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Case Report

Complex nasal reconstruction using first dorsal metacarpal artery free flap: a case report

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ABSTRACT

The columella is a key structure for nasal aesthetics and function. Its reconstruction poses a surgical challenge due to limited access, the need for structural support, and the requirement for a precise match in skin color and thickness. The kite flap, supplied by the first dorsal metacarpal artery (FDMA), has proven useful in various facial defects; however, its application in columellar reconstruction remains scarcely documented. We report a 31-year-old woman who developed complete columellar necrosis secondary to an untreated post-traumatic septal hematoma. Clinical examination revealed total absence of the columella, including soft-tissue coverage and cartilaginous support. A two-stage nasal reconstruction was performed using a free FDMA (kite) flap combined with a costal cartilage graft. The postoperative course was favorable, with no vascular complications and complete flap integration. Donor-site healing was satisfactory. Objective measurements demonstrated improvement of the nasolabial angle from 70° preoperatively to 95° postoperatively, and an increase in columellar projection from 1.2 mm to 4.8 mm. These findings reflect successful restoration of nasal contour and structural support. The FDMA Kite flap is a reliable and aesthetically suitable microsurgical option for columellar reconstruction in cases of severe tissue loss. Its thinness, dependable vascularity, and low donor-site morbidity make it a valuable tool for complex nasal reconstruction.

Keywords: Columella reconstruction, FDMA flap, Kite flap, Nasal reconstruction, Septal hematoma, Microsurgery

INTRODUCTION

The columella is a central structure in nasal architecture, contributing not only to tip projection and contour definition but also to the support of the alar complex and the external nasal valve. Its reconstruction presents significant challenges, as it requires precise surgical access, firm structural support, and tissues that match the surrounding skin in color, thickness, and texture. Despite advances in microsurgical techniques, the columella remains one of the most complex regions to reconstruct within nasal surgery.[1,2]

The kite flap, supplied by the first dorsal metacarpal artery (FDMA), has proven to be an effective option for the reconstruction of complex facial defects, particularly in the eyelids, cheeks, and nasal dorsum, due to its thin profile, flexibility, chromatic similarity, and reliable vascularity. However, its specific use in columellar reconstruction has been only sparsely reported in the literature.[3]

The complexity of columellar reconstruction lies in the fact that the defect may simultaneously involve skin, cartilaginous support, and even mucosal lining. When the loss is limited to skin, cutaneous grafts or local flaps have been used; when cartilage is affected, auricular composite grafts represent a common option. However, when the

defect includes mucosa, the reconstructive alternatives described in the literature are limited and lack standardization.

In this context, the present report describes the complex nasal reconstruction of a patient with columellar necrosis secondary to an untreated traumatic septal hematoma. A free FDMA flap combined with a costal cartilage graft was used with the objective of restoring the columellar structure in an integral manner, including skin coverage, structural support, and internal lining.

CASE REPORT

A 31-year-old woman with no significant medical history presented with a prior septal hematoma that had not been drained or treated, subsequently progressing to necrosis and complete loss of the columella.

At initial evaluation in the Plastic Surgery Service of the Hospital General de México, the patient was in good general condition, fully oriented, and without systemic comorbidities. Facial examination revealed Fitzpatrick skin type IV, thick skin, a bulbous nasal tip, and a wide alar base with collapse of the alar domes and total absence of the columella (Figure 1). Intranasal examination demonstrated moist and hyperemic mucosa with serous discharge, absence of the nasal septum, and hypertrophic inferior turbinates.[5]

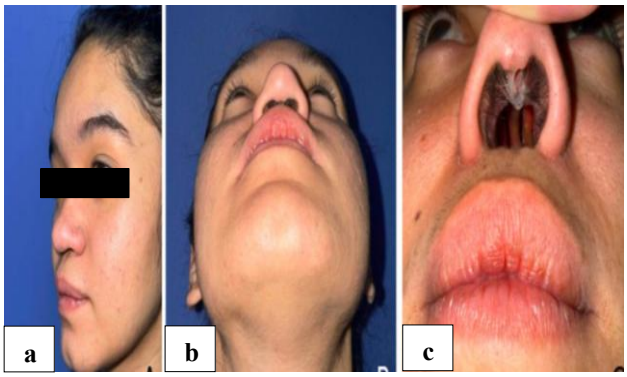

Figure 1 (a-c): Clinical images (a) three-quarter left view showing absence of the columella, (b) basal view demonstrating collapse of the nasal domes, and (c) intranasal view revealing complete absence of the columella; the inferior turbinates are visible in the background, with loss of the septal cartilage.

Laboratory studies—including a complete blood count, coagulation profile, and basic metabolic panel—were all within normal limits. Computed tomography confirmed absence of the columella, loss of septal cartilage, and retraction of the lower lateral cartilages.

A staged reconstruction was planned using a free flap based on the first dorsal metacarpal artery (Kite flap), combined with a costal cartilage graft to restore structural support.

Surgical technique

A 4×1.5 cm FDMA flap was designed on the dorsum of the left hand and elevated as a cutaneous island including the pedicle of the first dorsal metacarpal artery. An end-to-end arterial anastomosis was performed between the radial artery of the flap and the left facial artery, and a venous anastomosis was completed to a vena comitans. Additionally, a costal cartilage graft was harvested from the fourth rib to create a septal extension graft. The donor site was closed with a full-thickness skin graft obtained from the medial aspect of the left arm (Figure 2). The immediate postoperative course was uneventful, and the patient was discharged on postoperative day three.

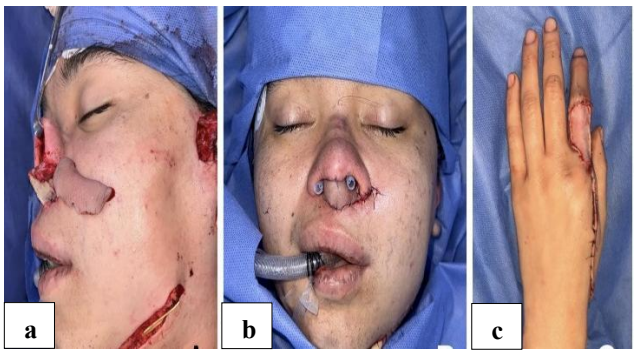

Figure 2 (a-c): Intraoperative images (a) left lateral view showing the assembly of the costal cartilage framework and the Kite flap prior to inset, (b) frontal intraoperative view demonstrating the Kite flap inset with adequate color, temperature, turgor, and a capillary refill time of two seconds. Nasal conformers were placed, and (c) left hand, dorsal surface of the proximal phalanx of the second finger, showing a full-thickness skin graft used to cover the secondary defect at the flap donor site.

At 30 days, the patient developed tissue retraction. Adhesiolysis and release of areas of tension were performed, along with nasal contour refinement through carving of the cartilage graft and definitive shaping of the flap. Supraperichondrial dissection of the lower lateral cartilages was carried out, revealing absence of the medial and middle crura as well as the septum. The previously harvested costal cartilage graft was sculpted and secured to serve as a central septal extension support.

Seguimiento and results

The postoperative course was satisfactory. During the immediate postoperative period and subsequent outpatient follow-up visits, the patient reported progressive improvement in nasal airflow and expressed satisfaction with the aesthetic outcome achieved. The donor site on the left hand demonstrated proper integration of the full-thickness skin graft, with preserved sensitivity, complete wound closure, and no limitation in the range of motion. No microvascular complications were observed, and there were no signs of infection,

inflammation, or flap necrosis in either the short or long term. The patient adhered strictly to postoperative recommendations, including the use of nasal conformers for 15 days and appropriate local care.

Objectively, the nasolabial angle improved from 70° preoperatively to 95° postoperatively, and columellar projection increased from 1.2 mm to 4.8 mm based on standardized clinical photographs. These findings demonstrate harmonious restoration of nasal contour and adequate functional and aesthetic integration of the flap (Figure 3).

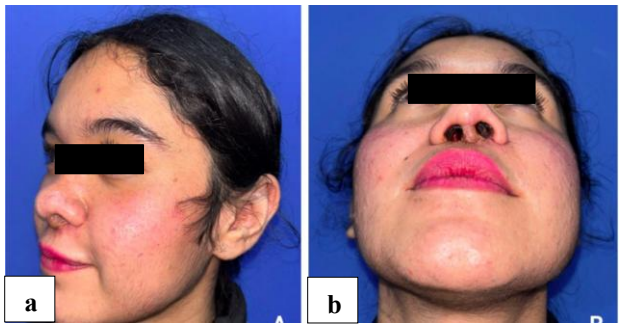

Figure 3 (a and b): Follow-up clinical images (a) three-quarter left view showing the reconstructed columella and nasal symmetry, and (b) basal view demonstrating complete reconstruction of columellar support with patent nostrils.

DISCUSSION

The nasal columella is a central anatomical structure that defines the nasolabial angle (90–110°) and contributes to the vertical support of the nasal tip. It is composed of skin, connective tissue, and the caudal segment of the septal cartilage.[3] Due to its superficial position and terminal blood supply, it is particularly susceptible to necrosis in cases of trauma, undrained septal hematomas, or deep bacterial infections.

Among these etiologies, untreated septal hematoma represents an underestimated condition, as it may lead to progressive ischemia due to compression of the subcutaneous vascular plexus. Dai et al reported a case of complete septal loss and columellar necrosis secondary to this complication. Wang et al noted that although the incidence of columellar defects is low, their aesthetic and functional impact is substantial, particularly in young patients. In a 10-year review, Ma et al found that columellar reconstruction accounted for less than 2% of nasal reconstruction cases, yet required complex microsurgical approaches.

Reconstructive alternatives include auricular composite grafts, as well as local, regional, and free flaps. Wang et al reported acceptable outcomes using auricular grafts for columellar defects, although they highlighted limitations such as cartilage resorption and texture mismatch in larger defects. Similarly, Ma et al noted that local flaps are useful for small defects but frequently distort nasal support, whereas microsurgical flaps offer superior outcomes in complex reconstructions. Cao et al compared grafts and flaps, concluding that free flaps provide better tissue integration, enhanced vascularization, and lower retraction rates, particularly in post-necrotic defects.

Local flaps are limited by alar distortion and insufficient laxity, while grafts are prone to resorption and poor neovascularization, often yielding suboptimal aesthetic results. In contrast, free flaps provide an autonomous vascular pedicle, enhancing tissue survival and enabling more predictable reconstructions. Furthermore, a multistage surgical approach offers additional benefits, including progressive refinement of cutaneous flaps, structural shaping of cartilage grafts, and aesthetic optimization.

In our patient, columellar necrosis secondary to an untreated septal hematoma resulted in cutaneous loss, structural retraction, and partial nasal tip collapse, necessitating a three-dimensional solution capable of restoring volume, support, and aesthetics. For this reason, a free flap combined with a costal cartilage graft was selected.

The flap used in this case, based on the FDMA, was originally described by Foucher and Braun as an island transfer from the dorsum of the index finger, and later refined by Dautel and Merle, who standardized its reliability through a constant pedicle and predictable surgical course.[1] According to the Mathes and Nahai classification, it corresponds to a type IIA flap, with a dominant artery and satellite venous drainage. It is an axial fasciocutaneous flap supplied by a branch of the radial artery, characterized by low donor-site morbidity and high microsurgical reliability.[11,12] In current literature, it is recognized as a versatile and safe alternative, with success rates exceeding 95% in experienced hands. To our knowledge, no previous reports describe the use of a free FDMA flap combined with cartilage for complex columellar reconstruction.

In this case, reconstruction restored objective parameters: the nasolabial angle improved from 70° to 95°, and columellar projection increased from 1.2 mm to 4.8 mm, reflecting the functional and aesthetic effectiveness of the procedure. These findings support the usefulness of the flap as an option for complex columellar reconstruction. Nevertheless, this report describes a single case, which limits the generalizability of the results. Additional studies and larger clinical series are required to validate the reproducibility of this technique and compare it with other available reconstructive options.

CONCLUSION

The flap used in this patient proved to be a versatile and effective alternative for columellar reconstruction in the

setting of severe tissue necrosis. Its thin profile, reliable vascularity, and aesthetic compatibility position it as a valuable microsurgical tool in scenarios where precision and progressive refinement are essential to successful nasal reconstruction.

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