FOREHEAD FLAP

Originally described by Sushruta in India, 600BC, this technique remains one of the best options, if not the first, for nose reconstruction. The English surgeon Carpue later popularized this technique in western countries in 1816[7].

The classical forehead flap is that in which a long piece of skin and muscle from the forehead is transferred to the nose. But there is also another type of forehead flaps; exclusively cutaneous flaps based on supratrochlear vessels or even branches from the angular artery that can be transferred to the nose or the medial aspect of the orbit. These flaps can be rotated without needing second stages.

The classical forehead flap that includes the frontalis muscle is a thick flap that will require a second stage to divide the pedicle and remodel the area.

Indications

This flap is mainly used to repair cutaneous or full defects of the nose. It can also be used to resurface full defects of the lower eyelid, although it is not the best option. As it is a thick flap, it needs adequate anchorage to the lateral orbital rim to avoid ectropion. In addition to this, at least two more stages will be needed to thin the flap conveniently. In any case, the frontal skin will never fit the physical properties of the original eyelid skin.

Vascularization and anatomy

Two main arteries, both branches from the ophthalmic artery, the supraorbital and the supratrochlear arteries, supply this flap:

- The supraorbital artery emerges, via a bone groove or a foramen, between approximately the medial and middle third of the upper orbital rim and courses upward and laterally and obliquely to supply the frontal muscle and the forehead.
- The suprathrochlear artery emerges at the supra-medial angle of orbit, courses upward, medially and obliquely.

Both arteries anastomose and create a rich subcutaneous and intramuscular network of vessels that allow multiple designs with different orientations, as long as the basic emerging points for these arteries are respected.

Markings

This flap is generally used to repair the nose and so the first step is to obtain a pattern of the defect to be reproduced on the forehead to determine the exact type and shape of the flap needed.

Secondly, the length of the pedicle has to be precisely determined. This is a flap that will generally rotate on a cutaneous pedicle between 90º and 140º to fit in place. This means that the length of the flap will be shortened by the effect of rotation on the emerging point of vessels. The more the flap has to rotate the more length of the pedicle will be lost. The design, which needs less rotation, will only be an option if it properly fits the defect.

Thirdly, the forehead flap can be based on one or both of the points from where these arteries arise from the cranium. Two examples of how to locate these points are shown in Fig. 4.14.

Fourthly, it is also essential to avoid using hairy skin from the head. Although the tip of the flap can be thinned (by no more than 1 or 2 cm for safety) and hair follicles eliminated, it is better to use glabrous skin.

Elevation

The flap is elevated from distal to proximal, and, as illustrated in figure 4.15, it can be de-epithelialized on its tip for better fitting (usually for the tip of the nose).

When repairing full thickness defects that have to be simultaneously resurfaced (nasal mucosa or conjunctiva in the eyelids), a skin or mucosal graft can be sutured on the muscular side of the flap; so it will provide an inner coverage for the defect.

Division of the pedicle is not only a matter of "cut and suture". Rotation of the pedicle and direct closure of the forehead results in local distortion of the eyebrows. Division of the pedicle has to include distribution of the excess skin to release tension in the area and reposition the eyebrows if necessary. The flap itself can be partially thinned at this stage.

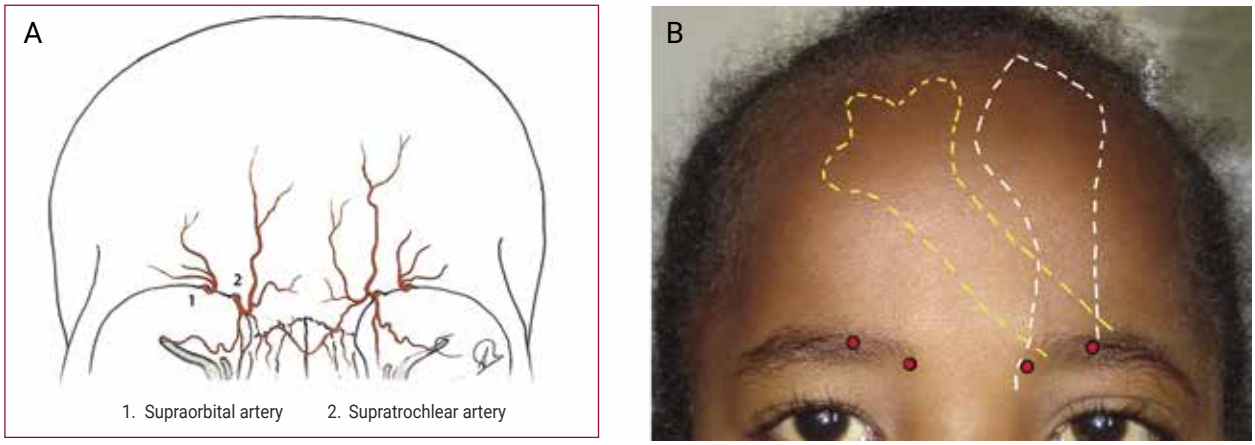

Figure 4.25. A) Arterial anatomy of the forehead, nasal and paranasal region. B) Red dots indicate where the supratrochlear and supraorbital vessels arise. Two possible designs are shown here, based on one or both the arteries.

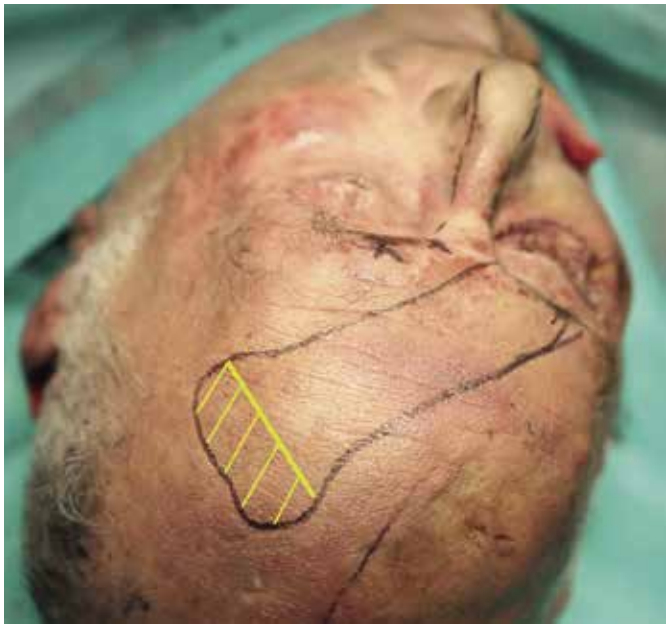

Figure 4.26. Forehead flap outlined on a fresh cadaver specimen. Both emerging points of the supraorbital and supratrochlear arteries are included at the base of the flap. Yellow lines at the tip of the flap indicate the area that can be thinned.

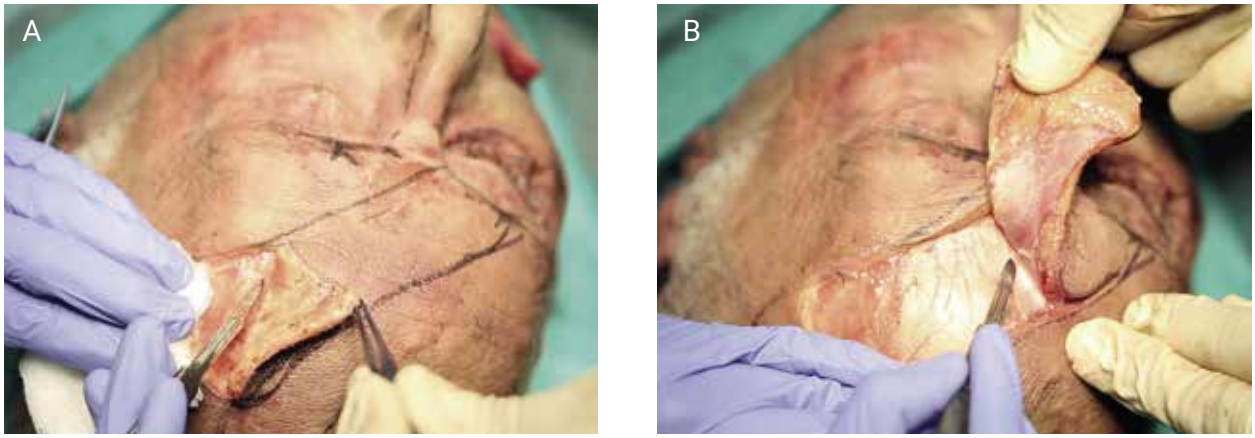

Figure 4.27. A) The tip of the flap is raised subcutaneously for 2 cm, leaving the muscle attached to the periostium. B) Beyond these 2 cm, elevation continues at the submuscular plane respecting the periostium over the forehead bone.

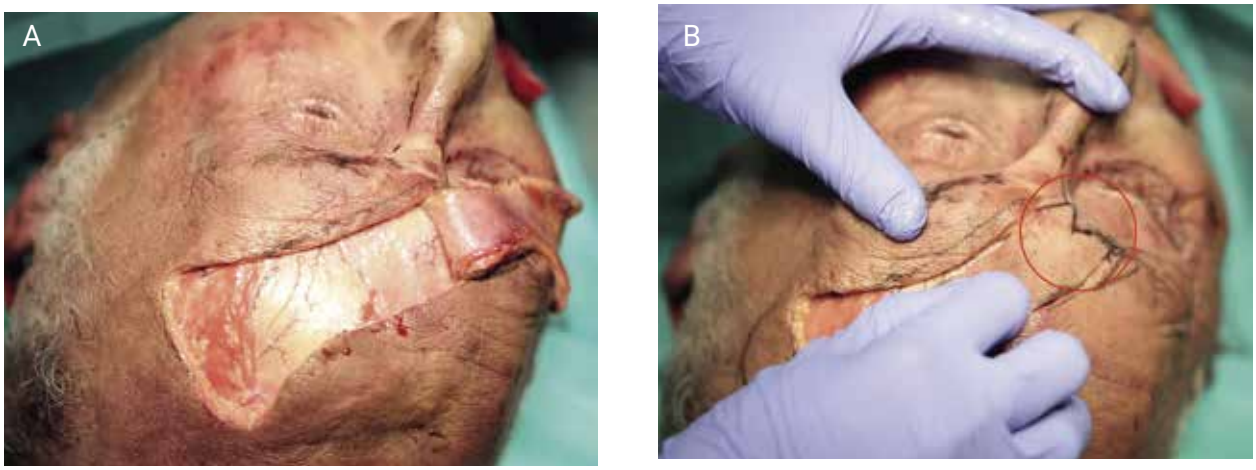

Figure 4.28. A) Flap including the frontalis muscle is completely raised towards the arteries emerging from the right orbit. B) If more length is needed, over the area of the emerging points, the skin (exclusively the skin) can be incised in "W" fashion taking great care to respect all subcutaneous tissue where the vascular network is. It is possible to gain 1 to 2 cm of length for the pedicle or release some tension to the tip of the flap.

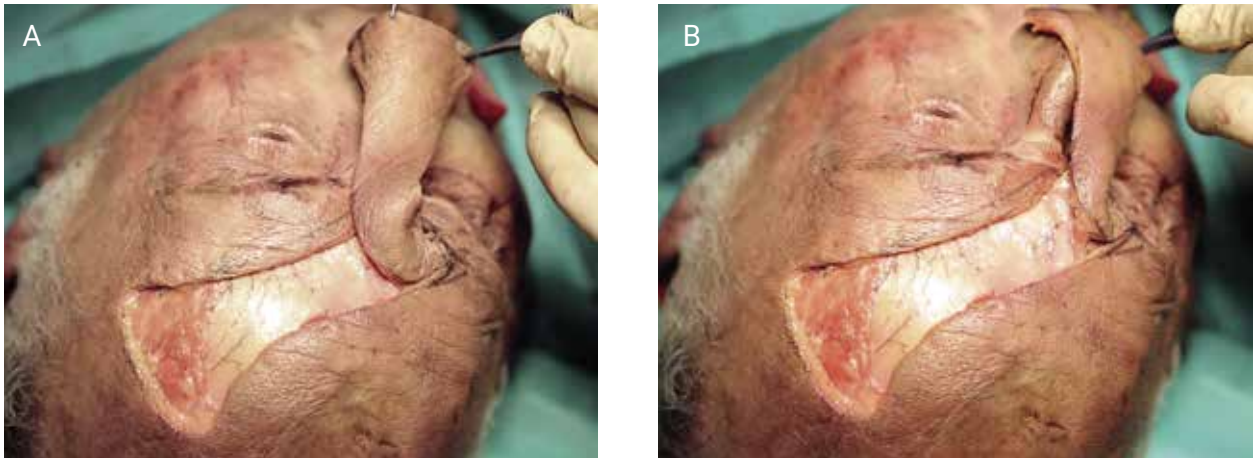

Figure 4.29. A) Without any cutaneous incision on the proximal pedicle the flap can easily reach the tip of the nose. B) If it is intended to repair the columela, the previously described cutaneous incision may help to lengthen the pedicle for an easy distal reach.

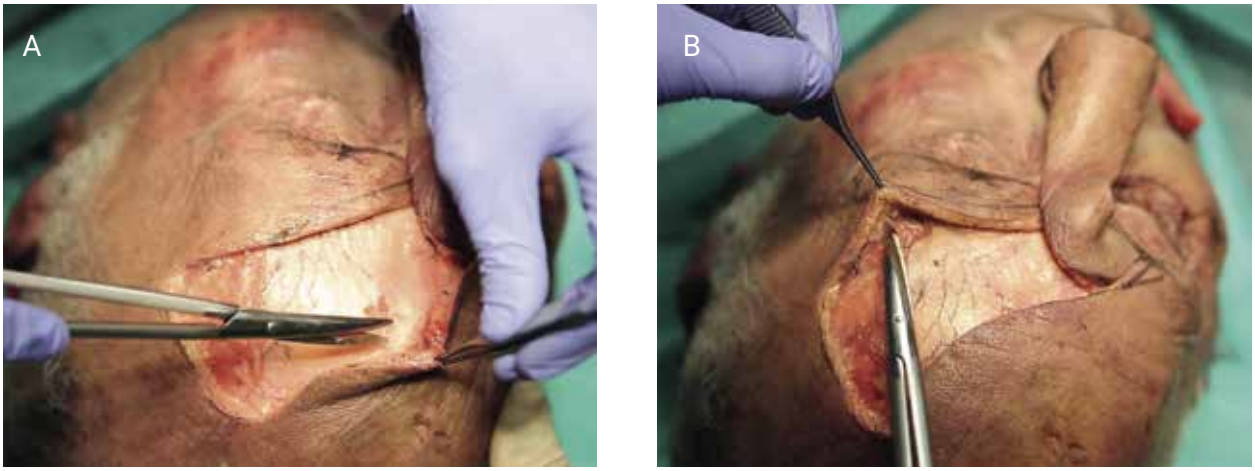

Figure 4.30. A) Donor area is usually repaired by direct closure, depending on the pedicle's width. Upper frontalis skin should always be generously freed from deep attachments to the periostium. B) Skin over the eyebrow should be freed conservatively (no more than 1 cm) to avoid excessive upper displacement of the ipsilateral eyebrow when suturing the donor area.

Figure 4.31. A) As soon as the donor area can be comfortably sutured, no more submuscular dissection is performed. B) Suture is performed in two layers. The distal donor area where the wider part of the flap is, can be repaired with skin grafts or left dressed for secondary healing that used to result in quite good scars.

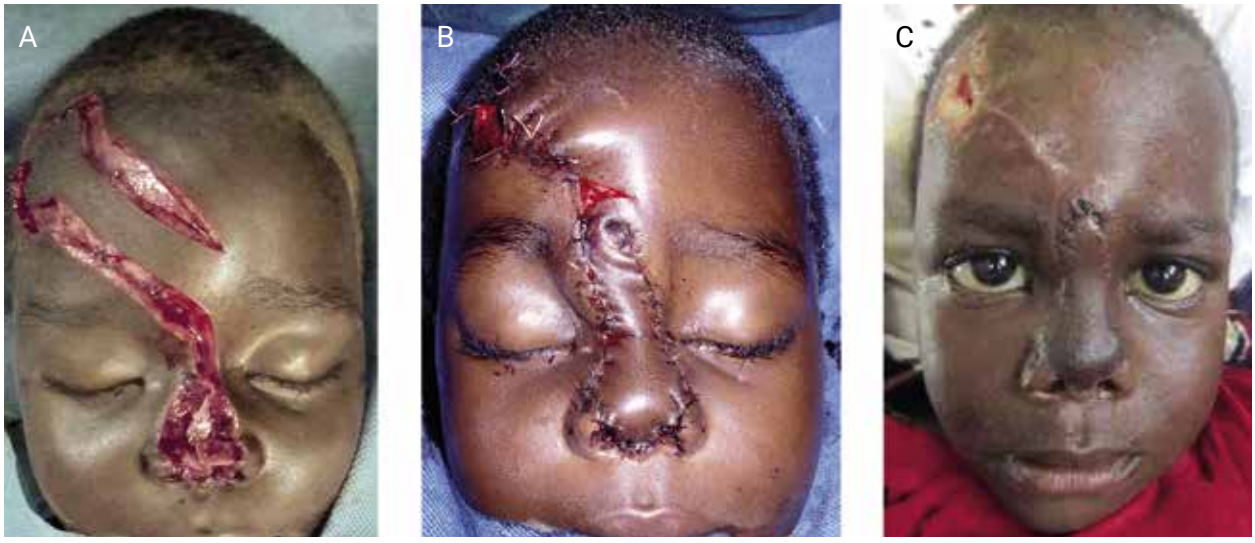

Figure 4.32. A, B and C. A) Flap elevated over the periosteum, based on both the left supratrochlear and supraorbital vessels to facilitate rotation of the flap and ensure vascularization. Cartilage grafts were used to repair the tip and nasal dorsum. B) Flap rotated to fit the dorsum, alar rims and columella. The donor area has been repaired by direct closure on the pedicle's area and secondary healing for the tip. C) The pedicle has been recently severed and the donor area still healing following a local infection. The flap fits perfectly with the aesthetic units of the face though the colour does not match yet.