



PARAMEDIAN FOREHEAD FLAP NASAL RECONSTRUCTION SURGICAL TECHNIQUE

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The paramedian forehead flap is a versatile pedicled flap based on the supratrochlear artery and is commonly used for nasal reconstruction. First described in 700 BC in ancient Indian literature by Sushruta Samita to reconstruct nasal defects from punitive tip amputation, it has subsequently become a workhorse of nasal reconstruction requiring more than 2cm soft tissue replacement on the external and internal nose¹⁻³.

Benefits of paramedian forehead flap

The paramedian forehead flap is simple to harvest, causes minimal donor site deformity, provides a large amount of skin and subcutaneous tissue that can be used for complete external and internal nasal defects, and has a robust vascular supply allowing successful flap inset even when perichondrium or periosteum of the recipient site has been removed or there is poor vascular supply. Drawbacks include that it is a 2-stage procedure, and transfer of hair bearing tissue in patients with a low-lying hairline to the external nose.

Framework concept of nasal reconstruction

The nose is composed of an internal mucosal lining, a cartilaginous and bony framework, and a cutaneous soft tissue envelope. It is critical to replace these removed subunits. If the overlying soft tissue is resected together with cartilage, a paramedian forehead flap must be accompanied by cartilaginous/bony framework reconstruction with cartilage or bone, based on preference and defect size. The authors prefer to use auricular cartilage when possible. If internal mucosal lining is missing as well, one must consider internal nasal grafts from adjacent tissue, or free grafts.

Surgical anatomy

The paramedian forehead flap is based on an axial blood supply from the supratrochlear artery, which exits the orbit 1.7- 2.2cm lateral to the midline at the level of the superior orbital rim⁴ (Figure 1).

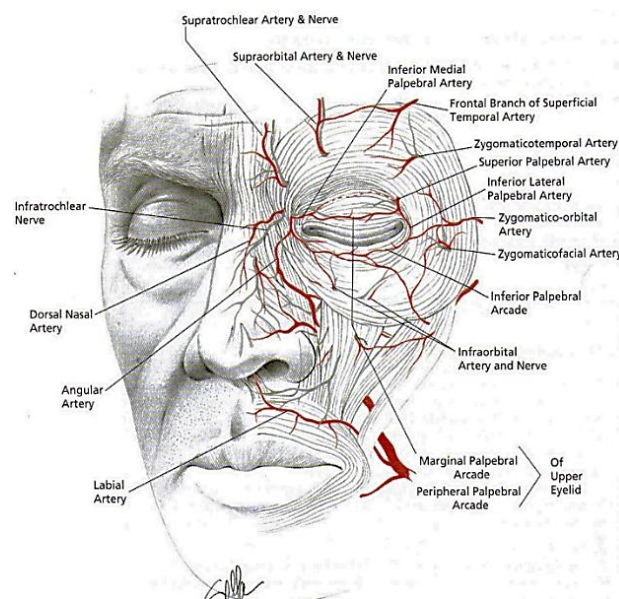


Figure 1: Superficial facial anatomy showing relationship of orbicularis oculi and supratrocheal artery

It then travels deep to the *orbicularis oculi* and superficial to the *corrugator supercilii* muscle (Figure 2). It then penetrates the orbicularis and frontalis muscles at the level of the brow to run in a subcutaneous and subdermal plexus approximately 2cm from midline or approximately at the level of the medial brow⁴.

Informed consent

Discussion of specific risks related to paramedian forehead flaps include

- Flap loss
- Need for revision surgery
- Loss of sensation around the forehead

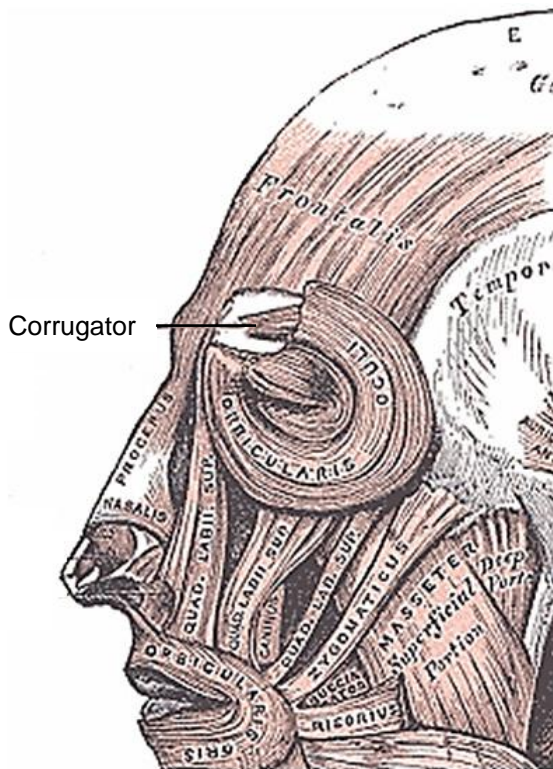


Figure 2: Facial muscles

- Open wound and resultant scar over the superior aspect of the forehead
- Risk of bleeding, especially initially as the undersurface of the flap is exposed
- Ensuring the patient understands that the pedicle of the flap will only be divided ~3 weeks after the initial surgery

Surgical technique

- The flap includes epidermis, dermis, subcutaneous tissue, frontalis muscle and associated fascia
- For nasal contouring, the frontalis muscle can be removed distally as well as the bulk of subcutaneous tissue, as the vascular supply has a large subdermal plexus component
- The supratrochlear nerve which provides sensation to the paramedian forehead is sacrificed as part of the pedicle division and therefore should not be isolated and preserved (Figure 1)

Prepping and draping

- Shave up to the anterior hairline and expose this region if a need for additional pedicle length is a possibility
- Prep the entire face with betadine-based solution and into the hairline
- Prep and expose the ears if one anticipates needing to harvest conchal cartilage

Preparing the nasal defect

- Draw the nasal subunits and consider removing entire subunits when >50% has been resected (Figure 3)

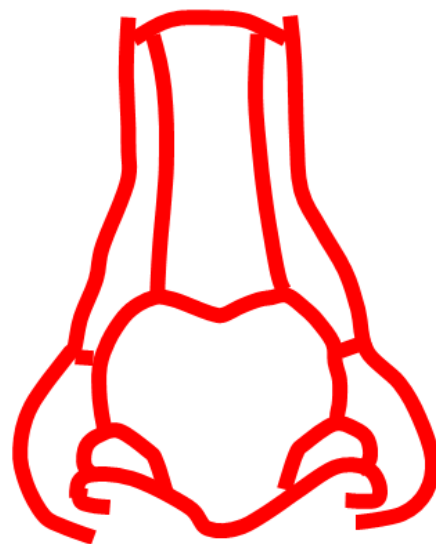


Figure 3: Nasal subunits

- Reduce the size of the nasal defect
- Inject vasoconstrictive local anaesthetic around the margins of the defect
- Undermine the defect in a supraperichondrial plane to mobilise the edges which will aid closure
- Reduce the nasal defect by local wound closure, or by performing a laterally based cheek flap (Figures 18, 19)
- The flap can be attached by anchoring sutures to the piriform aperture by drilling small holes in the bone

Making a template

- Using a template of the exact size and shape of the defect is a precise way to design a flap
- Dry the edges of the defect and mark them with a surgical pen so there is excess ink at the edges
- Use the unmarked internal surface of the foil of a suture packet, open it up completely so that the surface area is maximized, and press it onto the defect so that the inked margins are transferred onto the foil
- Cut the foil along the inked lines with scissors to create a template (*Figure 4*)



Figure 4: Foil nasal template cut to size of defect

Skin paddle design

- We typically harvest from the side **contralateral** to the nasal defect to allow for ease of rotation; however, one can use the ipsilateral side if there is scar or other prohibiting factors
- Skin paddle design is critical for good cosmetic and surgical outcomes
- Draw the pedicle location as described above (*Figure 5*)



Figure 5: Pedicle drawn from nasal defect foil template with length estimated by the gauze

- Use gauze or string from a sponge to determine how far superiorly the skin paddle must be taken from the forehead/scalp to cover the entire defect (*Figure 6*)



Figure 6: Gauze being used to determine forehead pedicle length (based on pedicle-to-nasal-defect marking)

- It needs to be emphasised that it is better to err on the side of having excess flap length
- Repeat the length measurement to ensure accuracy
- Draw the position of the supratrochlear artery approximately 2cm from midline (*Figure 5*)
- Place the shaped foil template on the forehead and draw the flap on the skin
- The pedicle is narrowed towards the supratrochlear artery but is not narrowed to less than 1.5cm (*Figure 5*)

Harvesting the flap

- Inject vasoconstrictive local anaesthetic around the flap, but not directly into the flap to avoid vasoconstrictive complications
- Starting at the tip of the pedicle, incise through skin and subcutaneous tissue using skin hooks to generate tension and to pull the skin up and away from the periosteum (*Figure 7*)

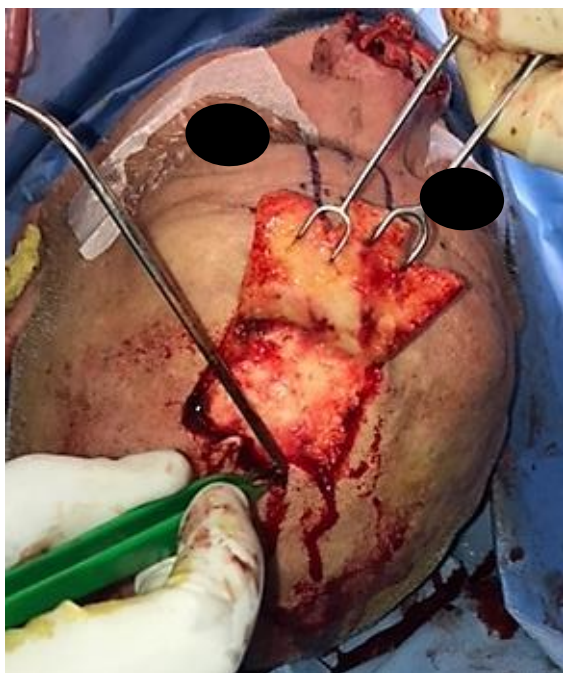


Figure 7: Distal tip being elevated in a subcutaneous layer

- One can harvest the distal segment of the flap in a subcutaneous plane to allow for thinning of the nasal contour, as illustrated in *Figure 7*.
- You will feel the *galea aponeurotica* separate as it is released from the scalp when this layer is entered
- Incise 5cm at a time down each of the lateral margins of the pedicle, ensuring to dissect down to and through *galea*
- Once the tip has been mobilised, finger dissection can be used in the loose galeal layer to establish a plane heading inferiorly toward the pedicle and making it easy to define the dissection plane
- You will recall that the supratrochlear vessels penetrate the frontalis muscle at the level of the brow to then travel superficial to the muscle
- Therefore, deepen the dissection to a subperiosteal plane to protect the vascular pedicle once you reach the superior aspect of the brow (*Figure 8*)

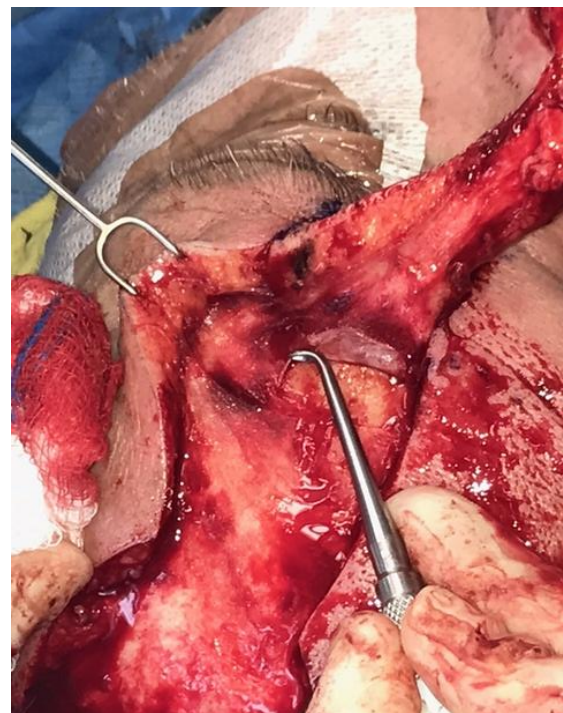


Figure 8: Supratrochlear artery and nerve demonstrated with elevator as dissection plane is changed to a subperiosteal plane

- This is achieved by incising the periosteum with a 15 blade and then using a Freer's dissector to blunt dissect inferiorly in this plane
- If the pedicle is long enough that it reaches without tension, then stop dissecting the pedicle. However, if there is tension on the pedicle, then continue to dissect through the corrugator muscle, as this step provides significant additional length
- Prior to inseting the flap, assess the blood supply of the flap at the tip by rubbing it with a dry swab and by assessing for bleeding

Inseting the flap

- ***Before inseting the flap, you should already have reconstructed any internal lining or cartilaginous defects.*** We typically use conchal cartilage to replace resected nasal cartilage
- If the flap comes from a hair-bearing region, one can cauterise individual hair follicles...this can be done at a later time
- The flap is set into the defect and its thickness assessed
- Some loss of flap volume is expected to occur with healing
- As the blood supply to the skin runs in the subdermal plexus, it is feasible to thin the flap to the subcutaneous plane by removing the frontalis muscle
- Secure the flap using interrupted deep dermal 4-0 monocryl sutures and 6-0 nylon interrupted cutaneous sutures
- Loosely wrap the undersurface of the pedicle with xeroform to prevent post-operative bleeding from the wound edges

Closing the donor site

- The donor site is then closed using interrupted deep dermal 3-0 Vicryl sutures

and 6-0 interrupted nylon cutaneous sutures and 5-0 nylon in the hairline

- If a large skin paddle was raised, primary closure of the donor site is difficult. In such cases we perform multiple lateral vertical cuts through the galea 2-3cm apart with electrocautery to increase the skin mobility (*Figure 9*)



Figure 9: Undermining and galeotomies performed to increase skin laxity and primary closure

- It is common to have a small remaining defect superiorly that is packed with Xeroform gauze and left to heal by secondary intention. This is encountered when the flap size is greater than 4.5cm, but the cosmetic outcome is favourable and secondary scar revision is often not even necessary (*Figure 10*)
- Both wounds are covered with steri-strips
- Before reversing the anaesthetic, prick the flap with a 25G needle. Bright red blood indicates a good blood supply

Postoperative care

- The wound is kept moist and free from crusting using dilute hydrogen peroxide in saline or sterile water and antibiotic ointment applied after cleaning twice daily
- Sutures are removed between Days 5 and 7



Figure 10: Following closure with a residual superior skin defect, which is common and heals well with local wound care

Pedicle division

- The pedicle is divided 3 weeks later once neovascularisation has occurred and the flap has gained a local blood supply
- Pedicle division has three basic goals:
 1. Dividing and inseting the superior aspect of the flap
 2. Thinning the flap if necessary
 3. Elevating the brow where it was previously drawn inferiorly with the pedicle
- The pedicle is typically divided under general anaesthesia, but can be done under local anaesthesia
- Prep and drape and keep the entire face exposed
- Inject local anaesthetic with a vasoconstrictive agent into both the brow and nasal reconstruction
- Place a clamp on the pedicle at the intended division site, ensuring enough distal pedicle length for proper inset
- Divide the pedicle

- Perform the nasal inset by thinning the pedicle in a subcutaneous plane and then trimming it to fit the residual defect
- An option at this stage is to elevate and thin the entire flap in a subcutaneous plane if there is excess bulk, using the previous incision lines
- Next turn your attention to the brow and elevating a triangular rotation advancement flap to raise the medial brow to the level of the contralateral brow (*Figures 11, 12*)
- The pedicle is then thinned proximally and inset



Figure 11: Pedicle had been divided (note divided pedicle inferiorly); now correcting donor eyelid position with triangular advancement flap



Figure 12: One month following flap take-down; note triangular advancement flap



Figure 13: One month following flap take-down

More clinical examples

Figures 14-17 are of a patient with soft tissue breakdown and exposure of titanium mesh following a previous resection and reconstruction with a soft tissue free flap.



Figure 14



Figure 15



Figure 16



Figure 17

Figures 18- 23 illustrate the laterally based cheek flap to reduce the nasal defect, the vascular pedicle and repair of a lateral nasal defect.



Figure 18



Figure 19



Figure 20

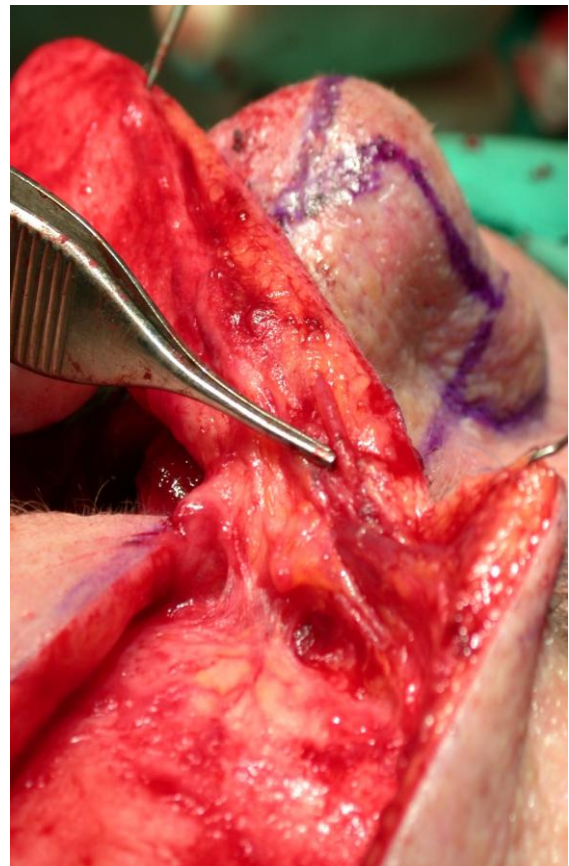


Figure 21: Vascular pedicle



Figure 22



Figure 23

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Flaps described in *The Open Access Atlas of Otolaryngology Head & Neck Operative Surgery*

- [Pectoralis major flap](#)
- [Cervicofacial flaps](#)
- [Deltopectoral flap](#)
- [Buccal fat pad flap](#)
- [Buccinator myomucosal flap](#)
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- [Medial sural artery perforator \(MSAP\) flap](#)

- [Gracilis microvascular flap](#)
- [Principles and technique of microvascular anastomosis for free tissue transfer flaps in head and neck reconstructive surgery](#)

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