCs). We synthesize current evidence from retrospective series, case reports, and systematic reviews to address how defect location, size, and depth influence flap selection, and to compare the NLF against alternative approaches such as the paramedian forehead flap and skin grafts. The facial subunit principle a fundamental framework in preoperative planning is reviewed in detail. Emphasis is placed on technical pearls and perioperative decision-making relevant to the resident's learning trajectory. Complications, their prevention, and management are also discussed. The available evidence supports the NLF as a first-line reconstructive option for mild-to-moderate nasal defects, with outcomes comparable or superior to more complex procedures in appropriately.

KEYWORDS: Nasolabial flap, nasal reconstruction, skin cancer, facial subunit principle, local flap, basal cell carcinoma, plastic surgery

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I. INTRODUCTION

The nose is the most prominent and aesthetically critical structure of the face. Its complex three-dimensional architecture, comprising multiple aesthetic subunits with distinct skin properties, makes nasal reconstruction one of the most challenging endeavors in plastic surgery. Non-melanoma skin cancers (NMSCs), primarily basal cell carcinoma (BCC) and squamous cell carcinoma (SCC), represent the most frequent indication for nasal reconstruction, given the predilection of these tumors for sun-exposed facial areas.¹

Among the available reconstructive options—which span from primary closure and skin grafts to locoregional and free flaps—the nasolabial flap (NLF) has emerged as

one of the most widely adopted techniques. Its long history, first described in the surgical literature in the nineteenth century, reflects its consistent reliability across diverse clinical scenarios. The NLF recruits well-vascularized, sebaceous skin from the cheek that closely resembles nasal skin in color, texture, and thickness, while allowing the donor scar to be concealed in the natural nasolabial crease.

This review is intended as a practical educational resource for plastic surgery residents. We synthesize current literature on the anatomical basis, classification, indications, surgical technique, and outcomes of the NLF in nasal reconstruction, with particular attention to principles that apply to the clinical decision-making process encountered during training.

II. THE FACIAL SUBUNIT PRINCIPLE IN NASAL RECONSTRUCTION

Any discussion of nasal reconstruction must begin with the facial subunit principle, first introduced by Gonzalez-Ulloa in 1956 and later refined by Burget and Menick in 1985.^{4,5} This framework conceptualizes the facial skin as a collection of aesthetic units grouped by their shared characteristics of color, texture, thickness, subcutaneous fat content, and hair distribution. The nose is subdivided into the dorsum, tip, columella, paired alar lobules, lateral sidewalls, and soft triangles.



Figure 1-Nose esthetic units

shadow and contour lines coincide with those junctions. (6) Second, when a defect involves more than 50% of a given subunit, it is often preferable to excise the entire subunit and reconstruct it as a whole rather than patch the partial defect, as this strategy typically yields superior aesthetic results by hiding scars at predictable natural folds. (7)

It is important to note, however, that the subunit principle should be applied with judgment rather than dogmatism. Several authors have cautioned against the unnecessary sacrifice of healthy tissue, particularly in elderly patients with multiple comorbidities or in cases where tumor margins are difficult to delineate macroscopically. (8) In such situations, a more conservative approach, prioritizing oncological clearance while minimizing tissue loss, may be preferable.

A. Preoperative Planning Principles

Successful nasal reconstruction requires a systematic preoperative analysis as outlined by Patel and Sykes.⁽⁹⁾ This involves: (1) characterizing the defect by skin color, thickness, tissue composition, location, and subunits involved; (2) applying the reconstructive ladder from simplest to most complex options; (3) considering adjacent anatomy and facial landmarks that do not tolerate distortion; and (4) designing flaps so that scars lie within relaxed skin tension lines and parallel to lines of maximal extensibility. Thorough application of these principles before each case enables the resident to develop a coherent preoperative plan rather than improvising intraoperatively.

III. ANATOMICAL BASIS OF THE NASOLABIAL FLAP

The nasolabial or melolabial flap is harvested from the cheek lateral to the nasolabial fold. This region offers several favorable tissue characteristics: skin laxity due to

gravity and facial aging, a rich subdermal vascular plexus, sebaceous texture similar to nasal skin, and proximity to the nose that facilitates easy transposition.⁽¹⁰⁾

The vascular supply of the NLF is random-pattern, relying on the subdermal plexus rather than a single axial vessel. However, facial artery perforators are consistently identified in a 1 cm² area along the nasolabial fold lateral to



Figure 2- Nasolabial flap blood supply

the alar base, forming the anatomical basis for islanded or propeller-type NLFs.³ The primary arterial contributors include branches of the angular artery, the superior labial artery, and the dorsal nasal artery.⁽¹¹⁾

Because the NLF is a random/perforator flap rather than an axial flap (unlike the paramedian forehead flap), it can theoretically be harvested from the same donor site more than once over time if needed, and it is not precluded by the absence of forehead skin.⁽³⁾ Furthermore, the random blood supply allows greater design flexibility in terms of pedicle orientation.

A. Pedicle Options

The NLF can be raised on a superior, inferior, or subcutaneous (islanded) pedicle, depending on the location of the defect and the surgeon's preference.⁽¹²⁾ Superior pedicle flaps are most commonly employed for defects of the alar lobule, tip, and lateral sidewall. Inferior pedicle flaps are suited for the upper third of the dorsum and sidewall, and can provide coverage for upper or lower lip defects as well as floor of nose reconstruction. Subcutaneous islanded flaps pivot on a perforator cluster and allow reconstruction of any nasal subunit with a wider arc of rotation and less pedicle bulk.³

IV. CLASSIFICATION OF NASOLABIAL FLAP

Based on their movement pattern, NLFs can be classified into four main types, each with specific indications.

Advancement (V-Y) flaps move along the long axis toward the defect. They are primarily indicated for infraorbital, medial canthus, and lateral nasal reconstruction and are well suited for areas where the lower or middle third of the nose meets the cheek. This is a single-stage technique.

Rotation flaps pivot at a base point with the lateral limit of the defect coinciding with the medial margin of the flap. They are indicated for upper lip lateral segment reconstruction or defects of the nasal sidewall, typically requiring 30° to 60° of rotation. This is also performed in a single stage.

Transposition flaps are lifted and rotated to reach an immediately adjacent defect. This technique is indicated for oral cavity reconstruction and complex alar or nasal tip

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defects, and the flap can be folded upon itself to restore nasal lining in combination with other flaps.

Interpolation flaps are passed over a bridge of normal skin to reach a defect not immediately adjacent to the donor site. Because the pedicle crosses non-defect skin, a second stage is required approximately 3 weeks after the first procedure to divide and inset the pedicle. These flaps are commonly used for nasal tip, columella, and full-thickness alar reconstruction.

V. INDICATIONS AND DEFECT ASSESSMENT

The NLF is indicated for cutaneous nasal defects resulting from NMSC excision, trauma, or prior reconstructive failures. Historically considered appropriate only for small alar defects (less than 1.5 cm), contemporary evidence from large case series demonstrates that the NLF can be safely applied to any nasal subunit and to multi-subunit defects in appropriately selected patients.(3,14)

Defect assessment should address size, depth, and subunit involvement. For superficial, partial-thickness defects less than 1 cm in diameter without cartilaginous involvement, primary closure, full-thickness skin grafts, or bilobed flaps may be preferable. For defects between 1.5 cm and 3 cm in the alar, tip, or sidewall subunits without full-thickness extension, the NLF is generally considered the technique of choice.(8) For large multi-subunit defects exceeding 3 cm, or those involving the full thickness of the nose, the NLF may need to be combined with a forehead flap or cartilage grafts, or the paramedian forehead flap may be preferred as primary reconstruction.

Patient factors also influence flap selection. Elderly patients with skin laxity and redundant nasolabial tissue are ideal candidates for the NLF, as tissue harvest is facilitated without donor-site tension. Patients who refuse forehead scarring, those on anticoagulant therapy who cannot tolerate multiple procedures, and individuals in resource-limited settings where two-stage surgeries are impractical are also excellent candidates for the single-stage NLF approach.(3)

A. Comparison with the Paramedian Forehead Flap

The paramedian forehead flap (PFF) has long been considered the "workhorse" for medium-to-large nasal defects. Its reliability, ample tissue volume, and skin texture match make it indispensable for extensive or full-thickness reconstruction. However, the PFF typically requires at least two surgical stages, often necessitates cartilage harvesting, and produces visible donor-site scarring on the forehead factors that may be unacceptable to some patients.(3)

Compared with the PFF, the NLF offers lower donor-site morbidity, superior scar concealment, shorter recovery, and the possibility of single-stage reconstruction. A recent systematic review and meta-analysis confirmed that complication rates of the NLF are comparable to or even lower than those of the PFF, with consistently high aesthetic and functional satisfaction in appropriately selected patients.(15)

VI. SURGICAL TECHNIQUE: STEP-BY-STEP APPROACH

A thorough understanding of the operative steps is essential for the resident approaching nasal reconstruction with the NLF for the first time.

A. Defect Delineation and Template Creation

After confirming tumor-free margins (by conventional excision with adequate margins or Mohs micrographic surgery), the defect should be carefully measured and delineated. Because the



three-dimensional anatomy of the nose causes soft tissue defects to appear smaller than they actually are, a foil template cut to the exact shape and size of the defect is recommended. This template is then

transposed to the nasolabial donor area to plan the flap dimensions accurately and to minimize intraoperative adjustments.(3)

B. Pedicle Selection and Flap Design

The choice of pedicle is guided by the aesthetic subunit involved, defect size, and the surgeon's experience. A tape strip matching the distance from the vascular source to the defect is a practical technique for testing pedicle reach before flap incision. For superior pedicle flaps, the medial margin is drawn parallel and slightly medial to the



Figure 4.- Nasolabial flap marking front view.

nasolabial fold, while the lateral margin extends from the modiolus to the naso-jugal groove. The flap width is determined by the defect dimensions, and excessive tension must be avoided to prevent distortion of the upper lip or lower eyelid.

C. Flap Harvest

A 15-blade skin incision is made, and the flap is elevated through the subcutaneous fat using electrocautery in cut mode or blunt scissor dissection. For reconstruction of the nasal tip, dorsum, or sidewall, subcutaneous tissue is removed, leaving only a thin layer of dermal fat to preserve the subdermal vascular plexus. For alar reconstruction, the flap is left thicker to replicate the natural puffiness of the lobule. The pincushion effect that



Figure 5.-Nasolabial flap

naturally occurs upon transposition of the flap also assists in reproducing alar convexity.(3)

D. Flap Tunneling and Inset

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When a skin bridge persists between the donor site and the defect (paramedian defects), a subcutaneous passage is created and the flap is de-epithelized in its proximal portion, then tunneled beneath the bridge. This technique preserves the skin bridge, which applies gentle pressure to enhance contour and keeps scars between—rather than across—nasal subunits. The "amphora" flap design, with a wider "belly" for coverage and a narrower "neck" for tunneling, facilitates this maneuver.(3)

Quilting sutures passed through the full thickness of the flap from the lining side are used to redefine the alar groove. Pinching subcutaneous sutures anchoring the flap to the periosteum of the maxilla—without crossing the dermis—restore the nasolabial-alar groove. The donor site is closed primarily before final flap refinements are performed.

E. Framework and Lining Considerations

When cartilage defects co-occur, repair with cartilage grafts from the contralateral alar cephalic strip, nasal septum, or auricular concha is recommended to prevent nasal valve collapse and maintain long-term structural integrity. For full-thickness defects involving the alar rim, a folded-in NLF provides internal lining, while for defects near the narinal opening, the NLF can reconstruct both skin and vestibular lining.(3,14)

F. One-Stage Versus Two-Stage Procedures

In general, one-stage procedures are preferred for smaller, adjacent defects amenable to rotation or advancement techniques. Two-stage interpolation flaps are indicated for larger or more complex defects not immediately adjacent to the donor site, where the pedicle must bridge intact skin. The decision should account for defect complexity, patient preference, and tolerance for staged procedures. Division of the pedicle at the second stage (typically 3 weeks post-operatively) ensures adequate neovascularization from the wound bed before complete detachment.(13)

VII. CLINICAL OUTCOMES AND EVIDENCE REVIEW

The largest case series on the NLF in nasal reconstruction was published by Cozzi et al., describing 378 consecutive patients treated over a 16-year period at a major Italian plastic surgery center.(3) In this series, all nasal subunits were involved, including 20 patients with multi-subunit defects, and all cases were performed as single-stage procedures. Functional and cosmetic restoration was achieved in all patients, with a mean hospital stay of 1.68 nights and an average surgical time of 61 minutes. Minor debulking procedures were needed in 10 patients (2.6%).

In a retrospective series of 310 patients with NMSC undergoing nasal reconstruction with locoregional flaps by Marcasciano et al., the overall complication rate was 2.3% for cases requiring revision (partial flap necrosis in 1 patient, wound dehiscence in 6), with an infection rate of

1.9% and a cancer recurrence rate of only 1.6%.⁸ The NLF was employed across multiple nasal thirds and was associated with satisfactory aesthetic results in all reported cases.

From the oncological perspective, Dorantes-Millan et al. reported a case of full-thickness nasal ala reconstruction following micronodular BCC excision with 5 mm margins, achieving histopathological free



Figure 6.- Nasolabial flap

margins and excellent cosmetic integration at 2-month follow-up.(11) This case reinforces the feasibility of immediate single-stage NLF reconstruction even for aggressive BCC subtypes, provided adequate oncological clearance is obtained.

The comparative evidence between NLF and PFF was synthesized in a systematic review by Chakraborty et al., which concluded that the NLF demonstrates complication rates comparable to or lower than those of the PFF, with high levels of aesthetic and functional satisfaction in appropriately selected patients.¹⁵ Complication rates for the NLF across pooled studies generally range from 2% to 5%, comprising partial necrosis, pin-cushioning, trapdoor deformity, and infection—all of which are manageable with conservative measures or minor revision.

VIII. COMPLICATIONS AND THEIR MANAGEMENT

Residents should be familiar with the potential complications of the NLF and their management strategies:

Trapdoor or pincushion deformity is the most commonly reported aesthetic complication. It results from scar contracture at the flap margins and can be minimized by designing the flap slightly smaller than the defect and avoiding excessive skin tension at inset. Late deformity may be managed with intralesional corticosteroid injections, serial compression, or surgical debulking.

Partial flap necrosis, though rare given the NLF's robust blood supply, can occur in islanded perforator designs due to venous congestion. Careful monitoring in the first 48 postoperative hours and early loosening of sutures if congestion is identified are key management steps.(3)

Asymmetry of the nasolabial fold results from blunting of the nasofacial angle at the donor site. This can be partially corrected by pivoting the flap above the nasofacial angle and placing key sutures to recreate physiological nasal concavities.(3)

Hair-bearing skin transfer is a concern in male patients, where the NLF donor site may include hair follicles. Harvesting the flap lateral—rather than medial—to the

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nasolabial fold usually avoids this issue, though it may not always be feasible in all male patients.(3)

Donor-site complications including wound dehiscence and infection occur in a small minority of patients and are generally managed with local wound care or oral antibiotics.(8)

IX. SPECIAL ANATOMICAL CONSIDERATIONS

A. Columellar Reconstruction

Columellar defects, whether arising from skin cancer excision, trauma, or iatrogenic injury, represent a particularly challenging subunit due to the unique skin characteristics and functional importance of the structure. Bilateral opposing NLFs a technique in which two nasolabial flaps are transposed and sutured together at the midline provide effective single-stage coverage of columellar and simultaneous upper lip defects. Faenza et al. described this approach in a 47-year-old patient with a 3-cm squamous cell carcinoma of the columella, achieving excellent functional and aesthetic outcomes at one-year follow-up.(15)

Alternative techniques for columellar reconstruction include nasal vestibule flaps, nasal sill advancement flaps, philtrum flaps, and peri-alar hatchet flaps—each with distinct advantages and limitations. Among these, the bilateral NLF remains the most versatile, as it allows simultaneous coverage of both the columella and the upper lip in a single surgical stage.(15)

B. Nasal Alar Reconstruction

The nasal alar lobule presents unique reconstructive challenges due to its convex three-dimensional shape, free margin, and the functional requirement of maintaining nasal airway patency. The NLF is ideally suited for alar reconstruction given its natural tendency toward pincushion convexity when transposed, which approximates the shape of the alar lobule.(3)

For full-thickness alar defects, the turnover-type NLF technique described by Schonauer et al. provides both internal lining and external coverage in a single stage without requiring cartilage or mucosal grafts, offering an effective alternative to two-stage interpolation flaps.(15)

C. Application of the Facial Subunit Principle in Practice

Núñez Castañeda and Chang Grozo conducted an observational study of 71 patients undergoing facial reconstruction for skin cancers, finding that the nose was the most common location for both BCC and SCC.(6) Reconstruction based on aesthetic facial units—using flaps that rotate, advance, or interpolate along subunit borders—consistently produced better-camouflaged scars and more natural results than conventional primary closure or non-unit-based flap designs. This study reinforces the importance of mastering subunit-based planning early in plastic surgery training.

X. A PRACTICAL ALGORITHM FOR THE RESIDENT

Drawing from the evidence reviewed, we propose the following simplified decision-making algorithm for the resident:

For defects < 1.5 cm, superficial, and not involving cartilage: consider primary closure, full-thickness skin graft, or bilobed flap.

For defects 1.5–3 cm, not full-thickness, involving the alar lobule, lateral sidewall, or tip: NLF (superior, inferior, or islanded pedicle) is the preferred option.

For defects > 3 cm or multi-subunit: consider NLF combined with forehead flap or cartilage grafts; if defect is extensive, the PFF may be the primary choice.

For full-thickness alar defects: islanded or folded-in NLF for single-stage reconstruction; interpolation NLF or NLF + PFF for multi-layer defects.

For columellar defects extending to the upper lip: bilateral opposing NLFs in a single stage.

In all cases: oncological clearance must be confirmed before definitive reconstruction, either by frozen-section analysis or Mohs micrographic surgery when available.

Table 1. Summary of Nasolabial Flap Types, Indications, and Surgical Stages

Flap Type	Primary Indication	Stages	Key Feature
Advancement (V-Y)	Infraorbital, medial canthus, lateral nasal wall	1	Moves along long axis
Rotation	Nasal sidewall, upper lip lateral	1	30–60° pivot
Transposition	Alar complex, nasal tip, oral cavity	1	Lifted over adjacent skin
Interpolation	Nasal tip, columella, full-thickness alar	2	Pedicle divided at 3 weeks
Islanded/Propeller	Perinasal, multi-subunit defects	1	Perforator-based; wider arc

XI. CONCLUSIONS

The nasolabial flap remains one of the most valuable tools in the plastic surgeon's reconstructive armamentarium for nasal defects. Its anatomical reliability, tissue compatibility, scar concealment, and feasibility as a single-stage procedure make it uniquely suited to the spectrum of nasal defects encountered following NMSC excision. The available evidence from case series, retrospective analyses, and systematic reviews consistently supports its application across all nasal subunits, including complex and multi-subunit defects when supplemented with appropriate framework correction and lining reconstruction.

For the plastic surgery resident, mastery of the NLF requires understanding its anatomical basis, the principles of the facial subunit approach, the nuances of pedicle selection, and the technical refinements that optimize cosmesis. An individualized preoperative analysis considering defect

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characteristics, patient factors, and available resources remains the cornerstone of successful nasal reconstruction. Future investigations with standardized patient-reported outcome measures and long-term follow-up will continue to

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