A WORKHORSE FOR NASAL RECONSTRUCTION: THE FOREHEAD FLAP

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ABSTRACT

Introduction: *Nasal reconstruction has always been a challenge for the surgeons. In this study we retrospectively reviewed our patients with nasal defects in whom the forehead flap was preferred for reconstruction.* ***Material and Method:*** *Between 1997 and 2000, 10 patients with various nasal tissue defects were reconstructed with forehead flap. In all cases, surgical excision of a basal cell or squamous cell carcinoma was the cause of the defect. We used cranial bone or cartilage grafts, nasolabial or buccal flaps as indicated.* ***Results:*** *In six patients, only the forehead flap was used. In addition, cranial bone graft, costal cartilage graft, nasolabial and buccal flap in three different patients, and ear cartilage grafts in three patients was used to reconstruct more complex defects. Two flaps showed minimal marginal necrosis and the rest healed uneventfully.* ***Conclusion:*** *Despite some of its disadvantages such as scar tissue development and the necessity for multistage surgery, the forehead flap is still considered as a workhorse for nasal reconstruction, because of its excellent color match, appropriate texture, rich and dependable vascular supply and good cosmetic results.*

Key Words: *Nose, Reconstruction, Forehead Flap.*

INTRODUCTION

Soft tissue defects of the face constitute one of the most difficult problems in plastic surgery, and nasal reconstruction has been always a great challenge for the reconstructive surgeon. For successful nasal reconstruction, both functional and aesthetic restoration should be provided. The forehead region is one of the main sources of skin and soft tissue. Its texturel, thickness and color accordance with the surrounding skin of the face and its excellent vascularity makes it an optimal tissue for nasal reconstruction (1).

Midline forehead flap was first described in the Indian medical treatise, by the writings of Sushruta Samhida in approximately 700BC. In those times, nasal amputation was used as a punishment to make criminals recognizable to the public. In 1500's, Branca performed nasal reconstruction using the mid-forehead flap (2). Then, reconstructive rhinoplasty and forehead flap techniques progressed in the 1900's due to nasal defects caused by battles, scorfula, syphilis, and cancer. In the 1960's, Millard designed horizontal transverse extensions for bilateral lobular reconstruction (3). Adamson reported his experience with expander usage of the forehead flap in 1988 (4).

In this study, we retrospectively reviewed our patients with nasal defects in whom forehead flap was preferred for reconstruction.

MATERIAL AND METHOD

Between 1997 and 2000, 10 patients with various nasal defects were reconstructed with forehead flaps. The cause of the nasal defect was surgical excision of skin tumors, such as squamous cell carcinoma basal cell carcinoma. Frozen-section biopsies were done peroperatively in all patients, and further excisions were performed when surgical margins were not tumor free or near to the tumoral tissue. Cranial bone grafts, cartilage grafts and other local flaps such as nasolabial or buccal flaps were used when needed. The patients who had stage 2 or higher squamous cell carcinoma; underwent bilateral modified radical neck dissection. For their further management, the patients were also consulted on with the oncology department.

Surgical Technique

Under either general or local anaesthesia, in a supine position with 30 degrees head elevation to decrease venous pooling, wide exposure including ears is supplied. We recommend tracing the supratrochlear artery before surgery using a doppler scan. A 1.2 to 1.5 cm flap base is sufficient, allows easier rotation without strangulation, and avoids eyebrow distortion (Fig. 1).

An aluminium foil template of the defect is used to design the forehead flap. When a paramedian flap is preferred, the centre of the template should be located approximately 2-cm lateral to the midline of the forehead (5). After infiltration of 0,5 % lidocaine with 1:400.000 adrenaline around the defect and flap, sparing its base, the flap is elevated from cranial to caudal direction in a relatively bloodless subfacial loose areolar plane. Reaching 1-2 cm. above the eyebrow level, blunt dissection is used to separate slips of corrugator supercilii muscle. Generally, the supratrochlear artery can be seen on the deep surface of the frontalis muscle and then flap elevation is continued down onto the root of the nose with meticulous dissection. Once adequate flap mobilisation is accomplished, the flap is rotated or transposed to the defect and is sutured with 5-0 or 6-0 nylon sutures (Fig. 1).

Donor site closure is achieved by extensive undermining of the remaining forehead and scalp. If it is not possible to close the donor site primarily, the edges are approximated and the remainder of the defect is left for secondary intention. Skin grafts are not always necessary for donor site healing, if the size of the defect is smaller than $2cm^2$. In this case, two or three weeks are needed for healing of the donor site.

If the wound heals uneventfully, division of the pedicle is safe three weeks after the first surgery (6). This procedure can be done under local anaesthesia during which further flap inset will be performed (Fig. 2).

RESULTS

The ages of the patients ranged from 52 to 85 years. Eight patients had squamous cell carcinoma and two patients had basal cell carcinoma. After resection of the tumors, six patients were reconstructed with the forehead flap. Bilateral neck dissection was performed in two patients with stage 2 or higher squamous cell carcinoma. Cranial bone graft and costal cartilage graft were used in two patients in whom full thickness of the anterior ½ of the nose was resected. Ear cartilage grafts in three and nasolabial and buccal flaps in one patient were used in addition to the forehead flaps. Two flaps showed minimal marginal necrosis and the rest healed uneventfully. In one patient, superficial necrosis has developed an area of about 1 cm^2 due to excess tension of the sutures. After debridement of the necrosis the wound healed secondarily within a week. Three patients with squamous cell carcinoma underwent radiation therapy according to their clinical status and tumor stage. Despite radiation therapy tumor rapidly progressed in one patient, re-excision of the tumor was done but he died within 8 months. All of the other patients have been followed without any problem.

DISCUSSION

A rich plexus of vessels supplied by the supraorbital, supratrochlear, infratrochlear, dorsal nasal and angular arteries perfuse the central part of the forehead. The rich anastomotic plexus located around the medial canthus can nourish an unilaterally based flap. Either supratrochlear or supraorbital vessels from one or both sides can nourish a midline forehead flap (7). Even if the

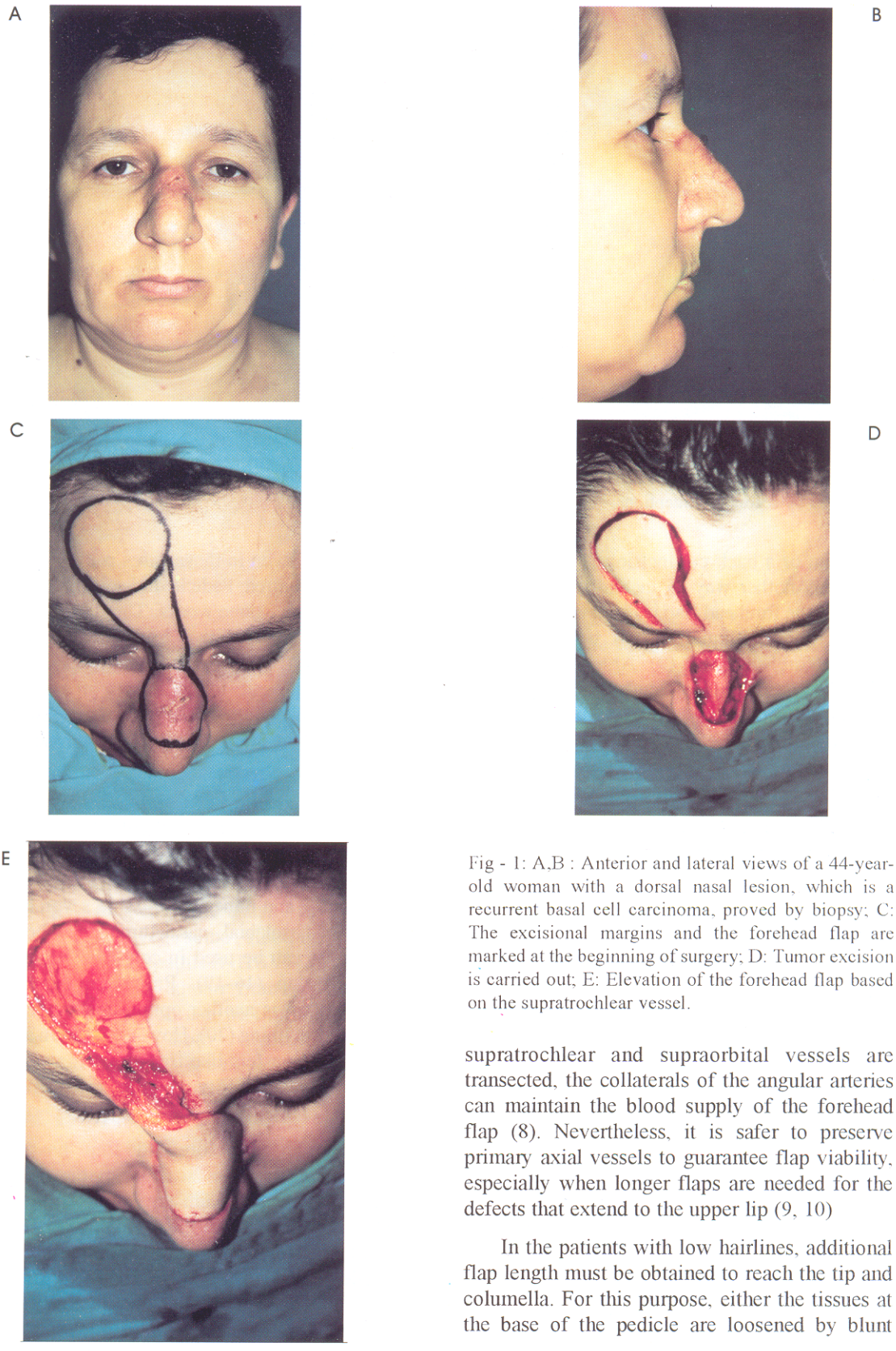

Fig - 1: A,B : Anterior and lateral views of a 44-year-old woman with a dorsal nasal lesion, which is a recurrent basal cell carcinoma, proved by biopsy; C: The excisional margins and the forehead flap are marked at the beginning of surgery; D: Tumor excision is carried out; E: Elevation of the forehead flap based on the supratrochlear vessel.

supratrochlear and supraorbital vessels are transected, the collaterals of the angular arteries can maintain the blood supply of the forehead flap (8). Nevertheless, it is safer to preserve primary axial vessels to guarantee flap viability, especially when longer flaps are needed for the defects that extend to the upper lip (9, 10)

In the patients with low hairlines, additional flap length must be obtained to reach the tip and columella. For this purpose, either the tissues at the base of the pedicle are loosened by blunt

Fig - 2: A, B: Anterior and lateral views of the patient after three months. Note the well-healed forehead scar, which is obtained by secondary intention.

dissection or a back cut incision is made on the glabella. Another way to increase the effective length of the forehead flap is to tilt the axis of the flap to a more oblique position, which is called "oblique forehead flap" (9). Although, not very desirable one can also extend the flap into hair bearing skin, but this requires secondary laser epilation procedures. Above all, the most important issue is to base the flap on to supratrochlear artery but not supraorbital.

Forehead flap use is not a complication-free procedure, and the complications usually depend on the circulatory insufficiency of the flap due to over-tension. If the flap shows any signs of a complication such as this, it is not sutured to the distal part of the defect until the vascular insufficiency is improved. In addition, any trimming or thinning is preferably done at a later stage to preserve distal vascular branches.

In most patients, donor sites can be closed primarily. When this is not possible, secondary intention is preferred to skin grafting, which usually causes an unsightly appearance. The defects heal very well when left open and aesthetic results are satisfactory; at least far superior to the skin graft application.

Forehead flaps can be prepared as an island flap with subcutaneous pedicle (11). However, this usually adds too much soft tissue at its pivot point. Thus, even in those cases pedicle division is usually required. Pedicle division can be safely performed after three weeks. The flap division is followed by edema that usually resolves in a month (12). If the pedicle division includes only the skin and soft tissue leaving the vascular structures intact, then the soft tissue swelling which is seen after the flap revision does not occur.

Simple coverage of facial defects with good cosmetic results is often difficult (13). Currently the superiority of forehead flap for nasal reconstruction is widely accepted (14, 15). If the nasal lining and bones are missing several other flaps like nasolabial, nasal turnover or bone or skin grafts can be used in conjunction with the forehead flap (16-19). Prefabrication of the forehead flap is another option to provide bone and mucosal lining (20). However, in such a case, free tissue transfers like free radial forearm flap give more flexibility to the reconstructive surgeon (21).

Although, the forehead flap has some disadvantages such as scarring of the forehead and requirement of multistage surgery, we agree with the comment that this ancient flap is still a workhorse for nasal reconstruction with its excellent color match, appropriate texture, rich and dependable vascular supply and good cosmetic results.

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