Original Clinical Research

Secondary reconstruction of burned nasal alae using rolled dermal flap with overlying full-thickness skin graft

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Summary

Introduction: Surgical reconstruction of the nasal tip is a very delicate procedure, as it must rebuild three different anatomical planes: mucosa, cartilage and skin with functional and aesthetic requirements. This procedure is even more difficult in burns patients, due to more limited donor sites and poor skin quality. Numerous flap options are available to reconstruct defects of the tip of the nose. The authors report their experience of nasal alar reconstruction by a scar tissue remodelling technique using a rolled dermal flap with overlying full-thickness skin graft.

Patients and methods: The medical charts of seven patients (five women and two men with a mean age of 30) treated between 1991 and 2006 were retrospectively reviewed. Six patients presented sequelae of a facial burn and one patient had congenital facial hemiagenesis.

Results: Reconstruction was bilateral for all burns patients and unilateral for the patient with facial hemiagenesis. The skin graft was raised from the medial aspect of the forearm in four cases, the retroauricular region in two cases and the groin in one case. One patient required a second surgical procedure for necrosis of the nasal tip. No nasal obstruction was reported with a mean follow-up of five years (range: six months to 15 years).

Conclusion: The rolled dermal flap with overlying full-thickness skin graft is a simple and reliable procedure for reconstruction of the nasal alae. Filling of the nasal alae defect and reconstruction of all anatomical planes are achieved in a single surgical procedure. The aesthetic and functional results were satisfactory, with minimal scarring of the donor site. This technique is very suitable for the treatment of burn sequelae and can also be used to treat nasal hemiagenesis and nasal mutilation by biting or facial trauma.

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Introduction

The nose is the first structure to be affected by burns of the face. Despite improvement of the initial management, the healing process inevitably leads to retraction of the tip of the nose, which is the first plane to be affected. The nasal tip is formed by the merging of the alae with the columna. It is the most prominent feature of the nose and its integrity is crucial for its aesthetic appearance. The nasal tip is formed by a complex interaction of skin, cartilage, and mucosa, which must be reconstructed in a single surgical procedure to achieve optimal results. The use of a rolled dermal flap with overlying full-thickness skin graft allows for the reconstruction of all anatomical planes in a single surgical procedure, providing a simple and reliable method for reconstructing the nasal alae.

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Due to their composition (three distinct planes: mucosal, cartilaginous and cutaneous), their particular anatomical shape and their role in nasal ventilation, the nasal alae are elements that remain very difficult to reconstruct and the results of reconstruction must be both aesthetic and functional.

The reconstruction techniques described in the literature are usually complex: local and regional flaps [1], distant flaps with or without skin expansion [2], free flaps [3] or even prefabricated flaps [4,5].

We report our experience of reconstruction of the nasal alae for burn sequelae and, in one case, malformation of the face, by means of a subcutaneous scar tissue remodelling technique using a rolled dermal flap [6].

**Patients and methods**

This retrospective study was based on seven patients undergoing unilateral or bilateral nostril reconstruction by a rolled dermal flap with overlying full-thickness skin graft between 1991 and 2006. Deformity of the nasal alae was secondary to burns in six cases and due to facial hemiagenesis in one case. The mean age of the patients (five women and two men) at the time of the operation was 30 years (range: 11 to 45 years).

The surgical technique was the same in every case. Skin drawing of the dermal flap donor site was performed before infiltration by preserving aesthetic units [7,8].

The lateral surface of the nose, the dermal flap donor site, was de-epithelialised (Fig. 1). The deep plane was reconstituted by an inferior-based inverted skin flap raised from the skin of the free edge of the nasal ala: a non-transfixing incision was performed 6 to 10 mm above the free edge, the most distal skin was detached and then inverted to constitute the internal aspect of the reconstructed nostril (Fig. 2). The inferior pedicle dermal flap was then incised and detached from the deep plane. The flap was then rolled and sutured to the nostril margin (Fig. 3). A free full-thickness skin graft was then used to cover the reconstruction and the dermal flap donor site according to aesthetic units (Fig. 4). A tulle gras dressing maintained by a bolster was left in place for five days. Internal nostril splints were maintained for five days and then replaced by a nasal conformer that was maintained for three to 12 months.

**Special cases**

A 35-year-old woman, who suffered a sulphuric acid chemical burn, presented panfacial burn sequelae (Fig. 5). Retraction of nasal alae was treated by two rolled dermal flaps covered by a skin graft raised from the medial surface of the arm. Bilateral inferior palpebral ectropion was treated during the same operation by a transposition flap harvested from the upper eyelid and a graft of the entire superior palpebral aesthetic unit. The appearance of the nose was satisfactory nine months postoperatively (Fig. 6). Other facial reconstruction procedures are planned.

An 11-year-old girl presented hemiagenesis of the right side of the face secondary to intrauterine chickenpox. Retraction of the right nasal ala was associated with facial nerve paralysis and an anophthalmic orbit (Fig. 7). Reconstruction of the nasal ala was performed by a rolled dermis and muscle flap and a skin graft harvested from the groin (Fig. 8). The nasal ala gradually closed during growth (Fig. 9).
Secondary reconstruction of burned nasal alae

Figure 3  Diagram and photograph. The dermal pedicle flap is incised and detached from the deep plane (right) and is then rolled and sutured to the nostril margin (left).

Figure 4  Diagram and photograph. All of the aesthetic units are covered by a full-thickness skin graft with internal nostril splints.

and was reinforced by a conchal cartilage graft. Rehabilitation of the patient’s facial nerve paralysis was performed by transposition of the posterior head of the temporalis muscle and orbit and eyelid rehabilitation of her anophthalmic orbit to allow fitting of a prosthesis (Fig. 10).

Figure 5  Front and side views of 35-year-old woman showing sequelae of a sulphuric acid chemical burn to the face. The tip of the nose and nasal alae are retracted.

Results

Reconstruction was bilateral in all burns patients \((n = 6)\) and unilateral in the patient with facial hemiagenesis. The

Figure 6  Front and side views nine months postoperatively. The flaps of scar tissue harvested from the lateral surfaces of the nose were used to restore the volume and lower the free edge of the nasal ala.
Figure 7  Front and oblique views of an 11-year-old girl with absence of the right nasal ala associated with facial nerve paralysis and an ipsilateral anophthalmic orbit.

full-thickness skin graft was harvested from the medial surface of the forearm in four cases, the retroauricular region in two cases and the groin in one case.

One patient developed necrosis of the tip of the nose that required surgical revision nine months after the first operation with repair by another full-thickness skin graft raised from the chest. One year after the end of treatment, this patient presented retraction of the nasal alae and underwent another bilateral reconstruction by rolled local flap and skin graft with an uneventful postoperative course.

The patient with facial hemiagenesis, treated by unilateral reconstruction of the nasal ala at the age of 11, subsequently presented retraction of the nasal alae during growth. The nasal ala was reinforced by a conchal cartilage graft on completion of growth.

No patients complained of nasal obstruction has been reported with a mean follow-up of five years (range: six months to 15 years).

Figure 8  Front and oblique views one year postoperatively. Reconstruction of the right nasal ala by a rolled and grafted dermal and muscle flap. Symmetry of the tip of the nose was obtained by partial rotation of the residual right nostril.

Figure 9  Front view four years postoperatively. Progressive closure of the right nasal ala with growth.

Discussion

The inferior pedicle dermal or dermis and muscle flap of the lateral surface of the nose is based on the very rich blood supply of the nasal dorsum. It is harvested randomly from the lateral surface of the nose, extending to varying degrees to the region of the medial canthus. In burns patients, the flap is fashioned from the frequently hypertrophic and scarred dermis, which has a more uncertain blood supply. To ensure a reliable blood supply, the pedicle must be as large as possible, the length-to-width ratio of the flap must not exceed two and the flap must have a constant thickness. After harvesting, the flap must not be folded or rolled more than twice [6].

Figure 10  Front and oblique views 15 years postoperatively. A conchal graft on completion of growth was used to reinforce the nasal ala with no subsequent retraction.
No case of flap necrosis was observed in this series, with only one case of skin graft necrosis. According to Barret et al., skin flaps raised from burned zone are not associated with a higher complication rate than those harvested from healthy zones [9].

Skin cover must be ensured by a full-thickness or split skin graft. In one case of the present series, the skin graft was too thin, resulting in a zone of necrosis at the tip of the nose that required surgical revision.

This same patient subsequently presented retraction of the nasal alae one year after completion of the reconstruction, which was successfully repaired by another rolled dermal flap harvested from the dermis of the previous skin graft.

This technique can be performed either unilaterally or bilaterally during the same operation. To ensure better cosmetic results, the skin graft must preserve the aesthetic units of the face. Skin graft donor site sequelae are minimal. A satisfactory functional result was obtained in every case, even in the patient with retraction of the nasal alae during growth, as nasal obstruction was only partial and the contralateral nasal fossa was perfectly functional.

Many techniques have been described to reconstruct nasal alae in burns patients, but none of them are completely satisfactory. Nasal reconstruction is generally performed with a forehead flap, with or without skin expansion. There is a growing number of reports of the use of free flaps to reconstruct the nasal alae.

Reconstruction of the deep mucosal and cartilaginous planes of the nasal alae requires a cartilage graft [1]. This graft is usually harvested from the helix due to the adequate shape of the cartilage and the barely visible donor site sequelae. This technique is often more difficult to perform in burns patients, who mostly present associated ear lesions. This graft is also poorly vascularized and requires a very vascular recipient site, which is not the case of the burned nose.

The forehead flap is well adapted to reconstruction of the nasal ala [10]. The colour and texture of the forehead skin are very similar to those of the nose. This flap requires three or four operations and reconstruction of the deep plane by a skin graft and a cartilage graft. A rolled dermal flap can be used to reconstruct the anatomical planes of the nasal alae in a single operation. The free edge of the nasal ala is repositioned or recreated and the subcutaneous tissue volume is redistributed to restore the curves and shape of the tip of the nose.

Hataya et al. reported a case of reconstruction of nasal alae in a burns patient by a vascular island skin flap pedicled on the infraorbital vessels [11]. This flap requires the use of a skin graft to cover the nasal alae and donor site. This technique results in a broader appearance of the tip of the nose and nasal alae and a larger quantity of skin is required to cover the reconstruction than with a rolled dermal flap.

Reconstruction of the nasal alae by a free flap derived from the base of the helix appears to give very satisfactory functional and aesthetic results [12,13]. Published reports of this type of reconstruction generally correspond to post-traumatic or post-tumour resection defects [14]. Use of this delicate technique, which requires intact superficial temporal vessels, facial vessels and helix would appear to be only exceptionally possible in burns patients and would be difficult to integrate into a global facial reconstruction strategy.

Facial burns exclude the patient from any form of social life [15].

Sequelae of burned nasal alae are generally associated with panfacial burn sequelae, requiring a large number of operations to restore a satisfactory appearance to the burned face. Reconstruction of the nasal alae is an integral part of the global management of the burned face.

According to Foyatier et al., nasal reconstruction is always the first step in the repair process, as it provides the greatest improvement of the physical appearance of the burned face [16].

The grafted rolled dermal flap is a simple, reliable and reproducible technique that rapidly provides satisfactory functional and aesthetic results, thereby facilitating social reintegration of patents with facial burns.

Conclusion

The grafted rolled dermal flap used to reconstruct the nasal alae is a simple and reliable technique, which can be performed with scar tissue. Filling of the defect and reconstruction of the anatomical planes of the tip of the nose are performed in a single procedure.

The aesthetic and functional results are satisfactory with minimal scarring of the donor site.

This technique is suitable for burn sequelae and can also be used to treat nasal hemiagenesis as well as mutilations caused by bites or road accidents.

This procedure also appears to be well adapted to surgery of children with burns or nasal malformations. As the use of scar tissue preserves all other potential treatment options, more complex surgical techniques can subsequently be used after completion of growth, when necessary.

Conflict of interest statement

None.

References


