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Innovative technique for large septal perforation repair and radiological evaluation

Valutazione radiologica e tecniche innovative per la riparazione di ampie perforazioni settali

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SUMMARY

Perforation of the nasal septum may have multiple causes: traumatic, iatrogenic, infectious, degenerative, overuse of vasoconstrictors, abuse of cocaine and more recently chemotherapy agents. Perforations are also classified according to their size and type of cartilaginous or osteocartilaginous deficit, as well as location (front, middle and rear). Many surgical techniques have been proposed to repair the perforation, although the results are often unsatisfactory for perforations of small and medium size; in large perforations permanent obliteration of the defect cannot always be ensured. It is often necessary to use tissues from inside the nasal turbinates or cartilage from other donor sites such as the ear or rib, and various techniques are discussed in light of the recent literature. The perforations observed in the last eight years and surgical approaches performed in open or closed approaches are taken into account. The authors propose a new technique that has been used with success in many types of septal perforation regardless of aetiology, and in particular large perforations, which allows for the use of the osteocartilaginous donor site as a hump. It is also useful in reductive rhinoseptoplasty, which targets selection to easily obtain mucopericondral flaps with an extramucosal technique.

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RIASSUNTO

La perforazione del setto nasale ha cause molteplici: traumatiche, iatrogene, infettive, degenerative, da abuso di vasocostrittori, da uso di cocaina e di recente anche da chemioterapici antineoplastici. Le perforazioni sono altresì classificate in funzione delle dimensioni e della tipologia del deficit cartilagineo o osteocartilagineo e della sede anteriore, mediana e posteriore. Molteplici tecniche di riparazione chirurgica del danno sono state proposte nel tempo e vengono riassunte nel presente lavoro per tipologia di approccio; i risultati conseguiti, sono soddisfacenti per le perforazioni di piccole e medie dimensioni, ma nelle grandi perforazioni non garantiscono sempre la permanente oblitterazione del difetto. Spesso si rende necessario l'utilizzo di tessuti prelevati all'interno delle fosse nasali come i turbinati o il prelievo di cartilagine da altre sedi donatrici come l'orecchio o la costa; le varie tecniche vengono illustrate alla luce della più recente letteratura. Gli Autori hanno valutato i pazienti osservati negli ultimi 8 anni e i risultati chirurgici conseguiti in particolare considerando, gli approcci chirurgici effettuati in approccio aperto o chiuso, endoscopico ed i materiali impiegati. Gli autori propongono tra le varie tecniche impiegate in questa serie di pazienti, una tecnica innovativa utilizzabile con successo in molti dei casi considerati di perforazione settale iatrogena che prevede l'utilizzo del gibbo osteocartilagineo quale sede donatrice, nonché la rinosettoplastica riduttiva quale scelta mirata per ottenere agevolmente lembi di scorrimento mucopericondrali e talora produrre anche un miglioramento estetico morfologico.

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Introduction

Closure of nasal perforation is one of the most fascinating and exciting of all procedures in nasal reconstructive surgery. It is a challenge for both the surgeon and patient, with the primary goal of restoring aesthetic aspects and recovering anatomical and functional integrity in the same procedure.

Surgical success is based on a precise definition of aetiology; location and the method employed during the intervention along with particular attention to pre- and post-operative care. The authors report their long-standing experience with the definition and treatment of perforations of the nasal septum, which in reality is not an infrequent pathology.

Aetiology and clinical features

The causes of nasal perforation may be local or systemic; in addition, various systemic illnesses may be responsible for the pathology, but there are limited data available regarding the frequency of the different causes of nasal septum perforation. A broad investigation in a Swedish population revealed a prevalence of septal perforation of 0.9%.

One of the first documented descriptions of perforation in an anatomopathological specimen is conserved in the Hunterian Museum of The Royal College of Surgeon in London (#1228). In the sagittal section, it is possible to see an important septal perforation of 1.5 cm with a round defined precise configuration in a patient suffering from syphilitic infection who died in the 17th century. Not only is the straight septum around the perforations visible, but it also possible to define margins and a certain degree of depression of the dorsal profile, which is a typical characteristic of the disease. To date, we have not personally observed such a disease as syphilis has now largely disappeared, although other systemic diseases have been seen

Table I. Aetiopathology of Nasal Septal Perforations.

Traumatic causes	
Previous surgery ⁷⁻¹¹	
Cauterization or embolization for epistaxis ^{12 13}	
Nasal packing ^{14 15}	
Nasogastric tube placement	
Septal haematoma from blunt trauma	
Battery or other foreign body in nose ¹⁶⁻²⁴	
Chronic nasal cannula use	
Turbulent airflow	
Inflammatory or infectious causes	
Sarcoidosis ^{25 26}	ACE >
Wegener granulomatosis ^{27 28}	ANCA >
Systemic lupus erythematosus ²⁹⁻³⁶	
Tuberculosis ^{37 38}	POSITIVE TEST
AIDS ^{39 40}	
Crohn's disease ⁴¹⁻⁴⁴	HISTOPATOLOGY
Autoimmune diseases ⁴⁵⁻⁵⁰	
Leishmaniasis ⁵¹⁻⁵³	
Cryoglobulinaemia ^{54 55}	
Celiac disease ⁵⁶	POSITIVE TEST
Invasive fungal sinusitis ^{57 58}	
Mycobacterium Kansas infection ⁵⁹	
Neoplastic causes	
Carcinoma	
T-cell lymphomas	HISTOPATOLOGY
Other causes	
Inhaled substances (e.g., cocaine, topical corticosteroids, long-term oxymetazoline or phenylephrine use) ⁶⁰⁻⁷⁵	
Chronic acid fumes ⁷⁶⁻⁷⁹	
Renal failure ⁸⁰	
Use of targeted/biologic therapies in the treatment of malignant and non-malignant diseases (bevacizumab) ⁸¹⁻⁸⁸	
Use of methotrexate or docetaxel in the treatment of malignant disease ^{89 90}	

during recent years which must be detected to better plan adequate treatment.

Table I lists the aetiopathology and causes of septal perforations, specific diagnostic tests of the different diseases and recent observations of septal perforations during the use of antineoplastic pharmacological treatment.

Table II provides some suggestions and precautions that should be adopted to prevent and avoid septal perforations in different circumstances⁹¹⁻⁹³.

Classification and diagnostic endoscopic features

Septal perforations are classified according to site and topography: cartilaginous, osteocartilaginous or intermediate, bone or posterior; according to size: small (< 1 cm in diameter), medium (1-2 cm) and large (> 2 cm). Often, the size of cartilage or bone perforation is greater than that of the mucosa, and therefore instrumental techniques for high-precision measurement of the perforation have been proposed⁹⁴⁻⁹⁶.

Physical examination of the nose begins with an evaluation of the external nose. Large perforations may result in loss of support to the dorsum of the nose and subsequent saddle nose deformity with occasional lateral deviation of the anterior part of the pyramid.

Table II. Suggestions and precautions in Nasal Septal Perforations (modified by Batniji 2012)⁹⁷.

Prescribe heated, humidified continuous positive airway pressure devices for patients with obstructive sleep apnoea.

Minimize steroid use in patients.

During septoplasty, minimize resection of cartilage and use meticulous technique to avoid bilateral tears in the mucosa.

Minimize nasal trauma during the insertion of nasogastric tubes by

(1) decongesting the nose with oxymetazoline or phenylephrine prior to nasogastric tube insertion, (2) inserting the nasogastric tube along the floor of the nose parallel to the hard palate and perpendicular to the plane of the face, and (3) lubricating the tip of the nasogastric tube.

Modify the nasal cannula in patients on long-term supplemental oxygen and humidify the supplemental oxygen. Taping 2 wooden toothpicks to the hub of the cannula (the thickened plastic part where the prongs are attached) modifies the nasal cannula. This directs the oxygen straight into the nose and away from the nasal septum.

When cauterizing the nasal septum for epistaxis, avoid cauterizing both sides simultaneously.

Stop cocaine use.

Stop or minimize use of topical nasal decongestants.

Run a humidifier in the bedroom.

Frequently use nasal saline sprays.

Use nasal emollients (especially before bedtime).

Decrease digital nasal trauma. Parents may want to place mittens on their young children's hands at night.

Discontinue the use of aspirin or non-steroidal anti-inflammatory drugs.

Anterior rhinoscopy is essential in initial examination of the patient, and may reveal the configuration of the perforation, the presence of crusting and irregularities of mucosal structure. Topical nasal decongestants may be utilized for intranasal inspection of the entire septum. Nasal endoscopy provides more information on the evaluation of the entire septum. Palpation of the septum with a cotton-tipped applicator provides valuable information regarding the integrity of the quadrangular cartilage in the remainder of the septum.

Diagnostic work-up

In diagnostic work up of septal perforation, several detailed laboratory investigations can be performed that are especially useful to detect medical causes of septal perforations. An algorithm such as that recently proposed by Batniji may be used, but for patients who use cocaine (often not admitted) is absolutely mandatory to identify on their urine the presence of cocaine catabolites in urine, or if possible and from hair; in these patients, it is advisable to not to perform surgery until after one year of cocaine cessation.

Diagnostic management of the nasal septum perforation is shown in the flow chart in Fig. 7, according to that proposed by Rami K. Batniji in 2012⁹⁷.

Surgical procedures

Many surgical procedures have been proposed to repair the defect, either by endonasal approaches using mucoperichondrial⁹⁸⁻¹¹⁵ or combined flaps with interposition of the graft using septal cartilage, uncinat process, middle turbinate, auricular or costal cartilage and temporal fascia¹¹⁶⁻¹³⁹, also utilizing a backwards extraction-reposition technique of the quadrangular cartilage¹⁴⁰ or using other non-autologous tissues or synthetic materials¹⁴¹⁻¹⁴⁷.

In large perforations, four Authors have suggested the use of labial and oral flaps¹⁴⁸⁻¹⁵¹.

The open approach is considered more likely to dominate the edges of the perforation and to ensure routine surgical dissection and reconstruction of the defect¹⁵²⁻¹⁶⁵. However, it is often not possible to obtain flaps that are large enough to cover the defect. To overcome this, some authors have suggested combining reductive rhinoseptoplasty to use the excess of mucosa that arises as a fabric to repair the septal perforation¹⁶⁶⁻¹⁶⁹.

Other authors have also proposed the use of expanders positioned under the mucoperichondrium to achieve the same result¹⁷⁰⁻¹⁷².

Radiological work-up

In many of our surgical cases, radiological specific work-up and elaboration techniques of imaging was performed before and after surgery for septal perforation to obtain

as much information as possible regarding nasal structure and framework; the method was applied to identify the loss of bone and mucosal layers, and to quantify and obtain exact measures of the defect to help in planning reconstruction. Some anatomic structures of the paranasal sinuses, and especially nasal septum which is of main interest in our cases, are not optimally visualized to plan surgical procedures by computed tomography (CT) and 2D MRI (Magnetic Resonance Imaging) with standard image reconstruction in the axial and coronal planes.

Elaboration of CT scans was performed, in addition to virtual 3D endoscopy (Fig. 8) using a work station furnished by the CT or MRI manufacturer. Multidetector CT scanners with 16 detector rows (or more) allow the acquisition of volumetric data sets that can be electronically reconstructed in any plane. Recent 1.5T (or 3.0T) MRI scanners equipped with new 3D acquisition sequences allow the acquisition of volumetric data sets as well, with the advantage (compared to CT) of better visualization of soft tissues with no radiation exposure.

These techniques give radiologists and surgeons the opportunity to visualize anatomic structures in greater detail and may help increase diagnostic accuracy and therapeutic planning of diseases of the paranasal sinuses and nasal septum.

Multidetector CT

CT examination of the paranasal sinuses is performed at our institution using a multidetector scanner (Sensation 16; Siemens, Erlangen, Germany). The scanner is equipped with 16 rows of detectors. Scanning is performed in the standard axial plane with a helical technique (120 kV, 100 Eff. mAs, pitch of 0.55, rotation time of 0.75 second, section thickness of 0.75 mm, and a 512 × 512 matrix).

The subject's head is placed in a neutral position, without chin tilt. The image data set is reconstructed with an individual voxel size of 0.75 × 0.75 × 0.75 mm.

The images included in the present article were reconstructed at a standard workstation (Wizard; Siemens) and at a standard PACS Workstation (Synapse, Fujifilm Medical Systems, equipped with Voxar 3D 6.3 software). The time required for multiplanar reconstruction of the CT image data set was about 3-5 min per reconstruction.

Purpose

Each reconstruction was tailored to better depict the structure of clinical interest, namely the nasal septum and paranasal sinuses. The anatomic location and orientation of the structures to be evaluated were confirmed on images in three orthogonal (axial, coronal, and sagittal) planes of reference. Moreover, 3D VRT (volume rendering technique) and animated three3D reformatting images were obtained to achieve the best overview of morphology and

local anatomy, integrating 2D information, thus providing an excellent preoperative “road map” and planning tool. Oblique and curved planes of section were defined to optimally depict any given structure.

Surgical technique

According to Foda 1999¹⁵⁷, the major goal in septal perforation surgery is not only to repair the perforation, but also to restore normal form and function to the nose. The increased surgical exposure provided by an open approach not only facilitates repair of large and posterior perforations, but also allows contemporary rhinoplasty. On the basis of these observations, in a large series of our patients (14 patients of the 87 observed over 8 years), reductive rhinoseptoplasty was performed with the principal aim to obtain more tissue in the same operatory field and to have the possibility of increasing the transfer and movement of flaps to cover the defect.

In 1995, Kridel affirmed that the possibility of correcting septal perforation and nasal external deformities in a unique set presents technical difficulties, and only challenging cases in which perforation is small and a dorsal hump can be removed are appropriate for synchronous correction.

In our opinion, due to the general features of the perforation, an oval form with a cranio-caudal diameter is generally less important than the antero-posterior one. It is thus more useful to reduce the perforation with contemporary reductive rhinoseptoplasty.

In the cases we present herein, an open external approach was adopted in the majority of cases with an extramucosal internal technique and removal of the hump; extracorporeal treatment of the septum was performed with modelling and reconstruction using the hump crushed and the covering of the obtained graft with fascia of compatible biological origin (pericardial fascia) or membrane obtained by heterologous auricular biocompatible cartilage. If the hole was completely covered with the graft, we employed the fascia. Otherwise, we utilized the cartilaginous membrane which is more consistent, and in our opinion provides a higher possibility of success.

In some cases from our experience, we used an endonasal approach with a reductive rhinoseptoplasty. In these cases, the septal was reassembled with an extracorporeal

technique and repositioned inside between the two sutured layers of mucosa.

After the initial experience, an open approach was routinely performed to obtain better exposition.

The sequence of step in the procedure generally adopted is detailed in Figs. 11-14.

Conclusions

The main objective in management of septal perforations is to restore the nasal framework and to close the defect to obtain complete healing of mucosa, and consequently less crusting and bleeding, which in some cases may persist despite the surgical effort.

Our aim was to repair the largest perforations by mainly utilizing the tissue present in the nasal field, and for this reason we began employing the hump to reassemble the septal defect; it is true that on occasion only transfer of mucosa and interpositioning of fascia may be successful, but for large defects we prefer a more consistent tissue to create more favourable healing and migration of epithelium. As affirmed by Foda¹⁵⁷, the disadvantages of surgery are that the difficulties in effectively closing a septal perforation are directly proportional to the size of perforation. Nonetheless, we also believe that the relative dimension of the external nose is important, regardless of the presence or absence of the hump that could be used for reconstruction.

For better surgical planning a precise diagnostic work up with laboratory exams is useful if the perforation may have a medical origin or if cocaine use is suspected or confirmed; regarding radiological work-up, we have long-standing collaborations with radiologists that have provided excellent results. Additional applications and developments could further improve both results and future simulations.

Repair of septal perforation is now a challenging lengthy procedure, and only few expert surgeons have dedicated themselves to such procedures. To better understand the actual efficacy of these procedures, more experienced surgeons should share their results to improve knowledge and to obtain larger study groups, with particular attention to the use of biological material utilized, which will increase the safety, efficacy and ease of the procedures for repair of septal perforations.

References

- ¹ Lanier B, Kai G, Marple B, et al. *Pathophysiology and progression of nasal septal perforation*. Ann Allergy Asthma Immunol 2007;99:473-9;quiz 480-1,521.
- ² Younger R, Blokmanis A. *Nasal septal perforations*. J Otolaryngol 1985;14:125-31.
- ³ Diamantopoulos II, Jones NS. *The investigation of nasal septal perforations and ulcers*. J Laryngol Otol 2001;115:541-4.
- ⁴ Vignes S, Chaillet M, Cabane J, et al. [*Nasal septal perforation and systemic disease*]. Rev Med Interne 2002;23:919-26.
- ⁵ Døsen LK, Haye R. *Nasal septal perforation 1981-2005: changes in etiology, gender and size*. BMC Ear Nose Throat Disord 2007;7:1.
- ⁶ Murray A, McGarry GW. *The clinical value of septal perforation biopsy*. Clin Otolaryngol Allied Sci 2000;25:107-9.

- 7 Stoksted P, Vase P. *Perforations of the nasal septum following operative procedures*. Rhinology 1978;16:123-38.
- 8 Schönsted-Madsen U, Stoksted PE, Outzen KE. *Septorhinoplastic procedures versus submucous resection of the septum, using septum perforation as an indicator*. Rhinology 1989;27:63-6.
- 9 Li Y, Xu G. [Complications of nasal endoscopic surgery]. Zhonghua Er Bi Yan Hou Ke Za Zhi 1998;33:142-5.
- 10 Ketcham AS, Han JK. *Complications and management of septoplasty*. Otolaryngol Clin North Am 2010;43:897-904.
- 11 Topal O, Celik SB, Erbek S, et al. *Risk of nasal septal perforation following septoplasty in patients with allergic rhinitis*. Eur Arch Otorhinolaryngol 2011;268:231-3.
- 12 Amin M, Glynn F, Phelan S, et al. *Silver nitrate cauterisation, does concentration matter?* Clin Otolaryngol 2007;32:197-9.
- 13 Bent JP 3rd, Wood BP. *Complications resulting from treatment of severe posterior epistaxis*. J Laryngol Otol 1999;113:252-4.
- 14 von Schoenberg M, Robinson P, Ryan R. *Nasal packing after routine nasal surgery--is it justified?* J Laryngol Otol 1993;107:902-5.
- 15 Dowley AC, Strachan DR. *Allergy to Merocel nasal packs causing septal perforation and inferior turbinate necrosis*. J Laryngol Otol 2001;115:735.
- 16 Bundgaard N, Tveterås K. [Perforation of the nasal septum caused by a miniature battery]. Ugeskr Laeger 1989;151:3323-4.
- 17 Kharoubi S. *Rhinolithiasis associated with septal perforation. A case report*. Acta Otorhinolaryngol Belg 1998;52:241-5.
- 18 García Callejo FJ, Martínez Beneito MP, Ortega Navarro MC. [Body piercing complications in otorhinolaryngology]. Acta Otorrinolaringol Esp 1998;49:338-9.
- 19 Umariya N, Chavda SV, Pahor AL. *An unusual cause of nasal septum perforation*. J Laryngol Otol 1999;113:1020-1.
- 20 Karkos PD, Karagama YG, Manivasagam A, et al. *Magnetic nasal foreign bodies: a result of fashion mania*. Int J Pediatr Otorhinolaryngol 2003;67:1343-5.
- 21 Lehman DA, Roy S. *Septal perforation caused by nasal magnetic foreign bodies*. Ear Nose Throat J 2005;84:266-7.
- 22 Greenberg M, Magit A. *Magnetic nasal foreign bodies in a 9-year-old male: opposites attract when it comes to nasal foreign bodies*. Int J Pediatr Otorhinolaryngol 2005;69:981-2.
- 23 Shermetaro C, Charnesky M. *Pediatric nasal septal perforation secondary to magnet misuse: a case report*. Ear Nose Throat J 2007;86:675-6.
- 24 Bao XL, Cai KM. [One case with perforation of nasal septum and palate caused by iatrogenic foreign body in nose and rhinolith]. Zhonghua Er Bi Yan Hou Tou Jing Wai Ke Za Zhi 2010;45:559.
- 25 Baum ED, Boudousquie AC, Li S, et al. *Sarcoidosis with nasal obstruction and septal perforation*. Ear Nose Throat J 1998;77:896-8, 900-2.
- 26 Patey O, Bonnieux P, Roucayrol AM, et al. *Sarcoidosis of the nose: report of a case with nasal perforation*. Sarcoidosis 1990;7:123-4.
- 27 Mann W, Bumb P, Märker-Hermann E. [Chronic rhinosinusitis with septal perforation. Differential diagnostic considerations]. HNO 2008;56:1129-34.
- 28 Kasifoglu T, Cansu D, Korkmaz C. *Clinical images: perforation of the nasal septum and palate due to Wegener's granulomatosis*. Arthritis Rheum 2008;58:2564.
- 29 Vachtenheim J., Grossmann J. *Letter: Nasal-septum perforation in systemic lupus erythematosus*. N Engl J Med 1974;291:51.
- 30 Snyder GG 3rd, McCarthy RE, Toomey JM, et al. *Nasal septal perforation in systemic lupus erythematosus*. Arch Otolaryngol 1974;99:456-7.
- 31 Bach GL. [Nasal septum perforation in disseminated lupus erythematosus, case report and literature review]. Z Rheumatol 1980;39:22-7.
- 32 Lerner DN. *Nasal septal perforation and carotid cavernous aneurysm: unusual manifestations of systemic lupus erythematosus*. Otolaryngol Head Neck Surg 1996;115:163-6.
- 33 Rahman P, Gladman DD, Urowitz MB. *Nasal-septal perforation in systemic lupus erythematosus--time for a closer look*. J Rheumatol 1999;26:1854-5.
- 34 Mascarenhas R, Tellechea O, Oliveira H, et al. *Nasalseptum perforation as the presenting sign of lupus erythematosus*. Dermatol Online J 2005;11:12.
- 35 Matsumoto FY, Clivati Brandt HR, Costa Martins JE, et al. *Nasoseptal perforation secondary to lupus vulgaris*. J Dermatol 2007;34:493-4.
- 36 Garg A, Wadhera R, Gulati SP, et al. *Lupus vulgaris of external nose with septal perforation--a rarity in antibiotic era*. Indian J Tuberc 2010;57:157-9.
- 37 Lai TY, Liu PJ, Chan LP. *Primary nasal tuberculosis presenting with septal perforation*. J Formos Med Assoc 2007;106:953-5. et al S, Cumberworth V. *Tuberculosis with secondary vasculitis presenting as a nasal septal perforation*. J Coll Physicians Surg Pak 2011;21:631-3.
- 39 Rejali SD, Simo R, Saeed AM, et al. *Acquired immune deficiency syndrome (AIDS) presenting as a nasal septal perforation*. Rhinology 1999;37:93-5.
- 40 Colebunders R, De Roo A, Benimadho S, et al. *A nasal septum perforation caused by a Varicella zoster infection in an AIDS patient*. Acta Otorhinolaryngol Belg 1997;51:49-50.
- 41 Bachmeyer C, Laurette F, Coutarel P, et al. [Perforation of the nasal septum in hemorrhagic rectocolitis]. Presse Med 1996;25:1890.
- 42 Kryssia RC, Henry ZB. *Nasal septum perforation: rare manifestation of Crohn's disease*. Indian J Gastroenterol 2006;25:214.
- 43 Sari S, Dalgic B, Yilmaz M, et al. *Nasal septal perforation in an adolescent girl with Crohn's disease: a rare extraintestinal manifestation*. Dig Dis Sci 2007;52:1285-7.
- 44 Goral V. *Rare and new extraintestinal complication of ulcerative colitis: nasal septal perforation*. Inflamm Bowel Dis 2012;18:E397-8.
- 45 Mathews JL, Ward JR, Samuelson CO, et al. *Spontaneous nasal septal perforation in patients with rheumatoid arthritis*. Clin Rheumatol 1983;2:13-8.
- 46 El Biaz S, Naji Y, Tijani A, et al. [Nasal septum perforation: initial presentation in a patient with rheumatoid arthritis]. Presse Med 2010;39:982-3.

- 47 Akar S, Dogan E, Goktay Y, et al. *Nasal septal perforation in a patient with Takayasu's arteritis; a rare association*. Intern Med 2009;48:1551-4.
- 48 Banerjee SS, Lammin K, Carpentier J. *Nasal septal perforation and antiphospholipid syndrome (Hughes syndrome)*. J Laryngol Otol 2007;121:1197-200.
- 49 Tsuda T, Nakajima A, Baba S, et al. *A case of relapsing polychondritis with bilateral sensorineural hearing loss and perforation of the nasal septum at the onset*. Mod Rheumatol 2007;17:148-52.
- 50 Avcin T, Silverman ED, Forte V, et al. *Nasal septal perforation: a novel clinical manifestation of systemic juvenile idiopathic arthritis/adult onset Still's disease*. J Rheumatol 2005;32:2429-31. Erratum in: J Rheumatol 2006;33:199-200.
- 51 Amini J. [Perforation of the nasal septum caused by leishmaniasis]. Ann Otolaryngol Chir Cervicofac 1976;93:691-4.
- 52 Vellin JF, Russier M, Mougeot G, et al. [Nasal leishmaniasis: a case report]. Ann Otolaryngol Chir Cervicofac 2005;122:100-4.
- 53 Brahn E, Pegues DA, Yao Q, et al. *Mucocutaneous leishmaniasis masquerading as Wegener granulomatosis*. J Clin Rheumatol 2010;16:125-8.
- 54 Vignes S, Chaillet M, Cabane J, et al. [Nasal septal perforation and systemic disease]. Rev Med Interne 2002;23:919-26.
- 55 Smith I, Smith M, Mathias D, et al. *Cryoglobulinaemia and septal perforation: a rare but logical cause*. J Laryngol Otol 1996;110:668-9.
- 56 Medina-Banegas A, Pastor-Quirante FA, Osete-Albaladejo J, et al. *Nasal septal perforation in a patient with subclinical celiac disease: a possible new association*. Eur Arch Otorhinolaryngol 2005;262:928-31.
- 57 Ruiz N, Fernandez-Martos C, Romero I, et al. *Invasive fungal infection and nasal septum perforation with bevacizumab-based therapy in advanced colon cancer*. J Clin Oncol 2007;25:3376-7.
- 58 Kuo WT, Lee TJ, Chen YL, et al. *Nasal septal perforation caused by invasive fungal sinusitis*. Chang Gung Med J 2002;25:769-73.
- 59 Bennett AM, Patel N, Kotecha B, et al. *Septal perforation secondary to Mycobacterium kansasii infection*. J Laryngol Otol 2003;117:992-4.
- 60 Vilensky W. *Illicit and licit drugs causing perforation of the nasal septum*. J Forensic Sci 1982;27:958-62.
- 61 Schwartz RH, Grundfast KM. *Nasal septal perforation from illicit drug use*. Am Fam Physician 1986;34:187-8.
- 62 Gendeh BS, Ferguson BJ, Johnson JT, et al. *Progressive septal and palatal perforation secondary to intranasal cocaine abuse*. Med J Malaysia 1998;53:435-8.
- 63 Yewell J, Haydon R, Archer S, et al. *Complications of intranasal prescription narcotic abuse*. Ann Otol Rhinol Laryngol 2002;111:174-7.
- 64 Goodger NM, Wang J, Pogrel MA. *Palatal and nasal necrosis resulting from cocaine misuse*. Br Dent J 2005;198:333-4.
- 65 Blaise G, Vanhootehem O, De La Brassinne M. [Perforation of the nasal septum in cocaine abusers]. Rev Med Liege 2005;60:845-8.
- 66 Simsek S, de Vries XH, Jol JA, et al. *Sino-nasal bony and cartilaginous destruction associated with cocaine abuse, S. aureus and antineutrophil cytoplasmic antibodies*. Neth J Med 2006;64:248-51.
- 67 Harper SJ, Jones NS. *Cocaine: what role does it have in current ENT practice? A review of the current literature*. J Laryngol Otol 2006;120:808-11.
- 68 Medina R, Espinós MA, Bartumeus P, et al J. [Septal perforation in cocaine abusers: utility of the computed tomography]. Radiologia 2009;51:90-2.
- 69 Miller FF. *Occurrence of nasal septal perforation with use of intranasal dexamethasone aerosol*. Ann Allergy 1975;34:107-9.
- 70 Soderberg-Warner ML. *Nasal septal perforation associated with topical corticosteroid therapy*. J Pediatr 1984;105:840-1.
- 71 Isaksson M, Bruze M, Wihl JA. *Contact allergy to budesonide and perforation of the nasal septum*. Contact Dermatitis 1997;37:133.
- 72 Cervin A, Andersson M. *Intranasal steroids and septum perforation--an overlooked complication? A description of the course of events and a discussion of the causes*. Rhinology 1998;36:128-32.
- 73 Deepak D, Panjabi C, Gudwani S, et al. *Nasal septal perforation in a patient with allergic bronchopulmonary aspergillosis and rhinitis on long term corticosteroids*. Asian Pac J Allergy Immunol 2001;19:287-90.
- 74 Chiang MY, Shah P. *Nasal septal perforation enlargement related to topical ocular steroids*. Br J Clin Pharmacol 2005;60:664-5.
- 75 Keyserling HF, Grimme JD, Camacho DL, et al. *Nasal septal perforation secondary to rhinitis medicamentosa*. Ear Nose Throat J 2006;85:376,378-9.
- 76 Sanz P, Moline JL, Sole D, et al. *Nasal septum perforation in chromate-producing industry in Spain*. J Occup Med 1989;31:1013-4.
- 77 Lin SC, Tai CC, Chan CC, et al. *Nasal septum lesions caused by chromium exposure among chromium electroplating workers*. Am J Ind Med 1994;26:221-8.
- 78 Williams N. *Nasal septal ulceration and perforation in jiggers*. Occup Med (Lond) 1998;48:135-7.
- 79 Castano R, Thériault G, Gauthrin D. *Categorizing nasal septal perforations of occupational origin as cases of corrosive rhinitis*. Am J Ind Med 2007;50:150-3.
- 80 Adler D, Ritz E. *Perforation of the nasal septum in patients with renal failure*. Laryngoscope 1980;90:317-21.
- 81 Fakhri MG, Lombardo JC. *Bevacizumab-induced nasal septum perforation*. Oncologist 2006;11:85-6.
- 82 Traina TA, Norton L, Drucker K, et al. *Nasal septum perforation in a bevacizumab-treated patient with metastatic breast cancer*. Oncologist 2006;11:1070-1.
- 83 Burkart CM, Grisel JJ, Hom DB. *Spontaneous nasal septal perforation with antiangiogenic bevacizumab therapy*. Laryngoscope 2008;118:1539-41.
- 84 Bengrine-Lefevre L, Afchain P, Chibaudel B, et al. [Nasal septum perforation and bevacizumab]. Rev Med Interne 2011;32:e43-5.
- 85 Marín AP, Sánchez AR, Arranz EE. *Nasal septum perfora-*

- tion in a breast cancer patient treated with bevacizumab. *Ann Oncol* 2009;20:1901-2.
- ⁸⁶ Power DG, Kemeny NE. *Nasal septum perforation and bevacizumab*. *Med Oncol* 2011;28:89-93.
- ⁸⁷ Ramiscal JA, Jatoi A. *Bevacizumab-induced nasal septal perforation: incidence of symptomatic, confirmed event(s) in colorectal cancer patients*. *Acta Oncol* 2011;50:578-81.
- ⁸⁸ Petrelli F, Cabiddu M, Barbara C, et al. *A patient presenting nasal septum perforation during bevacizumab-containing chemotherapy for advanced breast cancer*. *Breast Cancer* 2011;18:226-30.
- ⁸⁹ Lee SL, Neskey D, Mouzakes J. *Potential predisposition for nasal septal perforation with methotrexate use: report of 2 cases and literature review*. *Ear Nose Throat J* 2009;88:E12-4.
- ⁹⁰ Tan TH, Stevenson B, Yip D. *Docetaxel-induced nasal septal perforation*. *Intern Med J* 2006;36:471-2.
- ⁹¹ Fairbanks DN, Fairbanks GR. *Nasal septal perforation: prevention and management*. *Ann Plast Surg* 1980;5:452-9.
- ⁹² Eng SP, Nilssen EL, Ranta M, et al. *Surgical management of septal perforation: an alternative to closure of perforation*. *J Laryngol Otol* 2001;115:194-7.
- ⁹³ Kridel RW. *Considerations in the etiology, treatment, and repair of septal perforations*. *Facial Plast Surg Clin North Am* 2004;12:435-50,vi.
- ⁹⁴ Tanuma F, Mishima H, Kase Y, et al. *[A clinical treatise upon the nasal septal perforation]*. *Nihon Jibiinkoka Gakkai Kaiho* 1999;102:878-82.
- ⁹⁵ Rettinger G, Hosemann W. *Measuring the size of nasal septal perforations. A simple radiological method*. *Rhinology* 1988;26:157-9.
- ⁹⁶ Frank DA, Kern EB, Kispert DB. *Measurement of large or irregular-shaped septal perforations by computed tomography*. *Radiol Technol* 1988;59:409-12.
- ⁹⁷ Rami K Batniji. *Septal Perforation - Medical Aspects Treatment & Management*. Medscape Reference Feb. 2012 - emedicine.medscape.com
- ⁹⁸ Virte M, Tisserant J, Simon C, et al. *[Current status of the treatment of nasal septal perforations]*. *Ann Otolaryngol Chir Cervicofac* 1986;103:603-7.
- ⁹⁹ Jahn AF. *How I do it: a simple eversion flap for repair of small septal perforations*. *J Otolaryngol* 1994;23:69-70.
- ¹⁰⁰ Schultz-Coulon HJ. *Experiences with the bridge-flap technique for the repair of large nasal septal perforations*. *Rhinology* 1994;32:25-33.
- ¹⁰¹ Woolford TJ, Jones NS. *Repair of nasal septal perforations using local mucosal flaps and a composite cartilage graft*. *J Laryngol Otol* 2001;115:22-5.
- ¹⁰² Ayshford CA, Shykhon M, Uppal HS, et al. *Endoscopic repair of nasal septal perforation with acellular human dermal allograft and an inferior turbinate flap*. *Clin Otolaryngol Allied Sci* 2003;28:29-33.
- ¹⁰³ Zhang Q, Zhang J, Li S. *Endoscope-assisted repair of large nasal septal perforation using a complex mucoperichondrial flap and free tissue graft*. *Chin Med J (Engl)* 2003;116:157-8.
- ¹⁰⁴ Friedman M, Ibrahim H, Ramakrishnan V. *Inferior turbinate flap for repair of nasal septal perforation*. *Laryngoscope* 2003;113:1425-8.
- ¹⁰⁵ Huang Q, Zhou B, Han DM, et al. *[Endoscopic surgery for nasal septal perforation]*. *Zhonghua Er Bi Yan Hou Tou Jing Wai Ke Za Zhi* 2005;40:579-81.
- ¹⁰⁶ Tasca I, Compadretti GC. *Closure of nasal septal perforation via endonasal approach*. *Otolaryngol Head Neck Surg* 2006;135:922-7.
- ¹⁰⁷ André RF, Lohuis PJ, Vuyk HD. *Nasal septum perforation repair using differently designed, bilateral intranasal flaps, with nonopposing suture lines*. *J Plast Reconstr Aesthet Surg* 2006;59:829-34.
- ¹⁰⁸ Lee HR, Ahn DB, Park JH, et al. *Endoscopic repairment of septal perforation with using a unilateral nasal mucosal flap*. *Clin Exp Otorhinolaryngol* 2008;1:154-7.
- ¹⁰⁹ Islam A, Celik H, Felek SA, et al. *Repair of nasal septal perforation with "cross-stealing" technique*. *Am J Rhinol Allergy* 2009;23:225-8.
- ¹¹⁰ Islam A, Felek S, Celik H, et al. *[Repair of nasal septal perforation with different intranasal flap techniques and their outcomes]*. *Kulak Burun Bogaz Ihtis Derg* 2009;19:232-8.
- ¹¹¹ Teymoortash A, Werner JA. *Repair of nasal septal perforation using a simple unilateral inferior meatal mucosal flap*. *J Plast Reconstr Aesthet Surg* 2009;62:1261-4.
- ¹¹² Neumann A, Morales-Minovi CA, Schultz-Coulon HJ. *[Closure of nasal septum perforations by bridge flaps]*. *Acta Otorrinolaringol Esp* 2011;62:31-9.
- ¹¹³ Raol N, Olson K. *A Novel Technique to Repair Moderate-Sized Nasoseptal Perforations*. *Arch Otolaryngol Head Neck Surg* 2012;16:1-3.
- ¹¹⁴ Yousef-Mian M. *Repair of nasal septal perforation*. *Am J Rhinol* 1997;11:35-40.
- ¹¹⁵ Castelnuovo P, Ferrelli F, Khodaei I, et al. *Anterior ethmoidal artery septal flap for the management of septal perforation*. *Arch Facial Plast Surg* 2011;13:411-4.
- ¹¹⁶ Lopatin AS, Ovchinnikova EV. *[Peculiarities of the surgical treatment of nasal septum perforations]*. *Vestn Otorinolaringol* 2012;2:13-7.
- ¹¹⁷ Matton G. *Re: Ohlsén: Closure of nasal septal perforation with a cutaneous flap and a perichondrocutaneous graft*. *Ann Plast Surg* 1990;24:98.
- ¹¹⁸ Meyer R, Mayer B, Perko D. *[Concept and technique for closure of septum defects]*. *Handchir Mikrochir Plast Chir* 1991;23:296-300.
- ¹¹⁹ Meyer R. *Nasal septal perforations must and can be closed*. *Aesthetic Plast Surg* 1994 Fall;18:345-55.
- ¹²⁰ Nuñez-Fernández D, Vokurka J, Chrobok V. *Bone and temporal fascia graft for the closure of septal perforation*. *J Laryngol Otol* 1998;112:1167-71.
- ¹²¹ Mobley SR, Boyd JB, Astor FC. *Repair of a large septal perforation with a radial forearm free flap: brief report of a case*. *Ear Nose Throat J* 2001;80:512.
- ¹²² Pedroza F, Patrocinio LG, Arevalo O. *A review of 25-year experience of nasal septal perforation repair*. *Arch Facial Plast Surg* 2007;9:12-8.
- ¹²³ Presutti L, Alicandri Ciuffelli M, Marchioni D, et al. *Nasal septal perforations: our surgical technique*. *Otolaryngol Head Neck Surg* 2007;136:369-72.
- ¹²⁴ Li F, Liu Q, Yu H, et al. *Pedicled local mucosal flap and*

- autogenous graft for the closure of nasoseptal perforations.* Acta Otolaryngol 2011;131:983-8.
- ¹²⁵ Ma YX, Tao AZ, Lu C, et al. [Endoscopic repair of nasal septal perforation with acellular dermal matrix and pedicled mucoperichondrial flap]. Zhonghua Er Bi Yan Hou Tou Jing Wai Ke Za Zhi 2011;46:455-8.
- ¹²⁶ Dosen LK, Haye R. Surgical closure of nasal septal perforation. Early and long term observations. Rhinology 2011;49:486-91.
- ¹²⁷ Kazkayasi M, Yalcinozan ET. Uncinate process in the repair of nasoseptal perforation. Aesthetic Plast Surg 2011;35:878-81.
- ¹²⁸ Vuyk HD, Versluis RJ. The inferior turbinate flap for closure of septal perforations. Clin Otolaryngol Allied Sci 1988;13:53-7.
- ¹²⁹ Friedman M, Ibrahim H, Ramakrishnan V. Inferior turbinate flap for repair of nasal septal perforation. Laryngoscope 2003;113:1425-8.
- ¹³⁰ Stoor P, Grénman R. Bioactive glass and turbinate flaps in the repair of nasal septal perforations. Ann Otol Rhinol Laryngol 2004;113:655-61.
- ¹³¹ Liu B, Zhao R, Kong W. [To repair perforation of nasal septum with free mucosa of inferior turbinate]. Lin Chuang Er Bi Yan Hou Ke Za Zhi 2004;18:468-9.
- ¹³² Kazkayasi M, Tuna E, Kilic C. Bullous middle turbinate flap for the repair of nasal septal perforation. J Otolaryngol Head Neck Surg 2010;39:203-6.
- ¹³³ Mansour HA. Repair of nasal septal perforation using inferior turbinate graft. J Laryngol Otol 2011;125:474-8.
- ¹³⁴ Tastan E, Aydogan F, Aydin E, et al. Inferior turbinate composite graft for repair of nasal septal perforation. Am J Rhinol Allergy 2012;26:237-42.
- ¹³⁵ Martins M. [A contribution to the closing of perforations of the nasal septum (author's transl)]. HNO 1978;26:183-4.
- ¹³⁶ Chua DY, Tan HK. Repair of nasal septal perforations using auricular conchal cartilage graft in children: report on three cases and literature review. Int J Pediatr Otorhinolaryngol 2006;70:1219-24.
- ¹³⁷ Taskin U, Yigit O, Sisman SA. Septal perforation repairing with combination of mucosal flaps and auricular interpositional grafts in revision patients. Otolaryngol Head Neck Surg 2011;145:828-32.
- ¹³⁸ Guyuron B, Afrooz PN. Correction of cocaine-related nasal defects. Plast Reconstr Surg 2008;121:1015-23.
- ¹³⁹ Giacomini PG, Ferraro S, Di Girolamo S, et al. Large nasal septal perforation repair by closed endoscopically assisted approach. Ann Plast Surg 2011;66:633-6.
- ¹⁴⁰ Sarandeses-García A, Sulenti G, López-Amado M, et al. Septal perforations closure utilizing the backwards extraction-reposition technique of the quadrangular cartilage. J Laryngol Otol 1999;113:721-4.
- ¹⁴¹ Chhabra N, Houser SM. Endonasal repair of septal perforations using a rotational mucosal flap and acellular dermal interposition graft. Int Forum Allergy Rhinol 2012;2:392-6.
- ¹⁴² Parry JR, Minton TJ, Suryadevara AC, et al. The use of fibrin glue for fixation of acellular human dermal allograft in septal perforation repair. Am J Otolaryngol 2008;29:417-22.
- ¹⁴³ Ambro BT, Zimmerman J, Rosenthal M, et al. Nasal septal perforation repair with porcine small intestinal submucosa. Arch Facial Plast Surg 2003;5:528-9.
- ¹⁴⁴ Jasso-Victoria R, Olmos-Zuñiga JR, Gutierrez-Marcos LM, et al. Usefulness of bovine pericardium as interpositional graft in the surgical repair of nasal septal perforations (experimental study). J Invest Surg 2003;16:209-17.
- ¹⁴⁵ Deng C, Li R, Yang J, et al. [Repairing large perforation of nasal septum with titanium membrane and local pedicled mucoperiosteum flap]. Lin Chuang Er Bi Yan Hou Ke Za Zhi 2006;20:358-9.
- ¹⁴⁶ Daneshi A, Mohammadi S, Javadi M, et al. Repair of large nasal septal perforation with titanium membrane: report of 10 cases. Am J Otolaryngol 2010;31:387-9.
- ¹⁴⁷ Boenisch M, Nolst Trenité GJ. Reconstruction of the nasal septum using polydioxanone plate. Arch Facial Plast Surg 2010;12:4-10.
- ¹⁴⁸ Rettinger G, Masing H, Heini W. [Management of septal perforations by rotationplasty of the septal mucosa]. HNO 1986;34:461-6.
- ¹⁴⁹ Heller JB, Gabbay JS, Trussler A, et al. Repair of large nasal septal perforations using facial artery musculomucosal (FAMM) flap. Ann Plast Surg 2005;55:456-9.
- ¹⁵⁰ Kogan L, Gilbey P, Samet A, et al. Nasal septal perforation repair using oral mucosal flaps. Isr Med Assoc J 2007;9:373-5.
- ¹⁵¹ Hirshowitz B, Moscona R, Eliachar I. Closure of septal perforation in Osler-Weber-Rendu's disease by bilateral labial-buccal flaps. Case report. Plast Reconstr Surg 1978;62:296-9.
- ¹⁵² Romo T 3rd, Foster CA, Korovin GS, et al. Repair of nasal septal perforation utilizing the midface degloving technique. Arch Otolaryngol Head Neck Surg 1988;114:739-42.
- ¹⁵³ Goodman WS, Strelzow VV. The surgical closure of nasoseptal perforations. Laryngoscope 1982;92:121-4.
- ¹⁵⁴ Kridel RW, Foda H, Lunde KC. Septal perforation repair with acellular human dermal allograft. Arch Otolaryngol Head Neck Surg 1998;124:8.
- ¹⁵⁵ Romo T 3rd, Sclafani AP, Falk AN, et al. A graduated approach to the repair of nasal septal perforations. Plast Reconstr Surg 1999;103:66-75.
- ¹⁵⁶ Kridel RW. Septal perforation repair. Otolaryngol Clin North Am 1999;32:695-724.
- ¹⁵⁷ Foda HM. The one-stage rhinoplasty septal perforation repair. J Laryngol Otol 1999;113:728-33.
- ¹⁵⁸ Li Z, Zhang S. [With periosteal "sandwich" suturing and repairing septonasal perforation by nasal columella degloving]. Lin Chuang Er Bi Yan Hou Ke Za Zhi 1999;13:483-4.
- ¹⁵⁹ Newton JR, White PS, Lee MS. Nasal septal perforation repair using open septoplasty and unilateral bipedicled flaps. J Laryngol Otol 2003;117:52-5.
- ¹⁶⁰ Kridel RW. Considerations in the etiology, treatment, and repair of septal perforations. Facial Plast Surg Clin North Am 2004;12:435-50,vi.
- ¹⁶¹ Watson D, Barkdull G. Surgical management of the septal perforation. Otolaryngol Clin North Am 2009;42:483-93.
- ¹⁶² Wong S, Raghavan U. Outcome of surgical closure of nasal septal perforation. J Laryngol Otol 2010;124:868-74.

- ¹⁶³ Rokkjær MS, Barrett TQ, Petersen CG. *Good results after endonasal cartilage closure of nasal septal perforations.* Dan Med Bull 2010;57:A4196.
- ¹⁶⁴ Yildirim G, Onar V, Sayin I, et al. *The reconstruction of nasal septal perforation with high density porous polyethylene covered with fascia lata: an experimental study on rabbit model.* Clin Exp Otorhinolaryngol 2011;4:137-41.
- ¹⁶⁵ Yenigun A, Meric A, Verim A, et al. *Septal perforation repair: mucosal regeneration technique.* Eur Arch Otorhinolaryngol 2012;269:2505-10.
- ¹⁶⁶ Strelzow VV, Goodman WS. *Nasoseptal perforation--closure by external septorhinoplasty.* J Otolaryngol 1978;7:43-8.
- ¹⁶⁷ Kridel RW, Appling WD, Wright WK. *Septal perforation closure utilizing the external septorhinoplasty approach.* Arch Otolaryngol Head Neck Surg 1986;112:168-72.
- ¹⁶⁸ Foda HM, Magdy EA. *Combining rhinoplasty with septal perforation repair.* Facial Plast Surg 2006;22:281-8.
- ¹⁶⁹ Ribeiro JS, da Silva GS. *Technical advances in the correction of septal perforation associated with closed rhinoplasty.* Arch Facial Plast Surg 2007;9:321-7.
- ¹⁷⁰ Romo T 3rd, Jablonski RD, Shapiro AL, et al. *Long-term nasal mucosal tissue expansion use in repair of large nasoseptal perforations.* Arch Otolaryngol Head Neck Surg 1995;121:327-31.
- ¹⁷¹ Van Damme PA. *Long-term nasal mucosal tissue expansion use.* Arch Otolaryngol Head Neck Surg 1996;122:898.
- ¹⁷² Romo T. III : *Septal Perforation – Surgical Aspects.* Medscape Reference Jun 2012 emedicine.medscape.com

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Fig. 1. Septal perforation of one cm in a cocaine user. It is possible to note the circular configuration, infection and the ischaemic aspect of mucosa near the margin of the lesion.

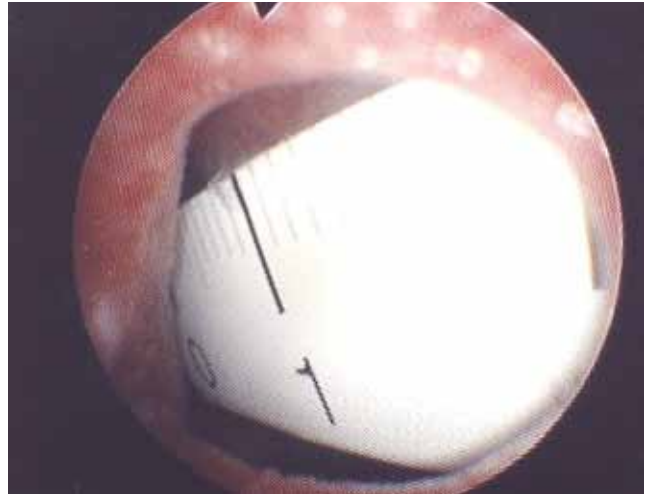


Fig. 4, 5. Patient with a septal perforation of almost 2 cm with irregularities of margins due to previous iatrogenic surgery.

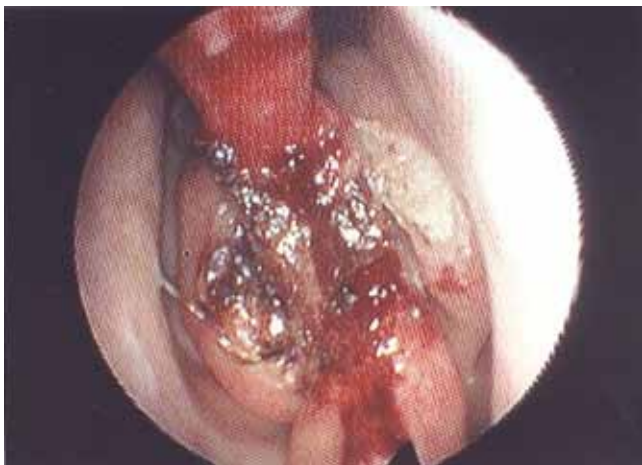


Fig. 2. Patient with a large septal perforation due to chronic acid exposition. The superior part of perforation is visible near the middle turbinate showing important vascularisation near the edges.

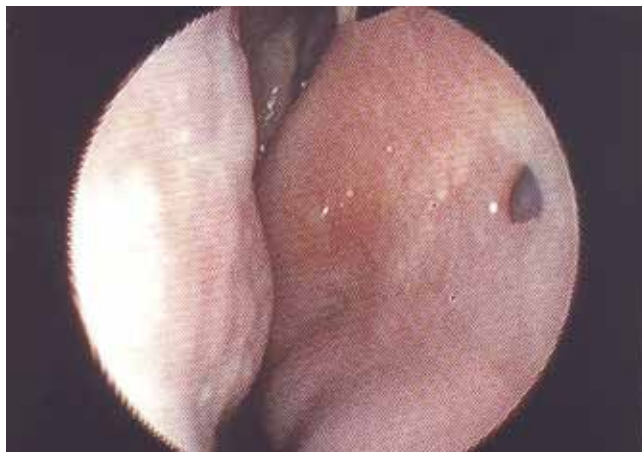


Fig. 3. Patient with a small perforation due to previous surgery with the contemporary presence of nasal atrophía and secretions.

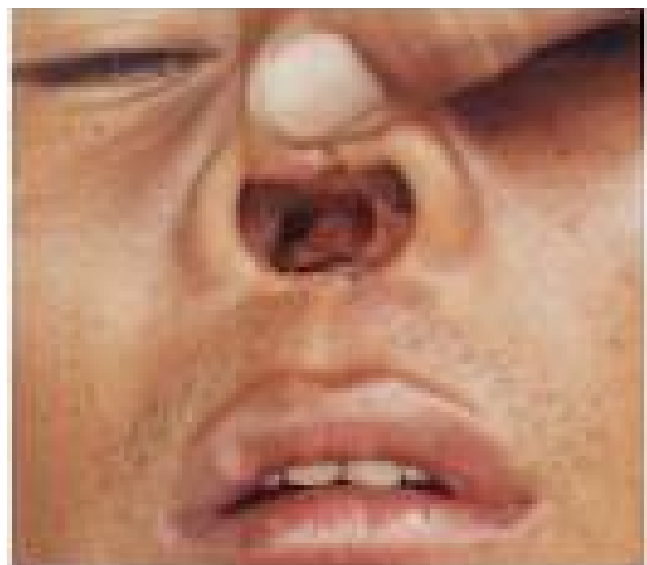


Fig. 6. Patient with perforation of septum and destruction of the columella.

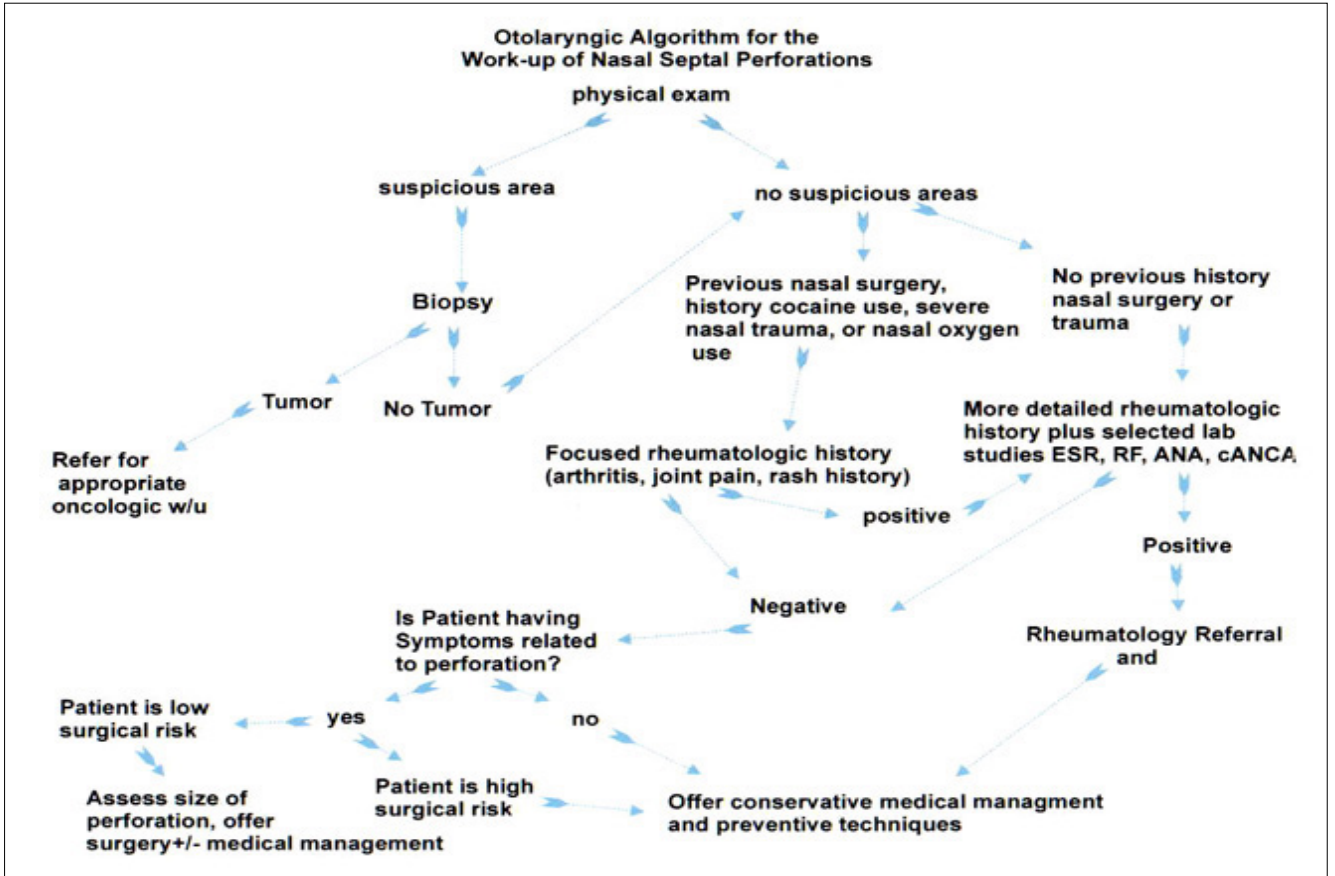


Fig. 7. [per autore: inserire didascalia]

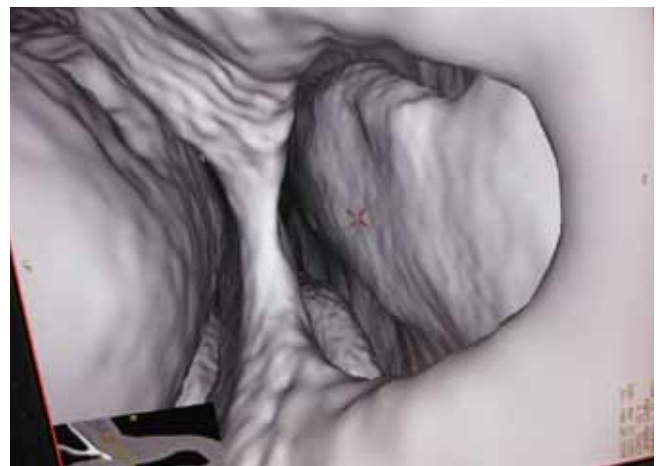


Fig 8. Virtual 3D endoscopy of a patient with septal perforation with a high resolution image of the nasal fossa, turbinates and margins of perforation.

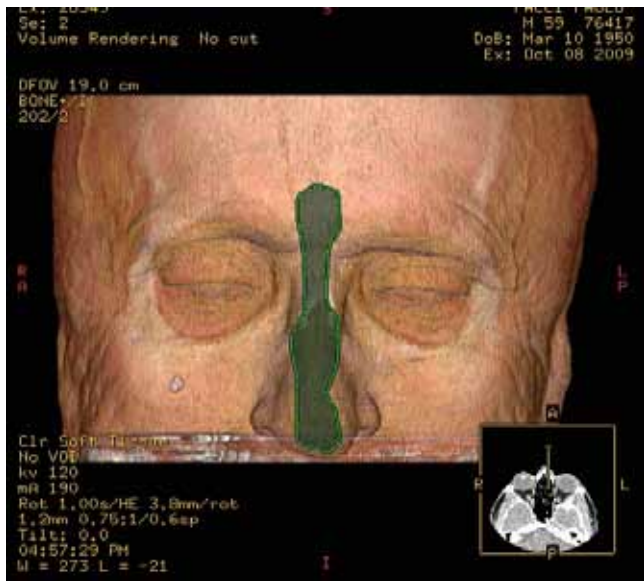


Fig. 9. Selection of reconstruction on a facial rendering.



Fig. 11. Endoscopic view after complete removal of the septum with suture perforation of the mucoperichondrial layers performed beginning posteriorly and advancing anteriorly in each side

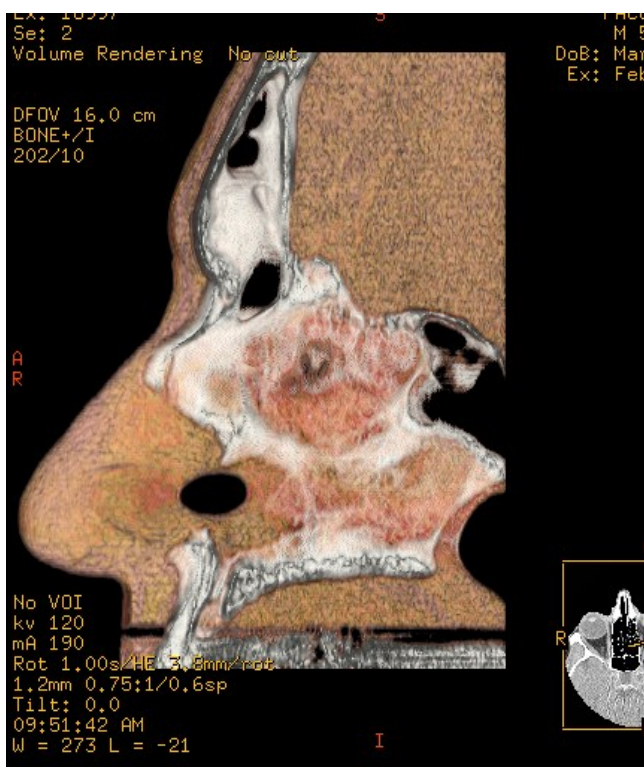


Fig. 10. Lateral sagittal selected view of a patient with a middle perforation; the exact location of perforation is visible along with the relationship with other bone structures.

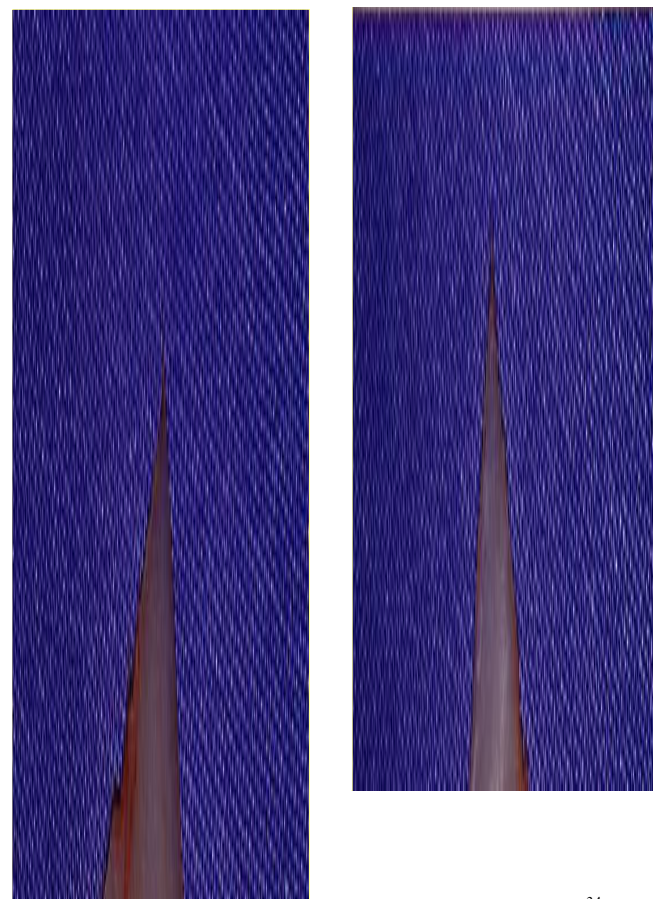


Fig. 12, 13. The hump removed is placed in the place of perforation during extracorporeal septoplasty, the septum is reassembled and modelled and covered with fascia.



Fig. 14. The septum is inserted in the middle during an open approach and fixed at the spine perichondrium and dorsal vault.

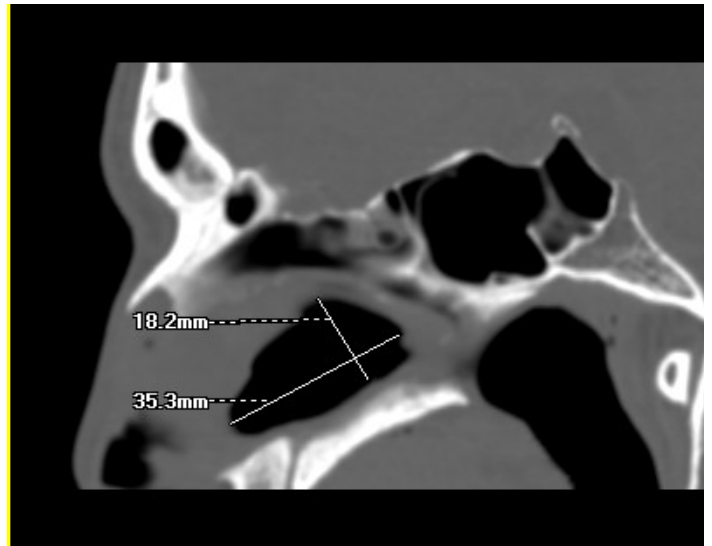


Fig. 15, 16. Endoscopic view of an iatrogenic septal perforation of a perforation larger than 3 cm, and a normal sagittal view with measures of perforation.

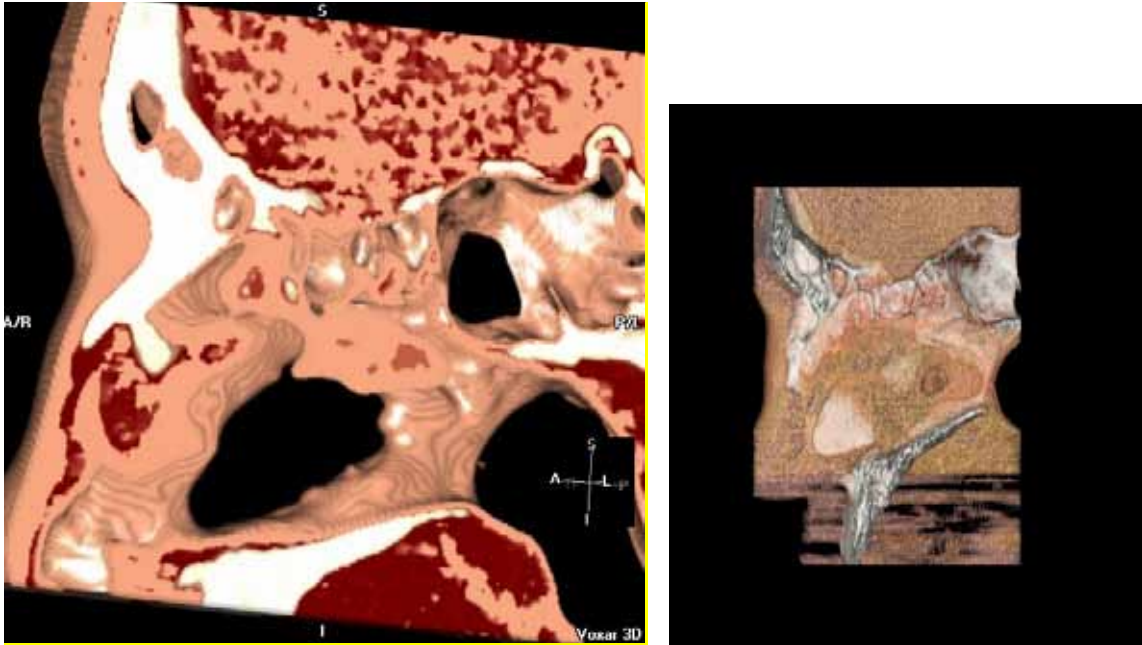


Fig. 17, 18. Elaborated CT reconstruction with the method described in the text, and post-operative reconstruction with repair of the perforation. The biological material utilized in reconstruction and repair of the perforation is visible.

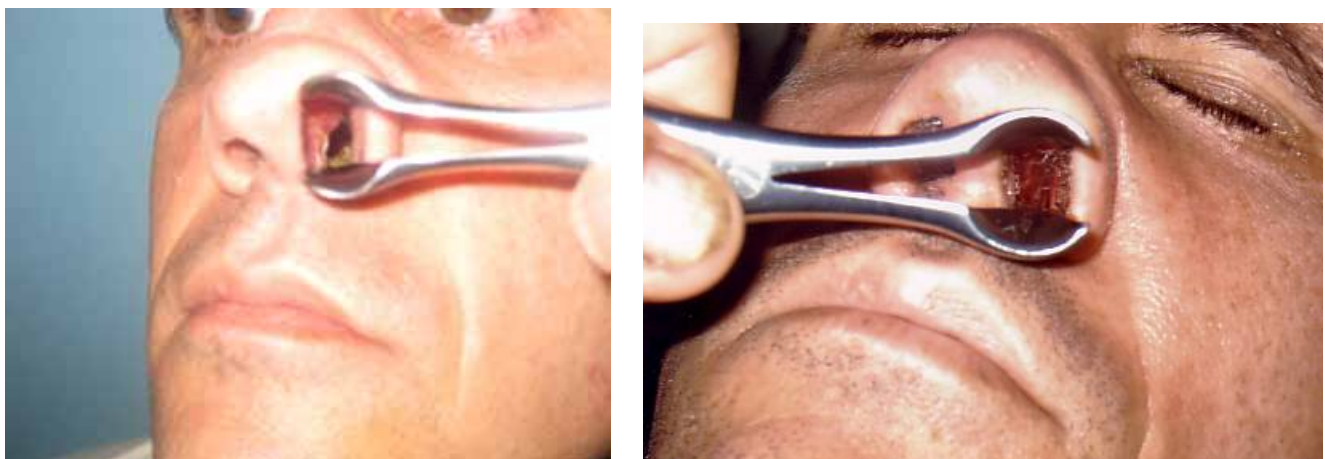


Fig. 19, 20. Pre- and Post-operative anterior rhinoscopy of the same patient in the previous figures.