Septal perforation and repair

Manuel A. Wexler, Los Angeles, California, U.S.A.

THE purpose of this paper is to review the etiology of septal perforations its, accompanying annoying symptoms, and present methods of surgical repair.
Correction by surgical repair must include understanding of the anatomy of the internal nose, with special attention to the internal ostium, the mucosa of the nasal cavity and its reflections; surgical techniques to utilize the structures available to the best advantage and a concept of nasal physiology which makes it imperative that septal perforations be repaired so that normal nasal respiration can be restored.

A. ETIOLOGY

a. Trauma
   1. The most frequent cause of septal perforation of the nasal septum is unquestionably that due to surgical trauma. Opposing lacerations of the mucoperichondrial flaps incurred inadvertently in the course of a submucous resection of the nasal septum procedure, will invariably produce a perforation which is permanent in nature.
   2. Trauma due to repeated chemical or electric cauterization for epistaxis.
   3. Digital Trauma.

b. Chronic illness
   1. The most common of which are syphillis, tuberculosis, typhoid fever, and diphtheria, non-specific granuloma, midline granuloma and malignancy.

c. Exposure to certain chemical irritants such as: arsenic salts, calcium arsenate, an insecticide used in agriculture, copper aceto-arsenate or Sweinfurt Green used for certain underwater paints.

d. Perforations of industrial origin due to the toxic necrotizing action of certain dusts, have for many years been known to produce septal perforation. These include: chromium salts, vapors of mercury, nitric and hydrochloric acids, chlorides, lime and cement.

B. SYMPTOMS

a. The most common symptoms of septal perforations are:
   1. Epistaxis
   2. Crusting which frequently requires constant removal to free the airway that becomes obstructed due to it's accumulation.

Presented at the Introductory Course in Septal Surgery, Everett (Washington) March 18-24, 1973.

3. Whistling noises that are produced by small perforations.
4. A foul odor may be present as secondary infection occasionally develops in the accumulated nasal secretions due to poor drainage.
5. Nasal obstruction.

C. PATHO-PHYSIOLOGY

The nasal septum divides the nose into two essentially equal nasal chambers, which function separately. A septal perforation uniting the two sides, will in effect produce one large cavity.

Where this occurs the air currents are seriously altered producing abnormal eddys, whirls and turbulence, which in turn causes crusting and scarring of the mucosa. Crusts are annoying, and are removed by either blowing or manual removal, this in turn produces further bleeding, nasal stuffiness or obstruction. In essence a nose that has been converted into a very wide nose, may even be compared to a mouth.

D. MUCOSAL REFLECTIONS

The entire nasal cavity is lined with mucous membrane. The Schneiderian membrane, is a continuous membrane lining the floor, lateral walls, roof and center partition (septum) of the nose and is continued into the paranasal sinuses.

In repair of perforations of the nasal septum it is necessary to replace the loss of tissue. The same type of tissue that was removed is preferable. Therefore, we must attempt to move the mucosa from one portion of the septum or other parts of the nose (floor, lateral walls) to cover the perforation area. In order to do this, flaps must be prepared from adjacent mucosa so that this tissue can be transferred or rotated from one place to another without tension. We can therefore take advantage of the fact that the mucosa is one continuous envelope lining the inner surfaces of the nose, and that it can be separated from the bony and cartilagenous structures by carefully elevating the mucosa with appropriate instruments thereby preparing flaps that can be rotated into the septum closing the perforated areas. The most important factor in repair of a septal perforation produced by loss of tissue, is that adequate tissue must be available to be developed into a flap that can be mobilized and rotated to the area of the perforation. Some perforations are so large that it is physically impossible to develop a flap large enough to cover the perforation.

Single or double pedicle flaps usually will provide adequate blood supply and will invariably take provided, there is no tension and that they are accurately sutured and remain in position long enough for healing to take place. Free grafts will almost invariably fail, due to the lack of blood supply. Flaps can be developed bilaterally, or in some instances the flap may be developed on one side of the septum and transferred to the opposite side leaving a raw surface on the original side, then a skin graft applied to the raw surface. A free split thickness skin graft, usually takes with little difficulty.

E. LOCATION OF PERFORATION

The most serious and most common perforations are those found in the anterior or mid-portion of the septal cartilage. When perforations are in these areas, air currents will immediately go into aberrant and abnormal directions.

Perforations in the posterior aspect of the septum at the junction of the perpendicular plate frequently are usually less troublesome for the air currents will have begun their normal course and have traversed most of the nasal cavity before going into its irregular pattern. A perforation high on the septum is more troublesome than one near the floor of the nose, again because the direction of the air currents are over the upper portion of the septum. Therefore, moving a perforation inferiorly or ventrally toward the floor of the nose will improve nasal function and will allow the air currents to traverse the nasal cavity in a normal direction. This is important because in very large perforations we may improve nasal function by closure of the perforation anteriorly, and transfer the perforation posteriorly, to an area that will be less harmful to the mucosa and the abnormal air currents will be considerably diminished. Development of mucosal flaps to repair a perforation in the septum will depend largely on the amount of normal mucosa and cartilage remaining.

In those cases where the septal cartilage has been partially preserved, the procedure is simplified, and the mucosal flaps can be developed without difficulty.

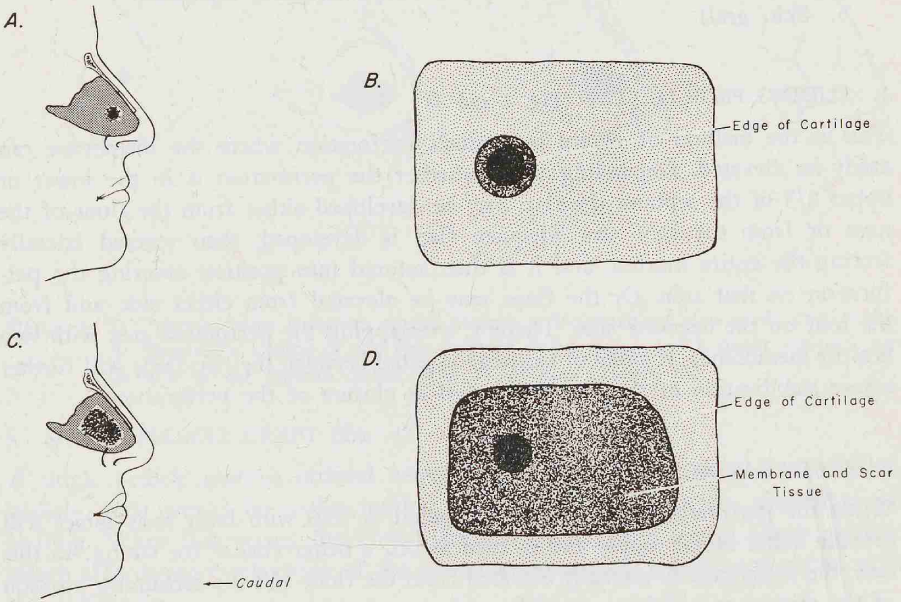

Figure 1. A and B: Perforation in which only a small amount of cartilage has been lost. C and D: Small perforation with a large amount of cartilage lost and only membrane and scar tissue remaining.

Those in which the cartilage has been extensively removed, will be much more difficult, and as a result the perforation will be much larger than it appears, for scarring of the remaining septal flap makes the dissection very difficult, and may even be physically impossible to accomplish, therefore, a portion of the scar must be excised until tissue that can be manipulated is encountered.

Except in very large perforations persistent careful dissection with proper sharp instruments, an adequate flap can be mobilized and shifted into proper position. Raw surfaces produced on the floor of the nose, lateral wall, or under the upper lateral cartilage, should be covered with a skin or mucosal graft.

F. REPAIR OF PERFORATION

a. Prevention
   1. Careful meticulous surgery, with particular attention to preservation of muco-perichrondrium and periosteum.
   2. Immediate approximation of lacerations of the mucosa if accidently or inadvertently made during surgery.
   3. Maxilla-premaxillary approach

b. Surgical repair
   1. Mobilization of available mucosa
   2. Single pedicle graft
   3. Double pedicle graft
   4. Attachment of turbinate to perforation with later separation
   5. Skin graft

1. SLIDING PEDICLE FLAP (Fig. 2 and 3)

This is the method of choice in a small perforation where the membrane can easily be elevated. Depending upon whether the perforation is in the lower or upper 1/3 of the septum, the flap may be developed either from the floor of the nose or from the roof. An adequate flap is developed, then severed laterally freeing the entire mucosa, and it is then sutured into position covering the perforation on that side. Or the flaps may be elevated from either side and from the roof on the opposite side. Thereby, overlapping the perforated area with two healthy membranes. A piece of cartilage inserted between the two flaps will further assure stabilization of the septum as well as closure of the perforation.

2. DOUBLE PEDICLE GRAFT

When the perforation is large and elongated, a flap with both ends intact will provide better blood supply and in turn afford a better chance for taking. In this case, the membrane is carefully elevated from the floor and the remaining position of the septum as widely as possible, and around the perforation in all directions. The elevated membrane is then incised as far laterally as possible and when freed can be moved upward over the perforation and attached to the membrane above.

First scarifying the mucosa above the perforation to allow for better healing of the rotated flap.

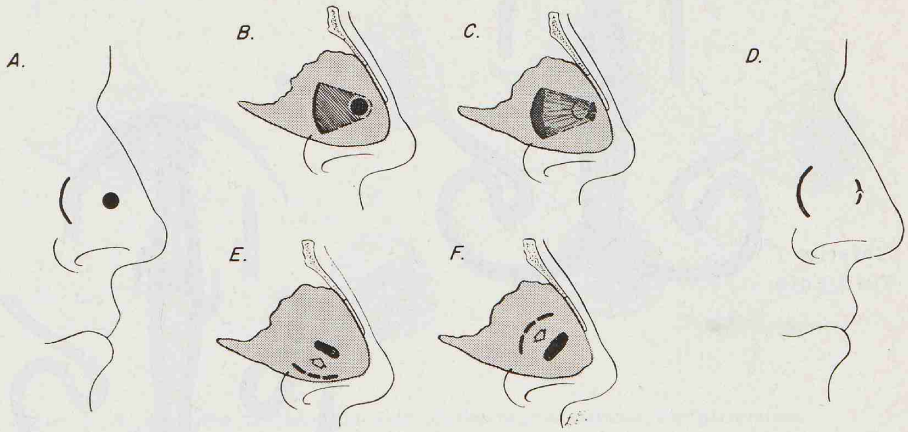

Figure 2: Closure of the perforation with a sliding graft either from caudally (Figures B-C) or dorsally (Figure E).

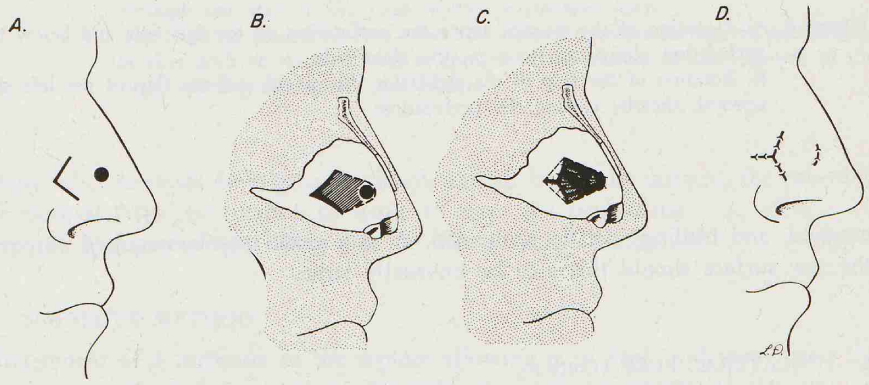

Figure 3. V-Y closure after elevation of the mucosa a V-shaped incision made posteriorly. A: Shows the sliding of the flap forward to be closed and a linear incision, the incision of the mucosa closed in a Y incision (Figure D).

3. SINGLE PEDICLE GRAFT (Fig. 4)

A single pedicle graft is utilized when it has been determined that the double pedicle graft would be under tension, thereby, jeopardizing the possibility of healing. When this occurs the double pedicle is converted into a single pedicle which affords more relaxation of the tissues and can more easily be stretched over the perforation.

The disadvantage of this type of flap is that the blood supply to the graft may be compromised and additional scar tissue is produced- also more raw surface is

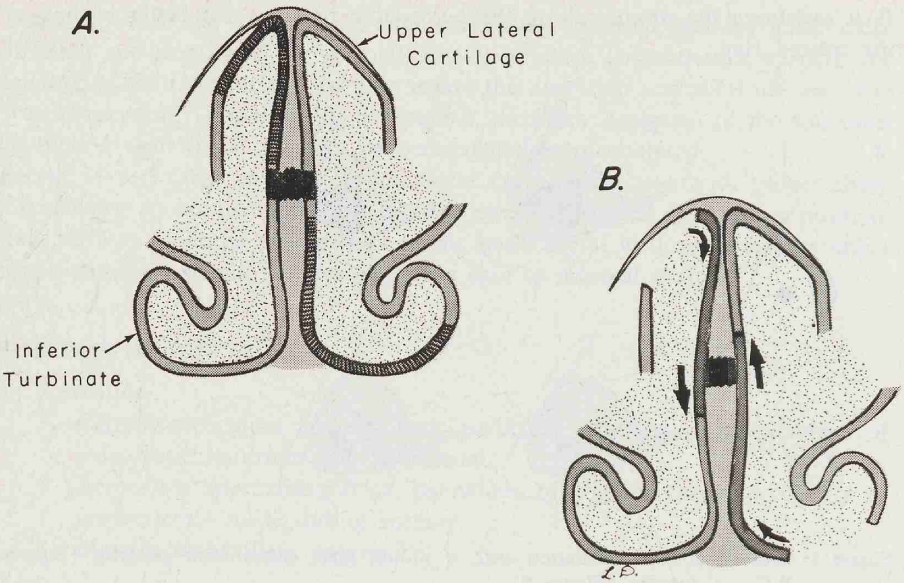

Figure 4. A: Elevation of the mucosa above the perforation on the left side and below the perforation along the floor on the right side.
B: Rotation of the flap of the right side downward and the flap of the left side upward, thereby closing the perforation.

exposed, and healing will be prolonged. A skin graft may be required to cover the raw surface should this area be unusually large.

4. UNILATERAL FLAP (Cottle)

In those cases where the perforation is completely healed and the membrane is then atrophic, attempts to elevate the membrane will lead only to a much larger perforation with shredding of the membrane present, and greatly reduce the possibility of closure. The unilateral flap will give us a much better opportunity for a successful closure.

The membrane is elevated from one side above, below, behind and in front of the perforation. The membrane is then incised caudally near the membraneous septum, then incisions below, above and behind will give us four separated flaps, still attached at the rim of the healed perforation. These flaps are then sutured so that the mucosa surface is in the opposite side of the septum, leaving a raw surface on the original side. A split thickness or mucosal graft is then applied to the raw surface to provide covering for that side. (Figure 5).

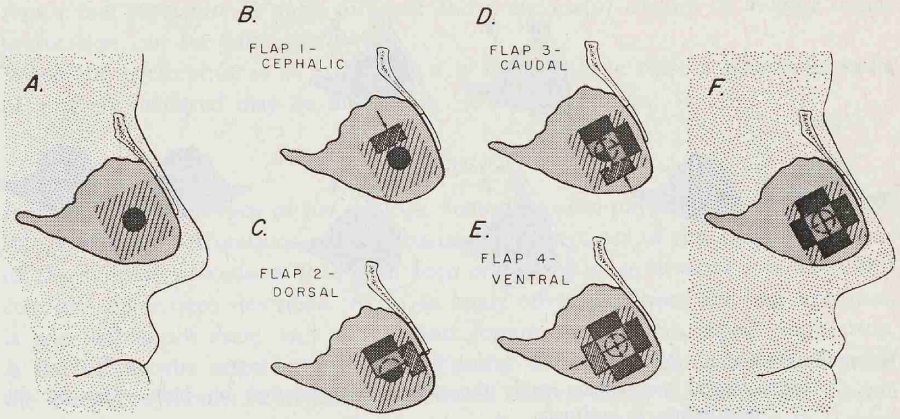

Figure 5. A: Elevation of the right side of the mucosa around the perforation.
B: A cephalic flap is then made.
C: A dorsal flap being elevated.
D: A caudal flap being elevated.
E: A ventral flap being elevated. All surrounding the perforation and not going through the scar or the edge of the perforation itself.
F: The flaps are folded on each other and sutured together closing the perforation. A skin graft or mucosal graft is applied to the mucosa of the left side of the nose, thereby closing the perforation.

Many other methods have been described, and all essentially utilized, the principle of mucosal flaps for rotation of tissue to cover the perforation.
I would like to mention others for the sake of completeness.

5. SEIFFERT'S METHOD

Attachment of a turbinate to the septum allowing it to heal, and then incise the mucosa over the turbinate freeing the turbinate from the septum. In our opinion this should be avoided as it will cause dysfunction of the turbinate.

6. SAUNDERS METHOD

Free skin graft advocated by Saunders similar to the method he uses in septal dermoplasty for control of epistaxis in congenital telangiectasis. A more radical procedure is advocated by Levey and Hammond who carry Saunders procedure further in utilizing a hemirhinotomy to allow for better exposure and access to the septum.

There will be instances when any one procedure may be the method of choice; however, it is well to be familiar with as many methods as possible and frequently a combinations of procedures will be required to achieve the desired result.

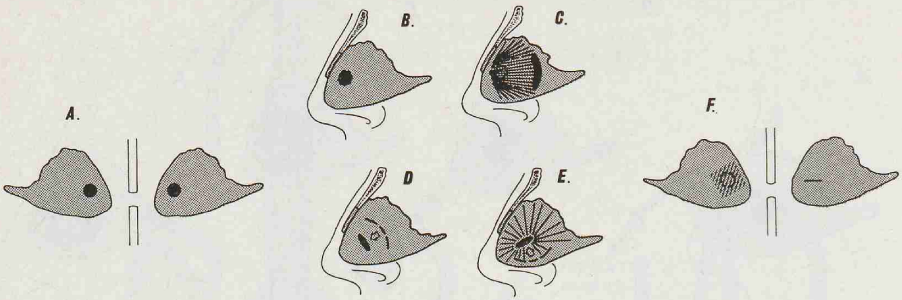

Figure 6. Method of choice.
The septal perforation with the membranes elevated on both sides of the perforation is outlined.
B: Debridement of the edge of the perforation enlarging the size of the perforation on that side.
C: Extensive elevation of the mucosa around the perforation.
D: Incision posteriorly; the flap is then rotated forward where it can be sutured in a linear incision.
E: Incision ventrally; the flap rotated dorsally and sutured horizontally.
F: The mucosa of the left side is closed; the shaded area on the right side indicates a mucosal graft applied to the raw surface closing the perforation bilaterally.

7. OWN METHOD (Fig. 6)

A procedure that has proven satisfactory is as follows:
The edges of the perforation are freshened. The membranes are carefully separated under magnification using blunt and sharp dissection. Lateral osteotomy and a push down procedure is accomplished.
This usually reduces the size of the perforation from above downward. The mucosa of one side usually the left, because it is more convenient to manipulate the tissues on that side is widely undermined along the floor into the inferior meatus and above under the upper lateral cartilages, and as far cephalic as possible. Releasing incisions are then made, thereby developing a sliding mucosal graft. The tissues are released until the perforation can be approximated easily and without tension. This closes only half of the perforation, and a raw surface is exposed through the remaining perforation of the right membrane. A mucosal graft is then removed from the cheek either free hand or with a dermatome. The graft is sutured into position covering the raw surface that presents through the dehiscence of the right side of the septal membrane. A Teflon splint is then sutured to either side of the septum, acting as an internal splint. This is allowed to remain for 10 days to 2 weeks. Allowing sufficient time for healing to take place.
Autogenous tissues such as bone, cartilage, and periosteum have been insinuated between the mucosal flaps and have also "proven satisfactory". Under any circum-

stance this procedure is quite difficult and a successful closure of a large septal perforation can be quite gratifying.

When the perforation is so large that it is impossible to close a prosthesis made of a plastic material may be molded to fit the perforation.

CONCLUSION

It is hoped that a review of the etiology, anatomy, patho-physiology, and symptomatology of nasal perforations will emphasize the importance of this condition. Many of the surgical procedures that have been employed in an attempt to correct this condition have been described. As in so many other conditions the best operation is one that is not done, and as the most common cause of a septal perforation, is the submucous resection operation. Careful surgery to prevent lacerations of the mucosa or should lacerations be produced inadvertently, the immediate closure and other steps necessary to produce primary healing is the best and surest method that can be used in the repair of the septal perforation.

Manuel A. Wexler, M.D.,
6360 Wilshire Blvd.,
Los Angeles, Cal. 90048,
U.S.A.