



Case report

Complex nasal reconstruction for skin cancer and posttraumatic deformity using a modified frontonasal flap – Case report

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ABSTRACT

Introduction and importance: Reconstruction of the nasal tip is challenging, especially when large defects are associated with compromised nasal soft tissues and framework. The frontonasal flap is an axial-pattern myocutaneous flap from the glabella and nasal dorsum that allows for various modifications in flap design to cover medium sized defects of the nasal tip.

Case presentation: A 66-year-old male patient presented with a large and ulcerated squamous cell carcinoma of the nasal tip that was associated with substantial posttraumatic damage of the nasal soft tissue envelope and cartilaginous vault of the dorsum. Considering patient comorbidity, risk factors, and specific nasal condition, a single-stage tumor resection and reconstruction using a modified frontonasal flap was intended. While tumor excision resulting in a tip defect of 1.5 × 1.5 cm and flap coverage were initially achieved in a single stage, histologically incomplete tumor resection and individual patient requests mandated further surgery, including re-excision, cartilage grafting, and soft tissue contouring.

Clinical discussion: The frontonasal flap allows for single-stage reconstruction of moderate size tip defects. Even in the case of prior soft tissue damage and scarring, the flap may be used safely pending individual adjustments in flap design. However, additional measures may be employed as needed to optimize the functional and aesthetic outcome in cases of complex nasal pathology.

Conclusion: In a case with a combined tumor and posttraumatic nasal deformity, an individualized surgical concept incorporating a modified frontonasal flap with adjunct cartilage grafting and soft tissue contouring achieved an excellent functional and cosmetic outcome.

1. Introduction

The frontonasal flap was originally described by Rieger in 1967 as a random-pattern skin flap of the nasal dorsum and glabella based on one side of the nose [1]. It was then modified by Marchac in 1970 as an axial-pattern skin-muscle flap based on a branch of the angular artery [2]. The flap was popularized to cover defects of the nasal tip and dorsum. The myocutaneous flap has a reliable blood supply and can be raised with a narrow skin bridge or as an island flap for enhanced mobility [3]. Its main advantages are the transfer of tissue from an area of skin excess, i.e. the glabella and nasal dorsum, to an area of skin deficiency, i.e. the nasal tip and alae, and provide skin of similar kind for reconstruction. Potential drawbacks of the flap are differences in skin thickness of the flap and surrounding tissues, limited flap mobility, contour deformities during flap transposition, retraction of the nasal tip and alae caused by

scar formation and flap shrinkage, and long scars that do not necessarily follow the nasal subunits [4]. Several flap refinements aimed to overcome these problems and improve clinical outcome [5–7]. Overall, the frontonasal flap performs favorably in reconstruction of the nasal tip compared to other local and regional flaps [8].

We present a patient with several comorbid conditions and risk factors that presented for surgical treatment of a nasal tip skin malignancy associated with a long standing posttraumatic nasal deformity. This case posed specific challenges to the plastic surgeon that mandated modifications of the standard frontonasal flap concept for a successful reconstruction.

2. Presentation of case

This work has been reported in line with the SCARE 2020 criteria

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Fig. 1. Preoperative clinical images show an ulcerated squamous cell carcinoma on the left side of the nasal tip. Late posttraumatic nasal deformities are also depicted, including an angular inverted-v-shaped scar over the dorsum, an irregular dorsal contour and indentation of the left sidewall as well as a drooping and under-projected nasal tip with an acute nasolabial angle of 45 degrees.

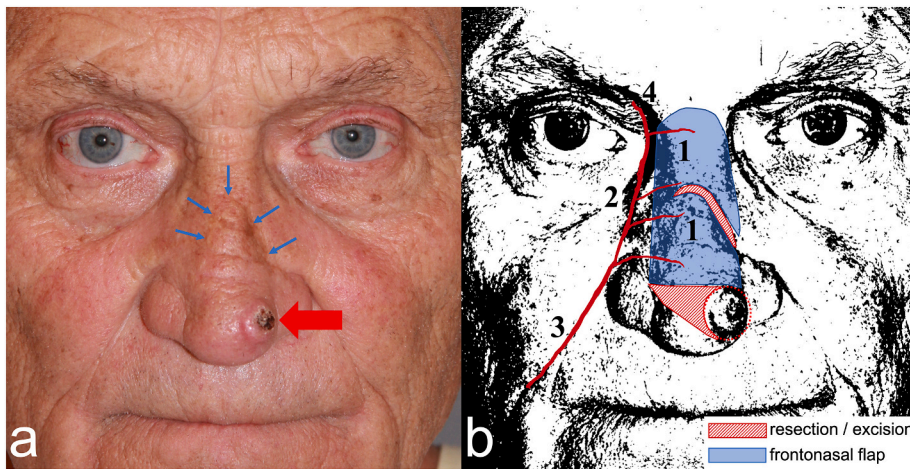


Fig. 2. Preoperative planning had to consider: a) a nasal tip skin malignancy (red arrow) and severe posttraumatic nasal deformity and scarring (blue arrows) and b) flap dimensions (blue area) related to anticipated defect size following tumor resection and scar excision (red cross-hatched areas). The tumor margin is marked by a red dotted circle. The frontonasal flap is supplied by branches (1) of the right angular artery (2), which is fed by the facial artery (3) and ophthalmic artery (4). The flap outline encompasses a distal triangular segment for coverage of the tip defect and a proximal rectangular segment for closure of the secondary dorsal defect.

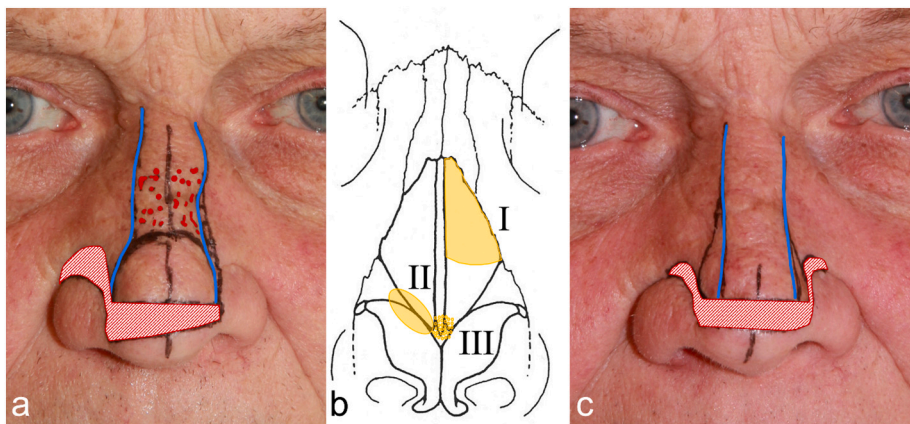


Fig. 3. The clinical image 6 months after tumor resection and reconstruction with a modified frontonasal flap (a) shows retraction of the left alar rim with asymmetry of the nostrils and fullness of the supratip area (red dots). In addition, as sequelae of a previous nasal trauma, there is asymmetry of the dorsal lines (blue lines) due to a defect of the left upper lateral cartilage. Surgical revision was planned with skin excision at the nasal tip and right alar crease (red cross-hatched area) to correct nostril asymmetry and (b) reconstruction of the left upper lateral cartilage (I) and right scroll region (II) with onlay cartilage grafts and augmentation of the supratip area (III) with diced cartilage from the ear, as marked in yellow. After the revision (c), symmetry of the dorsal lines (blue lines) and nostrils, tip elevation and improved supratip contour was achieved. Delayed healing at the tip resulted in a widened scar that was corrected by a “bullhorn”-excision (red cross-hatched area).

[9]. A 66-year-old male patient was transferred from his dermatologist for the urgent excision and histological confirmation of a fast growing nodular and ulcerated skin tumor of the nasal tip with a diameter of approximately 12 mm, suspicious for a keratoacanthoma or squamous cell carcinoma of the keratoacanthoma type. An inverse-v-shaped and contracted scar was found over the nasal dorsum and left lateral side wall after a nasal trauma in youth. The nasal tip was under-projected and drooping with an acute nasolabial angle of 45 degrees (Figs. 1, 2a).

The patient was on oral anticoagulation with rivaroxaban for atrial fibrillation and was treated for arterial hypertension. He was a moderate smoker and received prednisolone for chronic obstructive pulmonary disease.

Because of patient comorbidity and risk factors, a histologically controlled tumor resection and reconstruction using a modified frontonasal flap was planned as a single-stage procedure. Oral anticoagulation was stopped 24 h prior to surgery. All interventions were performed under local anesthesia as outpatient surgery by the senior author, a board-certified plastic surgeon. Oral anticoagulation was discontinued 24 h before surgery and the patient instructed to stop smoking two weeks before and after each operation. The tumor at the nasal tip and the adherent scar at the mid-dorsum were excised. Histologically controlled tumor excision resulted in a tip defect of 12 × 18 mm diameter. A centrally split myocutaneous flap was then raised in an epiperiosteal plane with a rectangular segment over the proximal and a triangular segment over the distal dorsum (Fig. 2b). The distal part of the flap was used to cover the tip defect and the proximal part to close the secondary

dorsal defect, i.e. donor site.

Final histology confirmed the diagnosis of an invasive squamous cell carcinoma (12 mm diameter, 7 mm thickness, T1N0M0, G2, UICC stage 1). The peripheral excision margin was free of tumor with an adequate safety margin. However, the carcinoma infiltrated the deep margin in an area of 4 mm diameter.

On the first postoperative day, the distal flap segment was well perfused while the proximal segment showed impaired perfusion near the left nasal sidewall. After one week, the distal segment of the flap was raised again for re-excision of the residual tumor. In addition, a demarcated marginal skin necrosis of the proximal flap segment was excised and the resulting defect covered by cheek advancement. Final histology confirmed clear resection margins and complete tumor excision.

At 6-months follow-up, swelling of the frontonasal flap had resolved and scars at the nasal root and lateral sidewall were inconspicuous. However, there was scar contraction at the nasal tip and a retraction of the left alar rim resulting in slight asymmetry of the nostrils (Fig. 3a). In addition, the patient requested the correction of preexisting post-traumatic nasal deformities, i.e. an indentation of the left lateral sidewall due to a defect of the left upper lateral cartilage and a drooping nasal tip with an under-projected supratip area. Surgical revision included subcutaneous thinning of the frontonasal flap at the supratip and cartilage grafting using conchal ear cartilage. The left upper lateral cartilage was reconstructed with an onlay graft and the supratip region augmented with diced cartilage. In addition, a cartilaginous lesion at the



Fig. 4. The postoperative clinical images demonstrate an excellent aesthetic result with straight dorsal contour and symmetric dorsal lines, symmetry of the nostrils, refined tip shape with improved projection and tip rotation with a nasolabial angle of 90 degrees, and inconspicuous scars at the nasion, left lateral sidewall, dorsum and tip.

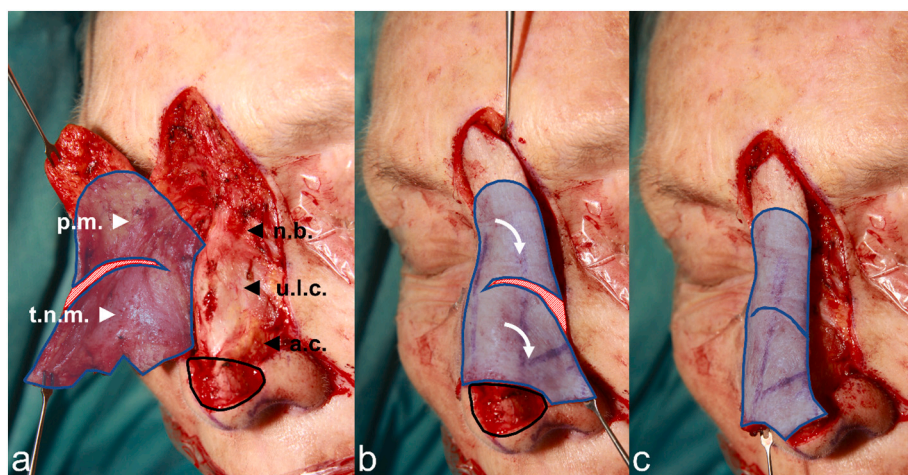


Fig. 5. Intraoperative images of a standard frontonasal flap and the superimposed outline of the modified bisected flap design with its upper limit at the nasal radix (blue shaded area) and excluding the glabellar skin extension of the standard flap. The flap is raised on branches of the right angular artery. The underside of the flap (a) shows the transverse nasal muscle (t.n.m.) in the center and insertions of the procerus muscle (p.m.) in the upper part of the flap. The red cross-hatched area denotes the central scar that divides the flap into a proximal and distal segment. The outline of the tip defect is marked with a black line. The alar cartilages (a.c.), upper lateral cartilages (u.l.c.) and nasal bones (n.b.) are exposed after tumor resection and flap harvest. The mobile proximal and distal flap segments are rotated (b) to close the defects at the nasal tip and dorsum (c).

right scroll area was repaired with an onlay graft (Fig. 3b). A marginal skin necrosis over the nasal tip healed secondarily and resulted in a widened scar that was corrected after another 6 months interval without further sequelae (Fig. 3c). Three years after the initial surgery and two years after the last revision, the overall functional and cosmetic result was excellent with a smooth and regular shape of the nasal dorsum, adequate projection and cranial rotation of the tip with an ideal nasolabial angle of 90 degrees, as demonstrated by standard nasal photography in 6 projections (Fig. 4), and unobstructed nasal breathing. There were no signs of recurrence of the squamous cell carcinoma. The surgical procedures were well tolerated by the patient. At late follow-up, the patient reported to be extremely satisfied with the significant improvement in nasal shape and function compared to the original preoperative condition.

3. Discussion

Coverage of nasal tip defects is challenging and can be performed with multiple techniques [4,10,11]. Reconstructive options include skin or skin-fat grafts [12], composite grafts [13] and various local and regional flaps [14–19]. Elderly patients often seek a simple and single-stage reconstruction, especially with preexisting comorbidity and risk factors, yet may desire a functional and aesthetically pleasing result [7,8]. The frontonasal flap is a versatile and robust myocutaneous flap with a reliable axial pattern blood supply [2,3]. Various modifications of flap design have been described to meet the individual needs of each reconstruction [5–8]. However, few information is available in the literature about the reliability of the frontonasal flap in the presence of previous nasal trauma with soft tissue impairment of the nasal dorsum.

In our case, because of patient age, comorbidity, and personal preferences, a single-stage reconstruction was favored. The combination of a large tumor of the tip and a long-standing posttraumatic deformity of the nose required an individualized surgical concept. The preoperative evaluation of the requirements of reconstruction led to the exclusion of several treatment options: I. The depth of the defect with potential exposure of alar cartilage and a preexisting instability and underprojection of the drooping tip in need of cartilage grafting precluded the use of a skin (-fat) graft [12]. II. The anticipated defect size superseded the usual dimensions of a bilobed flap [15]. III. The posttraumatic scars and deformity of the nasal dorsum rendered the use of a Rintala flap [16] or nasal sidewall island inversion flap [17] unreliable. IV. A two- or three-staged paramedian forehead flap [18] was not our first choice in an elderly patient with multiple comorbidities and anticoagulation.

Therefore, an axial frontonasal flap capable of covering a large nasal tip defect [19] was chosen and modified to meet the specific challenges

of our case. The classic flap design was converted into a bisected flap that allowed the excision of the transverse angular scar and the release of adherent, scarred soft tissues over the dorsum, yet preserving blood supply to each flap segment (Fig. 5a, b). The distal part of the flap was used to cover the tip defect while the proximal part allowed for direct closure of the secondary defect, i.e. donor site, at the dorsum (Fig. 5c). Instead of the typical angular shape of the frontonasal flap at the glabella, the upper border of the modified flap was curved to follow the contour of the radix, as described by Rohrich et al. [20].

While reconstruction of the nasal tip was initially achieved with a single procedure, incomplete tumor removal necessitated a second intervention. Subsequently, the request of the patient for improved nasal function and aesthetics was met with additional surgery not associated with the treatment of the tumor but related to impaired wound healing and posttraumatic deformity. Overall, the treatment achieved a significant improvement in nasal shape and function with no tumor recurrence and high patient satisfaction at three years follow-up. This case confirms the reliability and versatility of the myocutaneous frontonasal flap for nasal tip reconstruction despite previous trauma and soft tissue damage of the nasal dorsum by the use of a modified flap design adopted to preexisting scars and meticulous surgical execution.

4. Conclusion

Taking into account the complexity of this case with the combination of a tumor and posttraumatic nasal deformity as well as the functional and aesthetic requirements of reconstruction, an individualized surgical concept was established. A modified frontonasal flap with adjunct cartilage grafting and soft tissue contouring allowed us to meet these demands.

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Ethical approval

We declare that our institution does not require ethical approval of clinical case reports and that the study conforms to the ethical regulations of the declaration of Helsinki 1975 (revised, current version).

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the

written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

Both authors contributed to the conceptualization, study concept and design, and writing of the paper.

Registration of research studies

None.

Guarantor

The guarantor of this work accepts full responsibility for the study and the conduct of the study, had access to the data, and controlled the decision to publish.

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Declaration of competing interest

All authors declare no conflict of interest in formulating this article.

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