

Original Articles

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Nasal reconstruction after Mohs micrographic surgery: analysis of 208 cases

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ABSTRACT

Introduction: The nose is frequently affected by cutaneous carcinomas. Due to its functional and cosmetic importance, tumors on this location are preferably treated by Mohs micrographic surgery, which provides the highest cure rates. For repairing of surgical defects several options are available, including healing by second intention, primary closure, skin grafts, and flaps. In certain cases, one should consider a combination of methods.

Objective: To describe the authors' experience in nasal reconstruction after Mohs surgery and to assess if the number of involved subunits influenced the use of combined repairs.

Methods: Retrospective study of consecutive cases submitted to Mohs surgery and nasal reconstruction by one of the authors during a 3-year period.

Results: 208 cases were included, and the most common repair method were flaps (n = 82). Combined methods were performed in 44/154 (29%) cases with involvement of only one nasal anatomical subunit and 29/54 (54%) cases with multiple nasal subunits involved.

Conclusions: The dermatologic surgeon should be familiar with different options for nasal reconstruction. The combination of repair methods was often performed, mainly for wounds that affected more than one nasal subunit.

Keywords: Carcinoma, basal cell; Mohs surgery; Nose neoplasms; Surgical flaps

RESUMO

Introdução: O nariz é frequentemente acometido por carcinomas cutâneos. Devido à importância funcional e estética, tem como primeira indicação a cirurgia micrográfica de Mohs, método com a maior taxa de cura. Para reparo das feridas operatórias, inúmeras opções estão disponíveis incluindo cicatrização por segunda intenção, fechamento primário, enxertos cutâneos e retalhos. Em certos casos, deve-se considerar a combinação de métodos.

Objetivo: Descrever a experiência dos autores na reconstrução nasal após cirurgia de Mohs e avaliar se o número de subunidades anatômicas acometidas influenciou no uso de métodos combinados de reparo.

Métodos: Estudo retrospectivo de casos consecutivos submetidos à cirurgia de Mohs e à reconstrução nasal por um dos autores, num período de três anos.

Resultados: Foram incluídos 208 casos e o método de reparo mais comum foram os retalhos (n=82). A combinação de métodos foi utilizada em 44/154 (29%) casos com acometimento de apenas uma subunidade anatômica nasal e em 29/54 (54%) casos com múltiplas subunidades nasais envolvidas.

Conclusões: O cirurgião dermatológico deve se familiarizar com as diferentes opções de reconstrução nasal. A combinação de métodos de reparo foi frequentemente utilizada, principalmente para feridas com acometimento de mais do que uma subunidade nasal.

Palavras-chave: Carcinoma basocelular; Cirurgia de Mohs; Enxerto; Neoplasias nasais; Retalhos cirúrgicos

INTRODUCTION

The nose is one of the facial units most frequently affected by carcinomas of the skin.¹ Due to the aesthetic and especially functional importance of the nose, it is crucial to offer patients treatments with lower chances of recurrence. Thus, various guidelines recommend Mohs micrographic surgery (MMS) for cutaneous carcinomas located in this region.²⁻⁴ The technique consists of 100% assessment of the surgical margins, compared to examination of around 1% in the conventional excision.^{5,6} This complete assessment of the margins provided by MMS leads to the highest cure rate in the treatment of carcinomas, and its indication is thus important in noble areas of the face such as the nose.⁷

Even with MMS, which preserves healthy tissue, many nasal surgical defects are challenging because of the complex local anatomy, with its peculiar three-dimensionality. The priority of nasal restoration should be functional before aesthetic, but the latter should never be overlooked, since postoperative nasal deformities can have significant psychological impact.⁸ It is thus essential to combine both aspects, functional and aesthetic.

The repair of nasal surgical defects should consider their diameter and depth, the availability of adjacent skin, and the patient's expectations.^{9,10} Numerous options are available, including healing by secondary intention, primary closure, skin grafts, and flaps. A combination of methods should be considered in certain cases.

One of the main factors that influences the choice of reconstruction method is the availability of skin adjacent to the wound. On the nose, this availability is limited in the lower third, formed by the tip, ala, columella, and soft triangles. In the upper thirds (nasal sidewalls and dorsum), the skin usually tends to be less sebaceous and more elastic.

The study aimed to describe the authors' experience with nasal reconstruction after Mohs micrographic surgery and to assess whether the number of affected anatomical subunits influenced the use of combined methods for repair.

METHODS

This was a retrospective study of consecutive cases submitted to MMS and nasal reconstruction by one of the authors (FBC) from January 2017 to December 2019. The cases were from the private practice and the university hospital where the authors work. The study was approved by the local Institutional Review Board.

Nearly all of the surgeries were performed under local anesthesia with lidocaine and bupivacaine with vasoconstrictor. When necessary, nerve block (external nasal branch of the ethmoidal nerve, supratrochlear, or infraorbital) supplemented the local anesthesia. For larger reconstructions or more anxious patients, oral benzodiazepine (lorazepam) was associated at a dose of 1mg. Antibiotic prophylaxis is a controversial issue¹¹⁻¹³, and the authors follow the recommendation by Wright *et al.*, which consists of administering 2g of cephalexin 30 minutes before surgery in cases with higher likelihood of requiring nasal flaps and/or grafts or for patient's reasons (orthopedic prostheses, immunosuppression, prosthetic heart valves).¹⁴ Postoperative antibiotic (cephalexin 500mg every six hours for seven days)

was prescribed after complex surgeries, long duration or when cartilage graft was required.

Data analysis included a review of the photographic documentation and the following data: age, gender, Fitzpatrick skin phototype, tumor characteristics, defect size and number of anatomical subunits involved, number of MMS stages, reconstruction performed, use of antiplatelet agents or anticoagulants, smoking, and postoperative complications.

The nasal subunits were divided into dorsum and nasal sidewalls (upper thirds) and tip, ala, columella, and soft triangles (lower nasal third).¹⁵ The reconstruction methods were divided into healing by secondary intention, primary closure, flaps, or graft. When more than one method was used, it was referred as combined reconstruction. For analysis of the repair methods, we only considered the ones for closure of the nasal subunits. Methods used in adjacent subunits (cheek, for example) were not analyzed together, to avoid biases.

Complications were divided into two groups. Short-term complications were defined as bleeding that required reintervention, hematoma, infection, dehiscence, and flap/graft necrosis (partial or total). Long-term complications were defined as easily noticeable anatomical distortion (e.g., retraction of the nasal rim) and nasal obstruction.

RESULTS

The study included 208 cases from 190 patients. Two other patients were excluded, since they were referred to plastic surgery for reconstruction after MMS. Table 1 shows the demographic and surgical data.

The most primarily affected nasal subunits were the nasal sidewalls (n=75), followed by nasal tip (n = 52), dorsum (n = 45), and ala (n = 36) (Figure 1). In 154 cases, only one nasal subunit was involved, whereas in 54 two or more subunits were affected. In 15 cases, the wound extended to other subunits of the face (cheek=12, apical triangle=1, upper cutaneous lip=1, and eyelid=1). In such cases, the subunits beyond the nose were restored by primary closure or (n=8) by secondary intention (n=7).

Graph 1 shows the reconstruction methods performed. For the nasal dorsum, primary closure was the most frequently used. Flaps were the most common for the nasal sidewalls and tip, and grafts for the nasal ala. Regarding the flaps, in 82 cases they were the main repair method: rotation (n=21), island pedicle (n=15), transposition (n=14), advancement (n=12), island with lateral pedicle of the nasalis muscle (n=8), interpolation (n=6), and hinge (n=6). Two patients underwent surgical revision. One because of webbing on the inner canthus, treated with Z-plasty; and the other for thinning the flap. In four cases, intralesional steroids were used with satisfactory results for treatment of "trapdoor".

Among the 154 cases with involvement of only one nasal subunit, 110 (71%) were restored with a single method and 44 (29%) with combined methods. Among the cases with multiple nasal subunits involved (n=54), in 29 (54%) a combination of methods was used for closure (Graph 2).

TABLE 1: DEMOGRAPH AND SURGICAL DATA

Age (years)	Gender	Fitzpatrick phototype	Smoker	Antiplatelet agents or anticoagulants
Mean, 65	121 women	I:3	20	16: Salicylic acid
36 to 91	69 men	II:91		8: clopidogrel
		III:93		
		IV:3		
Tumors	Primary or recurrent	Anesthesia	Mean defect size (mm)	Number of stages
197 BCCs	180 primary	Local: 201	11 x 9 (lower 1/3)	1.6 (1 to 6)
9 SCCs	25 recurrent	Local + lorazepam: 3	13 x 11 (upper 2/3)	
1 SCC <i>in situ</i>	3 inc. excised	Local + IV sedation: 4	From 4 x 3 to 40 x 35	
1 basosquamous carcinoma				

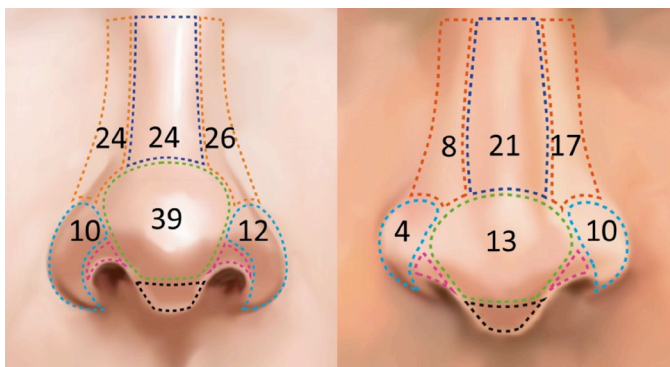
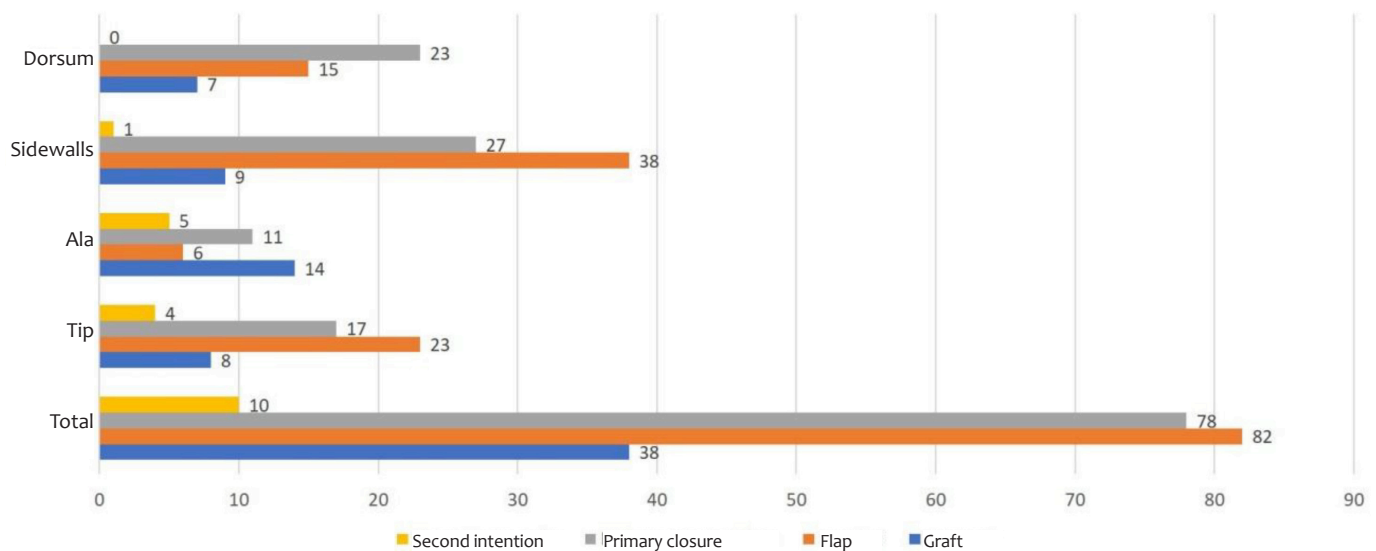


FIGURE 1: Location of tumors in women and men. The main affected subunit was considered. If a tumor affected the tip and dorsum, for example, the subunit with the predominant involvement was considered.
Nasal subunits: tip (green), ala (light blue), soft triangles (pink), columella (black), sidewalls (orange), and dorsum (dark blue).

Pre- and postoperative prophylactic antibiotics were used in 104 and 41 cases, respectively. Complications occurred in 6.2% (n=13) of the cases, 12 were short-term and one was long-term. The most common complications were infection (n=4) and partial graft necrosis (n=4), followed by partial flap necrosis (n=3), dehiscence (n=1), and nasal valve dysfunction (n=1). Infections were treated with oral antibiotics and healed uneventfully. Partial flap or graft necrosis were managed with local wound care. The patient that presented dehiscence, after early removal of the sutures, healed by secondary intention. The case of nasal valve dysfunction due to inadequate flap design evolved with partial improvement and refused surgical revision.

DISCUSSION

Similarly to previous publications, the current study demonstrated the variety of available options for nasal reconstruction and the frequent need for flaps and grafts, even on the upper thirds of the nose.¹⁶⁻¹⁹ It also showed that defects involving



*All the grafts were full-thickness

GRAPH 1: Main reconstruction method used according to subunits involved. For this analysis, in cases of combined closure, the main method was considered (the method that restored most of the defect).

multiple nasal subunits were more often repaired with a combination of methods. This is especially true for defects involving the nasal ala and sidewall, where preservation of the alar sulcus is essential for facial symmetry (Figure 2).^{20,21}

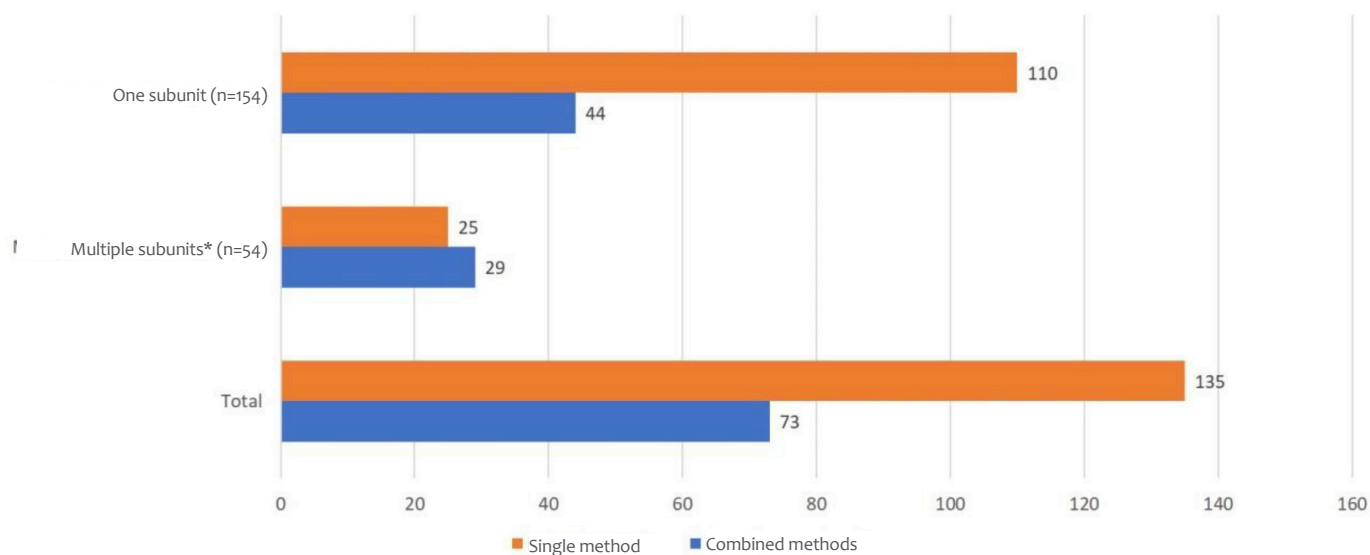
The repair choice varied according to the number and to nasal subunits involved. Similarly to previous reports, flaps were the most frequent reconstruction method.^{17,22}

In a study that compared the outcomes of flaps and grafts for nasal restoration, the authors showed that well-designed flaps were more likely to result in superior cosmetic outcome.²³

The nasal dorsum, due to the greater elasticity of adjacent areas (glabella and nasal sidewalls), was restored with pri-

mary closure or flap in 85% of cases. Figure 3 illustrates an excellent option of an advancement flap for this site, also known as the “east-west flap”.²⁴ When performing a vertical primary closure on the nasal dorsum, the standing cones should be long to reduce the risk of uneven levels between the sutured area and upper and lower adjacent areas.²⁵ Although hard to notice from a front view this unevenness is easily noticed from side view.

For the nasal sidewall, flaps and primary closure were the most frequently used, a finding consistent with the literature.^{17,26} Figure 2 illustrates a combined repair for a defect affecting multiple subunits, the main one the left nasal sidewall.



*Number of nasal subunits involved/cases: 2/40, 3/11, 4/3

GRAPH 2: Number of nasal subunits involved and reconstruction methods

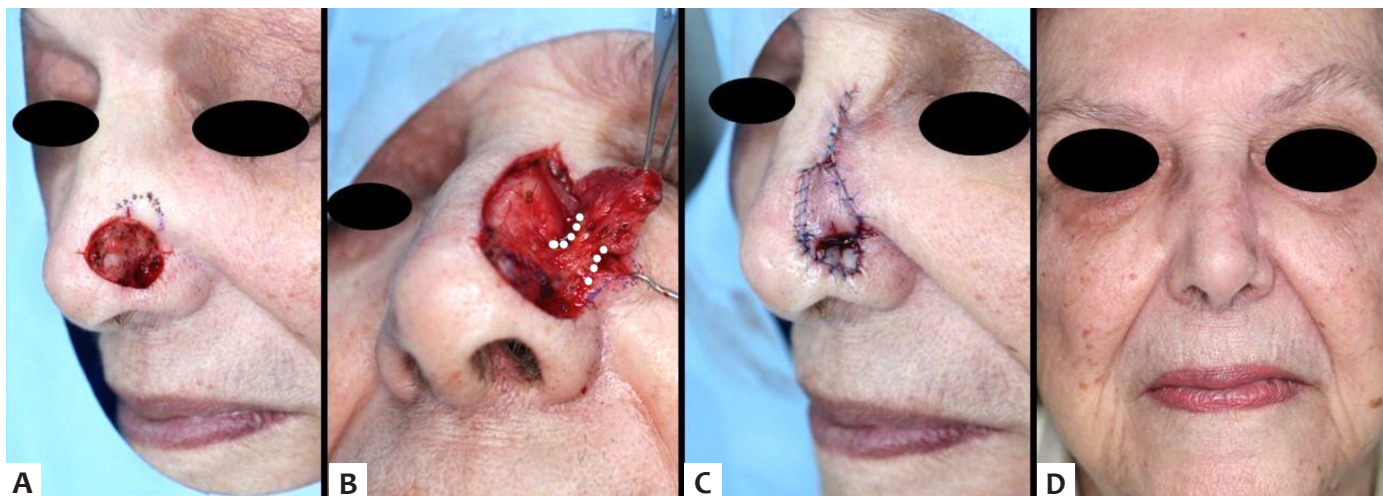


FIGURE 2: Combination of methods: island pedicle flap based on the nasalis muscle (“nasalis sling flap”), skin graft, and secondary intention
A) Surgical defect with involvement of nasal sidewall, ala, dorsum, and tip; **B)** Flap undermined. Unlike the regular island pedicle flap, this flap has a laterally based pedicle. (dotted white line). The flap is undermined in two distinct planes: supraperichondrial from the medial incision and subdermal from the lateral incision; **C)** Immediate postoperative view. The flap repaired the sidewall, dorsum, and tip (slightly involved). The nasal ala was restored with a skin graft harvested from the upper portion of the flap to avoid another donor area. The alar sulcus was left to heal by secondary intention to recreate its concavity; **D)** Two months postoperative, front view. Note recreation of alar sulcus and maintenance of nasal symmetry.

For flaps that recruit tissue from the cheek, two details deserve attention. The first is the maintenance of the nasofacial sulcus, especially when using lateral advancement flaps. This can be performed by fixing the deep portion of the flap on the nasofacial sulcus. Another detail is to adequately thin island pedicle flaps, since the nasal sidewall is much thinner than the cheek.

For the nasal tip, flaps and primary closure were the most common repair method. Among the flaps, the rotation was the most frequently performed. It allows incisions to be hidden bet-

ween subunits (sidewall and dorsum, or nasofacial sulcus). The disadvantage is that this flap requires long incisions and significant undermining for adequate mobility and avoidance of nasal tip distortion. Another frequently used option was a variation of the Burow's graft, which consists on the combination of primary closure and a hinge flap and graft (both from the Burow's triangle)²⁷, similar to the method illustrated in figure 4.

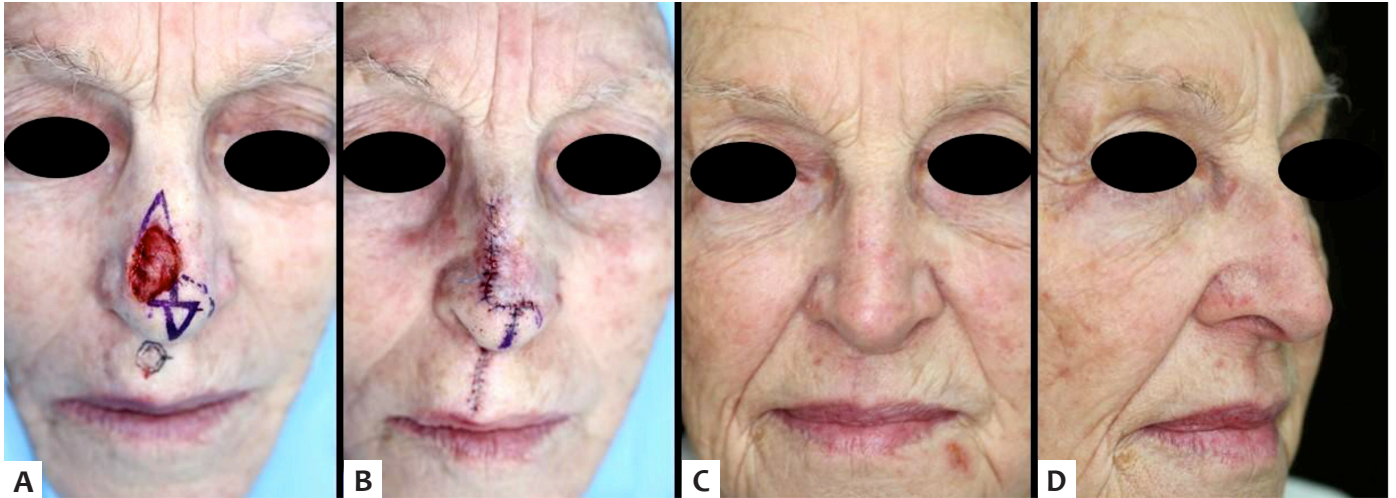


FIGURE 3: Unilateral advancement flap. A) Surgical defect involving nasal dorsum and tip. Flap design. It is important to remove "leftover" skin for adequate coaptation of surgical borders. This flap is also known as "east-west flap"; B) Immediate postoperative view; C) Two and a half months postoperative, front; D) Oblique view.

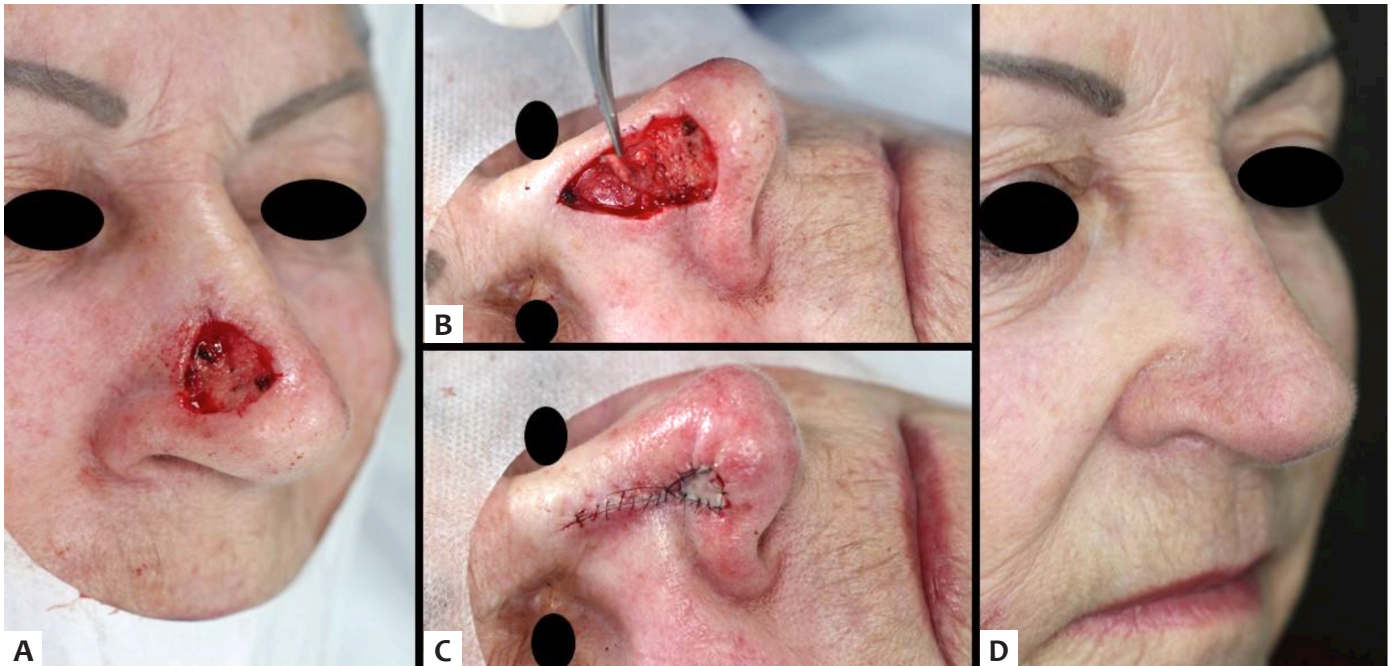


FIGURE 4: Primary closure combined with hinge flap and skin graft. A) Surgical defect with involvement of multiple subunits; B) 180-degree movement of hinge flap after de-epithelization (skin from the "de-epithelization" was used as graft); C) Immediate postoperative view. Defect restored with combined methods: primary closure for the upper third (sidewall and dorsum) and hinge flap with skin graft the for lower third (ala to tip transition); D) Two months postoperative

For extensive and deep defects of the nasal tip (in some cases with involvement of the dorsum), the paramedian forehead flap was performed (Figure 5), allowing adequate restoration of the nasal anatomy, as described in the literature.^{9,28-30}

The nasal ala was the only subunit where graft was the main repair method despite numerous described flaps from the ala itself.^{31,32} Because of the lack of support and the fact that the ala is a free margin, any minimal flaw when designing flaps from

the ala itself can cause local distortion. For this reason, this author usually prefers grafts for small defects³³ and secondary intention when the alar sulcus is involved, or a combination of both (Figure 6). Primary closure can be useful for small alar defects, mainly those located on the medial portion of the ala adjacent to the tip. On the central or lateral portion, even small primary closures can cause collapse because of the vector that "pushes the ala inward". In the current study, secondary intention was one of

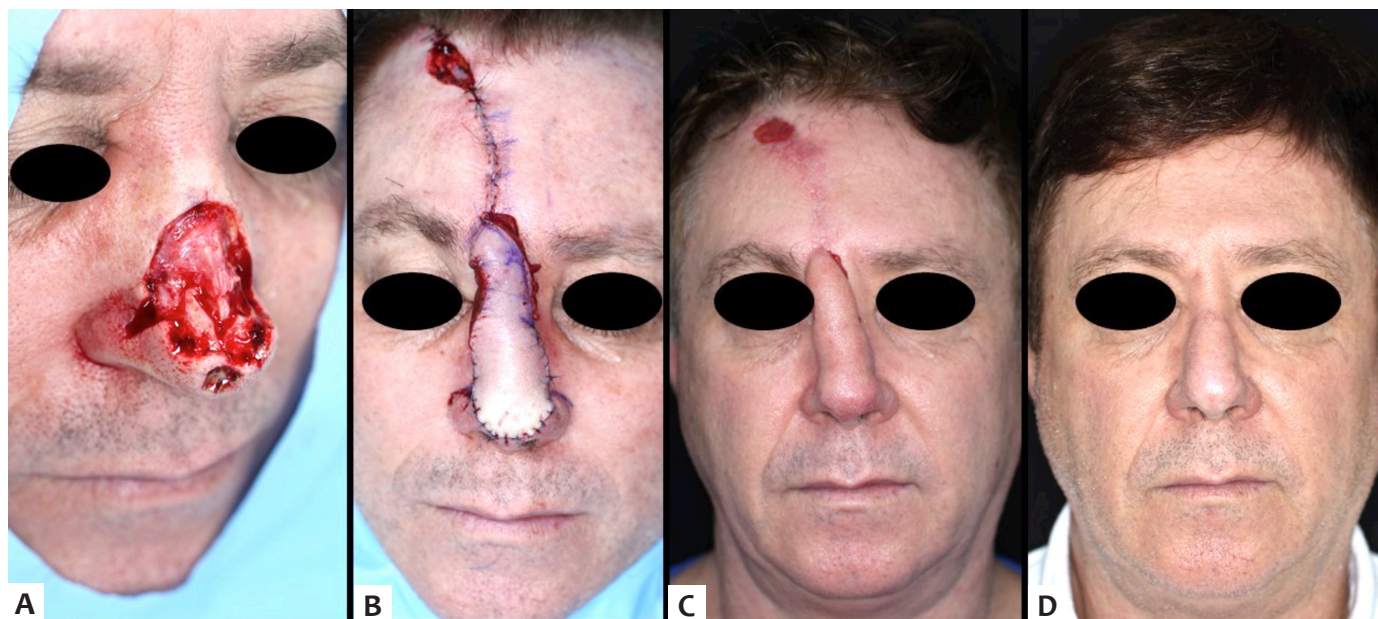


FIGURE 5: Paramedian forehead flap. **A)** Surgical defect after removal of a recurrent infiltrative BCC (treated twice with conventional excision in another institution) on the nasal dorsum and tip and a small primary BCC on the nasal tip. The defect area that affected the right inferior nasal sidewall and ala was partially closed primarily. Nasal dorsum and tip restored with paramedian forehead flap. Since the amount of cartilage removed was relatively small, the cartilages were reapproximated and no cartilage graft was used; **B)** Immediate postoperative, first stage. Donor area was partially closed and the rest left to heal by secondary intention. Note that the remaining of the nasal tip subunit was removed to camouflage the suture lines between the subunits; **C)** Preoperative view prior to second stage, performed after three weeks; **D)** Nine months postoperative with restoration of nasal anatomy. Incisions camouflaged between nasal subunits

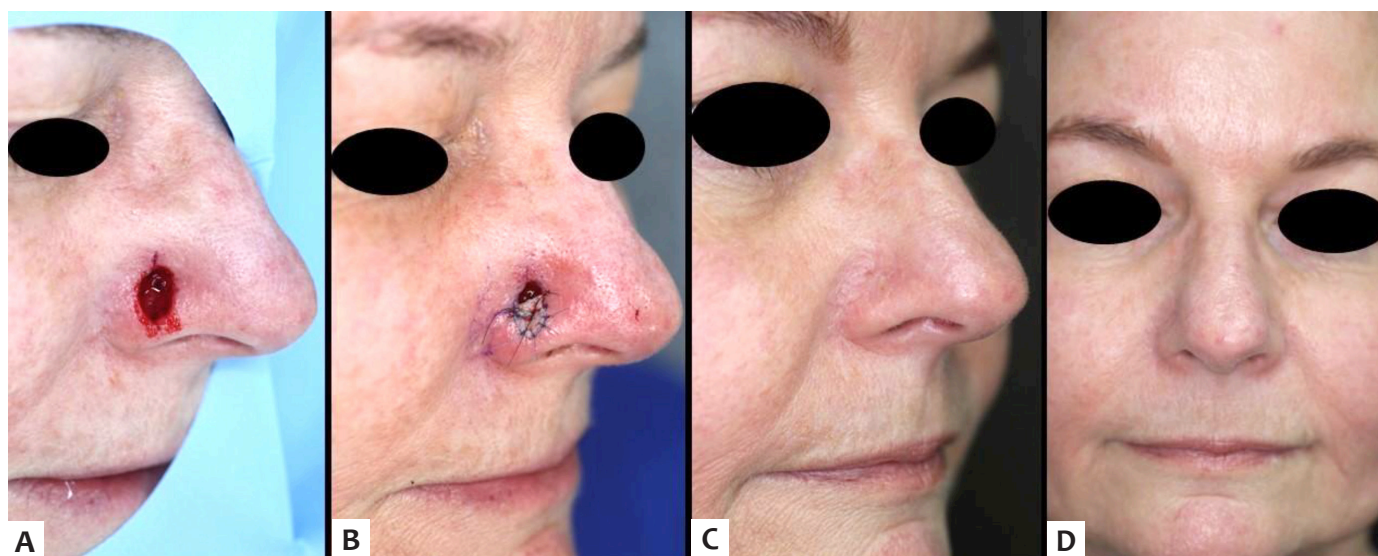


FIGURE 6: Graft combined with secondary intention. **A)** Surgical defect involving nasal ala and alar sulcus; **B)** Immediate postoperative view. Ala restored with a preauricular full-thickness skin graft. Alar sulcus left to heal by secondary intention; **C)** Two months postoperative oblique view; **D)** Front view. Note symmetry of alar sulci

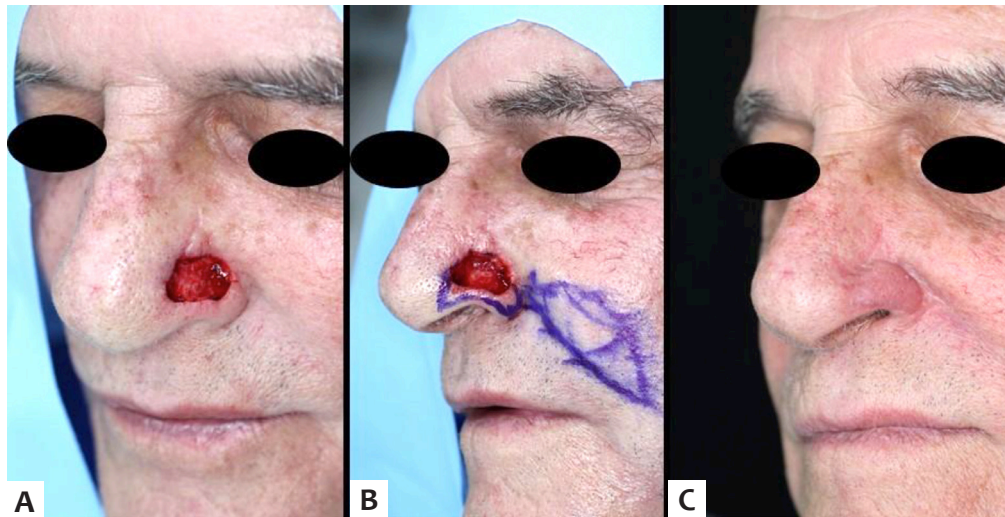


FIGURE 7: Nasolabial interpolation flap. A) Surgical defect on the left nasal ala with slight involvement of the inferior nasal sidewall and cheek. The patient was referred for MMS after excision with positive margins. Adjacent to upper portion of wound, note remaining area of a prior island pedicle flap, which was subsequently removed; B) Flap design. The template was based on the contralateral ala and did not include the defect area involving the nasal sidewall. Ideally, the flap pedicle should be longer, however, to avoid transferring beard follicles to the nose, the pedicle was shorter in this case (which limits the flap mobility). Although not shown in the images, a cartilage graft was used to ensure patency; C) Seven months postoperative with restoration of the nasal ala convexity and preservation of the alar sulcus.

the repair methods in 50% of the defects that involved the ala to some extent. The areas left to heal by secondary intention were mostly adjacent to the alar sulcus, a well-established practice in the literature.³⁴ Single-stage transposition flaps tend to obliterate the alar sulcus, causing easily noticeable asymmetry. Therefore, in cases with extensive involvement of the ala, the nasolabial interpolation flap (with cartilage graft) was performed (Figure 7). The technique requires two stages, however it allows recreating the entire alar subunit, besides preserving the alar sulcus.^{28,35,36}

Almost all the surgeries (97%) were performed under local anesthesia, which is consistent with the literature from the United States, where MMS is performed on a large scale and only on extremely rare occasions under sedation.³⁷⁻³⁹ Local anesthesia is the safest method for the patient, since MMS can take hours.^{5,39-42} It is essential to use established techniques to reduce discomfort from local anesthesia on every patient.

One limitation of the current study is its retrospective design. However, the data from each surgery were uploaded into a database immediately after the procedure. Long-term data were uploaded after follow-up visits. These measures minimize

possible retrospective study biases. Another limitation is that the study is based on a surgeon's preference, which can vary significantly, as reported by Alam et al.⁴³

Finally, the authors are not proponents of cookbook formulas such as "defects up to 1.5cm on the nasal tip should be closed with a bilobed flap" etc.⁴⁴ The authors recommend careful evaluation of each defect and each nose. Same size defects on different nasal tips can be repaired by completely different methods according to local characteristics.⁴⁵ Therefore, more important than memorizing algorithms is to become familiar with different repair methods and flap biomechanics. This does not mean that surgeons should always do a distinct reconstruction for every case, but that they have a reasonable range of options.

CONCLUSION

Dermatologic surgeons should be familiar with the different options for nasal reconstruction. The combination of repair methods was frequently performed, mainly for defects involving more than one nasal subunit.●

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