



REPAIR OF NASAL SEPTAL PERFORATIONS Ahmad Sedaghat, Benjamin Bleier

The most common causes of nasal septal perforations are trauma, iatrogenic *e.g.* septoplasty, and pharmacologic *e.g.* intra-nasal corticosteroids and cocaine abuse. Other aetiologies such as vasculitis, malignancy and infection should be considered when investigating a patient when a cause is not apparent.

Most septal perforations go unnoticed. The most troublesome signs and symptoms include a whistling sound, crusting and epistaxis; these are consequences of disruption of laminar airflow and its desiccating effect on the nasal tissues. In some cases with *e.g.* vasculitis or chronic picking at nasal crusts, septal perforations may grow in size and cause collapse of the dorsal or caudal supports leading to nasal deformity.

Despite its varied aetiology, the common mechanism for developing a septal perforation is disruption of blood flow and devitalisation of the septum. Despite its rich blood supply in the form of Kiesselbach's plexus, perforations most commonly involve the anterior septum; this plexus is comprised of the terminal branches of the superior labial, greater palatine and anterior ethmoidal arteries and does not tolerate vascular insults well.

Indications for septal surgery

Because septal perforations are not life-threatening, many may be treated conservatively by moisturising the nasal mucosa with saline irrigation and topical ointments. This may control symptoms and reduce the risk of enlargement of the perforation. Surgery is warranted only for patients who fail conservative treatment and are symptomatic. When septal perforations are related to an active disease *e.g.* vasculitis, malignancy or infection, treatment should be directed at the underlying disease

process. Only once the aetiology is controlled can treatment be tailored to the extent of the symptomatology.

Indications for surgery include

- Symptomatic perforations
 - Crusting
 - Whistling
 - Recurrent epistaxis
 - Nasal congestion
- Perforations refractory to conservative management
 - Nasal moisturizers
 - Septal button

Contraindications to surgery include

- Active underlying cause
 - Vasculitis
 - Malignancy
 - Infection
- Diameter/location precluding harvesting of adequate tissue for reconstruction (approximately >3cm)

Surgical anatomy

Bony & cartilaginous anatomy (Figures 1, 2)

The nasal septum has both bony and cartilaginous components. Anteriorly the septum is composed of the quadrangular cartilage. Posteriorly the septum consists of bone of the perpendicular plate of the ethmoid superiorly and the vomer inferiorly. The most inferior part of the septum is the maxillary crest which is a bony projection from the maxilla and palatine bone along the full length of the septum. The maxillary crest articulates with quadrangular cartilage anteriorly and the vomer posteriorly. Superiorly the perpendicular plate of the ethmoid attaches to the delicate cribriform plate (*Figure 2*). This has clinical relevance

ce as rough handling or twisting of the perpendicular plate can cause a fracture of the skull base, a cerebrospinal fluid leak and meningitis. The bony and cartilaginous components of the septum are covered by periosteum and perichondrium from which they receive their blood supply. Superficially it has a covering of respiratory mucosa.

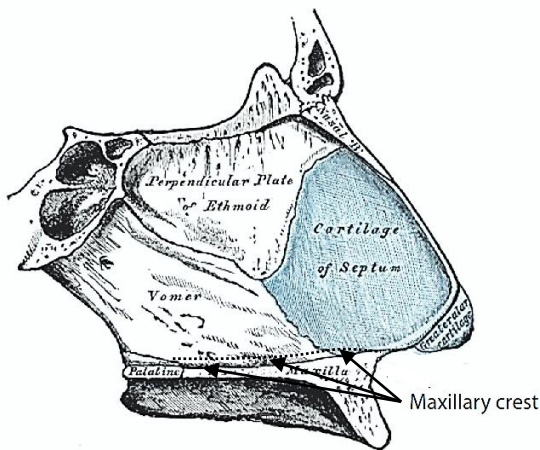


Figure 1: Bony and cartilaginous anatomy



Figure 2: Perpendicular plate of ethmoid attaches to cribriform plate

Vascular supply (Figures 3-5)

An understanding of the vascular supply is important if large mucoperiosteal flaps are to be used to repair a septal perforation (Figure 3). Venous outflow generally follows the arterial blood supply.

The nasal septum has both internal (ICA) and external carotid (ECA) artery supply.

The *anteroinferior septum* is supplied by the *septal branch of the superior labial artery*, and the *greater palatine artery* (Figure 3). The former arises from the facial artery, a branch of the ECA; the latter is a proximal branch of the internal maxillary artery, also a branch of the ECA.

The *anterosuperior septum* is supplied by the *anterior ethmoidal artery*; this arises from the ophthalmic artery, a branch of the ICA (Figure 5). These 3 vessels converge at the anterior septum to form *Kiesselbach's plexus*, a common origin of epistaxis.

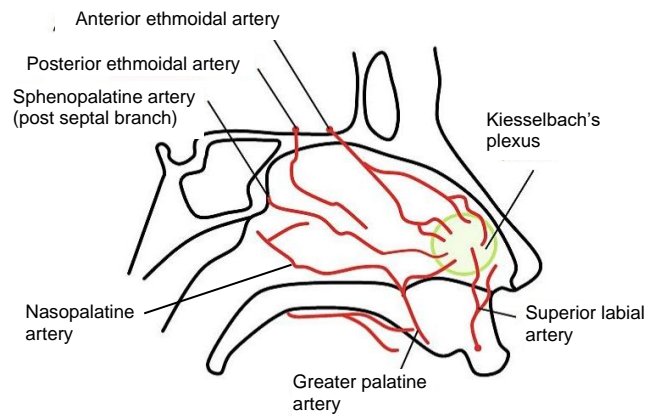


Figure 3: Arterial supply to nasal septum

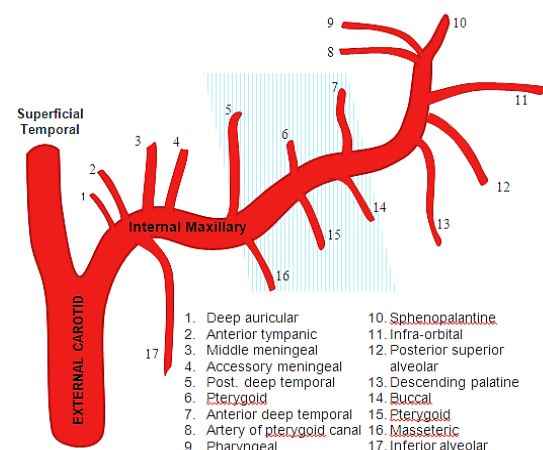


Figure 4: Branches of internal maxillary artery; blue shading denotes 2nd part of internal maxillary artery before it enters pterygopalatine fossa

Posterosuperiorly the septum receives its blood supply from the *posterior ethmoidal artery*, a branch of the ophthalmic artery (ICA) and the *posterior septal branch of the sphenopalatine artery*, a terminal branch of the internal maxillary artery (ECA) (Figures 5, 3).

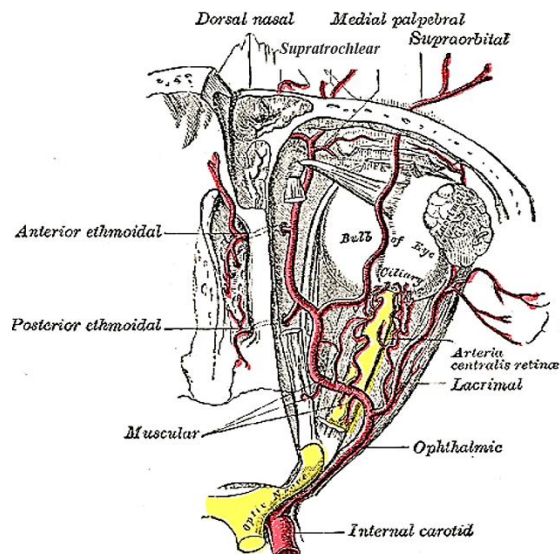


Figure 5: Ophthalmic artery gives rise to anterior and posterior ethmoidal arteries

Surgical approaches

Unless an endoscopic technique is used, access to the nasal septum can be very restricted. It is the authors' preference to do the surgery endoscopically due to the excellent visibility it affords. However, surgery may also be achieved with an operating microscope or with a headlight and nasal speculum. Non-endoscopic surgical approaches may include endonasal (+/-microscope), external rhinoplasty, alar release and midfacial degloving techniques.

Surgical techniques

A variety of techniques may be used to repair septal perforations ^{1, 2}

- *Intranasal mucosal flaps*: Inferior turbinate flap, quadrangular cartilage flap and a variety of mucoperiosteal flaps

- *Combinations of intranasal mucosal flaps and interposition grafts*: Graft materials that have been reported to have been used include temporalis fascia, mastoid periosteum, nasal septal tissues, acellular human dermal grafts, conchal cartilage and porcine small intestine mucosa ¹
- *Superiorly based buccinator myomucosal flap* (See chapter on [Buccinator myomucosal flap](#))

The authors favour using a **bipedicled anterior septal (BAS) flap**. This is the septal repair that will be described. The BAS is pedicled on the septal branches of the superior labial and greater palatine arteries (Figure 3). The *greater palatine artery* anastomoses via the incisive canal with the *nasopalatine branch of the sphenopalatine artery*. These vessels form an anastomotic network that extends as far as the mucosa of the posterosuperior septum.

Surgical Steps for Bipedicled Anterior Septal (BAS) flap

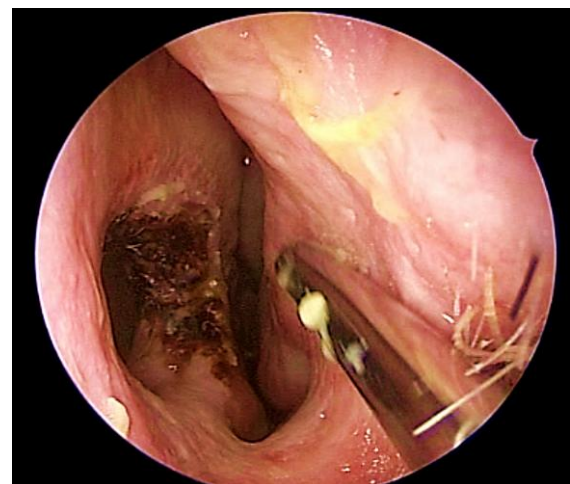


Figure 6: Septal perforation viewed from left nasal cavity before clearing crusts

- Decongest both sides of the nose using pledgets soaked in 1:1000 epinephrine, or alternatively pseudoephedrine. After several minutes, inject lidocaine with

epinephrine in submucoperichondrial planes bilaterally

- Clear the perforation of crusts
- Examine both sides of the septum and determine the side more amenable to elevation and rotation of a BAS flap (*Figure 6*)
- Make a hemitransfixion incision in the skin of the nasal vestibule to expose the septal cartilage on the side contralateral to the planned flap so as not to disrupt the blood supply to the BAS flap (*Figure 7*)

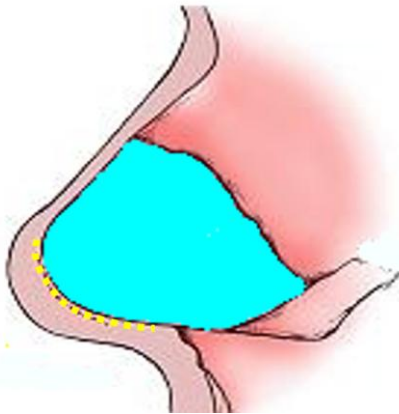


Figure 7: Hemitransfixion incision (Yellow line)

- Carefully elevate a mucoperichondrial flap in an anterior-to-posterior direction using a Cottle elevator up to the anterior edge of the perforation
- Use a #15 blade to incise the rim of the perforation circumferentially and establish a subperichondrial dissection plane (*Figure 8*)
- Elevate a subperichondrial flap around the entire perforation; this circumferential pocket will house the AlloDerm/fascial graft (*Figure 9*)
- Move to the opposite nose and elevate the BAS flap posteriorly and superiorly to the perforation up to the face of the sphenoid in anticipation of creating the bipediced rotation flap (*Figures 10*)

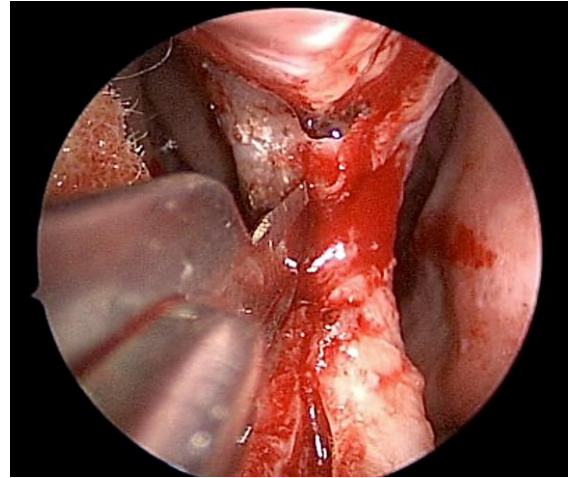


Figure 8: Establishing a subperichondrial dissection plane around the perforation

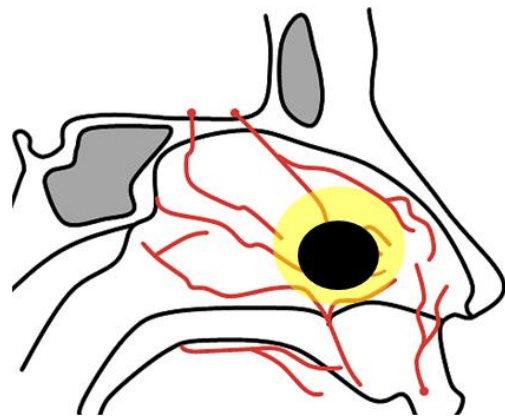


Figure 9: Elevated subperichondrial flap (yellow) around entire perforation (black)

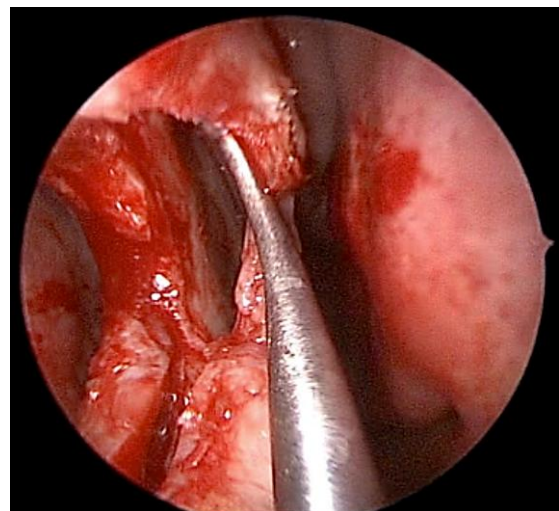


Figure 10: Elevating the submucoperichondrial flap

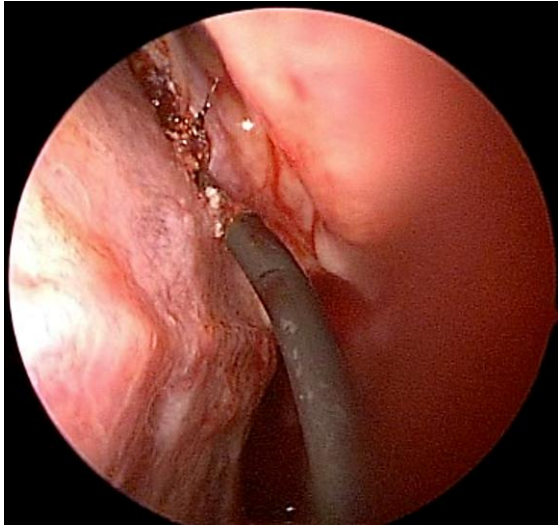


Figure 11: Elevation of flap up to the face of the sphenoid

- Leave the mucosa intact anteriorly and inferiorly to preserve blood supply to the flap from the septal branches of the superior labial and greater palatine arteries (Figure 11)
- Once the flap has been elevated off the septal cartilage and bone, incise the flap along the skull base from a line drawn vertically through the midpoint of the perforation up to the face of the sphenoid (Figure 12)
- Make a 2nd incision inferiorly to the face of the sphenoid at the level of the choanal arch, preserving the mucosal vascular pedicle inferiorly (Figure 12)
- Join these 2 incisions by a vertical incision along the sphenoid face (Figure 12)
- This creates a large mucosal flap which is pedicled anteroinferiorly (Figures 13)
- Once the flap has been elevated, attention is turned to closing the perforation
- This is performed in a multilayered fashion to minimize the risk of failure
- Cut AlloDerm or temporalis fascia in an ovoid shape, 1cm larger than the diameter of the perforation

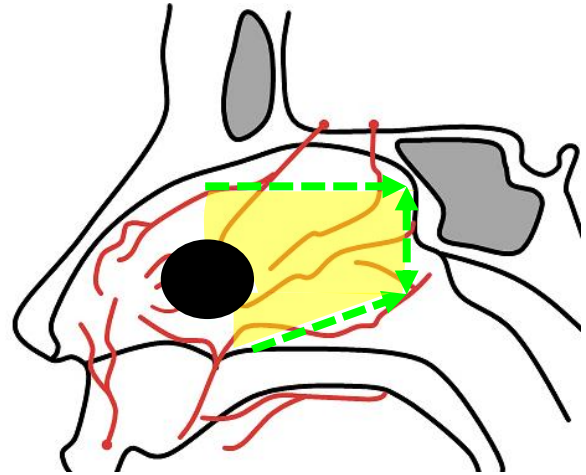


Figure 12: BAS flap (yellow) receives its blood supply from the septal branch of the superior labial artery; perforation (black); mucosal incision lines (green)

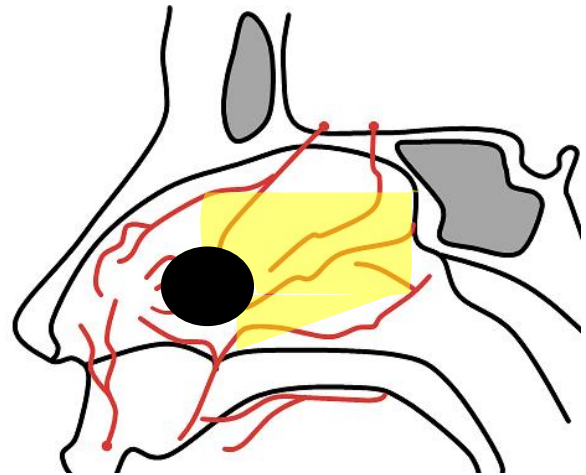


Figure 13: BAS flap (yellow) receives its blood supply anteroinferiorly from the septal branch of the superior labial and greater palatine arteries

- Insert the AlloDerm or fascia through the hemitransfixion incision to cover the perforation as seen in Figure 14
- Tack it to the caudal septal cartilage with a 4-0 plain catgut suture and then tuck it into the submucoperichondrial pocket taking care to fully overlap the entire perimeter of the perforation (Figure 15)

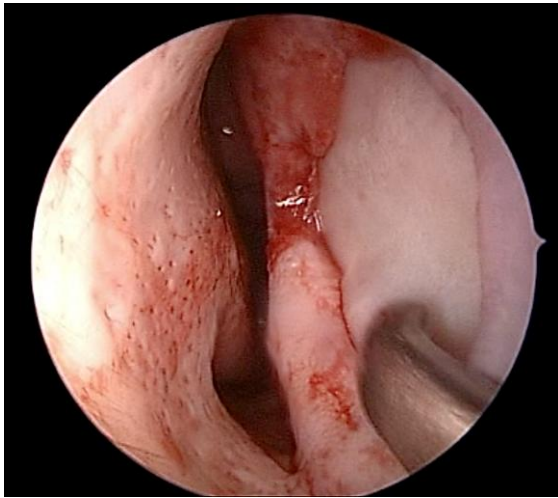


Figure 14: Interposition of graft (AlloDerm or fascia) in submucoperichondrial plane

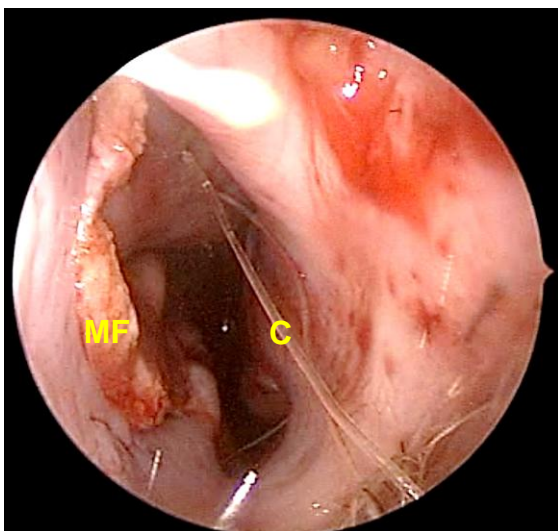


Figure 15: Note the mucosal flap (MF) covering the perforation and the catgut suture through the posterior edge of the flap (C)

- Rotate the posterior edge of the mucosal flap anteriorly to completely cover the perforation (Figures 15, 16)
- Insert a tacking suture through the posterior end of the AlloDerm/fascia to maintain its position
- Fix the flap with a single 4-0 plain catgut suture tacking stitch (Figure 15)
- Leave the knot loosely tied to prevent tissue necrosis as this portion of the flap has the most tenuous blood supply

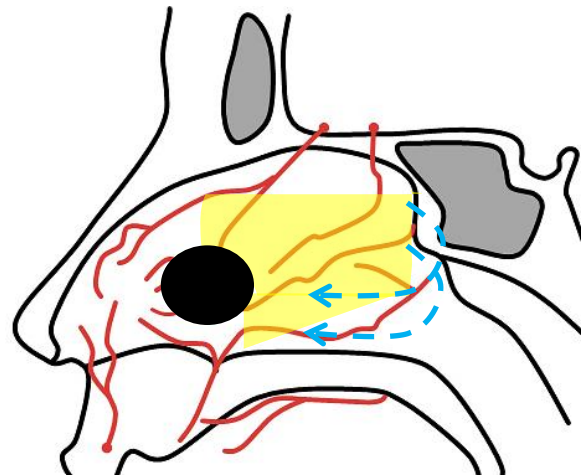


Figure 16: The posterior edge of the flap is rotated and advanced (blue arrows) to cover the perforation

- Place additional tacking sutures around the flap to keep it in position
- Insert splints (e.g. Doyle splints) bilaterally, held in place with a single 2-0 prolene U-stitch traversing the splints and the septum. The splints are left in place for 2-3 weeks

Comments

- Patient selection is critical as closure of septal perforations is notoriously difficult
- Subtotal perforations or perforations with no surrounding cartilage may not be good candidates for repair
- Some authors advocate use of bilateral flaps. This however incurs considerable risk of expanding the size of the perforation and uses up all septal reconstructive options should the surgery fail
- Good endoscopic suturing technique is critical to this repair; consequently, it should be undertaken only after these skills have been adequately practiced during routine endoscopic septoplasty

Complications

- Recurrence/persistence/increase in size of perforation
 - >2cm diameter is an independent risk factor for failure
 - Devitalised flap
- Epistaxis from raw mucosal edges produced during surgery
- Infection
- Crusting due to persistent turbulent air-flow around the reconstruction

References

1. Cogswell LK, Goodacre TE. The management of nasoseptal perforation. *Br J Plast Surg.* 2000 Mar;53(2):117-20
2. Goh AY, Hussain SS. Different surgical treatments for nasal septal perforation and their outcomes. *J Laryngol Otol.* 2007 May;121(5):419-26

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Authors

Ahmad R. Sedaghat, MD, PhD
Chief Resident
Department of Otolaryngology - Head and Neck Surgery
Massachusetts Eye and Ear Infirmary
Harvard Medical School
Boston, USA
ahmad_sedaghat@meei.harvard.edu

Benjamin S. Bleier, MD
Assistant Professor
Department of Otolaryngology
Massachusetts Eye and Ear Infirmary
Harvard Medical School
Boston, USA
benjamin_bleier@meei.harvard.edu

Editor

Johan Fagan MBChB, FCS(ORL), MMed
Emeritus Professor and Past Chair
Division of Otolaryngology
University of Cape Town
Cape Town, South Africa
johannes.fagan@uct.ac.za

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