

Endoscopic Sandwich Technique for Moderate Nasal Septal Perforations

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Objectives/Hypothesis: The aim of this article was to describe our surgical technique for the treatment of nasal septal perforations with diameters of 1 to 2 cm.

Study Design: Retrospective clinical research.

Methods: We reviewed 13 patients with moderate nasal septal perforations (1–2 cm diameter) treated with a sandwich technique (bone or cartilage and quadriceps fascia graft as an interposition graft) by an endoscope-assisted intranasal approach from January 2008 to June 2011. Follow-up periods were 3 months.

Results: Thirteen patients were treated with the sandwich technique. Twelve cases (92.3%) were completely healed. One case received incomplete closures without any postoperative symptoms. All patients were found not to have any complications after surgery.

Conclusions: The transnasal endoscopic sandwich technique for repairing moderate nasal septal perforation (1–2 cm) has a high success rate and is easy to perform.

Key Words: Endoscopes, reconstructive surgical procedure, nasal septum, perforation.

Level of Evidence: 4.

Laryngoscope, 122:2367–2372, 2012

INTRODUCTION

Nasal septal perforation implies a complete defect of cartilage or bone and mucosa in bilateral nasal septum. It may cause the symptoms of crusting, nasal bleeding and obstruction, dryness, discharge, and so on. The etiology varies, including postoperative complication after septoplasty, cauterizations, nasal foreign body, nasal spray, trauma, and so on. Surgical therapy is required by patients who suffer symptoms and are unsatisfied with medical treatment.

Although many approaches and techniques been reported—such as intranasal, extranasal, sublabial, and midfacial degloving approaches using direct suture and crossover flap, fascia, acellular allograft, cartilage, and bone graft techniques—the success rate still fluctuates between 75% and 96%, with a reperforation rate of 12% to 48%.^{1–14} It is a challenge for the ear/nose/throat surgeon when the perforation is >1 cm, because there is no standard choice of approach and technique.

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Editor's Note: This Manuscript was accepted for publication May 11, 2012.

The authors have no funding, financial relationships, or conflicts of interest to disclose.

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DOI: 10.1002/lary.23481

The purpose of this article is to report our surgical technique repairing nasal septal perforations between 1 and 2 cm in diameter via nasal endoscopy.

MATERIALS AND METHODS

Retrospectively, we reviewed all 13 patients with nasal septal perforation of moderate size (diameter, 1–2 cm) treated at the Department of Otorhinolaryngology, First Affiliated Hospital, Sun Yat-Sen University from January 2008 to June 2011. Data included demographics, presenting symptoms and signs, site and size of perforation, complications, recurrences, and clinical follow-up from 3 to 32 months (mean, 15 months).

Considering patients' general conditions and requirements, either general or local anesthesia was chosen.

Each step was performed with a 4-mm, 0° nasal endoscope.

Surgical Procedure

Vasoconstriction. The nose was packed with neurosurgical cottonoids soaked with 1:100,000 epinephrine under general anesthesia and with 1:100,000 epinephrine containing 1% dicaine under local anesthesia, especially in the area of the anterior ethmoid nerve. In the meantime, the sphenopalatine nerve was infiltrated with 1% lidocaine.

Incision. The surgical approach began with an incision at the left side of the septum. Before incision, anterior septal mucosa on the left side was infiltrated with 1:100,000 epinephrine for hemostasis and hydrodissection under general anesthesia, or 1% lidocaine was added for local anesthesia. A modified Killian incision was made 2 mm posterior to the caudal end of the quadrangular cartilage from the septal dorsum to the nasal floor, which should be a sufficient length. For facilitating elevation, the incision was made in mucosa with cartilage underneath (Fig. 1). If the incision were made in mucosa without cartilage underneath, elevation would be quite difficult, because mucosa is adherent with contralateral mucosa.

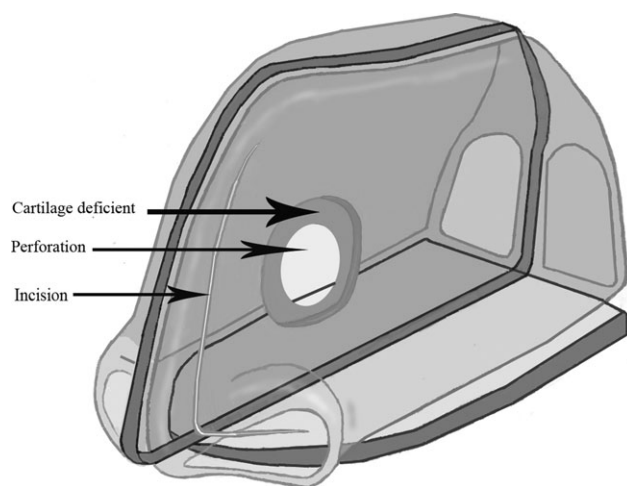


Fig. 1. Diagram of incision. A modified Killian incision was made 2 mm posterior to the caudal end of the quadrangular cartilage from the septal dorsum to the nasal floor and in the mucosa with cartilage underneath.

Elevation. Mucoperichondrial and mucoperiosteal flaps were developed bilaterally, beginning from the incision and proceeding posteriorly above and below the perforation using a Freer elevator. Bilateral posterior tunnels were meticulously elevated over the remaining septum to finally reach the vomer posteriorly. Usually, the margin of the perforation was excessively scarred and tightly adherent due to previous surgery. After bilateral mucosal flaps around the perforation had been fully released, the perforation was carefully incised along its circumference with a #15 scalpel. This sharp dissection avoided tearing and expanding the perforation (Fig. 2, 3). The nasal crest of the maxillary bone was removed at this step to form an implantation bed for grafts, and a spacious mucosal pocket was created for interposition grafts.

Preparing grafts. Our tissue choice for sealing and closing the perforation was autologous septal cartilage or bone and quadriceps fascia in the perforations <2 cm. Middle turbinate mucosa was prepared as free grafts (nonpedicled) if the perforation was about 2 cm.

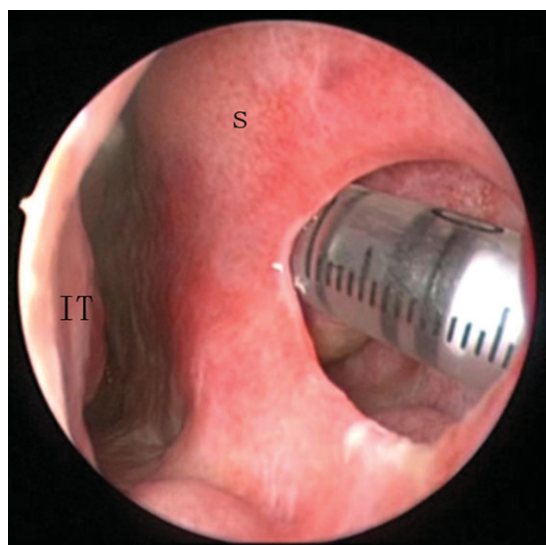


Fig. 2. Perforation located on the inferior anterior of the septum with a diameter of 1.5 cm. S = septum; IT = inferior turbinate.

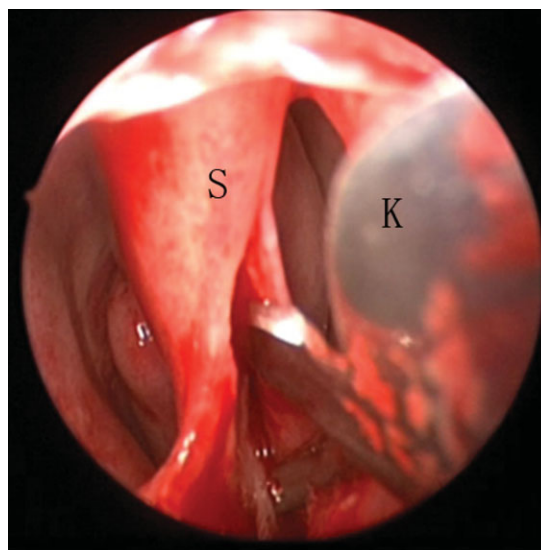


Fig. 3. The edge of the perforation was rimmed by a #15 scalpel for preventing laceration. S = septum; K = knife.

Residual septal cartilage was obtained as an interposition graft. If no cartilage was available, the perpendicular plate of the ethmoid bone or the vomer bone was resected instead of cartilage. The dimensions of the cartilage or bone plate must be 1.5 times larger than the perforation in diameter, so that its edges could go far beyond the perimeter of the original perforation. Quadriceps fascia was gained and then encapsulated the cartilage or bone bilaterally and entirely, so its size should be more than double the size of the perforation. In the case of perforation about 2 cm, middle turbinate was harvested with ethmoid scissors by cutting the superior edge from the anterior to the posterior direction and removing. Then the middle turbinate mucosal flap was created by dissecting the bone from the mucosa (Fig. 4). Free middle turbinate mucosal flap is liable to survive, and its pseudostratified columnar epithelium could rehabilitate the physical function of the nose.

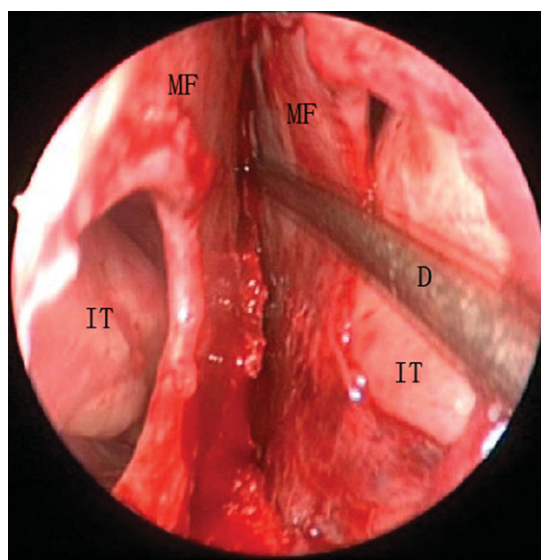


Fig. 4. Mucosal flap of septum was fully elevated. MF = mucosal flap; IT = inferior turbinate; D = dissector.

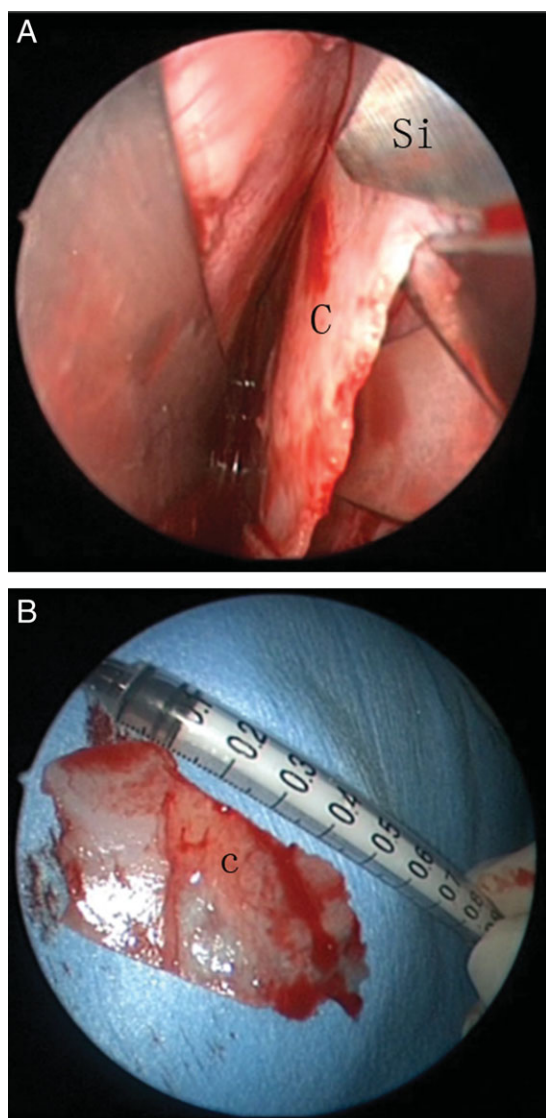


Fig. 5. (A) After complete dissection of the septal mucosa flap, the posterior superior septal cartilage was detached and extracted. (B) The size of the cartilage was around 3×1.5 cm. Si = scissors; C = septal cartilage.

Sandwich technique for implantation. The sandwich technique is a multilayer method. The triple-layer interposition grafts, cartilage or bone plate coated by two pieces of quadriceps fascia bilaterally, were interposed between two nasal septum mucosal flaps in a manner that would exceed the margin of the whole perforation by >5 mm. A fourth layer of middle turbinate mucosa was placed over the perforation as an overlay graft if necessary (Fig. 1). The aim of middle turbinate mucosa flap is fast healing and preserving the function of nasal epithelium. Biological glue (fibrin sealant) was applied next, which increased the adhesiveness between the cartilage or bone, fascia, and mucosa. Finally, layering of Gelfoam gauze secured and supported the grafts in position and was supplemented with expandable sponge packing (Figs. 5 and 6). And Fig. 7 showed the layered closure of septal perforation at the conclusion of the surgery.

Packing. Both nasal cavities were packed with expandable sponges (Medtronic-XOMED; Merocel, Jacksonville, FL). Sponges were kept for 72 hours postoperatively and then extracted.

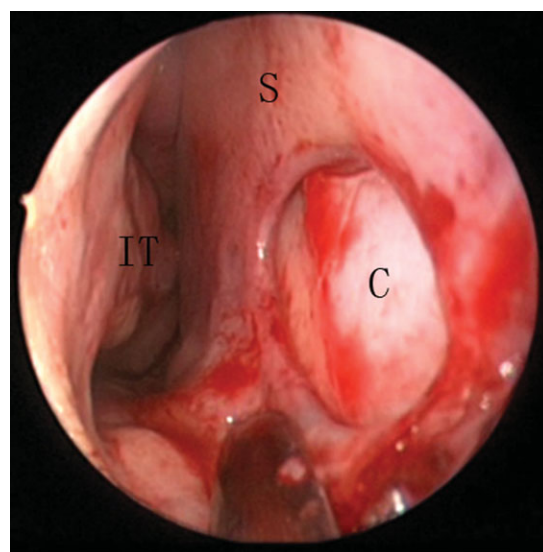


Fig. 6. Cartilage coating with fascia bilaterally was interposed between the mucosa flaps. S = septum; IT = inferior turbinate; C = septal cartilage.

Intravenous antibiotics were administered for 3 days postoperatively. After sponges were extracted, normal saline spray and ointment were applied for keeping the perforation moist until it had healed. Crust in the nose was cleaned regularly. Patients were discharged 5 days postoperatively. It is crucial to keep the nasal cavity moist postoperatively.

Postoperative follow-up was carried out monthly, including symptoms, perforation healing, re-epithelium, crust, and complications (Fig. 8). Fig. 9 showed perforation healed completely 2 months postoperatively.

RESULTS

Thirteen patients (nine males and four females) underwent endoscopic septal perforation closure from

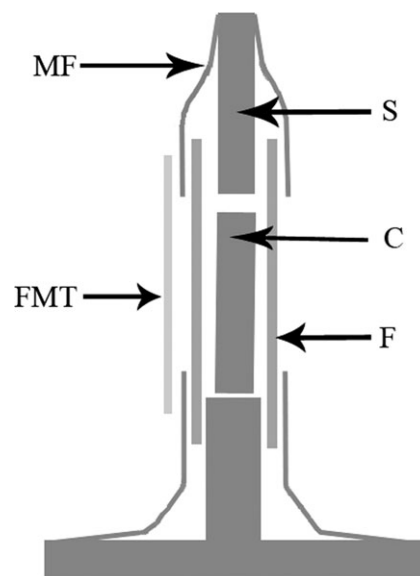


Fig. 7. Cross-sectional view of layered closure of septal perforation at the conclusion of the surgery. MF = mucosal flap of nasal septum; S = septum; C = cartilage graft; FMT = free mucosal flap of middle turbinate; F = fascia graft.

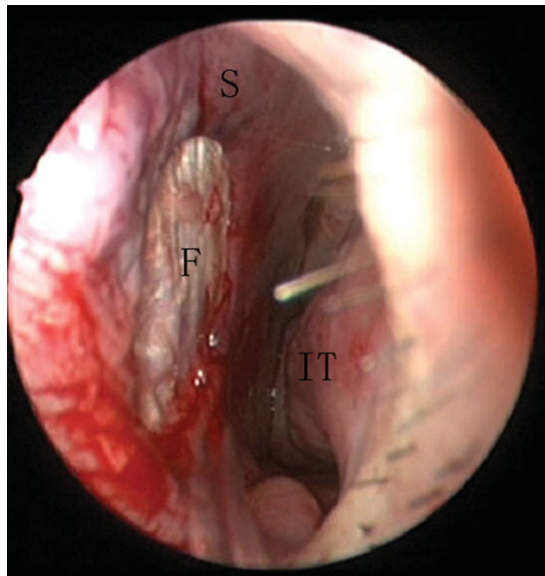


Fig. 8. Fascia, cartilage, and the mucosal flap were combined by biological glue. S = septum; F = fascia; IT = inferior turbinate.

January 2008 to June 2011 (Table I). Average age at presentation was 26.5 years (range, 9–50 years). The locations of the perforation were at the anterior septum. The maximum perforation was 20 × 20 mm. Primary etiology for septal perforations was surgery in eight of 13 patients (four patients by endoscopic sinus surgery and four patients by septoplasty), whereas in three patients symptoms were caused by foreign bodies in the nasal cavity, and in two patients symptoms were caused by permanent medication in the nose.

Three patients received local anesthesia, whereas the remainder were under general anesthesia. Two patients had chronic rhinosinusitis. Two patients (Table I, No. 5 and No. 10) underwent functional endoscopic

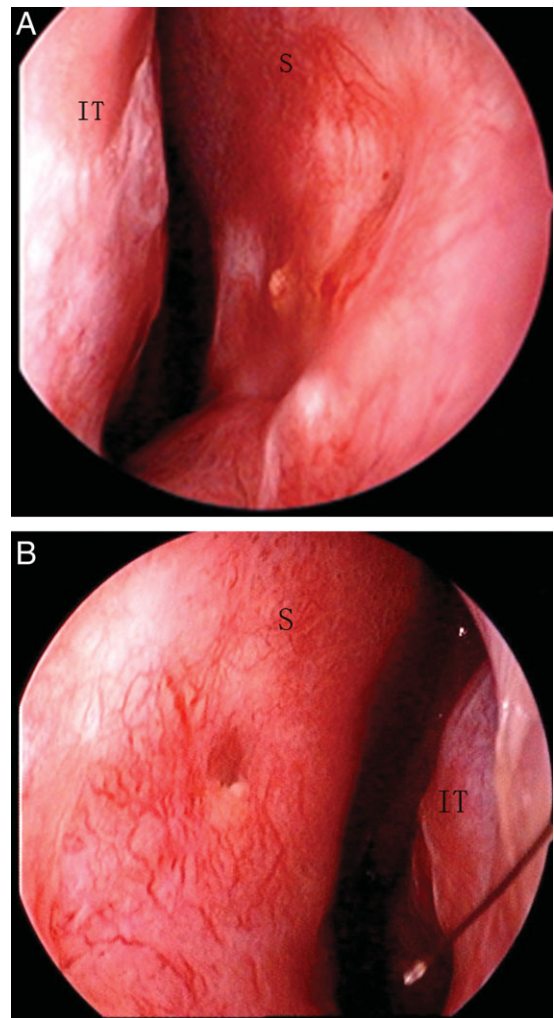


Fig. 9. Perforation healed completely 2 months postoperatively. (A) Right side view. (B) Left side view. IT = inferior turbinate; S = septum.

TABLE I.
Data of Septal Perforation Repairmen for 13 Patients.

No.	Age, yr	Etiology	Symptom	Size, mm × mm	Materials	Results
1	9	Foreign object (button batteries)	Epistaxis	12 × 10	C, F	Success
2	25	Endonasal medication	Blockage	20 × 20	C, F, M	Success
3	20	Endonasal medication	Blockage	17 × 13	E, F	Success
4	26	Septoplasty	Blockage	13 × 11	C, F	Success
5	35	Septoplasty	Blockage and discharge	10 × 10	C, F	Success
6	8	Foreign object (undefined)	Bloody discharge	15 × 15	C, F	Failure; became a 3 × 3-mm perforation
7	31	Septoplasty	Epistaxis	10 × 12	E, F	Success
8	21	ESS	Dryness	15 × 15	C, F	Success
9	39	ESS	Bloody discharge	15 × 17	C, F	Success
10	50	ESS	Dryness	10 × 10	C, F	Success
11	30	ESS	Dryness	15 × 20	C, F, M	Success
12	23	Septoplasty	Epistaxis	10 × 15	C, F	Success
13	27	Foreign object (button batteries)	Epistaxis	12 × 18	C, F	Success

C = septal cartilage; F = quadriceps fascia; M = free mucosal flap of middle turbinate; E = perpendicular plate of ethmoid bone; ESS = endoscopic sinus surgery.

sinus surgery at the same time. The procedure lasted for 75 to 140 minutes (mean, 97.50 ± 22.08 minutes). Blood loss was estimated at 13.33 ± 8.16 mL. Twelve patients were completely healed, whereas in one patient (Table I, No. 6), a 3×3 -mm perforation was discovered 2 months after surgery without symptoms; operation was not repeated (for details, see Table I). No crusting formation was observed after complete healing.

DISCUSSIONS

Septal perforation is a complete defect of the cartilage or bone and mucosa on both sides. The etiology varies, including iatrogenic (septoplasty for example), overpackage of the nasal cavity causing necrosis of mucosal membrane and septal cartilage, long-term vasoconstriction medication, coagulation, chemical burning, nasal foreign body, trauma, and systemic diseases (syphilis, tuberculosis, measles, etc.). Differential diagnosis should take into consideration systemic diseases. The symptoms of septal perforation are related to its size and location. Small and posterior perforations are asymptomatic, whereas large and middle to anterior perforations cause various symptoms. Most common is nasal blockage (65%), then crusting (43%), discharge (13%), whistle (8%), and epistaxis (5%).¹

Generally, asymptomatic perforations rarely require any treatment. The patients with mild symptoms should consider medical therapy at first. For those with severe symptoms or for whom medication fails, surgery is recommended.

Despite many different surgical techniques having been proposed for the closure of septal perforations, no standard protocol has been accepted. This multitude of different operations suggests that one procedure is not better than other procedures, but depends on the size and site of perforations, and the experience and skill of the surgeon.

As extranasal approaches cause scars and trauma, they are used in large perforations >3 cm or grafts that are larger than the nostrils. Surgical options have changed with the development of modern endoscopes. In the past 20 years, transnasal endoscopic technique has become increasingly popular. It causes less trauma and provides better surgical views, helping the surgeon to discover and close small and posterior perforations. Seventy-five percent to 95% of patients are successfully treated with this approach.^{3-6,8}

There are many techniques for septal perforation closure, including direct suture and tension release suture, which are easy to learn but more suitable for anteroinferior perforations. For perforations >1 cm, grafts and/or flaps are needed. Intranasal mucosal flaps such as inferior turbinate flap are widely used, with a success rate of 70%.⁹ The advantages are abundant vascularity of the flap and relative ease of harvesting. The disadvantages are the requirement of a two-stage procedure to release the pedicle and that its bulk may cause partial obstruction of the airway and even intranasal adhesion. Manipulation is complicated, entailing a series of difficult processes, such as elevation, rotation, and

suture, which must be performed in the narrow nasal cavity. The prepared mucosal flap is liable to retract; therefore, its dimension should be 1 cm greater than the original perforation. It is difficult to acquire a large mucosal flap in the nasal cavity, and there is significant donor site morbidity.

For 1 to 2-cm perforations, we prefer to use the nasal endoscopic sandwich technique (including fascia–cartilage–fascia) for closure. The success rate is 90% at 3-month follow-up. Generally, the time for secondary intention is in two months; a scarred area remains, the size of which depends on the size of the original perforation. We believe that the high success rate is based on the following principles. First, cartilage or bone acts as an excellent scaffold for epithelialization and provides a thicker septum to resist reperforation. In large perforations, there is the possibility of a lax septum after repair, due to the thinness of the fascia graft. This same concern has been addressed by other authors.¹⁴ Second, both sides of the cartilage are covered by connective tissue, such as turbinate mucosa or fascia, which provides an effective scaffold for epithelial migration and prevents exposure and scarring. Research shows that covering by unilateral mucosa is a risk factor for reperforation.¹³

Our sandwich technique is suitable for 1 to 2-cm perforations. The advantages include better surgical vision under endoscope, easier manipulation, and high success rate. No stitching is necessary, as the graft is inserted into the pocket created. Quadriceps fascia is easy to harvest, with minimal donor site deformity and morbidity. The graft is autogenous without rejection response risk and extra cost. For the surgeon, it requires skillful manipulation of endoscopic septal plastic surgery, but no crossover flap or suture of grafts. The instruments are simple, similar to endoscopic septal plastic surgery.

Key steps of this technique are as follows. First, a sufficiently long incision crossing from the top to the floor of the nasal cavity provides a better surgical field. Second, the incision should be far away from the perforation, at the mucosa with cartilage underneath. Third, detachment of the mucoperichondrial and mucoperiosteal flaps begins far from the perforation, moving toward the edge of it. In most cases, there is scar formation or cartilage loss near the perforation, which is difficult to dissect by elevator, and it is easy to tear more mucosa. Therefore, sharp dissection using a blade knife is recommended to separate the adherent mucosa. Dissecting the edge first is contraindicated. Fourth, the cartilage or bone graft should be 5 mm larger than the perforation, and the fascia should be the same size or larger than the cartilage. After surgery, the nasal cavity should be kept moist using normal saline or epithelium growth factor spray and ointment to reduce crust formation.

We have not used our technique for large perforations, because we think that for perforations of that size, this sandwich technique may cause central necrosis. Large perforations become smaller and require a second surgery. For better blood supply, a septal or nasal flap can be transferred to cover part of the perforation.

Surgical technique for closure of perforations >3 cm needs further discussion.

CONCLUSION

In our series, most septal perforations 1 to 2 cm in diameter can be successfully repaired using autogenous free tissue grafts applied by a nasal endoscopic approach. We achieved a high success rate at the first operation (12 of 13 patients, 92.3%). Above all, the endoscopic sandwich technique for septal perforation closure is safe, reliable, and easy to manipulate.

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