




Surgical Treatment and Reconstruction of Nasal Defects According to the Aesthetic Subunits Principles

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Abstract The aim of this study was to determine the prevalence of nasal skin cancer, its location by facial aesthetic subunits and the type of reconstructive procedures performed for each nasal subunit after excision for nasal skin tumors. Observational cross-sectional study of all consecutive patients with the diagnosis of skin tumor located in the nasal unit, treated from 2018 to 2019 by the department of head and neck surgery of a general hospital. 60 patients were treated with nasal skin tumors excisions. A total of 52 patients (86,6%) had basal cell skin cancer, 7 (11,6%) had squamous cell skin cancer and 1 (1,6%) had melanoma. Fifty-nine patients (98.33%) presented a primary tumor and just 1 case (1,66%) received a previous surgical treatment. Regardless of the type of tumor, the tip subunit was the most often involved with 29 (48,33%) cases in total. Despite of the nasal aesthetic subunit affected, the most frequent type of procedure used for reconstruction was the rotation or advancement flap, based on aesthetic nasal subunits, which was performed in 39 cases (65%). Nasal reconstruction after skin cancer can be very complex, especially since all patients have high expectations about the results. In order to achieve good results, there is a necessity for careful analysis of the

defect, correct planning and excellent technical execution of the procedures. Frequently, staged procedures will be needed to achieve an optimal result.

Keywords Facial aesthetic units · Skin cancer · Nasal reconstruction

Introduction

Non-melanoma skin cancer is one of the most common malignancy that occurs on Caucasian population with an increasing incidence [1]. The majority of these cases develop on the head and neck region; of these, 30% occur on the nose [2], as it is one of the most sun-exposed facial structures [3]. Since it is located on the midface in a central location, a minimal defect can produce aesthetic and psychosocial concerns for patients [4], even if the nose itself is well formed [5]. Anatomically, the nose is composed by skin, soft tissue containing bone and cartilage support framework, and an internal lining layer of stratified squamous epithelium and mucous membrane [6]. It is conformed by 10 aesthetic subunits: the root, dorsum, bilateral sidewalls, bilateral alar lobules, bilateral soft triangles, nasal tip and columella [4]. Each subunit has a unique topographical characteristic that guide its reconstruction.

The goal of reconstruction is to restore structural support and functionality of the nose, as well as to achieve an optimum aesthetic appearance [4]. It usually tends to require more additional reconstructive operations [1], due to the need for multi-staged surgeries and it is considered one of the most complicated procedures because of the inherent complexity of nasal defects [1]. The subunit principle states that when a defect includes more than one half of a subunit, the defect margins should be extended to

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Table 1 Skin tumor type per nasal aesthetic subunits

Nasal aesthetic subunit(s)	n, %	Skin tumor type		
		Basal cell skin cancer (n, %)	Squamous cell skin cancer (n, %)	Melanoma (n, %)
Dorsum	7 (11.6)	6 (85.7)	1 (14.3)	0
Left sidewall	4 (6.6)	4 (100)	0	0
Right sidewall	4 (6.6)	4 (100)	0	0
Tip	13 (21.6)	11 (84.6)	2 (15.4)	0
Left alar lobules	8 (13.3)	6 (75)	2 (25)	0
Right alar lobules	7 (11.6)	6 (85.7)	1 (14.3)	0
Tip/dorsum	9 (15)	9 (100)	0	0
Tip/right alar lobule	3 (5)	2 (66.6)	0	1 (33.3)
Tip/columella	1 (1.6)	1 (100)	0	0
Dorsum/left alar lobule	1 (1.6)	0	1 (100)	0
Tip/soft triangle/columella	1(1.6)	1 (100)	0	0
Tip/dorsum/right Alar lobule	2 (3.3)	2 (100)	0	0
Total	60 (100)	52 (86.6)	7 (11.6)	1 (1.6)

the boundaries of the subunit and then the entire subunit should be uniformly reconstructed [4]. This principle minimizes protruding scar formation by maintaining uniform tissue within a subunit and concealing scars along the borders of the defective subunit [4]. Convex nasal structures, such as the ala, tip, and bilateral soft triangles are suitable for applying the subunit principle because of the sharp boundaries that provide scar camouflage [6]. The foreseeable scar contracture that occurs from the cutaneous flap overlying the subunit wound also helps in reestablishing the desired convexity of the nasal subunit [4].

Therefore, the aim of this study was to determine the prevalence of nasal skin cancer (basal cell carcinoma, squamous cell carcinoma and malignant melanoma), their location by facial aesthetic subunits and the type of reconstructive procedures performed for each nasal subunit after excision for nasal skin tumors.

Material and Methods

The current study presents an observational cross-sectional study of all consecutive patients with the diagnosis of skin tumor located in the nasal unit, treated from 2018 to 2019 by the department of head and neck surgery of a general hospital. The inclusion criteria consist of patients treated during the period of study with the diagnosis confirmed by previous biopsy, who underwent surgery and attended to their post-operative follow-up visits. The patients included must have counted with the diagnosis confirmed by post-operative pathology. Patients with compromised edges in

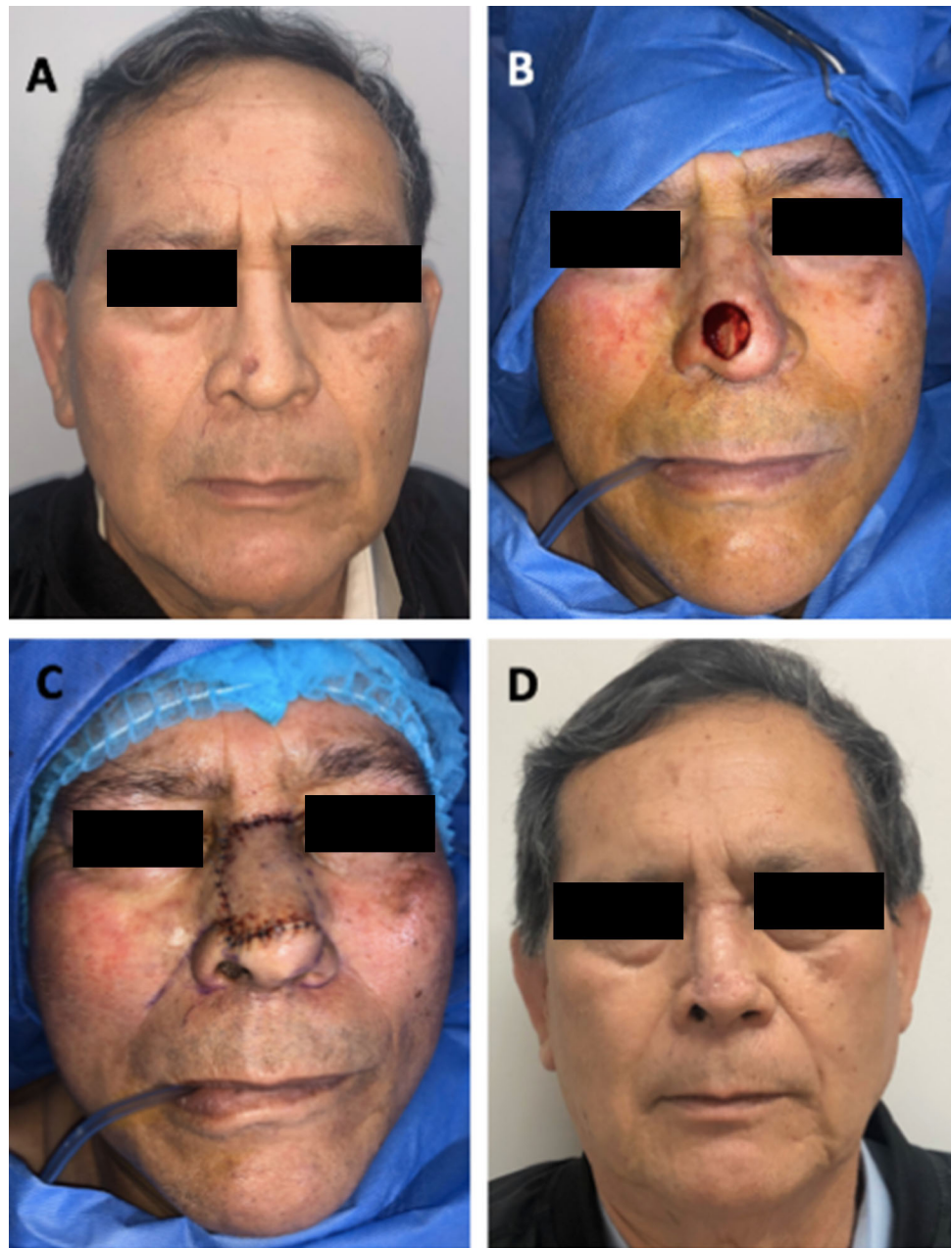
the pathological piece and who did not attend to their post-operative follow-up visits were excluded from the study.

Patient data was retrieved from patient records, operation reports, and pathology reports. This data was collected by our service health personnel. The variables taken into account were: age, sex, aesthetic unit(s) involved, histology, type of reconstruction and postoperative complications. The data was recorded into a database (Microsoft Excel 2010) and quality control was performed by double digitization of data. Data analysis was performed using the statistical package STATA 13.0. For univariate analysis, the categorical variables were expressed as frequencies (percentages). Informed consent was required in all the cases before the surgical act. This study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

Results

Between January 2019 and January 2020, 60 patients were treated with nasal skin tumors excisions. There were 33 males (55%) and 27 females (45%) with a mean age of 62 years (range, 39–88 years) at the time the procedure was done. A total of 52 patients (86.6%) had basal cell skin cancer, 7 (11.6%) squamous cell skin cancer and 1 (1.6%) melanoma (Table 1). Fifty-nine patients (98.33%) presented a primary tumor and just 1 case (1.66%) had a previous surgical treatment with Mohs surgery performed by a dermatologist in another hospital. No one else had previous treatment but biopsy.

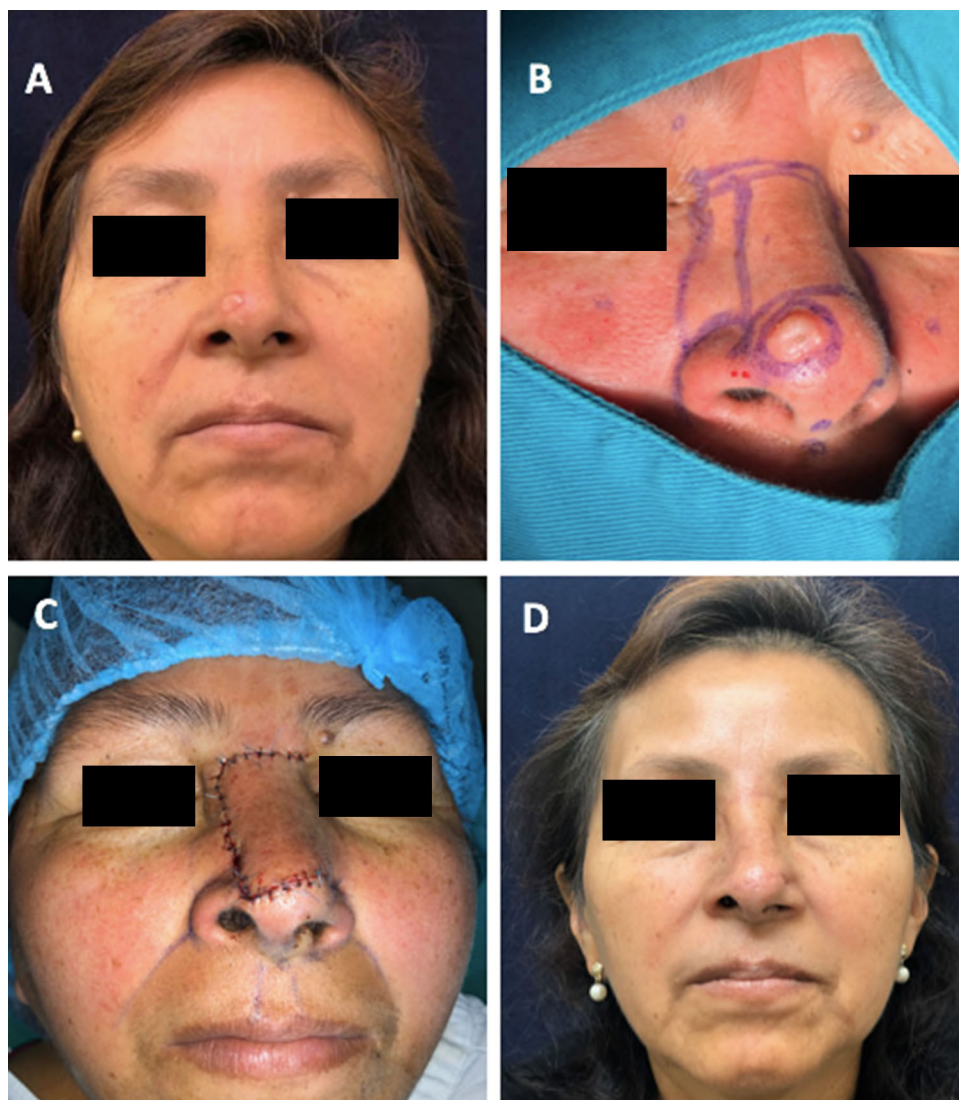
Fig. 1 Reconstruction of tip and partial dorsum subunits in one-stage procedure. **a** Pre-operative photography. **b** Intra-operative procedure. **c** Reconstruction according aesthetic units. **d** Post-operative result



Skin tumor distribution per nasal aesthetic subunits is shown in Table 1. Regardless of the type of tumor, the tip subunit was the most often involved with 29 (48,33%) cases in total (considering affection of the tip exclusively and combined with other subunits) (Fig. 1). The dorsum was the second subunit most affected with 19 cases (31,66%) in total, followed by the right alar lobule with 12 cases (20%) and left alar lobule with 09 cases (15%). In case of the sidewalls, there were 4 cases for each side (6,6%). It must be taken into consideration that 14 patients had at least 02 subunits involved (23,33%) (Figs. 2 and 3) cases with 03 subunits involved (5%).

Regardless the nasal aesthetic subunit affected, the most frequent type of procedure used for reconstruction was the rotation or advancement flap, based on aesthetic nasal subunits, which was performed in 39 cases (65%) of the total (Figs. 3, 4), followed by two stages reconstruction in 4 cases (6,6%) (Fig. 5) and three stages reconstruction in 17 cases (28,3%) (Fig. 6) (Table 2). We had 4 patients with complications (6,6%): 2 cases with distal necrosis of the flap, which were closed by second intention, 1 case of incomplete rotation of the flap that was revised in the operation room the next day, and finally a retractable scar that remains to be corrected. No tumor recurrences occurred in our population.

Fig. 2 Reconstruction of O2 subunits (tip and partial dorsum) in one-stage procedure. **a** Pre-operative photography. **b** Intra-operative procedure. **c** Immediate post-operative result. **d** Control



Discussion

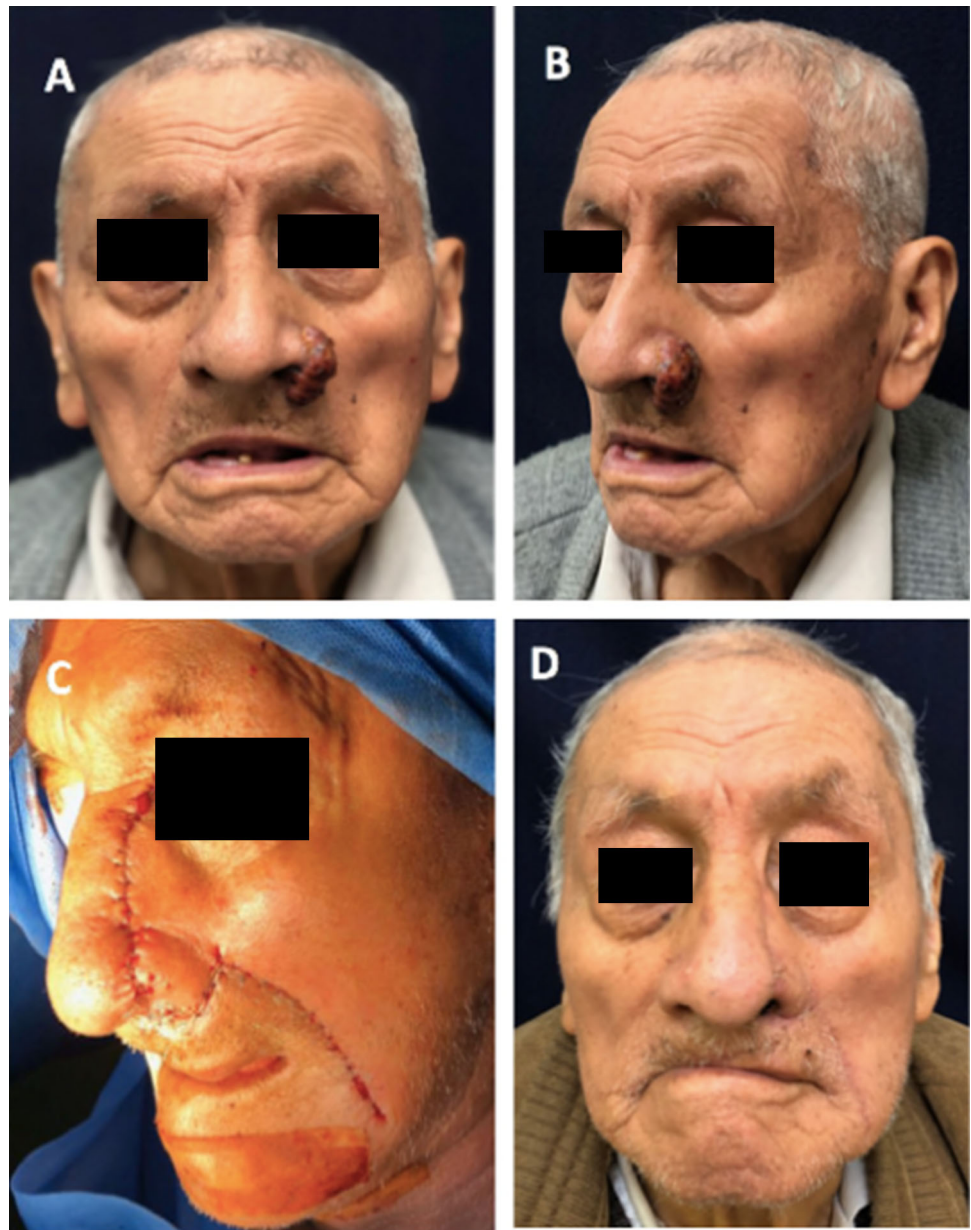
Nasal deformities caused by neoplastic disorders have presented a challenge to the reconstructive surgeon since antiquity [7]. Therefore, reconstructive surgeons have, for many centuries, used their abilities to develop innovative techniques to reconstruct this facial structure [7]. The unique anatomy of the nose, combined with its aesthetic and functional importance, makes its reconstruction a challenging but rewarding undertaking [7].

With medical advances in nasal reconstruction, the paradigm for management has become more sophisticated [8]. But even with this medical advances, some continue to perform nasal reconstruction procedures with different skin patches in which the defects are only partially covered without taking into account the nasal aesthetic subunits [8]. The concepts of Menick and Burguet [9], 10, 11

concerning nasal reconstruction taking into account the nasal aesthetic units as limits for resection and treatment helped avoid unfavorable cosmetic results seen when performing only “skin-patches” reconstruction. In this study, nasal reconstructions were performed following the concepts of Menick and Burget [5, 9, 10], obtaining favorable and harmonious aesthetic results. In fact, these subunits are well accepted by most plastic surgeons, at least with regard to their utility in nasal analysis [12].

In our study, we found that the most common histology was basal cell cancer, affecting 86,6% of patients, followed by squamous cell cancer (11,6%) and melanoma (1.66%). These results correlate with Rohrich [12], Uzun [13] and Boyd et al. [14] who also studied the prevalence of skin cancer in patients who underwent nasal reconstruction. They also agree with other authors, like Choi [15] and Kang [16], who studied skin cancer in the facial region in

Fig. 3 Reconstruction of left alar lobule in one-stage procedure according to aesthetic units. **a, b.** Pre-operative photography. **c** Reconstruction according aesthetic units. **d** Post-operative result

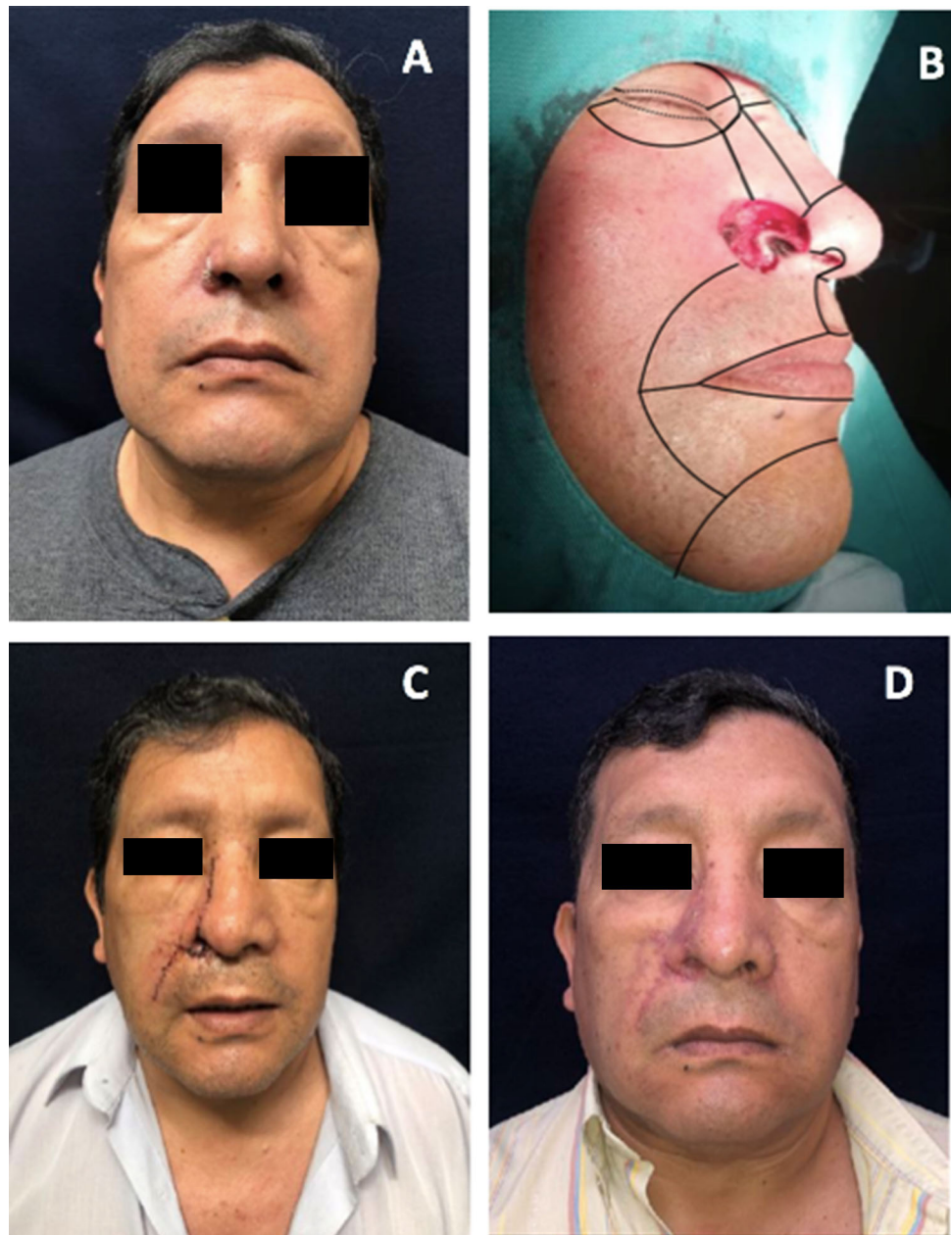


general. Regarding the most affected aesthetic subunit, we found that the tip was the most common location (48,33%). This result are consonant with the study of Boyd et al. [14], who found that the nasal tumor arose primarily on the nasal tip, followed by the ala, the sidewall and the dorsum, but contradict with the results presented by Rohrich et al. [12], who found that the most common location for nasal reconstruction was the dorsum (53%), followed by the ala (33%) and tip (17%). Moolenburgh et al. [17] found that the most frequent location was the nasal ala (29%), followed by the dorsum (24%), tip (21%) and sidewall (16%). On the other hand, our study found that 28,3% of patients presented more than one subunit affected at the time of

surgery. Related to that, Moolenburgh et al. [17] found that 6% of their population presented an initial tumor that had already spread widely over more than one subunit; and Boyd et al. [14] described that 2.7% of their patients had 2 lesions involving more than 1 nasal subunit that were simultaneously treated.

Despite that most of our cases were reconstructed in one stage using rotation or advancement flap (65%), based on aesthetic nasal subunits, a considerable percentage (34.9%) of our patients required two or three stages of reconstruction. The multi-stage surgery was also used by Moolenburgh [2], Singh [17] and Boyd [14] in their studies. In addition, Taghinia et al. [18] state that multiple procedures

Fig. 4 Reconstruction of right alar lobule in one-stage procedure according to aesthetic units. **a** Pre-operative photography. **b** Reconstruction according aesthetic units. **c** Immediate post-operative result. **d** Control

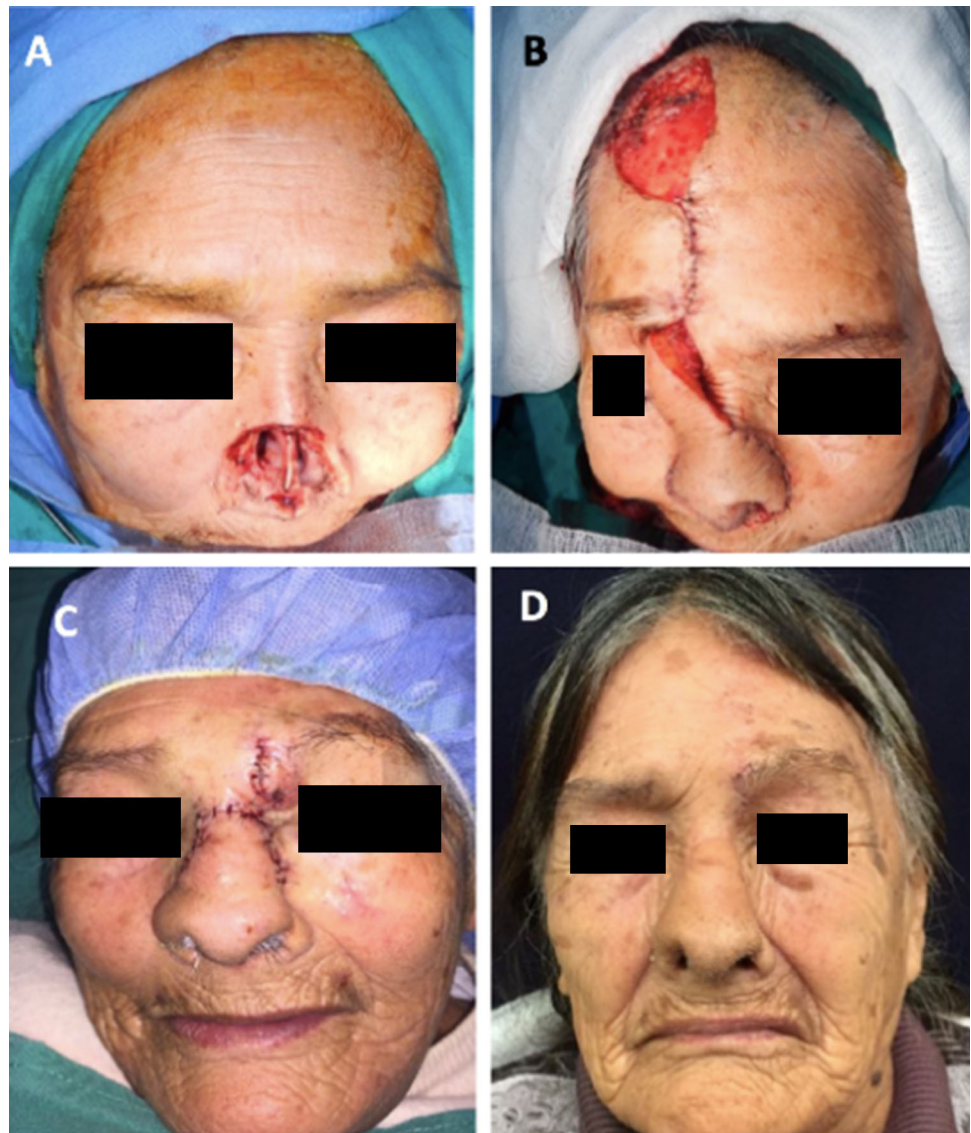


are needed to reconstruct a functional and aesthetic nose. Philips et al. [19] account that an important consideration in nasal reconstruction is the timing. They state that the benefits of immediate reconstruction are fresh wound bed, avoiding scar/radiated tissue and a single operation for the patient [19]. On the other hand, delaying the reconstruction can allow for clear margins to be confirmed and to avoid radiation or other adjuvant therapy, which can damage the reconstruction [3, 19].

There is the wrong belief that patients in developing countries can tolerate an aesthetically poor result as they value more a quick resolution of their problem rather than

the aesthetical appearance. For that reason, many surgeons do not suggest their patients the possibility of a multiple staged surgery. In our experience, we have noticed that when the patients end up with unpleasant aesthetics outcomes, there exists many complaints, even when they are of old age. We also consider that it is almost impossible to develop a clean technique with a correct projection of the nasal tip or a correct tissue restructuring with a completely normal appearance or with cartilage placement if the surgery is performed in a single time, since it is very difficult for the flap to survive, with not promising outcomes for an aesthetically result, especially when treating the nasal tip.

Fig. 5 Reconstruction of nasal tip and dorsum in two-stage procedure according to aesthetic units. **a** Fist procedure: excision of squamous cell carcinoma. **b** Fist procedure: forehead flap. **c** Second procedure: flap remodeling. **d** Post-operative result



Moolenbugh et al. [2] state that a minimum of three and maximum of seven operations were performed in their study to achieve an acceptable end result, which is in line with other studies [14, 17].

The percentage of complications obtained in our study was of 6.6%, including cases of distal necrosis if the flap, incomplete rotation of the flap and retractable scar. Some findings coincide with those described by Menick et al. [20], who found some complications as an imperfect nasal contour, retraction of soft tissue and nostril stenosis in their study, and which corrections consisted of soft tissue debulking, use of secondary cartilage grafts, tissue rearrangement, or a second regional flap. On the other hand, Rustemeyer et al. [21] found that the main complication

after local flaps for nasal reconstruction was dehiscence and aesthetic deficits.

Conclusion

Nasal reconstruction after skin cancer can be very complex, especially since all patients have high expectations about the result. Careful analysis of the defect, correct planning and excellent technical execution of the procedures have the same importance in order to get good results. Frequently, staged procedures will be needed to achieve the optimal result. It is really important to understand the nasal subunits concepts to avoid the patchy appearance. A successful reconstruction can provide a lifetime satisfaction

Fig. 6 Reconstruction of nasal tip and columella subunits in three-stage procedure using a forehead flap. **a** Pre-operative photography. **b** First reconstruction using a forehead flap. **c** Second reconstruction with atrial cartilage graft. **d** Post-operative result after third procedure (flap remodeling)

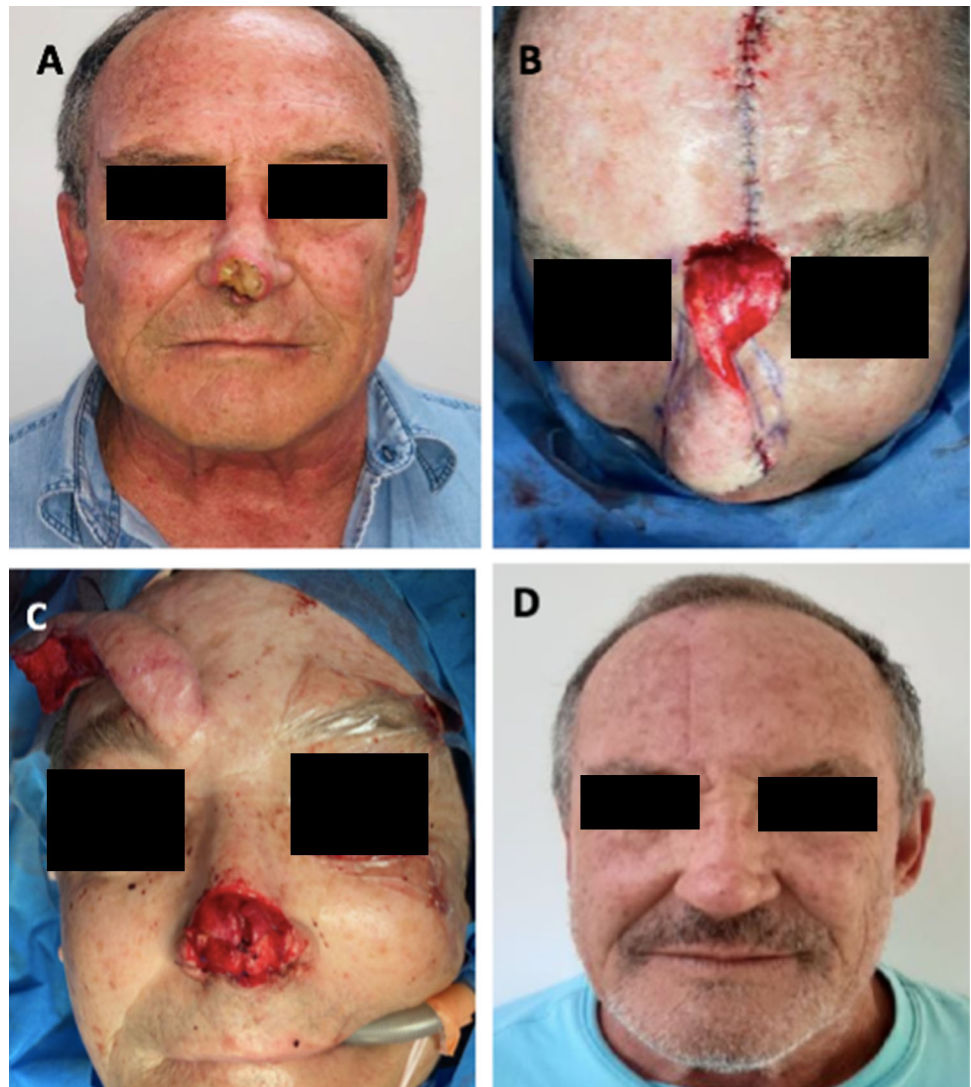


Table 2 Skin tumor distribution and type of reconstruction per nasal aesthetic subunits

Nasal aesthetic subunit	Type of reconstruction			Total
	One stage flap	Two stages flap	Three stages flap	
Dorsum	7 (100)	0	0	7 (11.6)
Left sidewall	4 (100)	0	0	4 (6.6)
Right sidewall	4 (100)	0	0	4 (6.6)
Tip	1 (7.7)	3 (23)	9 (69.3)	13 (21.6)
Left alar lobules	8 (100)	0	0	8 (13.3)
Right alar lobules	7 (100)	0	0	7 (11.6)
Tip/dorsum	5 (55.5)	0	4 (44.4)	9 (15)
Tip/right alar lobule	1 (33.3)	1 (33.3)	1 (33.3)	3 (5)
Tip/columella	0	0	1 (100)	1 (1.6)
Dorsum/alar lobule	1 (100)	0	0	1 (1.6)
Tip/soft triangle/columella	0	0	1 (100)	1 (1.6)
Tip/dorsum/alar lobule	0	0	2 (100)	2 (3.3)
Total	39 (65)	4 (6.66)	17 (28.33)	60 (100)

for the patient, who is able to get his normal life back as soon as possible.

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Declarations

Conflict of interest Author 1 declares that he has no conflict of interest. Author 2 declares that she has no conflict of interest

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent “Informed consent was obtained from all individual participants included in the study.

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