Surgical pearls in forehead flap reconstruction after skin carcinoma. Case series

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Background: The paramedian forehead flap based on the supratrochlear artery remains a fundamental technique in nasal and facial reconstruction following oncologic resection, particularly in the lower third of the nose, where skin color, thickness, and texture match are critical to aesthetic success.
Objective: To describe the clinical outcomes and key technical considerations in nasal and facial reconstruction using the forehead flap, based on the experience of a tertiary care center in Mexico City.
Methods: A retrospective, observational, and descriptive study was conducted, including patients over 18 years of age who underwent nasal or facial reconstruction with a forehead flap following oncologic excision between March 2022 and March 2025. Demographic data, oncologic diagnosis, defect location, surgical technique, and complications were recorded. Final aesthetic outcomes were subjectively evaluated by two independent plastic surgeons.
Results: Five patients were included, with a mean age of 74.8 years. The majority were male (60%) and had comorbidities such as hypertension, diabetes, and COPD. Basal cell carcinoma of the nasal ala was the most common diagnosis. The forehead flap demonstrated high reliability, low complication rates, and satisfactory aesthetic outcomes. Technical refinements such as delayed thinning, aesthetic subunit planning, and Doppler-guided pedicle selection contributed to improved results.
Conclusion: The forehead flap remains a reliable and versatile option for reconstructing complex nasal and perinasal defects in elderly oncologic patients. Meticulous preoperative planning, precise surgical technique, and staged refinements are essential to optimize outcomes. These strategies can be safely adopted in secondary and tertiary centers with reconstructive expertise.
Keywords: forehead flap, surgical pearls, facial reconstruction, nasal reconstruction, surgical planning, supratrochlear artery, skin cancer, oncologic surgery, aesthetic subunits, reconstructive techniques.

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Case Series

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The axial forehead flap based on the supratrochlear artery has been described for over a century as a cornerstone in nasal reconstruction of complex full-thickness facial defects, particularly in the lower third of the nose, where matching skin texture, color, and thickness is critical for achieving an acceptable aesthetic outcome (1). This reconstructive need is especially relevant given that basal cell carcinoma (BCC) and squamous cell carcinoma (SCC) account for over 90% of non-melanoma skin cancers, with steadily increasing rates in recent decades and an estimated global incidence exceeding 5 million cases annually, up to 30% of which involve the nose—making the facial region the most frequently affected site (2,3).

Its straightforward design, reliable vascularity, and versatility have established the forehead flap as the first-line option for complex oncologic defects (4,5). However, it is not without limitations: it tends to be bulky compared to the recipient skin, often requires progressive thinning, involves multiple surgical stages, and may leave visible scars at the donor site, potentially impacting the patient's quality of life (6). These limitations have led to various technical modifications, including thickness adjustments, contralateral flap design to preserve vascularity in cases of ipsilateral damage, and careful planning based on nasal aesthetic subunits (7,8). Additionally, factors such as skin phototype, comorbidities, and smoking can influence flap viability and donor site healing (9,10). Recent literature emphasizes the importance of meticulous preoperative planning, precise surgical execution, and postoperative refinements to optimize both functional and aesthetic outcomes (11).

Given the sustained rise in skin cancer incidence and the high proportion of cases involving

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Patient	Age (years)	Gender	Smoking	Comorbidities	Phototype	Diagnosis	Location of the defect
1	65	F	Yes	HTN, DM	IV	Basal cell carcinoma	Right nasal wing
2	76	M	Yes	COPD	III	Melanoma	Front region
3	80	M	No	None	IV	Basal cell carcinoma	Left nasal wing
4	72	M	Yes	Heart disease	III	Basal cell carcinoma	Left nasal wing
5	81	F	No	None	III	Melanoma	Left nasal wing

Table 1. Sociodemographic characteristics of treated patients

the nose, this clinical series aims to present our institutional experience through illustrative cases, highlighting key aspects in the planning, execution, and refinement of this fundamental reconstructive technique.

Methods

A retrospective, observational, and descriptive study was conducted, including patients treated at the Plastic and Reconstructive Surgery Department of the Hospital Central Sur de Alta Especialidad de Pemex in Mexico City, between March 2022 and March 2025.
All patients over 18 years of age who underwent nasal or facial reconstruction with a forehead flap following oncologic resection were included. Patients with a history of previous reconstruction in the same region, follow-up of less than 6 months, or incomplete medical records were excluded.

Data collected included sociodemographic characteristics, oncologic diagnosis, defect location, surgical technique used, and any intraoperative or postoperative complications. Aesthetic outcomes were also subjectively evaluated. Information was obtained from clinical records and preoperative, intraoperative, and postoperative photographs. Two independent plastic surgeons rated the final aesthetic result as excellent, good, fair, or poor based on symmetry, aesthetic appearance of the flap, and patient satisfaction, as expressed during a follow-up visit three months after the final procedure. The final score was calculated by averaging the evaluations of both surgeons (appendix 1).

The surgical techniques were selected according to the characteristics of the defect and the general condition of the patient. In all cases, flap design adhered to the principle of nasal aesthetic subunits, ensuring a pedicle centered over the supratrochlear artery. The choice of pedicle side, initial flap thickness, donor-site closure method, and timing of refinement were individualized based on clinical presentation and vascular viability.
The study was approved by the institutional ethics committee and was conducted in accordance with the principles of the Declaration of Helsinki.

Surgical Technique and Recommendations

The success of the forehead flap depends on meticulous preoperative planning, precise surgical execution, and progressive staged refinements aimed at optimizing shape, respecting aesthetic subunits, and minimizing scarring. Based on our experience and the literature, we propose the following technical recommendations:

1. Preoperative Planning

Marking should be done with the patient seated to ensure facial symmetry and account for gravitational effects on soft tissues (1,5,7).

- Define the recipient defect and identify the involved nasal subunits (5,11).
- Outline nasal aesthetic subunits to position scars along natural lines (5,11).
- Select the better-perfused side; in compromised cases, consider a contralateral flap (6,8). Doppler ultrasound is helpful in patients with previous surgery, radiotherapy, or vascular anomalies to accurately identify the supratrochlear artery and select the safest flap base (12,13) (figure 1).
- Delimit a pedicle base of 1.2–1.5 cm to ensure blood flow and allow tension-free frontal closure (9,10,14).
- Use clear anatomical landmarks (eyebrows, hairline) to guide the design (7,9).
- Design the flap in a teardrop or trapezoidal

Patient	Surgical technique	Donor closure	Complications	Later refinements	Number of surgical stages	Final aesthetic result
1	Classic ipsilateral	Primary	None	Defatting, scar revision	2	Excellent
2	Contralateral + graft	Graft	Partial dehiscence	Defatted	3	Good
3	Classic ipsilateral	Primary	None	Defatted	2	Excellent
4	Frontal + nasolabial	Primary	Positive margins (expansion)	Defatting, scar revision	3	Good
5	Classic ipsilateral	Primary	None	Defatted	2	Excellent

Table 2. Surgical details of treated patients

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Figure 1. Supratrochlear arteries are identified to verify their adequate patency.

shape for a harmonious transition (10,14).

- Assess forehead skin laxity to plan for primary closure or skin grafting if needed (7,15).
- Confirm the design prior to anesthesia infiltration to avoid distortion.
- For irregular defects, a sterile suture wrapper can be used intraoperatively to trace the exact 3D shape and transfer it to the forehead, allowing for precise, anatomical planning and avoiding tissue redundancy or shortage (5,7,9).

2. Flap Elevation

- **Dissection Plane**:

  Performed in the supraperiosteal plane, including the supratrochlear artery and satellite veins. Controlled thinning of the distal portion can be done to match nasal skin thickness while preserving the dermis to maintain perfusion (7,10,14).

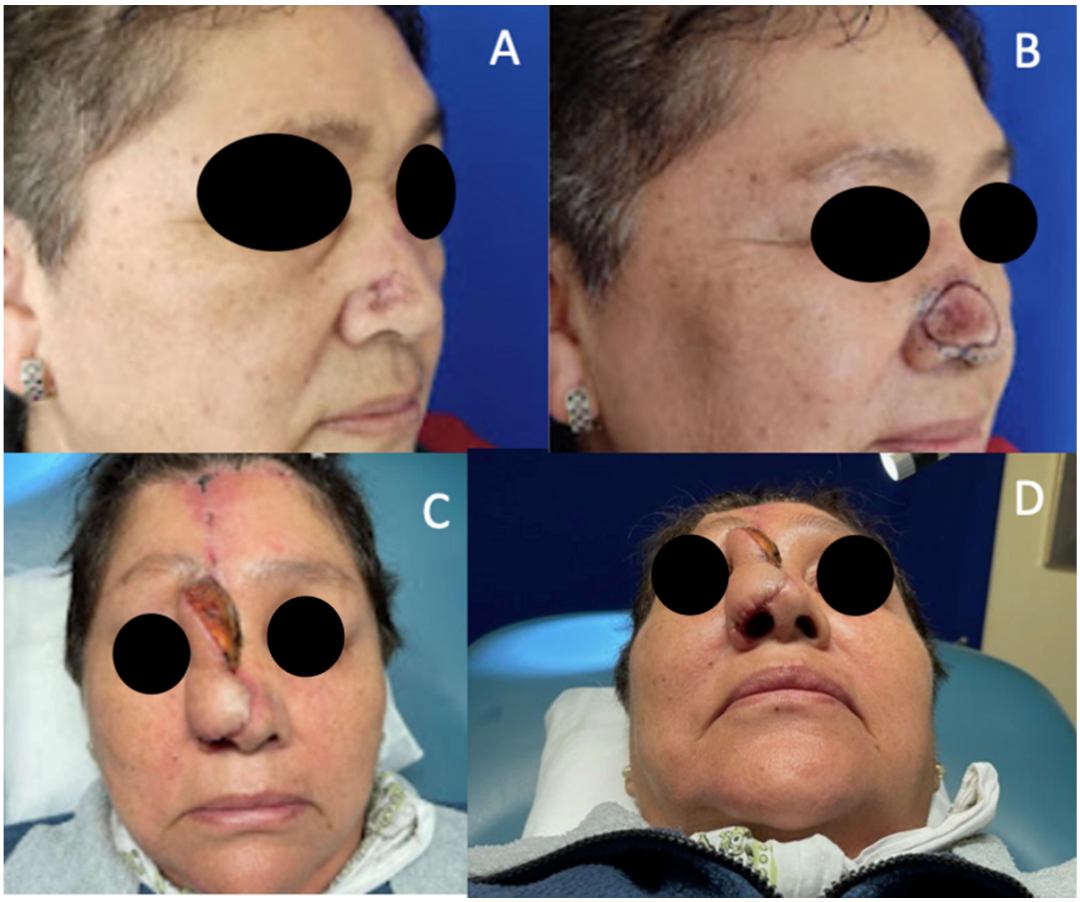

Figure 2. Neoplastic lesion in a 65-year-old female patient (A). Preoperative markings are shown to ensure lesion-free margins (B), and subsequent images after the first reconstructive stage using a forehead flap; the thickness of the flap pedicle ensures adequate postoperative perfusion (C and D).

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Figure 3. Indications and follow-up for patients with suspected nasal neoplasia referred by the oncosurgery department.

- **Pedicle Preservation**

  Maintain a minimum width of 1.2–1.5 cm centered on the supratrochlear artery, avoiding torsion or kinking that may impair flow (9,10,14) (figure 2).

- **3D Adaptation**

  Elevation should follow nasal contours and aesthetic subunits, checking for closure harmony on the surgical table (5,11).

- **Hemostasis and Protection**

  Perform meticulous hemostasis to prevent hematomas; minimize pedicle manipulation, keeping it moist and protected to avoid desiccation.

- **Special Considerations**

  In patients with thick skin or vascular comorbidities, delay flap thinning until the refinement stage. If vascularity is insufficient, widen the pedicle or redesign it on the contralateral side (6,8,10,16).

3. *Donor Site Closure*

Primary closure was performed whenever possible. In cases of excessive tension, split-thickness skin grafts were used. Absorbable intradermal sutures contributed to better aesthetic outcomes.

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Figure 4. Images at 1 (A, B, C) and 6 (D, E, F) months after the second reconstructive stage in a 65-year-old female patient. Between both stages, the patient was advised to use sunscreen and perform postoperative massage.

4. *Refinement Stage*

Refinements are essential for optimizing aesthetic integration, recreating subunits, and improving the 3D contour. These procedures were scheduled between 3–4 weeks (17) after initial surgery (once vascularization was consolidated), and occasionally between 3–6 months to allow for tissue maturation (5,8,10).
Common refinements included:

- Pedicle division and frontal wound closure (some surgeons prefer a third stage at 6–8 weeks for improved flap contouring) (1).
- Selective defatting to refine aesthetic lines (9).
- Sculpting to recreate natural grooves such as the alar crease or nasal dorsum (11).
- Scar revision using complementary techniques (15).
- Cartilage grafting for structural support or correction of depressed areas (5,14).

Patients should be informed that refinement is an inherent part of achieving optimal outcomes (5,9,11).

5. *Postoperative Considerations*

- **Immediate (First 2 weeks)**: Monitor for signs of distal ischemia or venous congestion; maintain head elevation, strict hygiene, and avoid trauma (6,7).
- **Intermediate (2–6 weeks)**: Scar massage and nasal physiotherapy as needed.
- **Long-term**: Daily photoprotection (18,19), silicone patches (15), and ongoing follow-up to assess for refinement needs (figure 3).

Ultimate success depends on the initial technique, close follow-up, constant communication with the patient, and timely management of complications (8,15) (figures 3 – 4).

Results

A total of five patients were included, with a mean age of 74.8 years (range: 65–81 years). The majority were male (60%). Regarding risk factors, three of the five patients were active smokers at the time of surgery. The most frequent comorbidities were hypertension, type 2 diabetes mellitus, chronic obstructive pulmonary disease (COPD), and heart disease. Fitzpatrick skin types III and IV predominated, which presented additional challenges in scar management and risk of hyperpigmentation.

Three patients were diagnosed with basal cell carcinoma (BCC) located on the nasal ala, while the other two had melanoma—one on the forehead and one on the left nasal ala. This distribution aligns with the high incidence of skin cancer in sun-exposed areas, such as the lateral subunits of the nose.

The nasal ala was the most commonly affected subunit (4 cases), while one case involved a defect in the forehead region. A summary of the sociodemographic data (Table 1) and surgical details (Table 2) is presented below.

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Figure 5. Frontal (A) and lateral (B) views of basal cell carcinoma on the left nasal ala in a 72-year-old male patient. The resection area on the left nasal ala performed by the oncology team is shown, as well as the design of the forehead flap to cover the defect (C). Ipsilateral forehead flap rotation and defect closure with a small graft are shown (D and E). Basal (F) and frontal (G) views show the covered defect in the left nasal ala. Frontal (H), lateral (I), and basal (J) views of the same 72-year-old male patient with Fitzpatrick skin type IV, one month after pedicle division of the forehead flap, which is shown to be well integrated.

Discussion

This case series reinforces the continued relevance of the forehead flap as a valuable tool for reconstructing complex nasal and perinasal defects. Its robust vascular reliability, excellent color and texture match, and versatility have made it the first-line option for large, full-thickness defects or those with significant structural involvement (4,5).

In our series, the most frequently affected site was the left nasal ala, consistent with previous studies identifying this subunit as particularly vulnerable to oncologic lesions, especially basal cell carcinoma (3). The presence of risk factors such as smoking and comorbidities reflects the real-world scenario of geriatric oncology patients, in whom skin quality and vascularity may be compromised. Nevertheless, the forehead flap showed a low rate of necrosis and major complications, consistent with reports in the literature (18).

The technical recommendations presented here—including upright patient evaluation, respect for aesthetic subunits, accurate defect measurement, and the use of Doppler ultrasound to localize the pedicle—are in line with the foundational principles proposed by Burget and Menick (2,6) and validated by more recent authors (3,9,16). Contralateral flap design in selected cases with ipsilateral vascular compromise proved to be a safe alternative, provided that donor-site closure is well-planned and grafting is anticipated if necessary.

A frequent challenge in our series, as in others, was initial flap bulkiness and the need for staged refinements. Deferring thinning procedures for at least 4–6 weeks helps preserve vascularity and achieve a more natural nasal contour (7,9,14). At this stage, aesthetic subunits and lines can also be recreated, optimizing final results.

Postoperative care is essential for ensuring long-term success. Sun protection, scar massage, and

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Nasal symmetry **4 = Complete symmetry or minimal asymmetry, not noticeable.** **3 = Mild asymmetry, perceptible only on close view or with maneuvers.** **2 = Moderate asymmetry, visible on standard frontal view.** **1 = Severe asymmetry, significant distortion of subunits.** **0 = Marked deformity, no preservation of basic nasal anatomy.**	Comparison of the nostrils, alae, and dorsum with the contralateral side.	0–4
Aesthetic integration of the flap **3 = Excellent integration, no visible transition lines.** **2 = Good integration, with slight perceptible disharmony.** **1 = Poor integration, clear difference in color, thickness, or texture.** **0 = Poor integration, evident discordant appearance.**	Match in color, texture, thickness, and transition between flap and adjacent nasal skin.	0–3
Patient's subjective satisfaction **3 = Very satisfied with the aesthetic outcome.** **2 = Generally satisfied, with minor concerns.** **1 = Dissatisfied, but accepts the outcome.** **0 = Very dissatisfied, considers reoperation necessary.**	Reported verbally by the patient during the final consultation.	0–3

Interpretation of Total Score (0–10):
- 9–10: Excellent outcome
- 7–8: Good
- 5–6: Fair
- <5: Unsatisfactory

Annex 1. Scoring sheet for aesthetic outcomes of the forehead flap.

silicone patch application contribute to better scar maturation, while close surveillance in the early postoperative period allows for prompt intervention in cases of venous congestion or distal ischemia (10,11,20). These supportive measures are critical adjuncts to the surgical technique and significantly impact patient satisfaction.

This study is limited by its retrospective design and small sample size, which limits generalizability. Additionally, patient satisfaction was not measured using standardized tools such as the FACE-Q. However, our findings are consistent with current literature and underscore the importance of systematic and refined technique.

Prospective studies with larger samples, standardized quality-of-life assessments, and cost-effectiveness analyses are needed to confirm the superiority of these technical recommendations in terms of both function and aesthetics.

Conclusion

The forehead flap remains a cornerstone in facial reconstruction for oncologic defects in the

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elderly population. Systematizing specific techniques for planning, elevation, and refinement of the forehead flap allows for complication minimization and improved functional and aesthetic outcomes. These recommendations can be readily adopted in secondary and tertiary care centers with reconstructive surgery expertise.

Conflicts of interests

The authors have no conflicts of interests.

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