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Paramedian Forehead Flap for the Reconstruction of Extensive Nasal Defects

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PALABRAS CLAVE

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Colgajo fronto-nasal
paramedial

Abstract

Background: The Department of Dermatology at Hospital Universitario de Guadalajara in Spain is a referral center for Mohs micrographic surgery. Consequently, we are regularly faced with the problem of repairing large surgical defects on the nose. The paramedian forehead flap is currently one of the techniques of choice for the repair of such defects.

Materials and methods: We review our experience in the repair of nasal defects using the paramedian forehead flap over the period from 2004 to 2008. We describe the surgical technique, complications, and final results.

Results: Ten patients (mean age, 75.1 years) were treated using this flap. Two patients also required cartilage grafts and reconstruction of the internal nasal lining. The most common complications were bleeding (60%) and partial necrosis (10%). The final cosmetic and functional results were considered good or excellent in 90% of cases.

Conclusions: The forehead flap continues to be one of the best options for the closure of surgical defects of the nasal pyramid larger than 2cm. Adequate knowledge and careful application of the technique allows excellent results to be obtained with few complications.

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Colgajo fronto-nasal paramedial en la reconstrucción de defectos nasales extensos

Resumen

Introducción: El Servicio de Dermatología del Hospital Universitario de Guadalajara es un centro de referencia en cirugía de Mohs, por lo que con cierta frecuencia nos vemos enfrentados al problema de la reconstrucción de defectos quirúrgicos nasales de gran

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tamaño. El colgajo frontonasal paramedial está considerado en la actualidad como una de las técnicas de elección en la reconstrucción de defectos nasales extensos.

Material y métodos: Revisamos nuestra experiencia en la reconstrucción nasal mediante el colgajo fronto-nasal paramediano entre los años 2004 y 2008. Describimos la técnica quirúrgica, las complicaciones y los resultados finales.

Resultados: Diez pacientes con una media de edad de 75,1 años fueron reconstruidos mediante este colgajo. Un 20% requirió además injertos cartilaginosos y reconstrucción de la cobertura nasal interna. Las complicaciones más frecuentes fueron el sangrado (60%) y la necrosis parcial (10%). Los resultados finales, tanto estéticos como funcionales, fueron considerados buenos o excelentes en el 90% de los pacientes.

Conclusiones: El colgajo fronto-nasal sigue siendo una de las mejores alternativas para el cierre de defectos quirúrgicos mayores de 2 cm localizados en la pirámide nasal. El conocimiento de su técnica y su realización cuidadosa permite obtener excelentes resultados con pocas complicaciones.

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Introduction

The nose is one of the most important centers of visual attention of the face and is a common site of tumors. Mohs micrographic surgery is used annually in our hospital on approximately 100 occasions, around 40% of which involve different subunits of the nose. Reconstruction in these cases can often be challenging. There are numerous possibilities for the closure of small or medium-sized defects, such as direct closure, local flaps, or grafts. However, the reconstruction of complex nasal defects is a challenge to the surgical dermatologist.

The skin of the forehead is very similar to that of the nose, both in color and texture. Along with its proximity, this makes it one of the donor sites of choice for the reconstruction of large nasal defects. In addition, it has a rich blood supply with known anastomotic plexuses that ensure adequate vascularization.

The forehead flap is a myocutaneous flap with an axial blood supply derived from the supratrochlear artery. This flap, first described by Millard^{1,2} and subsequently modified by Menick and Burguet,^{3,5} was proposed as an improvement on the classic reconstruction technique using the median forehead flap. Those authors described the paramedian variant based on a single supratrochlear artery; this flap has a narrower pedicle, which allows for greater rotation and length, facilitating the closure of extensive or distal nasal defects.

We present a series of 10 patients treated surgically for nonmelanoma skin cancer (NMSC) of the nose, with reconstruction using the paramedian forehead flap.

Objective

We describe our experience with the use of the paramedian forehead flap for reconstruction of large nasal defects. We also review the recent literature, including the modifications proposed to the classic technique.

Material and Methods

A retrospective review was performed of patients undergoing surgery for NMSC of the nose with reconstruction using a

paramedian forehead flap in the Dermatology Department of Hospital Universitario de Guadalajara between January 2004 and December 2008. The following variables were analyzed: age, sex, cardiovascular risk factors, tumor diagnosis, surgical technique, site of the defect, complications, and outcome. Complications evaluated included bleeding, hematomas, infections, necrosis, and tumor recurrence.

Outcome was evaluated by an independent dermatologist using functional and cosmetic criteria.

Description of the Technique

The paramedian forehead flap is performed in 2 stages. The first stage is usually performed under general anesthesia or local anesthesia (2% mepivacaine with 1:100 000 epinephrine) with sedation. The outline of the defect is drawn preferably on the healthy side in order to avoid distortion due to scarring of the operated area. The pedicle of the flap is then outlined on the superomedial aspect of the orbit, between 1.5 and 2.5 cm from the midline (Figure 1A). In unilateral defects we prefer to use a contralateral flap to avoid excessive rotation of the flap and obstruction of the patient's visual field. The length of the flap is then determined by measuring the distance between the defect and the pedicle; the arc of rotation is simulated with a swab or suture and the outline is then copied onto the forehead. The initial incision of the flap is made at its uppermost point, to reach a superficial plane in the subcutaneous cellular tissue. This plane between the fat and the muscle fascia is then followed to a distance of 2 cm above the eyebrow, after which dissection is continued immediately superficial to the periosteum (Figure 1B).⁶⁻¹⁰ After dissection of the flap, it is sutured to the receptor site by direct suture. The use of Doppler ultrasound to locate the supratrochlear artery prior to the operation has been described, although we did not use it in our patients as the supratrochlear artery tends to follow a constant course.

Closure of the donor area is almost always by direct suture, although it is occasionally necessary to create an advancement flap or approximate the borders and allow second-intention healing. Finally, at 3 weeks, the base of the flap is sectioned in a second operation, usually under local anesthesia (Figure 1C).

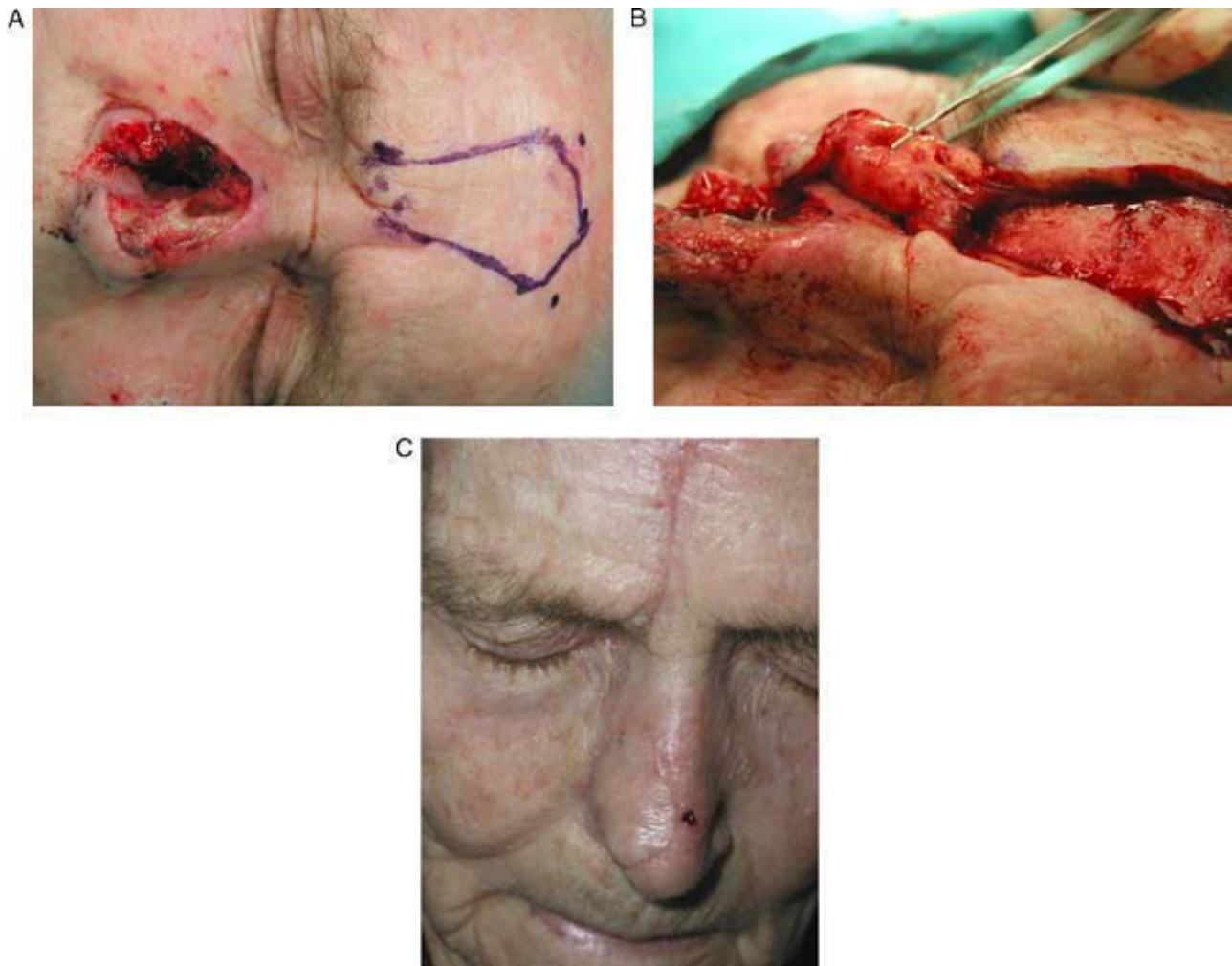


Figure 1 A, Surgical defect. The pedicle is drawn on the medial part of the eyebrow and the outline of the defect on the forehead (patient 7). B, Dissection in a deep plane above the eyebrow (2 cm), attempting to visualize the artery. C, Result 6 months after reconstruction with the paramedian forehead flap (patient 7).

Results

A description of the cases and of the variables studied is given in the Table.

Ten patients (5 men and 5 women) underwent surgery for NMSC of the nose, with reconstruction using a paramedian forehead flap. Patients were aged between 51 and 89 years, with a mean age of 75.1 years. All tumors were excised using Mohs micrographic surgery as they were recurrent tumors, had unclear borders, or were of large size, and they were in an anatomical area in which maximum preservation of healthy tissue is essential. Reconstruction was performed under general anesthesia in 2 patients and under local anesthesia with sedation in the remaining 8, after evaluation by the anesthesiology department of our hospital. Tolerance of the surgical procedure was acceptable in all cases, and no anesthetic complications were detected.

The diagnosis of the resected tumor was basal cell carcinoma in 9 patients and mixed malignant tumor in 1 patient.

After excision, all the resulting defects measured more than 2 cm in diameter and affected the full thickness of the subunit in 2 patients. These 2 patients required cartilage grafts to the ala nasi to prevent inspiratory collapse, along with reconstruction of the internal lining of the nose (septal mucoperichondrial flap and rotated nasolabial flap); both procedures were performed during the same operation as the flap reconstruction. The subunits most frequently affected were the tip of the nose (Figure 2A) and the ala nasi.

We would also like to draw attention to the fact that the defect in patient number 6 affected the nose, the cheek, and the eyelids. This required reconstruction in various stages, using paramedian forehead flaps from both pedicles in association with other techniques.

Bleeding was the most common complication, occurring in 6 of the 10 patients. It generally presented as oozing from the surgical field occurring in the first 24 hours after surgery and resolved spontaneously or after the use of local hemostatic agents. All the flaps were viable, although partial necrosis of the distal tip of 1 flap did occur (patient



Figure 2 A, Patient 2 after excision of a basal cell carcinoma using Mohs micrographic surgery. B, Patient 2; result 3 years after reconstruction using a paramedian forehead flap.

3). This affected the columella nasi and required a second intervention to reconstruct this anatomical subunit in order to maintain the orifice and contour of the nares. There were no infections or hematomas and no tumor recurrences after a follow-up period of 1 to 4 years.

The cosmetic and functional outcomes were fair in 10% of patients, good in 10%, and excellent in 80% (Figure 3).

Discussion

The median forehead flap was used for decades as the technique of choice for reconstruction of large defects of the nose. However, this flap, taken from a midline position as it was first described, has certain limitations. It has a broad base, producing a significant defect in the donor area, difficulty at the time of rotating the flap, and a length that is often insufficient, particularly for reconstruction of the distal areas of the nose.



Figure 3 Patient 9 after section of the pedicle.

In the 1970s, Millard^{1,2} published cases in which the forehead flap had been taken from a paramedian position and demonstrated that viability of the flap did not require the presence of both supratrochlear arteries. Subsequently, Burget and Menick^{3,5} refined and popularized the concept of the paramedian forehead flap. More recently, Shumrick and Smith,⁶ Mangold et al,¹¹ and McCarthy et al¹² have studied the anatomical bases of the flap, leading to multiple refinements in the design of this variant. Those authors have demonstrated the existence of numerous anastomoses of the supratrochlear artery with arteries such as the supraorbital artery, the dorsal artery of the nose, and the angular and infraorbital arteries, forming a plexus that augments and ensures the vascular supply of the flap.

In our experience the paramedian forehead flap is an excellent alternative for the reconstruction of nasal defects with a diameter of greater than 2 cm and situated on the lateral wall, tip, or dorsum of the nose or ala nasi, and achieves good cosmetic and functional results. It provides a sufficient surface covering with skin of similar characteristics to the nasal skin in terms of color and texture. The flap is richly vascularized, making it possible to perform other procedures in the same operation, such as reconstruction of the lining of the nose and of the osseocartilaginous support in full-thickness defects.¹³ Furthermore, the use of a single pedicle based on one of the supratrochlear arteries means that the contralateral pedicle is available for further reconstructive surgery. This is useful in central, complex, or large facial defects, as occurred in one of our patients.

Complications are uncommon if the flap is adequately designed and the technique performed with care. The most common complication is bleeding within the first 24 hours, usually as oozing from the surgical field; this tends to resolve spontaneously or after the use of local hemostatic agents. However, we would like to mention that, although this has been considered a complication in our study, it is a common phenomenon and may be considered as normal, as this is a flap with an open pedicle. This is an important factor to take into account, as excessive pressure over the

Table 1 Clinical Characteristics of the Patients, Diagnosis, Surgical Procedure, and Results of Surgery

Patient	Age, y	Past History	Diagnosis	Surgical Procedure	Resulting Defect	Complications	Functional Outcome	Cosmetic Outcome
1	89	COPD/AF/ acenocoumarol	BCC recurrence	Mohs	Ala nasi to tip of nose and skin of columella nasi	Bleeding	+++ ^a	+++
2	85	HT	BCC	Mohs	Dorsum to tip of nose	No	+++	+++
3	54	HT/DM/dyslipidemia/ smoker	BCC recurrence	Mohs	Dorsum to tip of nose, ala nasi, and columella nasi	Bleeding, necrosis of the columella nasi	+ ^b	+
4	51	None	BCC recurrence	Mohs	Whole ala nasi and partial tip and dorsum of the nose	Bleeding	++ ^c	++
5	77	Dyslipidemia	BCC recurrence	Mohs	Lateral nose and ala nasi/eyelids/ right cheek	No	+++	+++
6	93	No	MWT recurrence	Mohs	Lateral nose and ala nasi	No	+++	+++
7	68	COPD	BCC recurrence	Mohs	Lateral nose and ala nasi	Bleeding	+++	+++
8	71	HT	BCC recurrence	Mohs	Dorsum to tip of nose and ala nasi	Bleeding	+++	+++
9	83	HT	BCC recurrence	Mohs	Whole ala nasi and lateral nose	Bleeding	+++	+++
10	80	HT	BCC	Mohs	Ala nasi	No	+++	+++

Abbreviations: AF, atrial fibrillation; BCC, basal cell carcinoma; COPD, chronic obstructive pulmonary disease; HT, hypertension; MWT, mixed malignant tumor; Mohs, Mohs micrographic surgery. ^aExcellent outcome; ^bFair outcome; ^cGood outcome

area of the pedicle to prevent bleeding could compromise flap viability.

Significant necrosis only occurred in 1 patient in our study (patient 3), despite adequate planning and flap dissection. Smoking and other cardiovascular risk factors probably played a role in the onset of the complication in this patient, a hypothesis supported by studies performed by Kinsella et al¹⁴ and Goldminz and Bennett,¹⁵ who reported a significant increase in the risk of flap necrosis in smokers compared to nonsmokers. Reece¹⁶ recently proposed including the periosteum for the 3 cm above the supraorbital ridge with the aim of including the deep branch of the supratrochlear artery in the flap. He considered that this modification would be particularly useful in patients who were smokers or diabetic, as it would increase and optimize the vascular supply to the flap.

One of the disadvantages of the paramedian forehead flap is its limited length, which can be insufficient in distal defects of the tip of the nose or columella nasi. In our experience and that of other authors,^{6,16} the use of an oblique or transverse design when planning the distal part of the flap in these cases does not compromise the vascular supply and can increase its length. More recently, Kelly et al,¹⁷ in a study of the paranasal region, demonstrated the existence of a rich anastomotic arcade formed by the supratrochlear artery, infraorbital artery, and branches of the facial artery; this ensures the blood supply to the flap. Modifications to the classic technique have been proposed on the basis of these findings, using a narrower pedicle with its base at the level of or below the medial canthus. In this way, the pedicle of the flap can be extended to enable reconstruction of more distal or larger areas without affecting viability of the flap.

Another inconvenience of the technique is the need for a 2-stage surgical procedure and the presence of a vertical scar on the forehead, although, in our experience, this is not particularly unsightly.

Finally, there are 2 general principles that should not be forgotten: a) before reconstruction of any surgical defect left by skin cancer, it is essential to be certain that the margins are tumor free; and b) in full-thickness defects of the nose, we must restore the cartilaginous support and internal lining of the nose in a previous operation or during the same procedure, in order to preserve adequate function.

In summary, the paramedian forehead flap is versatile and enables excellent cosmetic and functional results to be achieved in the reconstruction of nasal defects over 1.5 to 2 cm in diameter, particularly when associated with loss of cartilage or in the full-thickness defects of the nasal wall. The numerous publications on this technique in recent years reflect its current popularity and usefulness for the reconstruction of complex defects of the nasal pyramid; many authors consider it to be the technique of choice for these defects.

Conflict of Interest

The authors declare that they have no conflict of interest.

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