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Microscopic approach for repairing nasal septal perforations using bilateral advancement flaps

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Abstract

Background Septal perforations consist in an anatomic defect of the mucosal, cartilaginous and/or bone tissues of the nasal septum. A huge variety of approaches and techniques for nasal perforation repair have been reported.

Methodology/principal Between January 2008 and January 2017, 38 patients were treated for nasal septal perforation in Department of Otorhinolaryngology Head and Neck Surgery, Fundación Jiménez Díaz University Hospital, Madrid, Spain. A novel approach is presented based on microscope. Septal perforation closure was performed with endonasal bilateral advancement flaps-established technique and autologous cartilage and muscle temporal fascia grafts. We performed a retrospective review of closure rates and complications.

Results A postoperative follow-up of at least 12 months was performed in 37 patients. The mean size of perforation was 1.33 cm. After the withdrawal of the silicone splints, perforations were completely closed in all cases. However, during the follow-up, four patients resulted in a reperforation, so our closure rate was 89.19%. For all cases, symptoms related to septal defect were solved. Only one case was reported of local infections that was resolved with antibiotics in a few days.

Conclusions Microscopic approach of septal perforation closure using bilateral advancement flaps can be an affordable technique with a high percent of success and low rate of complications.

Keywords Perforation · Septum · Surgery · Flap · Microscope

Introduction

Septal perforation consists in an anatomic defect of the mucosal, cartilaginous and/or bone tissues of the nasal septum. This situation may cause dynamic alterations of the nasal flux and humidity. Even though 66% of patients with a

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known nasal perforation are asymptomatic, crusting, bleeding, rhinorrhea, local pain, dryness, recurrent epistaxis, nasal obstruction or postnasal drip, are frequently observed [1]. Anterior perforations are usually more symptomatic than posterior ones [2].

Main causes of this defect include trauma, chemicals or drugs abuse, local infections, inflammatory diseases and previous surgery, this last one being responsible for as much as a 57–66% of all perforations [3].

Only symptomatic perforations require treatment. This fact coupled with a complicated surgical technique justifies very few published series with more than 50 patients [3–8]. A huge variety of techniques for nasal perforations repair have been reported, though none of them showed significantly better results. This leads to the idea that no single technique is recognized as being uniformly reliable. No series have been published in English literature based on a microscopic approach.

Generally speaking, a graft and a flap are usually required to close the defect. Many types of grafts have been described for this purpose, such as those providing temporal muscle fascia (TMF), mastoid periostium, auricular or tragal cartilage grafts, or alloderm [2]. The origin of the flaps might be either intranasal (lateral wall, inferior turbinate, uncinate process, septal mucosa…) [3–15] or extranasal (nasolabial or labiobuccal mucosal flaps, or free skinflaps…) [16], and could be uni or bilaterally performed.

No consensus on the classification of the perforation size has been reached. Defects longer than 2 cm are considered large perforations, being the upper limit of small perforation differs from 0.5 [13] or 1 cm [8, 10, 11]. It is commonly accepted that larger perforations are more susceptible for surgical failure [17].

Materials and methods

We present a retrospective series of patients that underwent septal perforation closure surgery between January 2008 and January 2017 by a microscopic endonasal approach. Surgery was performed in Hospital Universitario Fundación Jiménez Díaz by the same surgical team. The study followed the guidelines of the Research Ethics Committee of the hospital.

All patients were previously examined using nasal speculum and fiberoptic endoscopic examination, and their clinical variables were registered, including symptoms, habits, previous nasal surgeries, use of drugs or medications and any other possible cause of perforations.

Only symptomatic patients who had undergone a previous medical treatment without improvement were chosen for surgery. Patients with perforations bigger than 2 cm did not undergo surgery since higher failure has been described.

In our hospital, the great majority of septoplasties are performed through a microscopic approach. This approach provides the possibility of better teaching for our residents and minimizing the risks inherent in septal surgery, such as perforation or persistence of nasal septal deviations. Therefore, given the experience acquired, most septal perforations surgical procedures are performed using a microscopic approach.

A Leica M525 F50 microscope was used in all surgeries. The usual working distance was 207–470 mm, with a maximum zoom of 6:1.

Surgical technique

The first step of the surgery was harvesting the grafts (autologous cartilage and TMF). After that, an incision in the perimeter of the perforation was carried out, to decrease the risk of tearing the mucoperichondrium when the subperichondrial dissection reaches the limits of the perforation. Next step was nasal septal dissection. This is the most important and challenging part of the surgery, due to the fact that most patients had undergone a previous surgery, and the resultant fibrotic tissue results increases the difficulty of dissection. The dissection was started with a hemitransfixion incision on the anterior border of the septal cartilage, as described by the Cottle septoplasty technique [18]. The dissection was carried through the subperichondrial layer and it should include all the space around the perforation, from the nasal floor to almost the roof (Fig. 1a). This step diminishes the tension in the mucoperichondrium layer and reduces the risk of creating a new perforation or enlarging the previous one.

When the dissection is completed, it is necessary to create the advancements local flaps. We built one superiorly pedicled flap with an irrigation depending on the anterior ethmoidal artery territory, in one side of the nose. On the other fossa, an inferiorly pedicled flap was built, with sphenopalatine arterial irrigation (Fig. 1b). The reason for using opposed flaps consists on avoiding the confrontation of the repair at the same level when the inferior flap is moved up, and the superior flap is moved down (Fig. 1c). However, in individualized cases (for example, perforations with small craniocaudal diameter), it is possible to create bilateral inferior pedicle flaps uniquely.

The flaps of each fossa were sutured with 4/0 resorbable monofilament at different levels closing the mucosal perforation in both sides, so the wounds were not opposed (Fig. 1c). After that, the combined cartilage (auricular or septal) and TMF graft was inserted at the defect level, wrapping both of them together.

The last step of the surgery corresponds to a transfixing suture of bilateral flaps with the combined graft of cartilage and TMF (Fig. 1d). After that, for minimizing local damage,

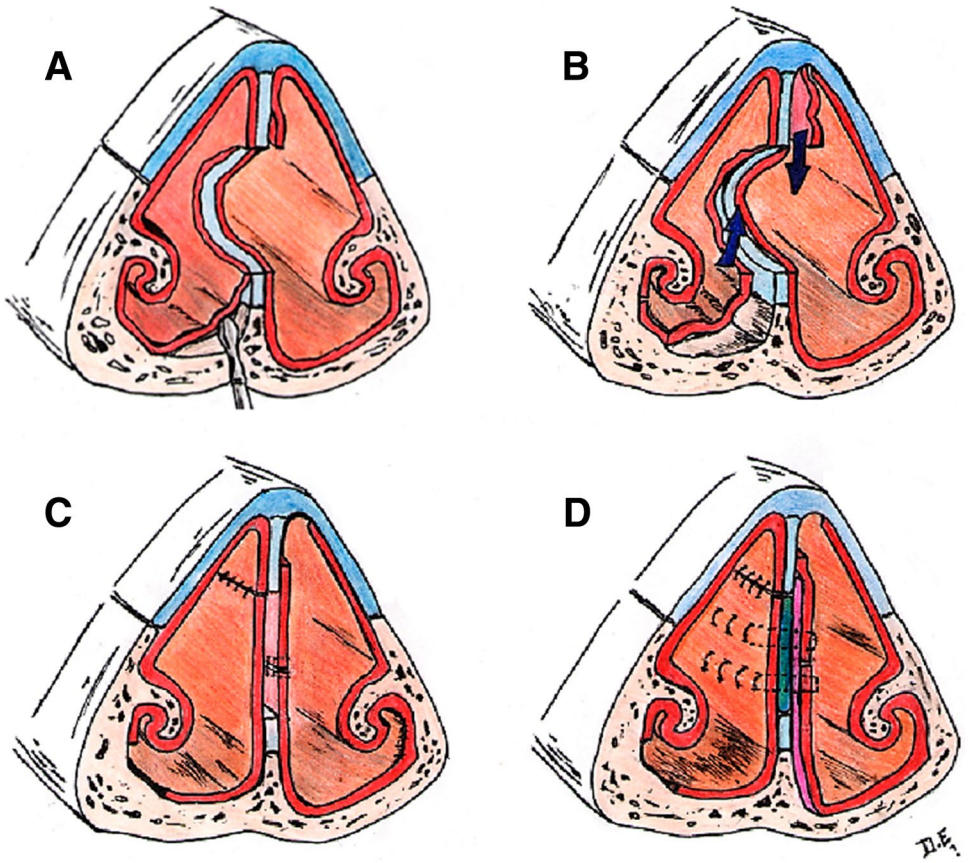

Fig. 1 Surgical technique. Dissection of bilateral flaps (**a**), advancement of inferior and superior flaps (**b**), non-opposite sutures of bilateral flaps (**c**) and interposition of temporal muscle fascia and cartilage between bilateral flaps, with transfixing suture (**d**)

paraseptal silicone splints were placed in both sides. Bilateral nasal packing was used in all patients.

Next day after surgery, nasal packing was removed and patients were discharged. Follow-up assessment after surgery included support ear bandage removal (4 days after surgery), paraseptal silicone splints removal (3 weeks after surgery) and healing assessment (2, 6, and 12 months after surgery). Symptoms and complications were registered in each visit.

A video showing the details of surgical technique is included in Supplementary Material.

Quantitative variables were described by the mean and the standard deviation. Qualitative variables were described by frequencies and percentages. The relationship between the variables studied was carried out with the Fisher's exact test or the Student's *t* test. All variables were related to perforation size and the final outcome of the surgery. The significance level for all tests was set at 0.05 and the statistical analyses were performed using Stata 14.

Results

We identified 45 patients who underwent septal reconstruction during the period of our study. Endonasal technique by a microscopic approach was performed in 38 patients, one of whom did not have an adequate follow-up. In all of them bilateral advancement flaps technique with cartilage and TMF graft was performed, with at least 12 months follow-up (Table 1). 26 of them were male (70.27%) and 11 (29.73%) were female. Mean age at the time of the surgery was 42.1 years in a range from 22 to 66.

The most frequent complaining was nasal obstruction (84%), followed by nasal bleeding (30%) and crusting (23%).

The aetiology of the perforation could not be established in 6 patients (16.22%). The causes reported were previous septal surgery (59.46%, $n=22$), nasal toxics, usually cocaine (16.22%, $n=6$) or other chemicals (2.7%, $n=1$), or nasal picking (5.4%, $n=2$).

All perforations were located at the anterior cartilaginous septum. The perforation size was measured in office with a ruler placed inside the nose. The mean size of the perforation was 1.33 cm (0.3–2 cm).

The mean time of follow-up after the surgery was 26.24 months (range 19–69 months).

After the withdrawal of the silicone splints, perforations were completely closed in all cases. However, before the sixth month of follow-up four patients presented a reperforation. All of these reperforations were smaller than previous (1.1–0.5 cm, 1.5–0.2 cm, 0.3–0.1 cm and 0.8–0.1 cm) with an average of 73.84% of closing of the previous perforation

Table 1 Characteristics and surgery outcomes of the treated nasal septal perforations

	% (*N*)	Successful rate	*p*
Sex			0.296
Male	70.27% (26)	84.61% (22)	
Female	29.73% (11)	100% (11)	
Aetiology			0.837
Previous septoplasty	59.46% (22)	90.91% (20)	
Nasal toxics	18.92% (7)	85.71% (6)	
Unknown	16.22% (6)	83.33% (5)	
Nasal picking	5.4% (2)	100% (2)	
Size			1.0
Small (< 1 cm)	45.95% (17)	88.23% (15)	
Medium (≥ 1 to <2 cm)	48.65% (18)	88.89% (16)	
Large (≥ 2 cm)	5.4% (2)	100% (2)	
Graft			1.0
TMF + auricular cartilage	86.49% (32)	87.5% (28)	
TMF + septal cartilage	13.51% (5)	100% (5)	

TMF temporal muscle fascia

diameter. Therefore, our closure rate of septal perforation was 89.19%.

Sex, age of presentation and aetiology of perforation did not find to be determining factors in septal perforation size. Likewise, sex, age of presentation, aetiology, and size of the perforation were not found to be significant factors in outcome of septal perforation surgery.

Local mucosal infection was the unique complication reported in only one patient (2.7%), resolved without any sequel.

For all cases, symptoms related to septal defect were solved, and all of them remain asymptomatic including patients with reperforation.

Discussion

Septal perforation consists in an anatomic defect of several tissues of the nasal septum, and its treatment has always been a challenge for ENT specialists. The most common cause of septal perforation is previous septal surgery [4, 6, 10, 15, 19], as described in our series, being a notable decreasing factor of the operative outcome [8].

Indication of closure of septal perforation should be well justified because the long-term postoperative complications of this surgery may include reperforation, synechiae, vestibular stenosis, saddle nose deformity, lacrimal duct stenosis, hypoesthesia, dislocation of the cartilage graft, and postauricular granuloma [4, 20].

Many surgical approaches have been suggested including classical endonasal [4, 6, 10, 11], rhinoplasty [5] or endoscopic [7, 14, 15] approaches, with similar closure rates reported. In the last years the number of publications of endoscopic approaches has increased significantly. They describe advantages including the less-invasive procedure, the absence of donor site and its morbidity and the closure of defects longer than 2 cm [7, 9, 14, 15]. Likewise, they agree on the optimal exposure of the operative field [21] and the possibility of looking around the corner. The disadvantages of this approach are the time-consuming and years of endoscopic experience requirements [21], in addition to the difficult handling of the anterior perforations.

To date, no series have been published in literature based on a microscopic approach until ours. The reason of using a microscopic approach is justified since nasal surgery is usually performed in our department with microscopic view, adding magnification and better illumination at the surgical field, and providing also an excellent view for residents in training. Due to the magnification provided we are able to identify minimal mucoperichondrial perforations that may appear during the surgery, and therefore avoid the increase of its size, repairing them at the moment and minimizing the risk of failure. Unlike the endoscopic approach, the microscopic approach provides the possibility of using both hands by the operating surgeon, the stereoscopic view, and a very good view of the perforation margins. Therefore, our group proposes the use of the microscopic approach to make the flaps dissection easier, to identify higher tension areas and eventual microperforations, and to diminish the chance of surgical failure.

Regarding the possible outcome-predictive factors, three determinants for the successful repair of nasal septal perforation have been identified: the size of perforation, bilaterality of flap coverage, and interposition of graft materials [17].

No consensus on the classification of the perforation size has been reached. Defects longer than 2 cm are considered large perforations, but the upper limit of small perforation differs from 0.5 [13] or 1 cm [8, 10, 11]. It is commonly accepted that larger perforations are more susceptible for surgical failure [17] because there is a limited amount of mucosa available to provide vascular supply to the graft. So the process of integration becomes more difficult [21] and there is an excessive tension in the perforation site approximating the mucosal flaps [21].

Most of the reviewed series advocate the use of bilateral flaps to be able to nourish the graft [3–6, 10, 11]. When unilateral failure occurs, this may not be detrimental to the reconstruction as the other vital mucosal flap supports the healing by secondary intention of the opposite failed flap [12]. Conversely, some authors postulate the use of unilateral flaps with good results [1, 2, 9, 15, 22]. Some of them use unilateral inferior meatal mucosal flap with inferior turbinate without describing nasal obstruction or empty nose syndrome [7].

Table 2 Series of nasal septum repair with more than 30 patients

References	Cases	Size perforation (cm)	Approach	Main technique and graft	Closure rate (%)
Sarandeses et al. [10]	30	< 1–2	Endonasal	BAF. Backward extraction–reposition of nasal cartilage septum	87
Schultz-Coulon [4]	400	0.5–5	Endonasal	BAF. Cartilage	92.5
Foda and Magdy [5]	80	1–5	External Rhinoplasty	BAF. TMF or acellular dermal allograft	70–90
Tasca and Compadretti [11]	30	< 2	Endonasal	BAF. Backward extraction–reposition of nasal cartilage septum	86.6
André et al. [12]	43	0.5 to > 2	Variable (mainly external rhinoplasty)	BAF. Acellular dermal allograft or cartilage with TMF	93
Re et al. [13]	31	< 0.5 to < 2	Variable (mainly endonasal)	BAF. TMF and tragal cartilage	87.1
Ribeiro and da Silva [6]	258	1–3.5	Endonasal	BAF. TMF and septal or auricle cartilage	99
Pedroza et al. [3]	68	< 1 to > 3	Endonasal and External Rhinoplasty	BAF. TMF, conchal cartilage and/or mastoid cortical bone	97
Presutti et al. [14]	31	< 3	Endoscopic	Bilateral monopedicled mucosal flap No graft	90.3
Teymoortash et al. [7]	55	2.3 (1.1–3.8)	Endoscopic	Unilateral rotational flap of the floor of the fossa, inferior nasal meatus and inferior turbinate. No graft	94.5
Hanci and Altun [15]	31	< 2	Endoscopic	Unilateral superiorly base middle turbínate mucosa flap. No graft	93.5
Virkkula et al. [8]	81	0.1–3	Variable (mainly endonasal)	BAF. TMF	78

TMF temporal muscle fascia, *BAF* bilateral advancement flaps

As we described in our technique, it is important not to face the sutures on each flap which avoids jeopardising the intervening septal cartilage/bone in case one of the flaps fails to heal [12]. Further the use of vertical mattress sutures helps flaps keep the margins everted. In case of large posterior septal perforations there has been recently described a simple technique that involves endoscopic removal of the posterior septal keel with a marked improvement in the patient's symptomatology [23].

The use of graft material was addressed by Moon [19], who finds that the graft material and the presence of trauma history yields little or no difference in the reperforation rate, opposed to Kridel [24], who considers absolutely crucial a connective tissue interposition graft placed between the flaps. Many types of grafts have been described for this purpose being the most used autologous TMF and cartilage. Such cartilage can be obtained from the auricle or after a septoplasty if it is needed. Some authors even advocate for a backward extraction–reposition technique [10, 11]. There is an increasing tendency to use autogenous connective tissue or alloderm [5, 12] with the advantage to eliminate donor-site morbidity and to fit in all sizes of perforations, but is associated with high cost [21]. Some authors who describe turbinate-dependent flaps do not need to use additional grafts [7, 15].

In our series, we decided to use both grafts and advanced flaps in three layer (mucoperichondrium flap–graft–mucho-pericondrium flap) technique, because it has been reported to have a high success rate and covers most of the negative predictive factors stated above [4].

Our septal perforation closure rate was 89.19% similar to other series [3–8, 11–15] as shown detailed in Table 2. Even though there was lack of closure in three patients, all of them markedly improved their symptoms.

A long-term follow-up is always required, since reperforations usually appear months after the surgery and short-term results are always better compared to those observed at 1- or 2-year follow-up [13]. We suggest a minimum 18-month follow-up, although the only 4 cases of reperforation in our study took place at least 5 months after the surgery.

The strength of our series is based on the homogeneity of the surgical technique in a large number of patients. The clinical outcome of our series shows that our technique may have a good result for long-term septal perforations, though a larger series is required for increasing the strength of our findings.

Conclusion

Microscopic approach of septal perforation closure using bilateral advancement flaps can be an affordable technique with a high percent of success and low rate of complications. Clinical outcome has also been extremely good with a high grade of patient satisfaction, and hence can be considered for symptomatic patients.

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Compliance with ethical standards

Conflict of interest Authors declare no conflict of interest.

References

1. Newton JR, White PS, Lee MS (2003) Nasal septal perforation repair using open septoplasty and unilateral bipedicled flaps. J Laryngol Otol 117(1):52–55
2. Ayshford CA, Shykhon M, Uppal HS, Wake M (2003) Endoscopic repair of nasal septal perforation with acellular human dermal allograft and an inferior turbinate flap. Clin Otolaryngol Allied Sci 28(1):29–33
3. Pedroza F, Patrocinio LG, Arevalo O (2007) A review of 25-year experience of nasal septal perforation repair. Arch Facial Plast Surg 9(1):12–18
4. Schultz-Coulon HJ (2005) Three-layer repair of nasoseptal defects. Otolaryngol Head Neck Surg 132(2):213–218
5. Foda HM, Magdy EA (2006) Combining rhinoplasty with septal perforation repair. Facial Plast Surg 22(4):281–288
6. Ribeiro JS, da Silva GS (2007) Technical advances in the correction of septal perforation associated with closed rhinoplasty. Arch Facial Plast Surg 9(5):321–327
7. Teymoortash A, Hoch S, Eivazi B, Werner JA (2011) Experiences with a new surgical technique for closure of large perforations of the nasal septum in 55 patients. Am J Rhinol Allergy 25(3):193–197
8. Virkkula P, Makitie AA, Vento SI (2015) Surgical outcome and complications of nasal septal perforation repair with temporal fascia and periosteal grafts. Clin Med Insights Ear Nose Throat 8:7–11
9. Castelnuovo P, Ferreli F, Khodaei I, Palma P (2011) Anterior ethmoidal artery septal flap for the management of septal perforation. Arch Facial Plast Surg 13(6):411–414
10. Sarandeses-Garcia A, Sulsenti G, Lopez-Amado M, Martinez-Vidal J (1999) Septal perforations closure utilizing the backwards extraction–reposition technique of the quadrangular cartilage. J Laryngol Otol 113(8):721–724
11. Tasca I, Compadretti GC (2006) Closure of nasal septal perforation via endonasal approach. Otolaryngol Head Neck Surg 135(6):922–927
12. Andre RF, Lohuis PJ, Vuyk HD (2006) Nasal septum perforation repair using differently designed, bilateral intranasal flaps, with nonopposing suture lines. J Plast Reconstr Aesthet Surg 59(8):829–834
13. Re M, Paolucci L, Romeo R, Mallardi V (2006) Surgical treatment of nasal septal perforations. Our experience. Acta Otorhinolaryngol Ital 26(2):102–109
14. Presutti L, Alicandri Ciufelli M, Marchioni D, Villari D, Marchetti A, Mattioli F (2007) Nasal septal perforations: our surgical technique. Otolaryngol Head Neck Surg 136(3):369–372
15. Hanci D, Altun H (2015) Repair of nasal septal perforation using middle turbinate flap (monopedicled superiory based bone included conchal flap): a new unilateral middle turbinate mucosal flap technique. Eur Arch Otorhinolaryngol 272(7):1707–1712
16. Romo T III, Sclafani AP, Falk AN, Toffel PH (1999) A graduated approach to the repair of nasal septal perforations. Plast Reconstr Surg 103(1):66–75
17. Kim SW, Rhee CS (2012) Nasal septal perforation repair: predictive factors and systematic review of the literature. Curr Opin Otolaryngol Head Neck Surg 20(1):58–65
18. Cottle MH, Loring RM (1948) Surgery of the nasal septum; new operative procedures and indications. Ann Otol Rhinol Laryngol 57(3):705–713
19. Moon IJ, Kim SW, Han DH, Kim ST, Min YG, Lee CH et al (2011) Predictive factors for the outcome of nasal septal perforation repair. Auris Nasus Larynx 38(1):52–57
20. Dosen LK, Haye R (2011) Surgical closure of nasal septal perforation. Early and long term observations. Rhinology 49(4):486–491
21. Cassano M (2017) Endoscopic repair of nasal septal perforation. Acta Otorhinolaryngol Ital 37(06):486–492
22. Lee HR, Ahn DB, Park JH, Kim YH, Sin CM, Youn SJ et al (2008) Endoscopic repairment of septal perforation with using a unilateral nasal mucosal flap. Clin Exp Otorhinolaryngol 1(3):154–157
23. Beckmann N, Ponnappan A, Campana J, Ramakrishnan VR (2014) Posterior septal resection: a simple surgical option for management of nasal septal perforation. JAMA Otolaryngol Head Neck Surg 140(2):150–154
24. Kridel RW (1999) Septal perforation repair. Otolaryngol Clin N Am 32(4):695–724