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Reconstructive

Expanded Uses of the Dorsal Nasal Flap: Redefining the Nasal Reconstruction Algorithm

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Background: Defects of the nose present complex reconstructive challenges to the plastic surgeon. We present our experience with using the dorsal nasal flap (DNF) to provide a durable reconstruction even in sizable defects that would otherwise be considered necessitating a paramedian forehead flap.
Methods: We conducted a retrospective chart review of patients who underwent reconstruction by DNF following resection of skin cancers on the nose. Six flap-type modifications are described: limited, standard, double, combined, extended, and readvanced.
Results: From 2015 to 2021, a total of 51 patients underwent DNF reconstruction. The most frequently used flap types were the limited or standard configurations. There is a general trend of utilizing increasingly complex flap types to reconstruct larger defect sizes, as depicted in our reconstructive algorithm. There were no flap losses.
Conclusions: Our study expands the indications of the DNF and redefines the nasal reconstruction algorithm. However, our proposition is not absolute in that one must consider tissue pliability and the location of the defect. *(Plast Reconstr Surg Glob Open 2025; 13:e6488; doi: 10.1097/GOX.0000000000006488; Published online 28 January 2025.)*

INTRODUCTION

The incidence of nonmelanoma skin cancer in the United States is 1 million cases per year, with more than 20% of these malignancies occurring on the nose.[1] Defects of the nose following tumor extirpation present complex reconstructive challenges to the plastic surgeon given the paucity of local tissue and intricate nasal subunits.[2] An ideal reconstruction provides an adequate match in tissue quality and is performed in a single stage, thus minimizing patient morbidity and discomfort.[3]

The first description of nasal reconstruction was documented around 700–600 BC by Sushruta.[4] In 1967, Rieger[5] popularized the dorsal nasal flap (DNF), describing it as a random skin flap based at the lateral nasal margin to repair defects that were less than 2 cm in size and located in the distal half of the nose, particularly at the tip. In 1975, Marchac and Toth[6] modified the Rieger flap by defining an axial pedicle based on branches of the angular artery near the medial canthus, coining the axial frontonasal flap. This narrower pedicle allowed for greater flexibility and rotation of the flap.[6] Subsequently, there have been several minor modifications described by various authors.[7–11]

Historically, the paramedian forehead flap has been considered the gold standard for nasal reconstruction. It is generally indicated for defects that are larger than 2 cm in diameter and is known to provide the most aesthetic reconstructive result.[12–15] However, this procedure introduces considerable morbidity and necessitates staging, which can pose limitations to its routine use.[16] Additionally, this patient population frequently develops recurrences or subsequent new primary cutaneous malignancies that require re-excision, thus further limiting the reconstructive options. Therefore, it may be prudent to preserve the forehead flap until necessary.

The DNF utilizes local tissue to reconstruct defects of the nose in a single stage.[17] It is classically described as a rotation-advancement flap of the dorsal nasal skin from the cranial two-thirds of the nose and glabella to cover defects that are located caudally.[18,19] In this study, we present the senior author's experience with utilizing this versatile and robust flap to reconstruct central nasal defects that may otherwise be seen as requiring a paramedian forehead flap based on traditional size criteria.

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METHODS

A retrospective chart review of patients who had undergone reconstruction by DNF following Mohs resection by the senior author from 2015 to 2021 was conducted. Formal institutional review board approval was obtained from the Lahey Clinic's institutional review board. Written informed consent was obtained from patients for chart review and photograph documentation. Patient demographics including age, sex, etiology, comorbidities, and smoking history were recorded from the electronic medical record.

The cases were categorized by 6 flap modifications, as defined by the senior author: limited, standard, extended, double, combined, and readvanced (Fig. 1). The limited DNF requires less dissection, often sparing the glabella region and, therefore, can only cover small defects. The standard DNF involves the conventional flap design with additional tissue recruitment from the glabella. The double DNF utilizes 2 opposing rotation-advancement flaps—often in a yin-yang configuration—to reconstruct 1 or 2 nasal defects that are usually located over the mid-dorsum of the nose. The combined DNF may be used for larger defects and recruits a secondary named flap such as the nasolabial (interpolated or superiorly transposed) or Mustardé cheek flap. The extended DNF extends from the margin of the defect beyond the standard DNF marking to recruit additional local tissue, often from the cheek. This extension adds additional soft tissue in the vertical dimension which can be used to reconstruct nasal lining if needed. The readvanced DNF is used in cases where patients previously underwent

Takeaways

Question: Can the dorsal nasal flap (DNF) provide a reliable and durable single-staged reconstruction for sizable defects that would otherwise be considered to necessitate a paramedian forehead flap?

Findings: This retrospective study included 51 patients who underwent DNF reconstruction of defects up to 38 mm in size. There is a general trend of utilizing increasingly complex flap types to reconstruct larger defect sizes, as depicted in our reconstructive algorithm.

Meaning: This study expands the indications of the DNF and redefines the nasal reconstruction algorithm.

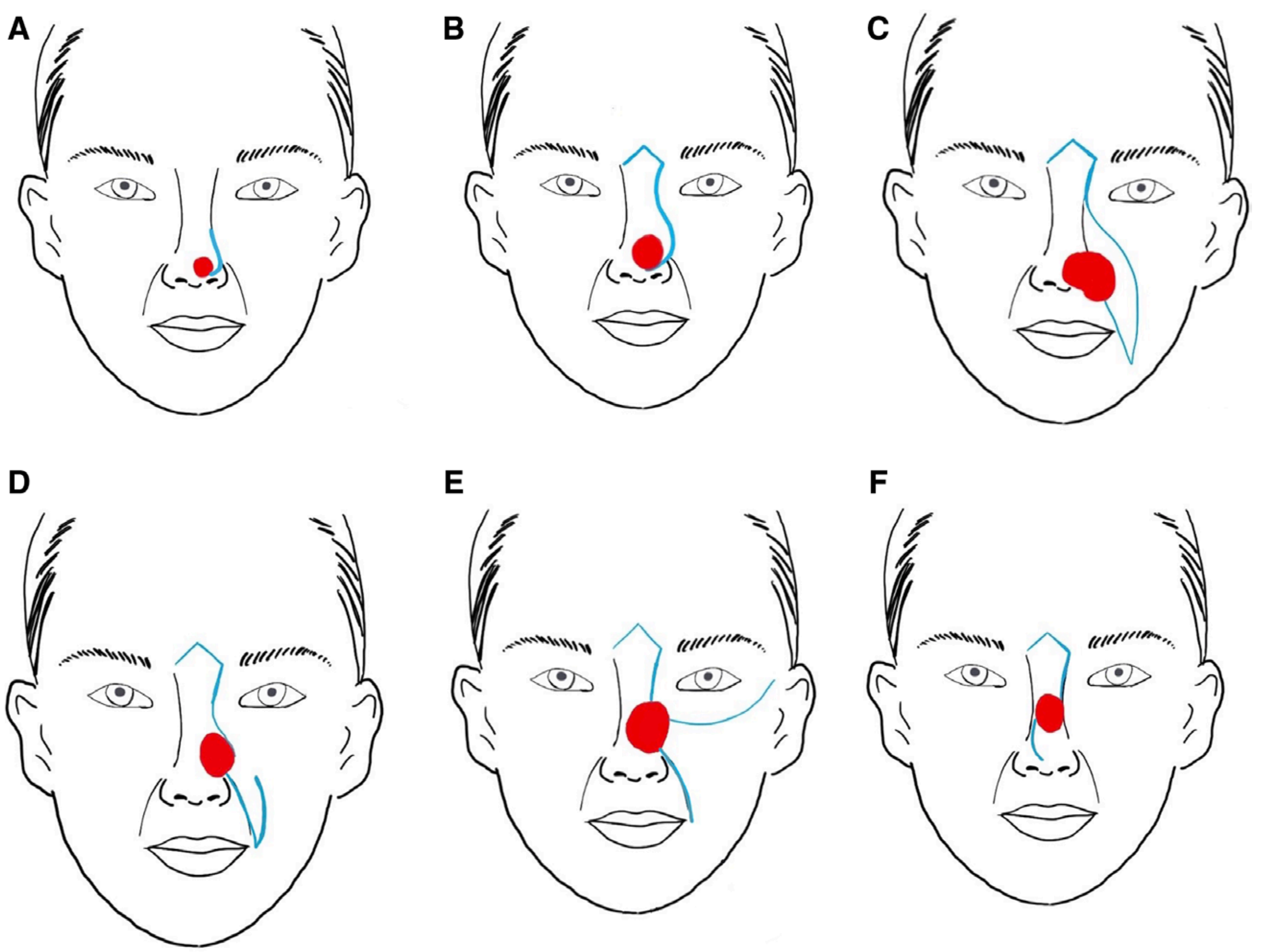

Fig. 1. DNF modifications: limited (A), standard (B), extended (C), combined (nasolabial flap) (D), combined (Mustardé cheek flap) (E), and double (F).

Table 1. Patient Demographics

Flap Type	Limited	Standard	Extended	Double	Combination	Readvanced
Mean age, y	66	69	86	68	69	60
Etiology						
BCC	17	18	1	2	6	1
SCC		1			1	
Melanoma		1	1		2	
Defect location						
Tip	13	13	2		2	1
Dorsum	4	7		2	7	
Cartilage graft	1	3	1	1	3	
Comorbidities						
Diabetes	2	3	1	2		
Smoking history	9	8	2		8	
Cardiovascular disease	5	11	2		4	
Anticoagulation	1	6	1	1	1	
Antiplatelet	3	4	1	1	1	1

Table 2. Number of Flaps by Modification Type

Flap Type	Number
Limited	17
Standard	20
Double	2
Combination	9
Extended	2
Readvanced	1
Total	51

Table 3. Defect Sizes by Flap Type

Flap Type	Defect Diameter Range (mm)	Defect Diameter Mean (mm)
Limited	7–16	12
Standard	10–26	17
Double	21–24	22
Combined	14–32	25
Extended	22–38	30

DNF reconstruction and developed a recurrence or new primary cancer, requiring readvancement of the prior flap to close a new defect.

In addition to flap-type modification, the defect location, defect diameter, use of cartilage graft, secondary flap, revisions, complications, and recurrences for each case were recorded. The mean and range of defect sizes were calculated by flap type. All statistical analyses were performed using R version 4.0.3, with 2-sided 0.05 level of significance.

RESULTS

From 2015 to 2021, a total of 51 patients underwent reconstruction with a DNF by the senior author. The patient demographics are shown in Table 1. Nearly all cases were first treated by Mohs excision; 2 patients presented for revisional surgery following reconstruction for Mohs by a surgeon outside of our institution.

The first patient presented to an outside institution with basal cell carcinoma (BCC) of the nasal tip, where they underwent Mohs excision and reconstruction with a supraclavicular full-thickness skin graft. Three years later, they sought excision of the skin graft and reconstruction by the senior author to improve cosmesis. The newly created defect size was 20 mm and was reconstructed with a standard DNF.

The second patient was treated for nodular BCC of the nasal tip with Mohs surgery and reconstruction by a bovine collagen xenograft. They developed a depressed wound and a 3-mm nasocutaneous fistula. One year later, the senior author excised the wound, creating a 10 × 15 mm defect, then utilized a skin turnover flap for intranasal lining and a standard DNF for external coverage. Overall, most defects were reconstructed using the limited or standard configurations, whereas the least utilized modifications were the extended, double, and readvanced (Table 2).

Table 3 lists the ranges and means of defect sizes by flap type. There is a general trend of larger defect sizes with increasingly complex flap types, consistent with our reconstructive philosophy.

These data were then used to develop the senior author's reconstructive approach to the selection of DNF type by defect size and location (Fig. 2): for defect diameters less than 15 mm, the limited flap type is generally used for reconstruction. For defects that measure between 15 and 20 mm, the standard flap type is utilized. For large defects that are greater than 20 mm and located on the mid-dorsum, the double DNF was used. For similar-sized defects involving the ala or sidewall, either the extended or combined DNF can provide adequate coverage. Figure 3 depicts a box plot that illustrates the median, 25th and 75th quartiles, as well as the range of defect sizes by flap type.

Complications included minor dehiscence (18%), delayed wound healing (9%), donor site hematoma (2%), hypertrophic scarring (4%), cellulitis (8%), and alar retraction (2%). Alar retraction was defined by a vertical height difference of 2 mm along a horizontal axis between the soft triangles of the normal and retracted sides. These were treated at the time of office-based revision by using

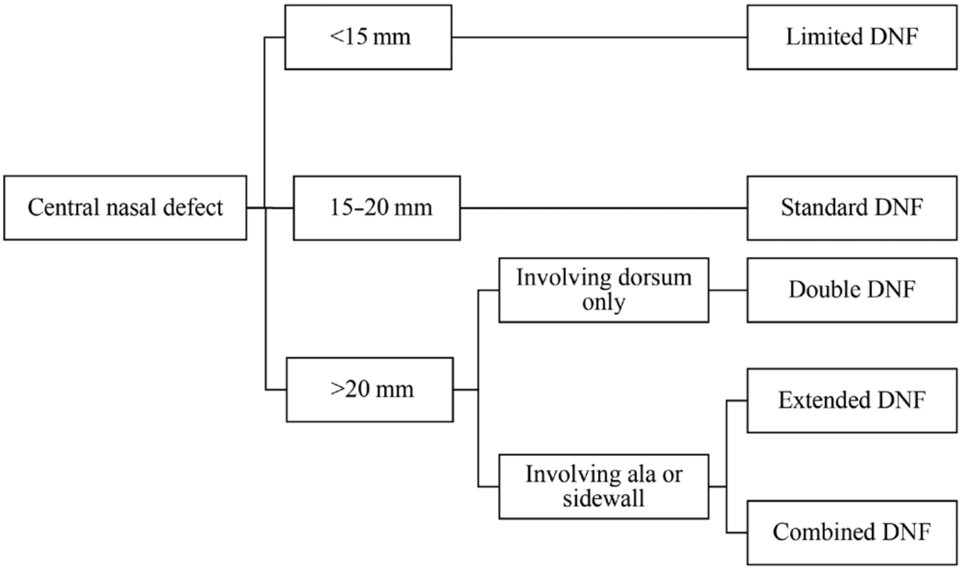

Fig. 2. Nasal reconstruction algorithm.

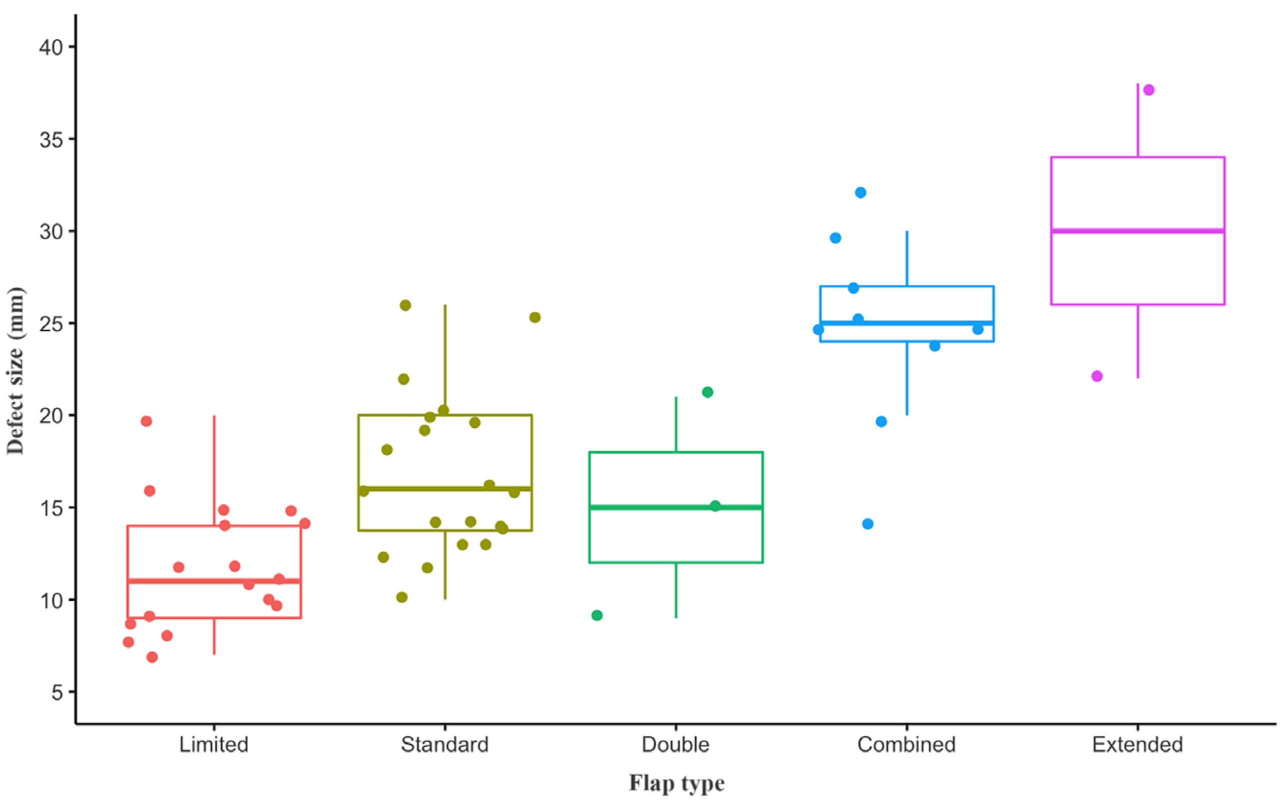

Fig. 3. Box plot. Of each box, the central bold line represents the median defect size, whereas the top and bottom perimeter are the 25th and 75th quartiles. The vertical lines represent the range.

"spare parts" from flap debulking to fashion a dermal-fat graft that is then placed along the retracted alar rim via an endonasal rim incision.

Note that there were no partial or complete flap losses. Although revision rates were relatively high—ranging from 33% in combination to 60% in standard flap types—the senior author prefers to err on preserving vascularity of the flap at the first stage and, therefore, has a low threshold to leave debulking to a later stage. These minor revisions were always performed under local anesthesia, and our patients were counseled preoperatively regarding this point.

Fig. 4. Case 1. A, 11 x 10mm defect of sidewall. B, Limited DNF.

Surgical Technique of the Standard DNF

The nasal subunit principle is critical to consider when designing the DNF. For instance, to maximize the reach of the caudad portion of the DNF, the tip of the flap can be contralateral to the pedicle such that this requires a scar that crosses the midline of the nose. However, this incision should follow the nasal tip subunit and contour, thereby concealing the scar. Furthermore, in designing and transposing the flap, the nasal tip should be rotated (ie, elevated) symmetrically rather than pulling from a lateral vector so as not to distort the midline. If additional flap advancement is required, cephalad extension of the DNF toward the glabella should follow the dorsal aesthetic lines of the nose.

Following the marking of the flap design, local anesthesia with epinephrine is injected. The flap is incised incrementally beginning with the caudal tip. If the defect size is small and nasal skin laxity is adequate, the flap will often advance to cover the wound without further extending the incision into the glabella (limited DNF). Note that the incision is designed to gently curve laterally to the nasal sidewall–cheek junction to increase flap advancement. As the incision progresses cephalad and approaches the nasal radix, it curves medially onto the nasal dorsum. Care must be taken to avoid incising the concave area near the medial canthus to avoid scar contracture and bow-stringing. If additional rotation advancement is needed for wound coverage, the incision is extended into the glabella to recruit more tissue (standard DNF). The flap is incised above the perichondrium/periosteum and elevated off the nasal cartilage/bone to the contralateral side where the angular artery is visualized and protected.

The DNF is trimmed and thinned judiciously, then rotated and advanced to cover the nasal defect. Due to the nature of the rotation-advancement flap, a dog ear often results at the distal portion of the flap. This can be debulked later under local anesthesia. The cheek skin can be elevated in the subcutaneous plane and advanced medially to close the lateral donor site defect.

Case 1: Limited DNF

A 65-year-old man presented with BCC of the left nasal sidewall. Mohs excision resulted in a wound measuring 11 × 10 mm (Fig. 4).

A DNF based on the right angular artery was designed. The flap was incised incrementally to the level of the medial canthus only and was found to be adequate for closure. He healed uneventfully without the need for revision.

Case 2: Standard DNF

An 85-year-old woman underwent Mohs excision of right nasal ala BCC, resulting in a 14 × 12 mm wound near the alar rim (Fig. 5).

A right-sided standard DNF was used for reconstruction. The incision was extended from the wound margin along the contralateral border of the nasal tip to increase flap rotation and minimize the dog ear. Alar rim grafts were fashioned from conchal cartilage to prevent notching. There were no complications or revisions.

Case 3: Extended DNF

An 87-year-old woman presented following staged Mohs excision of a lentigo maligna. This resulted in a large defect measuring 38 mm in diameter of the left nasal ala and adjacent cheek. Of note, the alar wound was of full thickness (Fig. 6).

An extended DNF recruiting adjacent skin along the superior edge of the wound was designed. The flap was rotated

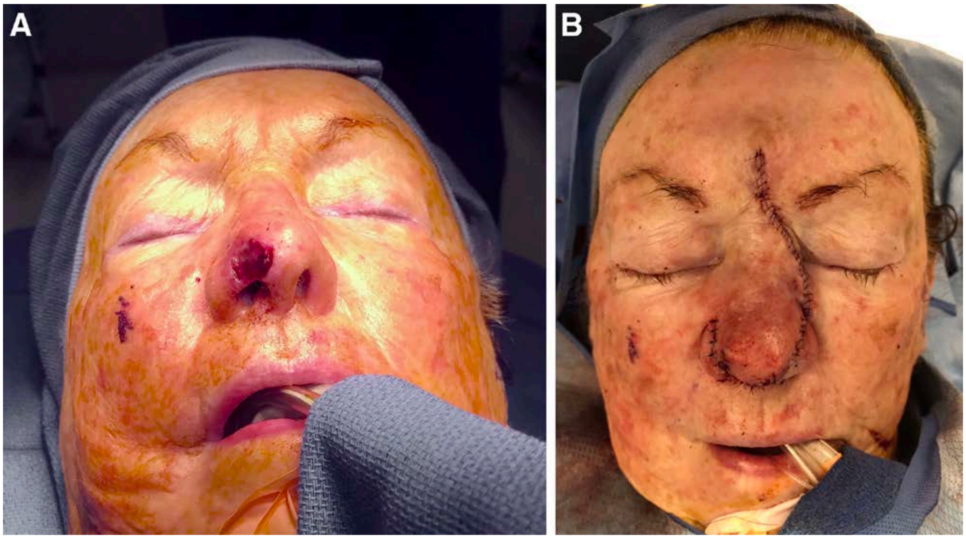

Fig. 5. Case 2. A, 14 x 12mm defect near alar rim. B, Standard DNF.

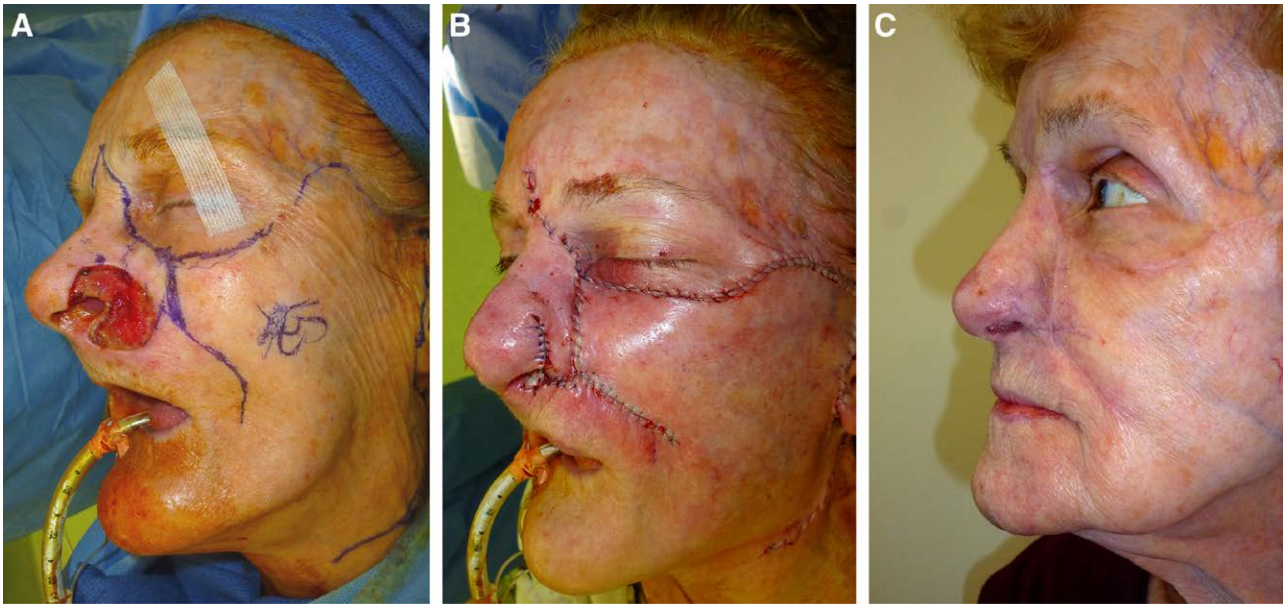

Fig. 6. Case 3. A, 38mm diameter defect of left ala and cheek. B, Extended DNF with vertical extension that will recreate the internal nasal lining. A cervicofacial flap was used to close the DNF donor site C, Postoperative photo at 6 months.

inferiorly while the caudal tip (the extended component of the flap) was folded to recreate the alar rim and internal nasal lining. For the resulting cheek donor site defect, a cervicofacial flap extending laterally from the defect to the preauricular crease and inferiorly to the neck was designed.

Subsequently, she required revisions under local anesthesia for scar contracture and nasal obstruction due to excessive bulk of the flap. These were treated by Z-plasty and debulking.

Case 4: Double DNF

A 63-year-old man underwent Mohs excision of a BCC on the nasal dorsum, resulting in a defect measuring 21 × 15 mm. Note that this defect is located over the mid-dorsum rather than distally at the tip (Fig. 7). Initially, a DNF based on the right angular artery was elevated. However, this flap was insufficient to reach the inferior edge of the wound. Therefore, another DNF was designed based on the contralateral angular artery. These 2 flaps were rotated and advanced in a yin-yang fashion to achieve coverage.

The patient underwent 2 revisions for a widened scar and “pin-cushioning” of the superior flap. This entailed scar excision, flap thinning, and z-plasties, which were all performed under local anesthesia.

Case 5: Combined DNF

A 57-year-old woman presented with BCC of the nasal dorsum. Mohs excision resulted in a 25 × 22 mm defect (Fig. 8). A standard DNF was insufficient to cover the entire defect.

Fig. 7. Case 4. A, 21 x 15mm defect of nasal dorsum. B, Double DNF.

Fig. 8. Case 5. A, 25 x 22mm defect of nasal dorsum. B, Combined DNF with cheek flap. A small area was left open to avoid compromising the perfusion to the tip of the cheek flap. C, Postoperative photo at 11 months.

Therefore, a left cheek flap was elevated to cover the inferior portion of the nasal defect. A small portion of the incision of the tip of the left cheek flap was intentionally left open due to increased tension compromising flap perfusion. This area healed by secondary intention.

Several months later, the patient returned for a scar contracture revision by Z-plasty under local anesthesia.

Case 6: Limited DNF Followed by Readvanced DNF

A 60-year-old man initially presented with BCC of the nasal tip and left ala. He underwent Mohs excision, resulting in a 10 × 9 mm defect of the nasal tip, and a 12 × 11 mm defect of the left ala. The tip defect was reconstructed with a left-based DNF without glabellar extension (limited DNF). The alar defect was closed with a superiorly based transposition nasolabial flap. We excluded the alar defect from our study, as this was a separate defect that was not reconstructed with a DNF. Pathological analysis confirmed that the oncological margins were negative.

Two years later, the patient was found to have a new BCC on the nasal tip. Mohs excision resulted in a 21 × 10 mm defect involving the nasal tip (Fig. 9). The prior DNF was elevated and extended further cephalad into the glabella to achieve additional advancement needed for coverage. He did not require revisions.

DISCUSSION

Cancer resection of the nasal skin envelope presents a complex reconstructive challenge to the plastic surgeon.

Fig. 9. Case 6. A, 21 x 10mm defect of nasal tip following Mohs resection of new BCC. B, Readvanced DNF.

The ideal reconstruction provides a match in tissue quality, is aesthetically pleasing, and is performed in a single stage with minimal donor site morbidity and risk profile.[20,21]

With the present study, we redefined the reconstructive algorithm for central nasal defects. Traditionally, defects larger than 2 cm necessitated the paramedian forehead flap for adequate coverage.[3,22] However, this method has several disadvantages: first, the forehead flap is performed in multiple stages, requiring at least 2 instances of general anesthesia.[19,23] This can carry considerable morbidity, particularly in this patient population who are usually of an advanced age. Second, before division and inset, the raw undersurface of the pedicle often oozes and can even bleed briskly, which can require an emergency room visit for hemorrhage control.[16] Third, these patients commonly present with recurrences or new primary cancers of the nose, and therefore, preserving the forehead flap as a lifeboat may be prudent. When absolutely necessary, the senior author considers using a forehead flap for the following indications: central defects more than 35 mm (while factoring for the location of defect and skin laxity), prior nasal surgery with unfavorable scars for the use of DNF, prior radiation, or large composite alar defects.

In our series, central nasal defects up to nearly 4 cm in diameter were reconstructed with a modified DNF, effectively sparing the paramedian forehead flap. In our experience, although smaller defects can be reconstructed by other methods such as the bilobed flap or skin graft, the former does not follow nasal subunit principles and can result in unsightly scars and pin-cushioning contracture, whereas the latter does not produce durable repair, can heal with a depressed scar, and can be a poor match in color and texture. On the other hand, the DNF is an excellent local flap option for the following reasons: first, it adheres to nasal subunit principles by concealing scars aesthetically along the nasal contours. Second, it provides "like" tissue for a suitable quality match and durable repair. Third, the reconstruction can be performed in a single stage. Fourth, with new primary malignancies or recurrences, the flap may be readvanced to reconstruct the new defect.

We note that there are limitations to the DNF and its modifications as illustrated in this study. In Figure 3, note that there is an overlap in defect sizes among different flap types. We attribute this observation to the patient's native tissue quality and elasticity. For instance, in an older individual with lax nasal skin, a limited DNF may stretch sufficiently to cover a 16-mm defect. Whereas in patients with less tissue laxity, a history of irradiation, or prior scar tissue, additional tissue recruitment from the glabella may be needed for defects as small as 10 mm, thus necessitating a standard DNF. Similarly, our algorithm depicted in Figure 2 can serve as a guideline but has several caveats: first, these nasal defects are generally centrally located. Second, the defect sizes are not absolute and can vary based on nasal skin pliability. Third, the location of the defect can influence the selection of flap type.

In our series of 51 patients, the complication rate was relatively low and minor in morbidity. The predominant complications were minor dehiscence or delayed wound healing, which were both treated by local wound care. Although the number of revisions was high, these were generally performed under local anesthesia. At the initial stage, the senior author is judicious with debulking of the flap and excising dog ears to minimize the risk of compromised vascularity to the flap. Therefore, patients are routinely counseled preoperatively that they will likely require revisions under local anesthesia to achieve a more aesthetic nasal contour. In the senior author's experience, these nasal flaps are extraordinarily sensitive to changes in perfusion which can result in venous congestion, thus causing devastating partial or complete flap loss. We believe that a planned revision under local anesthesia to refine cosmesis outweighs the risk of devastating flap loss.

Furthermore, this not only negates the need for another instance of general anesthesia but also the use of an operating room, which often comes at a premium in availability and cost.

Our study has several limitations. The sample size is expectedly small, especially when separated by flap type. Furthermore, this study is based on the experience of a single surgeon. Taken together, the generalizability of our findings may be limited. Furthermore, one could argue to avoid any revisional procedures by aggressively debulking or excising dog ears at the time of initial flap reconstruction. However, we believe that the risk of devastating complications such as flap loss does not outweigh a planned minor revision.

CONCLUSIONS

The present study expands the use of the DNF in the reconstruction of larger defects and in turn redefines the nasal reconstruction algorithm. Plastic surgeons faced with complex defects can utilize our principles to reconstruct larger defects that would have traditionally necessitated a paramedian forehead flap. We believe that our approach lowers morbidity and provides cosmetic and durable coverage while preserving the paramedian forehead flap in a population at risk for recurrence and needing further reconstruction.

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DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

PATIENT CONSENT

Patients provided written consent for the use of their images.

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