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Defect closure after successful skin cancer surgery of the nose: a report of 52 cases

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Abstract

Introduction: Malignant keratinocyte tumors—that is, basal cell carcinoma (BCC) and squamous cell carcinoma (SCC)—are commonly found on sun-exposed body areas such as the nose. The primary aim of tumor surgery is complete excision. Due to anatomical, functional, and aesthetic issues, reconstruction of such defects remains a challenge.
Patients and methods: We report on a series of 52 patients that were treated from 2015 to 2019 at the Goldman Clinic in Porto Alegre, Brazil. The mean age was 63 years (range 28–82 years, standard deviation 14.25 years). Thirty-nine (75%) patients were male and 13 (25%) female. The histological diagnosis was BCC in 49 patients and SCC in three.
Results: Nasal defect closures were located on the nasal dorsum, tip, alar nose, and nasion. The nasal dorsal and alar region were the regions most commonly involved. All tumor specimens were 3D histologically investigated. A nasolabial flap was the reconstructive option in 40 subjects (76.9%). A bilobed flap was used in six patients (11.5%). Other flaps used for defect closure were a Rintala flap (n = 2), tunneled island flap (n = 1), and frontal flap (n = 1). Adverse events were rare and manageable. Three relapses were noted during follow-up.
Conclusions: Nasal reconstruction requires an armamentarium of surgical techniques to tailor the procedures based on tumor localization, size, and depth, and patients' needs.

Keywords: basal cell carcinoma, defect closure, dermatologic surgery, Mohs surgery, nose, squamous cell carcinoma

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Introduction

The nose is a central part of the mid-face and plays an important role in nasal respiration, olfaction, and phonation. Observers spend the largest amount of gaze time on the nose and eyes, underscoring its prominent position in the central face for non-verbal communication and aesthetics (1). The area is highly exposed to ultraviolet radiation, which contributes to exogenous ageing and skin cancer development, in particular keratinocyte tumors such as basal cell carcinoma (BCC), and less often squamous cell carcinoma (SCC). An estimated 5.4 million keratinocyte skin cancers were diagnosed alone in the US in 2012 (2).

BCC is the most common skin cancer, and it accounts for > 90% of all malignant skin tumors of the head and neck (3). Complete surgical excision is the treatment of choice for BCC. It is superior to medical and physical treatments, and it is the primary aim of surgery (4, 5). SCC accounts for up to 10% of skin malignancies on the nose (6). SCC on the nose is more common in females than in males (7).

The localization of tumors on the nose presents some special features. The relapse rate for BCC on the nose is 2.5 times higher than for other body parts (8). BCC on the nose is often considered a high-risk cancer due to uncertainty in pre-surgical identification of tumor margins (9). Therefore, one-third of all incomplete BCC excisions are found here (10). In a series of 1,750 BCCs of the head-and-neck region, the recurrence rate of BCC was 1.6%. The highest recurrence rate (15.5%) was seen in cases of morphea-like BCC, compared to 3.9% among solid BCC. The recurrence rate among Ro resected tumors was 0.24%, compared to 19.8% among R1 resections (Pearson's chi-squared test = 56.000). Multivariate analysis of risk factors for recurrences demonstrated an odds ratio for recurrences of 54.89 (95% confidence interval, 21.16, 142.37) in the case of R1 resection status (11).

In a recent prospective Swedish study of 3,911 BCC surgeries, 4.6% of tumors were incompletely excised. Morphea-like BCC on the nose had the highest rate of an incomplete excision, at 61.5% (12). In a retrospective cohort study of 2,305 patients surgically treated, the odds ratio (OR) for an incomplete excision was 3.06 for tumors on the nose (13). These data demonstrate the challenges of Ro tumor resection on the nose.

During planning of reconstruction, the complex structure of the nose requires careful consideration. The nasal surface is made up of several concave and convex subunits—the tip, dorsum, sidewalls, alar lobules, and soft triangles—separated from one another by ridges and valleys (14). When planning defect closure after Ro resection of BCC, anatomical and aesthetic principles require careful consideration. The skin of the nasal tip and alae is thicker, more sebaceous, adherent, and less flexible, whereas on the dorsum, columella, and sidewalls the skin is thin, loose, compliant, and less sebaceous (15). The aesthetic subunits are the tip, columella, nasal bridge, alar base and alar side wall, and dorsal side wall (16).

Here we report on a series of 52 patients with BCC or SCC of the nose with a focus on surgical techniques for defect closure and outcome.

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Patients and methods

We report on Brazilian patients with BCC or SCC of the nose treated from 2015 to 2019 by Mohs surgery. The age and sex of the patients, tumor entity, and localization were recorded. All tumor specimens underwent 3D margin control by the pathologist.

We report on defect closure after complete excision of the lesions and report on adverse events and outcome. Depending on area, size, and depth of the resulting defect after tumor surgery, various techniques were used.

Nasolabial banner flaps are used to reconstruct alar, sidewall, and columnar nasal defects (Figs. 1–2). The appropriately sized flap has its inferior margin of the incision placed along the nasolabial fold. After anesthesia, the flap is sharply dissected along its borders. It is then elevated to the level of the mid cheek and dissected bluntly to the base of the flap. The nasolabial flap is harvested as a thin, pedicled flap. The rotation is always medial (17).

A bilobed flap is mainly used for reconstruction of sidewall defects. The lesion to be removed should be marked with an appropriate margin. The pivot point is marked across the dorsum of the nose about the size of the wound diameter. The first transposition flap has the length of the defect with a narrower base. The second transposition flap should be slightly longer, have a narrower base than the first one, and be excised with a triangular tip, thus leading to a linear scar and decreasing the chance of having a dog ear. The transposition arc is 90 degrees, with each transposition flap having an arc of 45 degrees. A deep absorbable suture is placed at the angle created by the separation of the flaps. The remainder of the flap is then secured in place. The tip of the second flap requires trimming to fit into the secondary defect created by the first flap (18).

The Rintala flap is a transposition flap for reconstruction of nasal dorsum and nasal tip defects. It is critical that the base not be too narrow for the length of the flap to ensure sufficient vascular supply. Two Burow's triangles are removed at the base of the flap in the glabellar region. For defects of the glabellar over the middle third of the nasal dorsum, a Rintala flap is transferred employing the original design and technique dissected on a supraperiosteal

Figure 1 | Basal cell carcinoma (BCC) of the nasal sidewall in a 66-year-old woman: a) clinical presentation of an ill-defined tumor plaque, b) preoperative planning of excision margins and nasolabial flap, c) resulting defect after tumor removal and creation of the flap, d) transposition of the banner flap for defect closure on the sidewall, e) after defect closure, f) follow-up after 11 months with good texture, no tumor relapse.

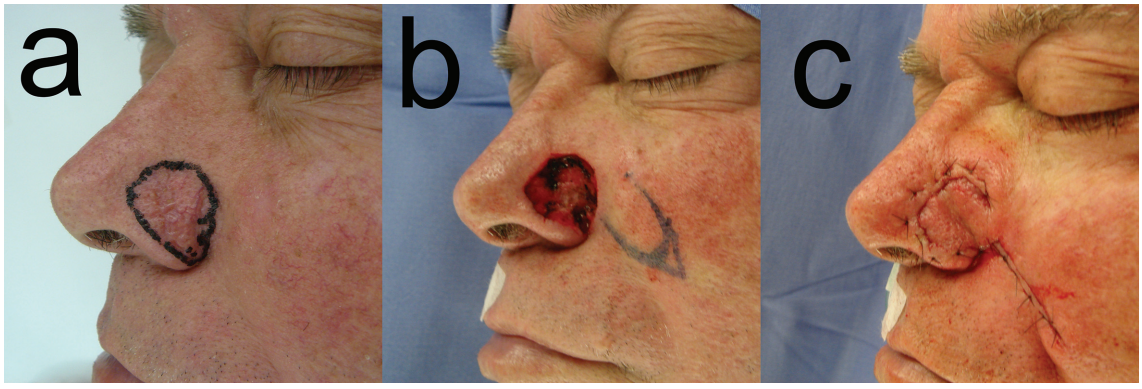

Figure 2 | Large basal cell carcinoma (BCC) with ill-defined borders and the ala: a) preoperative marking of the excision margins, b) planning of a nasolabial banner flap after complete tumor removal, c) defect closure.

plane. For defects of the lower third of the nasal dorsum over the nasal tip, the blood supply through the lateral nasal artery is added to the distal end of the flap, preparing a long flap with stable blood supply. Special attention must be paid to scar care on the forehead to obtain a good aesthetic outcome (19).

The tunneled island flap is a variant of island flaps used for alar and dorsum defects. These flaps are intensely irrigated and extraordinarily mobile, and the tunnel created allows a more direct course toward the primary defect. The design for this flap allows planning the scar on the donor area to be placed in a transition area of cosmetic units such as the nasolabial fold. Another advantage is the ability to repair deep defects. It is essential to avoid compromise of blood flow due to tension or compression by the tunnel (20).

The median frontal flap is used to reconstruct larger defects of the nasal dorsum, sidewall, and tip. The blood supply originates from the supratrochlear artery unilaterally or bilaterally. The width of the flap should be limited to 3 cm to ensure that the forehead donor defect can be closed primarily. The dissection should preserve the galea and periosteum of the bone. The flap can be used immediately owing to its excellent blood supply. The pedicle can be disconnected after approximately 3 weeks (21).

Results

A prerequisite for defect closure after tumor surgery is a complete Ro resection of the tumor, which was possible in all our patients.

A total of 52 patients were treated from 2015 to 2019. The mean age was 63 years (range 28–82 years, standard deviation 14.25 years). Thirty-nine (75%) patients were male and 13 (25%) were female.

Nasal defect closures were located on the nasal dorsum, tip, alar nose, and nasion. The nasal dorsal and alar region were the regions most commonly involved. A nasolabial flap was the reconstructive option in 40 subjects (76.9%) (Fig. 3). A bilobed flap was used in six patients (11.5%) (Fig. 4). Other flaps used for defect closure were a Rintala flap ($n = 2$), tunneled island flap ($n = 1$), and frontal flap ($n = 1$).

All lesions were sent for 3D pathological analysis. BCC was diagnosed in 49 patients (94.2%) and SCC in 3 patients (5.8%). Ro resection was achieved in all tumors.

Three patients presented with a relapse (5.8%) with a minimum of 3 months after surgery. They presented with infiltrative or multifocal BCC. Superficial epitheliolysis was observed in two cases. Three patients needed a second procedure to improve scar quality. No flap loss or other side effect was observed (Table 1).

Figure 3 | A 42-year-old woman with basal cell carcinoma (BCC) on the ala: a) preoperative presentation of the tumor, ill-defined margins, b) defect after Mohs micrographic surgery, c) nasolabial flap for the defect closure, d) follow-up 6 months later with good texture and minor scarring.

Figure 4 | Basal cell carcinoma (BCC) on the nasion in a 48-year-old man: a) clinical presentation of the tumor, b) and c) preoperative planning of excision margins and bilobed flap, d) defect after tumor excision, e) creation of the bilobed flap for defect closure, f) defect closure on the nasion.

Table 1 | Patients, flaps, and outcome.

Sex	Age	Diagnosis	Flap	Relapse	Complication
M	30	BCC	Nasolabial	No	Hypertrophic scar
M	46	BCC	Nasolabial	No	No
F	68	BCC	Nasolabial	No	No
M	29	BCC	Nasolabial	No	No
F	36	BCC	Nasolabial	No	No
M	59	BCC	Nasolabial	No	No
M	67	BCC	Nasolabial	No	No
F	65	BCC	Nasolabial	No	No
M	43	BCC	Nasolabial	No	No
M	80	SCC	Nasolabial	No	No
M	77	BCC	Nasolabial	No	Hypertrophic scar
M	80	SCC	Rintala	No	No
M	82	BCC	Nasolabial	No	No
F	63	BCC	Nasolabial	No	No
M	68	BCC	Tunneled island	No	No
M	60	BCC	Nasolabial	No	No
M	56	BCC	Nasolabial	No	No
F	42	BCC	Nasolabial	No	No
M	49	BCC	Bilobed	No	No
F	63	BCC	Nasolabial	No	No
M	69	BCC	Nasolabial	No	No
M	67	BCC	Nasolabial	No	No
M	39	BCC	Nasolabial	Yes	No
F	43	BCC	Nasolabial	No	No
M	55	BCC	Bilobed	No	Hypertrophic scar
M	68	BCC	Nasolabial	No	No
M	78	SCC	Bilobed	No	No
M	70	BCC	Nasolabial	No	No
F	71	BCC	Nasolabial	No	No
M	50	BCC	Tunneled island	No	No
F	39	BCC	Nasolabial	No	No
M	81	BCC	Rintala	Yes	Epitheliolysis
F	78	BCC	Rintala	No	No
M	74	BCC	Nasolabial	No	No
M	52	BCC	Nasolabial	No	No
M	71	BCC	Nasolabial	No	No
F	75	BCC	Nasolabial	No	No
M	75	BCC	Nasolabial	No	No
M	60	BCC	Nasolabial	No	No
F	72	BCC	Nasolabial	No	No
M	74	BCC	Frontal	Yes	No
M	59	BCC	Nasolabial	No	No
F	65	BCC	Nasolabial	No	No
M	62	BCC	Nasolabial	No	No
M	56	BCC	Nasolabial	No	No
M	58	BCC	Nasolabial	No	No
M	76	BCC	Nasolabial	No	No
M	43	BCC	Bilobed	No	Epitheliolysis
M	37	BCC	Nasolabial	No	No
M	50	BCC	Nasolabial	No	No
F	64	BCC	Bilobed	No	No
M	61	BCC	Bilobed	No	No

M = male, F = female, BCC = basal cell carcinoma, SCC = squamous cell carcinoma.

Discussion

We report on nasal reconstruction after skin cancer surgery, which requires detailed knowledge of anatomy, assurance of a complete tumor removal, and surgical skill. Surgery was performed using Mohs surgery, which examines all of the tumor margins during surgery through precise mapping. Although the original procedures used frozen sections, delayed Mohs with formalin-fixed tissue provides better quality of tissue preservation. This is of particular importance in the case of pigmented tumors with melanoma as a differential diagnosis. On the face, Mohs surgery leads to a higher percentage of complete cure compared to wide excision. The difference is less pronounced on other body areas such as the trunk (22–24). We used both types: Mohs with frozen sections during the surgical procedures and delayed Mohs on formalin-fixed tissue. The original Mohs procedure is very expensive in Brazil,

and this is why this technique was performed in a minority of patients.

Reconstructing the nose is an aesthetic and sometimes also functional challenge due to its complex structure. For optimal aesthetic outcomes, it is generally necessary to replace an entire subunit if more than 50% of the subunit is involved (25, 26). In superficial BCC, photodynamic therapy is an alternative treatment, but the complete response rate is inferior to surgery (27).

Successful nasal reconstruction after complete tumor excision requires detailed knowledge of the complex anatomy of this area and advanced surgical skills (28). Different types of nasal reconstruction are used depending on the size and topography of the defect, skin quality, functionality and aesthetics, and the patient's characteristics (17–21, 25, 26, 28–35). Depending on nasal subunits and the size of the defect, different techniques are possible.

In this study, a nasolabial flap was the reconstructive option in 76.9% of cases. A bilobed flap was used in 11.5%. Other flaps used for defect closure were a Rintala flap, tunneled island flap, and frontal flap. The relapse rate was 5.8%. Relapse rates of nasal BCC in the literature vary between 7.1% and 28.1% (34, 35). The OR for incomplete excision is 3.06 to 3.70, which is significantly higher than any other part of the face except the ears (12, 13). Although incomplete excision is a known risk factor for relapse, all tumors excised in this study were Ro resected.

In a study from South Korea, 111 nasal skin cancer surgeries on the nasal tip and nasal ala were analyzed. For nasal ala reconstruction, the most commonly used surgical technique was the nasolabial flap, whereas for the nasal tip bilobed flaps were preferred. These techniques and primary closure yield the best cosmetic outcome compared to other flaps and transplants (33).

In a retrospective analysis of 321 BCCs on the nose from Dresden, primary closure was possible in 105 tumors, advancement flaps were used in 91, rotation flaps in 47, transposition flaps in 34, and combined procedures in six cases. In 36 patients, full-thickness skin grafting (FTSG) was performed. In two patients, healing by secondary intention was preferred (25).

On the dorsum of the nose, FTSG and primary closure are preferred for defects up to 3 cm, whereas the forehead flap is preferred for defects larger than 3 cm. At the sidewalls, rotation and cheek advancement flaps, and FTSG are options for smaller lesions (< 3 cm), and a forehead or transposition flaps are options for larger defects, sometimes in combination. On the nasal tip, advancement or rotation flaps, island pedicle flaps, and FTSG are options, whereas for larger defects the forehead flap is preferred. Nasal ala reconstruction of the full thickness requires composite grafts or a forehead flap with a cartilage graft. Smaller skin defects may be covered by rotation, advancement, and transposition flaps. Healing by secondary intention is an option for smaller superficial defects (36).

In difficult cases with larger defects of several aesthetic subunits, dermal templates may be useful for defect closure (37, 38). We have experience with sandwich transplantation for larger defects of the dorsum and tip of the nose using an elastin-collagen matrix plus FTSG in one session (39).

In conclusion, our case series demonstrates the versatility of local flaps for defect closure on the nose. The treatment can be tailored for the patient according to localization and the size of the defect to obtain optimal results.

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