A Review of 25-Year Experience of Nasal Septal Perforation Repair

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Objective: To report the long-term follow-up of 25 years of experience in 100 consecutive cases of septal perforation (SP) repair using the technique of the senior author (F.P.).

Design: From 1981 to 2006, a total of 100 consecutive patients were surgically treated and followed up for 1 to 10 years. The medical records of 68 of the patients were retrospectively examined. Outcomes were assessed based on comparison of the results of preoperative and last follow-up assessment of SP size and symptoms. The SP repair technique consists of subperichondrial/periosteal dissection, rotation of nasal mucosa for tension-free closure, with no mucosa incision if possible, and a multilayer closure with interposition graft.

Results: The most common symptoms were nasal obstruction (72%), crusts (50%), and epistaxis (31%). Previous nasal surgery was the pathogenetic factor in 39 cases (57%). Fifty-two patients (76%) presented with SPs measuring 1.0 to 3.0 cm in diameter. The internal approach was used in 54 cases (79%), and temporal muscle fascia and conchal cartilage were concomitantly used in 45 cases (66%). The great majority of patients (40 [59%]) received more than 5 years of follow-up. The success rate of closure was 97%. Two patients (3%) presented with reperforation measuring less than 1.0 cm in diameter.

Conclusions: The senior author’s SP repair technique is easily accomplished, provides good visualization, and is low in cost. Also, in our experience, the success rate of closure has been 97%.

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METHODS

PATIENTS

From January 1981 to January 2006, a total of 100 consecutive patients were operated on by the senior author. All patients were evaluated and questioned about clinical symptoms, medical history, and social habits. An anterior rhinoscopy and/or a nasofibroscopy was performed, and nasal cavities were evaluated with especial attention to SP characteristics, size, and location. The patients were followed up for 1 to 10 years. The medical charts of 68 patients were retrospectively examined. The other 32 records were inadequate (missing data), or the patients had not returned for postoperative consultation and follow-up. Outcomes were assessed based on comparison of the results of preoperative and last follow-up assessment of...
SP size and symptoms. Ethical approval was obtained from CES University Committee on Ethics, Bogotá, Colombia.

SURGICAL TECHNIQUE

The surgical procedure can be performed through an internal or external approach, depending on the surgeon’s skills and the size and location of the SP. In general, we prefer the internal approach. The external approach is limited to large perforations (>2.0-3.0 cm) in which the graft is bigger than the nostril size.

The postcartilaginous incision, which was described by the senior author at an otolaryngology meeting in 1978, is made at the cephalic border of the lower lateral cartilage as follows: it is begun 3 mm from the valvular edge at the posterior aspect of the lateral crus and is continued anteriorly until it reaches the cephalic border of the medial crus. An incision is then made at the cephalic margin of the medial crus and is connected, posteriorly to anteriorly, to the first incision at a right angle in the apex of the vestibular vault. The tissue is dissected through the incision, and the flap is held toward the lateral part using mosquito forceps, thereby providing ample access to the septal and the nasal dorsum (Figure 1).

As with any flap closure, the extent of mucosal elevation is greater than the distance to be closed. The elevation of bilateral mucoperichondrial flaps is begun at the caudal septum and is carried posteriorly all around the perforation using a Cottle ball-ended elevator. The elevation extends inferiorly along the maxillary crest and floor of the nose, close to the attachment of the inferior turbinate on both sides, and superiorly just lateral to the junction of the upper lateral cartilages and the septum. As a last step, the edges of the perforation are entered, and each whole mucoperichondrial flap is separated from the residual septal cartilage and bone (Figure 2).

The goal is maximum tension-free closure of both mucosal flaps. When possible, mucosal incision should be avoided, and mucosal rotation and suture of the perforation should be performed (Figure 3). If no tension-free closure is achieved, mucosal incisions can be performed with minimum extension. A posterior-to-anterior longitudinal incision is made across the nasal floor, below the inferior turbinate (close to its attachment), up onto the lateral pyriform aperture. Then, the flap is advanced superiorly and medially to ensure that there is enough mucosa for closure. If not, a cut is made superiorly, in the mucoperichondrium, at the lateral portion of the upper lateral cartilage, creating another bipedicle flap to advance inferiorly (Figure 4). Next, after the advancement of the flaps, the perforation is closed in each flap using interrupted 5-0 chromic gut sutures, from posterior to anterior, with the aid of a lanced blunt curette to prevent tearing of the mucosa (Figure 5). Any granulation tissue that is present on the edges of the perforation is removed to provide edges that are more likely to heal.

A graft should be placed between the mucosal flaps to reconstruct the septal support, to serve as second tissue layer, and to prevent apposition of opposing suture lines. It also provides a second layer of defense if the primary closure should break down (Figure 6). The preferred material is the temporalis fascia (deep temporal fascia), the harvesting technique for which is the same as that used for tympanoplasties. It is placed on both sides, medial to the flaps and lateral to the septum. Auricular conchal cartilage is also harvested as an autograft for rhinoplasties. It is placed between the 2 layers of fascia as a substitute for the lack of septal cartilage and/or bone (Figure 7). Mastoid cortical bone, with its periosteum attached, is used in large posterior perforations in which a tension-free suture can-
not be performed. The postcartilaginous incisions that are made to promote access to the procedure are sutured with interrupted 4-0 chromic gut sutures. The repaired septal flaps are protected during their healing phase by the placement of a splint on both sides of the septal flaps, secured by 2-0 nonabsorbable silk sutures, and usually removed in 10 days. The postoperative evolution is similar to that of septoplasty.

**RESULTS**

Sixty-eight of the medical charts of the 100 patients who were operated on by the senior author were retrospectively evaluated. Thirty-five (51%) of the patients were male and 33 (49%) were female. The clinical symptoms at the first consultation were nasal obstruction (n=49 [72%]), crusts (n=34 [50%]), epistaxis (n=21 [31%]), and nasal whistling (n=5 [7%]). The cause was identified in 63 patients (93%). Previous nasal surgery was responsible for 57% (39/68) of the cases of SP.

<table>
<thead>
<tr>
<th>Cause</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nasal surgery</td>
<td>39 (57)</td>
</tr>
<tr>
<td>Nasal trauma</td>
<td>16 (24)</td>
</tr>
<tr>
<td>Nose picking</td>
<td>3 (4)</td>
</tr>
<tr>
<td>Cocaine</td>
<td>2 (2)</td>
</tr>
<tr>
<td>Acid fumes</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Leishmaniasis</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Cauterization of epistaxis</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Unknown</td>
<td>5 (7)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>68 (98%)</strong></td>
</tr>
</tbody>
</table>

*The total percentage does not add up to 100 because of rounding.

The size of the SPs was measured during the patients’ physical examinations: 8 (12%) were less than 1.0 cm in diameter; 39 (57%) were 1.0 to 2.0 cm in diameter; 13...
(19%) were 2.0 to 3.0 cm in diameter; and 8 (12%) were 3.0 cm or more in diameter. The internal approach was used for closure in 54 cases (79%); temporalis fascia and conchal cartilage were concomitantly used in 45 cases (66%). Temporalis fascia, conchal cartilage, and mastoid cortical bone were used alone or in combination in the rest of the cases.

The patients were followed up for 1 to 10 years. Ten patients (15%) were followed up for 1 to 2 years, and 18 patients (26%) were followed up for 2 to 5 years; the great majority, 40 (59%), received more than 5 years of follow-up. The success rate of SP closure was 97% (n=66). Two patients (3%) presented with reperforation measuring less than 1.0 cm in diameter (Table). All 66 patients with successful SP closure related improvement of nasal symptoms. The 2 patients who presented with reperforation still had a few symptoms, all of which were able to be managed with clinical therapy. Figure 8 shows 2 cases of SP closure, and Figure 9 shows 1 case of SP closure performed concomitantly with rhinoplasty.

Table. Distribution and Closure Success Rates of Nasal Septal Perforation Repair According to Size of Perforation

<table>
<thead>
<tr>
<th>Size of Perforation, cm</th>
<th>No. (%)</th>
<th>Patients (n = 66)</th>
<th>Closure Success Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1.0</td>
<td>8 (12)</td>
<td>8 (100)</td>
<td></td>
</tr>
<tr>
<td>1.0-2.0</td>
<td>39 (57)</td>
<td>39 (100)</td>
<td></td>
</tr>
<tr>
<td>2.0-3.0</td>
<td>13 (19)</td>
<td>12 (92)</td>
<td></td>
</tr>
<tr>
<td>≥3.0</td>
<td>8 (12)</td>
<td>7 (88)</td>
<td></td>
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</tbody>
</table>

The medical management of SP involves (1) assessment of the cause of perforation and removal or minimization of that cause; (2) efforts to minimize symptoms in individu-
Because the causes of nasal SP are varied, performing a detailed laboratory evaluation on every patient is cost prohibitive. The laboratory study is complementary and should follow clinical leads. Even in cases in which a cause has been found, a biopsy may be necessary if the SP or the ulcer/lesion progresses, because more than 1 disease may be involved and malignancies should be excluded. We had some cases of concurrent leprosy and leishmaniasis or epidermoid cancer.

In the present study, previous nasal surgery was the cause in 57% of the cases. Other traumatic causes (eg, nasal trauma, nose picking, and cauterization of epistaxis) account for almost all the other cases. Therefore, prevention plays an important role in averting the development of SP and should be directed at removing or minimizing stressors known to irritate and traumatize the nasal septum. Otolaryngologists and facial plastic surgeons need to be aware that nasal surgery should always be performed in a conservative and cautious manner, with meticulous technique.

Patients with SP caused by cocaine use must be assessed by a psychiatrist, who can evaluate their mental health. Before undergoing surgery, the patient must quit the addiction and be treated with ointments until mucosal healing is complete. Otherwise, the surgery is doomed to fail. In our experience, only 10% of such patients are suitable for SP repair; the other 90% fail a psychological evaluation, generally because they do not quit using drugs.

The symptoms associated with SP include nasal obstruction, crusting, drainage, recurrent epistaxis, a whistling sound coming from the nose, parosmia, and neuralgia. The present study included only patients who underwent SP repair, so they were all symptomatic at the first consultation. The most common symptom was nasal obstruction (77%), which can be explained by the disruption of the normally laminar airflow associated with SP that increases the turbulence of the airflow stream, thereby decreasing the net amount of air that is able to pass through the nasal vault to nasopharynx and beyond, thus causing nasal congestion.

Some patients with SP are asymptomatic and, as such, do not require treatment. Medical therapy can play an important role in the treatment of symptomatic SP. It includes saline sprays and irrigations, humidifiers, application of antibiotic ointment, and prosthetic buttons. When used aggressively, these therapies may obviate the need for surgical treatment. While some authors report improvement with such therapies, others maintain that they are poorly tolerated, causing increased mucus production, crusting, and a foreign body sensation.

A large number of techniques have been described for the surgical repair of SP, suggesting that it poses a significant challenge to the surgeon. Various approaches have been advocated depending on the size and site of the perforation, including external rhinoplasty, alarotomy; and endonasal, sublabial, midfacial degloving, and endoscopic procedures. Surgical procedures include enlarging the perforation, septal rotation flaps, inferior turbinate pedicle flaps, sublabial mucosal flaps, nasolabial flaps, radial forearm free flaps, pericranial...
Several autologous interposition grafts, including temporal muscle fascia, septal cartilage, nasal turbinate, conchal cartilage, mastoid bone with periosteum, ear tragus cartilage with perichondrium, perichondrocutaneous, pericranium, ethmoid bone, and iliac crest, as well as an acellular human dermal allograft, have also been used for SP repair.

Joseph, in 1931, and Safian, in 1935, brought into practice the technique proposed by Steifet in 1926, which was based on the transposition of an inferior turbinate flap. Since then, several other authors have suggested the use of rotational mucosal flap from the inferior nasal turbinate in a 2-stage procedure. However, symptomatic perforations usually extend too far anteriorly to be reached by a turbinate flap. Furthermore, the use of this flap has been associated with postoperative complications such as intranasal adhesions between the septum and the inferior turbinate and nasal stenosis.

Anterior and/or large perforations may be closed with a buccal mucosal flap rotated from under the upper lip and passed through an incision into the floor of the nose. The procedure has enjoyed limited popularity because buccal mucosa does not transform itself into ciliated, mucus-producing, self-cleansing mucosa. Likewise, any procedure that implants skin into the nose results in a nose that produces foul-smelling crusts.

Because the goals of operations to repair a perforation should be to close the SP and to restore normal function, intranasal advancement flaps can be used to achieve normal nasal structure and function. Therefore, the present technique is based on 4 principles: (1) subperichondrial/periosteal dissection of the nasal mucosa; (2) rotation of the mucosa from the septum, floor, and roof of the nasal cavity for tension-free closure; (3) no mucosa incision if possible; and (4) multilayer closure with an interposition graft. The SP is a hole in 3 distinct contiguous layers composed of both right and left mucoperichondrial flaps and the intervening cartilage, all of which must be separated from each other and repaired individually. The larger the vertical height of the perforation, the more difficult the repair. Larger SPs require greater tissue mobilization and can result in greater tension in closure.

The association of a connective tissue interpositional graft with an intranasal mucosal flap is well described by several authors. The hypothesis is that the graft creates a barrier between both repaired flaps during healing and thus decreases the risk of incisional breakdown. Gollom, Fairbanks and Fairbanks, Kridel et al., and Goodman and Strelzow have all advocated the use of bilateral mucosa transpositional flaps taken from the floor of the nose, with the interposition of a connective tissue graft as a necessary component.
Temporalis fascia has been selected as the graft of first choice owing to its faculty to serve as a template for overlying tissue migration and vascularization and its very low metabolic requirements. In the great majority of our cases (66%), we used temporalis fascia on both sides, with a conchal graft between them. Conchal grafts have been used to repair the lack of bone and/or cartilage. Small perforations could be repaired only by suture and temporalis fascia interposition. In large and posterior SPs in which a tension-free suture could be accomplished, we used mastoid cortical bone with periosteum.

Ninety-seven percent of the SPs were closed using the technique described herein, a percentage that compares favorably with historical data. The 2 cases in which repair was unsuccessful were tertiary rhinoplasties with a previous SP repair attempt. At the first consultation, one patient presented with an SP measuring 2.5 cm in diameter; the other, with an SP measuring 3.4 cm in diameter. Both patients had a successful closure at the beginning, but, as time passed, crusts and a reperforation occurred. Both patients had a successful closure at the beginning, but, as time passed, crusts and a reperforation occurred. 

In conclusion, we describe a technique that we believe is easily accomplished, offers good exposure, and is low in cost. Furthermore, in our experience, the use of the technique, which was developed by the senior author, has achieved a 97% success rate in SP closure.

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Author Contributions: Study concept and design: Pedroza. Acquisition of data: Pedroza. Analysis and interpretation of data: Pedroza. Drafting of the manuscript: Pedroza, Patrocini, and Arevalo. Critical revision of the manuscript for important intellectual content: Pedroza. Statistical analysis: Pedroza. Study supervision: Pedroza.

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REFERENCES