HOW I DO IT

Endoscopic "Racket-on-Donut" Technique for Large Anterior Nasoseptal Perforations

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INTRODUCTION

Nasoseptal perforations (NSPs) have a variable etiology. The most common causes are iatrogenic (nasal surgeries), trauma, nose picking, nasal substance abuse, systemic inflammatory diseases, or chemical exposures. Reduction of crusting can be achieved with intranasal humidification, irrigation with isotonic saline, local application of antibiotic ointments, and a topical emollient. Unfortunately, septal buttons have been associated with many complications such as pain, epistaxis, irritation, or crusting, and may contribute to a steady erosion of the perforation edges and eventual enlargement of the defect.

There is currently abundant literature advocating different methods of NSP repair. A recent survey by members of the American Academy of Facial Plastic and Reconstructive Surgery and the American Rhinologic Society demonstrated that the respondents had a similar preference for the endoscopic and external rhinoplasty approaches, followed by the endonasal approach. This study concluded that surgeons favored NSP repair using bilateral intranasal mucosal advancement flaps with an interposition graft.¹

Many endoscopic techniques for NSP repair have been developed. Anterior ethmoidal artery flap is the most commonly used endoscopic technique with a high success rate.^{2,3} Recently, Marino-Sanchez et al.⁴

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described a purely endoscopic surgical repair of NSP with a unilateral rotation septal flap pedicled to the greater palatine artery (GPA). The authors demonstrated that closure of very anterior NSP through an endoscopic endonasal approach can be achieved with a unilateral rotation mucosal flap based on the GPA. Additionally, in a radiological study and case series, Santamaría-Gadea et al.⁵ demonstrated the feasibility of using this flap to close large NSPs. This procedure depends upon intact septal cartilage surrounding the perforation and therefore is not applicable in those cases in which a prior septoplasty has removed such cartilage.

Based on the original description of the GPA flap, and even though identifying the pedicle by direct vision may corroborate flap vascularization,⁵ dissecting around the pedicle in a narrow space to achieve proper rotation of the flap may be very hard and risky because the artery could be accidentally damaged. Furthermore, following incisions described by the authors could generate a bulky pedicle and make the reconstruction more difficult. Consequently, it might produce nasal obstruction at the inferior level of the nasal valve. The Racket-on-Donut technique, as a modification of GPA flap, aims to simplify the procedure and improve postoperative outcomes.

METHODS

Description of the Racket-on-Donut technique step by step.

- Using a ruler, the incisive foramen is located and marked at 1.5 cm from the anterior nasal spine or at the point previously measured in the CT scan, if available.
- Septal osteo-cartilaginous support is palpated, and the nasal mucosa is infiltrated either with a solution of bupivacaine (0.25%) and epinephrine (1:100,000) or saline. The infiltration must be performed in a subperiosteal and subperichondrial plane.
- The racket-shape flap should be one third bigger than the NSP. Once the flap size is estimated, the posterior incision starts 1 cm below the olfactory neuro-epithelium and extends

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downwards until reaching the nasal floor, 2 cm posterior to the previously marked incisive foramen (Fig. 1A).

- An anterior incision is made as high as needed and extended downward through the posterior border of the NSP to the nasal floor, 1 cm anterior to the incisive foramen. Both anterior and posterior incisions are joined superiorly with an incision parallel to the skull base.
- A circumferential donut-shape incision around the perforation in its superior, anterior, and inferior aspects is performed (10). NSP margins must not be refreshed to avoid damaging the inverted edges (IE) flap. A small anteriorly based triangle in the anterior portion of the donut-shape flap is excised (Fig. 1B).
- The modified GPA (mGPA) mucoperichondrial/mucoperiosteal flap is harvested starting at the superior incision and advanced downwards to the nasal floor. The mucoperichondrium around the perforation (IE) is elevated toward the perforation edges and flipped to the contralateral nasal cavity (Fig. 2A, B).
- The mGPA flap is rotated anteriorly and then sutured to the remnant mucosa with an absorbable suture (Fig. 2A). Silicone nasal splints are fixed to the columella and left in place for 4 weeks. No nasal packing is needed.

CASE SERIES

A series of 13 patients (39.2 years from 18 to 65 years; 6 female) with anterior NSP is presented. The etiology was nose picking (n = 6), drug abuse (n = 6), and previous nasal surgery (n = 1). All NSPs were located anterior to the incisive foramen. The antero-posterior and supero-inferior NSPs diameters were 16.7 (10–27 mm) and 14.8 (10–25 mm), respectively. All cases were repaired by mGPA and IE without interposition grafts. Two months after surgery, both mGPA and IE flaps were completely integrated to the septal mucosa, and the osteo-cartilaginous septal support that had been left denuded during surgery showed complete reepithelialization (Figs. 3, 4, and 5) (Video S1).

The main follow-up was 16.4 (6–38 months). No complications were observed (Table I).

DISCUSSION

The main trunk of the GPA enters into the nasal fossa through the incisive foramen (nasopalatine canal),



Fig. 1. (A) Design of the Racket-on-Donut technique. Combination of a modified greater palatine artery flap (racket/3 incisions; starting with posterior and then anterior and finally superior) and an inverted edges (donut/1 step donut-shape incision) flaps. (B) Intraoperative view of the mucoperichondrial aspect of inverted edges flap.



Fig. 2. (A) Intraoperative view of the mucosal aspect of the inverted edges flap from the contralateral nasal cavity. (B) Rotation and fixation of the modified greater palatine artery flap.



Fig. 3. Right nasal cavity. (A) Preoperative view of nasoseptal perforation. (B) Long-term view of the modified greater palatine artery flap.



Left side

Before surgery

Inverted edges



Long-term follow-up

Fig. 4. Left nasal cavity. (A) Preoperative view of nasoseptal perforation. (B) Long-term view of inverted edges flap.



Before surgery

During surgery

Fig. 5. Sagittal plane of sinus CT scan. (A) Preoperative view of nasoseptal perforation. (B) intraoperative view of modified greater palatine artery flap and inverted edges flap.

where it anastomoses with the posterior septal branch of the sphenopalatine artery and anterior ethmoidal artery to supply the antero-inferior portion of the nasal septum. Neurovascular structures traversing this canal include the nasopalatine nerve providing sensory input to the pterygopalatine ganglion. Using Cone-beam computed tomography (CBCT), the shape of the canal has been observed most commonly to be a funnel or Y-shape in the coronal plane. The exit of the GPA into the nasal cavity is located at 1.5 ± 0.2 cm to the anterior nasal spine and the area of the septal portion of the GPA flap is 18.1 ± 1.4 cm^{2.5}

The different surgical techniques for NSP repair are related to the size, location, and the remnant of osteo-cartilaginous support of the nasal septum.¹ The Racket-on-Donut technique is proposed for anterior



Video S1. Racket-on-Donut technique for a large anterior nasoseptal perforation repair Video content can be viewed at https://onlinelibrary.wiley.com/doi/ 10.1002/lary.30747 NSP located anterior to the GPA foramen. The Racketon-Donut technique includes two flaps: the mGPA flap and the IE flap. The IE flap is a mucosal flap rotation technique, in which the edges of the NSP are raised and rotated to the contralateral nasal fossa. The presence of septal osteo-cartilaginous support around the perforation and in the posterior remnant septum is crucial to harvest the flaps.

LIMITATIONS

Patients with NSP posterior to the incisive canal are not candidates for the use of mGPA and IE flaps. NSPs reaching the superior or anterior septal margins do not have enough mucosa available to harvest the IE flap. Finally, this technique is not applicable for those patients with previous surgery and over-resection of septal cartilage or those without osteo-cartilaginous support because of difficulties in harvesting the flap.

ADVANTAGES

The advantages of the Racket-on-Donut technique are: (1) harvesting the flap is easier and faster; (2) the pedicle is thinner than the original GPA flap, avoiding bulky mucosa at the nasal valve area; (3) having nasal mucoperichondrium (inverted edges) in the opposite side promotes the healing process and creates an additional layer to cover the defect; and (4) there is a lower risk of damaging the GPA during the dissection.

CONFLICT OF INTEREST STATEMENT

I. Alobid has received honoraria for consultancy and conferences from Viatris, Roche, Sanofi, GSK, MSD, Menarini, Salvat and Novartis. A. Santamaria-Gadea has received honoraria for consultancy and conferences from Sanofi and GSK.

TABLE I. Case Series Cohort Characteristics and Follow-up.						
Case	Age (years)	Gender	Etiology	A-P Diameter (mm)	S-I Diameter (mm)	Follow-up (months)
1	18	Female	Drug abuse	18	10	18
2	38	Male	Nose Picking	10	10	38
3	42	Male	Drug abuse	27	12	24
4	35	Male	Nose picking	20	25	6
5	50	Male	Nose picking	10	10	11
6	55	Female	Post-septoplasty	20	20	8
7	22	Female	Nose picking	12	12	6
8	56	Male	Nose picking	20	20	36
9	52	Male	Drug abuse	20	20	24
10	38	Male	Drug abuse	20	18	6
11	55	Female	Drug abuse	25	20	12
12	24	Female	Nose picking	15	15	24
13	25	Female	Nose picking	20	20	15

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