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The Nasal Septum

A complete overview for the role of the septum in nasal surgery

R. NOCINI – G. MOLTENI – S.A. MOCELLA – D. BERTOSSI

The Nasal Septum

A complete overview for the role of the septum in nasal surgery

Foreword by LIVIO PRESUTTI

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FOREWORD

The proposal of writing a book dedicated exclusively to the pathology and surgery of the nasal septum fulfills a training gap, which was greatly waited for so far. Pathology and surgery involving the nasal septum have been the major topic of study since 1905 when Killian (Killian G. The submucous window resection of the nasal septum. Ann ORL 1905; 14: 363) described the first technique for correcting deviations. The purpose of this textbook is therefore not to propose some novel practice in the field, but to gather in a single volume the overall approach to septal pathology and surgery, which grew up in a translational and multidisciplinary fashion over this latest century. The impact with the pathologies of the nasal septum is almost immediate as just as the Medical Specialization School in Otolaryngology has started, but also for those practitioners who are introducing to approach Maxillofacial Surgery or Plastic and Reconstructive Surgery. Yet, despite the enormous spread of these pathologies, the high number of professionals who dedicate themselves to them, the very long experience of many schools and also the considerable contribution that Distinguished Italian Masters have given to the topic, we have not yet managed to standardize indications, surgical techniques, management of failures and complications, so far. This handbook, examining the septal pathology as a whole, will give rise to a sort of manual for all those Experts having contributed to the field, just to be used in case of management doubts or practical questions. Furthermore, it is essential for all Doctors in Specialized Training in Otolaryngology and related branches with the aim of carrying out a correct classification of the various pathologies, setting correct therapeutic indications, performing surgical interventions according to the best international standards, and managing properly any complication.

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CHAPTER XIV – RECONSTRUCTVE SURGERY POST ONCOLOGICAL TREATMENT

Chiarini Luigi, Alexandre Anesi

ABSTRACT

Removal of components of the nasal septum for oncological causes is a frequent intervention. Reconstruction of the septum mainly consists in rebuilding the L-strut, which is the key to the structural support. The L-strut defect might be partial (more frequent) or total. External and internal lining have also to be rebuilt when missing. Lining reconstruction is fundamental to nourish the graft and to avoid post-operative complications. Considerations regarding immediate or delayed procedures have to be evaluated. There are many different types of grafts that can be harvested (septal cartilage and bone, costal cartilage and bone, auricular cartilage, cranial bone, radial bone). The graft used to rebuild the neo-septum has to be chosen according to the extent of the defect and to the surgeon's experience.

INTRODUCTION

As we've seen throughout the previous chapters, nasal septum defects may have a wide etiology. In the present chapter we will focus on those related to oncologic surgery. Reconstructive aspects are undoubtedly a key aspect of the therapeutic strategy in oncologic surgery. The restoration is aim at to reestablish not only the nasal function, but also the psycological-aestethical features, which primarily contribute to the self-identity and self-image of the patient.

In the field of facial surgery, and even more so in nasal one, an aesthetically pleasing reconstruction is of great value. The centro-facial position of the nose, in fact, makes it a key element of our connotations, as well as self-perception. Since ancient times this has led to the development of techniques that allowed the reconstruction of the nose following its partial or total amputation. The aim of these interventions was to rebuild this organ both from a functional and an aesthetic point of view. Menick FJ. Nasal Reconstruction : Art and Practice.; 2009.

Surgical techniques have obviously evolved over time, even if some of them have remained at the basis of nasal reconstructive surgery. As well known, rhinopoiesis was already practiced by ancient Egyptians. The technique described in the Indian Veda codes is even more famous and it is still

today one of the most effective and aesthetically appreciated reconstructive surgical techniques of the nose, with some adaptations that modernized it. Subsequently, the technique implemented by the so-called "Italian school" also gained popularity. It was described around 1500 and it involved the use of autologous tissues of the arms. Baker SR. Principles of Nasal Reconstruction. New York, NY: Springer New York; 2011.

Phillips TJ. Total nasal reconstruction: a review of the past and present, with a peak into the future. Curr Opin Otolaryngol Head Neck Surg. 2019;27(5):420-425.

With respect to the theme of the reconstruction of the nasal septum object of this chapter, it is interesting to note that these ancient surgical techniques are dedicated to the reconstruction of the superficial layer and not of the nasal septum itself. Therefore, in a nasal septal defect we would like to bring to your attention from now on that any reconstruction of the superficial layer or of the alar / lateral cartilages must be considered a surgical phase that can only be performed in presence of adequate reconstruction of the structural septal support. This need can find a metaphor in the building phases of an edifice: if we compare the nasal septum to the foundations, the cartilages can be assimilated to the walls and the soft tissues are comparable to the roof. It is then evident that the walls and the roof can have an adequate stability only with solid foundations. Furthermore, if the cartilagineous and soft tissue complex confers function and aesthetic unity to the nasal pyramid, their restoration is not feasible in the absence of a reconstruction of the structural component of the septum. Here we can anticipate that this structural component of the septum consists mainly of the L-strut. Burget GC, Menick FJ. Aesthetic Reconstruction of the Nose. 2nd ed. (Book MY, ed.).; 1994.

The indications for reconstruction have changed over time. Traumatology and malformations (together with amputations performed for legislative reasons) were previously the main causes of nasal amputation. To date, however, nasal oncological pathologies are one of the main reasons for nasal amputation. In surgical oncology, nasal septum defects might be present before the operation or might be the consequence of the demolition. In fact, the septum represents a natural anatomic barrier between the two nasal fossae. It can be involved both as the primary site of cancer onset or as a local spreading site. Squamous cell carcinoma (SCC) constitutes more than half of the primary malignancies of the nasal septum, followed by adenocarcinoma and malignant melanoma. SCC is also the most frequent malignancy of the nasal cavity in general. Nasal septum can be infiltrated also by tumors developed from surrounding tissues (primarily the skin). Extensive

carcinomas of the upper lip both from the skin lining and from the oral vestibular lining or from the minor salivary glands can affect the anterior nasal septum. Huizing EH, Groot JAM de. Functional Reconstructive Nasal Surgery.; 2015. https://www.wolterskluwer.com/en/solutions/ovid/functional-reconstructive-nasal-surgery-13680. Accessed March 11, 2022.

In this chapter we will focus on this topic, analyzing the principles and the indications to the reconstruction of the nasal septum following an oncologic demolition. A brief overview of the main techniques and of the complications and their management is also here discussed.

Finally, the psychological aspects related to nasal reconstruction should not be underestimated. In fact, the final restoration is often performed with several surgical procedures; therefore, patient's compliance is essential to adhere to the numerous reconstructive phases. A thorough preoperative evaluation will help to make the best decision by mutual agreement for the patient's sake. The patient must have a leading decision-making role in the reconstructive therapeutic strategy to be adopted. The psychological importance of an aesthetic and satisfying reconstruction has been well evaluated in the oncology field. The nose, and the face in general, are a key-element of personal identity. Furthermore, obvious nasal defects can certainly influence aspects of sociality and interpersonal relationships. The nose literally has central importance in the face, occupying the central third on the horizontal axis and the central fifth on the vertical axis. Menick FJ. Nasal Reconstruction : Art and Practice.; 2009.

RECONSTRUCTIVE PRINCIPLES AND INDICATIONS

In nasal reconstruction, three main components have to guide the rebuilding strategy:

- External lining;
- Structural support;
- Internal lining.

Clearly the relationship between these three layers is interdependent. Specifically, the structures that provide the support need the protection and nourishment guaranteed by the other two lining layers. Otherwise, there is a risk of graft infection and necrosis, with consequent extrusion of the avascular tissue. In this context, the septal reconstructive surgery is involved in providing structural support.

The septum anatomically comprises a bony portion, formed by the perpendicular lamina of the ethmoid, and a cartilaginous portion, which includes the quadrilateral lamina (Figure 1). The postero-caudal portion of this lamina does not substantially contribute to structural support, and it can be removed and used in partial septal reconstruction. The quadrangular cartilage is inserted on the vomer in an appropriate allocation. Therefore, speaking of anatomical reconstruction of the septum in a strict sense is improper. In fact, what needs to be reconstructed is the so-called L-strut, a fundamental element to provide adequate structural support to the nose.

The L-strut consists of two main parts:

- A cephalic component, which forms the nasal dorsum, and which articulates with the frontal bone. It is made of an osteo-cartilaginous nature, determined by the nasal bones and the quadrilateral lamina.
- A shorter caudal component that provides support to the tip. It articulates with the anterior nasal spine and contributes to the columella. It is formed by the caudal portion of the quadrilateral cartilage. At the same time, it provides support to alar cartilages, thus forming together a tripodal configuration.

Leaving a large septal defect could lead to functional and aesthetic sequelae. Impaired breathing, nosebleeds, infections, and even whistling when breathing are just some of the functional consequences. Quadrangular cartilage reconstruction can be performed by placing cartilage and bone remnants between two layers of internal lining. It is important that these fragments are covered by two layers of internal lining, because they provide nutritional support.

Clearly, nasal structural support is not only provided by the L-strut, but also by the nasal bones and the upper and lower lateral cartilages. These structures can also be demolished for oncological reasons and therefore must be rebuilt. It is important to underline that these structural components have both an aesthetic and functional role (for example in the constitution of the

internal nasal valve or the Misk valve): so, they are crucial in rhinopoiesis. Since the nasal bones and the upper/lower lateral cartilages are not part of the septum, the surgical techniques necessary for their reconstruction will not be addressed in this chapter. Anyway, some of them, such as the spreader grafts, can both contribute to functionality and to increase the stability of the dorsal septum. Menick FJ. Nasal Reconstruction : Art and Practice.; 2009.

There is still no consensus on the gold standard in L-strut reconstruction. However, we believe that the first step is to simply classify the possible septal defects. Afterward, we can then talk about the restoration techniques based on the demolition performed, starting from this classification. In this sense, for reconstructive purposes, the possible L-strut deficits can be classified as follows:

- Partial demolition of the L-strut, with consequent deficit of its caudal component.
- Partial demolition of the L-strut, with consequent deficit of its cephalic component.
- Total demolition of the L-strut.

Partial defects are more common and generally result from the removal of malignant skin lesions. Demolition of the caudal component of the L-strut is generally due to malignant lesions originating from the columellar skin or the nasolabial filter region. Extensive carcinomas of the upper lip on both the skin and mucous or minor salivary glands can also affect the columella and the caudal component of the L-strut. The reconstruction of this portion is also called "columellar strut". The demolition of the cephalic component of the L-strut, on the other hand, is usually determined by the removal of carcinomas of the skin of the nasal dorsum or forehead. The reconstruction of this portion is also called "dorsal strut". In both cases, the L-strut can be directly infiltrated, or it can be demolished due to surgical radicality reasons.

A total demolition of the L-strut, on the other hand, can occur both in the case of malignant tumors originating from the internal nasal and paranasal structures, and from very infiltrating and extensive skin oncological malignancies. It is generally accompanied by simultaneous total nasal amputation, as extensive excision and disease-free resection margins will be required to obtain oncological radicality. Another aspect to consider in this situation is that an adjuvant radiotherapy treatment is usually required unless the general clinical conditions discourage it. This therapeutic procedure should ideally be undertaken within a maximum of 2 months following the demolition surgery. An immediate nasal reconstruction can provide important psychological relief to the patient, also in anticipation of a subsequent emotionally demanding radiotherapy.

Furthermore, radiotherapy determines well known chronic toxic effects on local tissues, thus damaging their vascularization and trophism. When placing tissutal grafts and/or flaps, complex spontaneous tissue remodeling processes start early and last several weeks. The oncological need to undertake radiotherapy within 2 months of surgical treatment can compromise the remodeling process of the graft itself and cause its late failure. Therefore, a thorough assessment must be made, and the possibility of delayed reconstructive surgery must be taken in consideration. An immediate post-resective reconstruction also allows the use of fresh and non-radio treated tissues. Radiotherapy could compromise the quality of the rebuilding structures and aesthetically affect the success of the reconstruction. Conversely, undertaking reconstruction after radiotherapy is more difficult as the quality of local tissues is diminished due to impaired trophism and vascularization. Huizing EH, Groot JAM de. Functional Reconstructive Nasal Surgery.; 2015. https://www.wolterskluwer.com/en/solutions/ovid/functional-reconstructive-nasal-surgery-13680. Accessed March 11, 2022. The transfer of tissues with increased vascularity (vascular microsurgery) can overcome this important problem. Furthermore, in the field of head and neck cancers, disease relapse mainly occurs in the first two years following the resective procedure. A delayed rhinopoiesis therefore allows both to wait for the definitive outcome of the histological examination, and to guarantee an easier clinical and radiological follow-up in the first key-period. In the meantime, the loss of the nasal pyramid can be compensated using prosthetic manufacts, which are increasingly realistic and guarantee a satisfying aesthetic result. The negative aspect of using these prostheses is the need for constant maintenance, combined with wear and imperfect functional performance compared to the reconstruction with autologous tissues. Moreover, the economic aspect linked to the purchase of a patient-specific prosthesis should not be overlooked.
Finally, it should be considered that a total rhinopoiesis very frequently is a two-step procedure, although it can be performed in a single step. It is preferred to divide the rhinopoiesis into two steps because the aesthetic-functional results are better, thanks to the remodeling that can be performed after having ascertained an appropriate engraftment of autologous tissues.
It should be remembered that in the past it was preferred to place the bone and cartilage grafts only at a later surgical stage, while the external and internal linings were primarily reconstructed. However, the literature showed that the results were aesthetically worse. The graft placement procedures were way more complex, due to the fibrosis created following the first surgical steps. Burget's studies, on the other hand, have shown that a bone or cartilage graft has a good chance of engraftment if adequately protected and vascularized. Further grafts can be placed later, for

final aesthetic-functional purposes (onlay grafts, spreader grafts, etc.). Burget GC, Menick FJ. Aesthetic Reconstruction of the Nose. 2nd ed. (Book MY, ed.).; 1994

The principles listed above must therefore guide the surgeon and the patient in the decision of the reconstructive process.

TECHNIQUES

The reconstruction of septal structures, of the L-strut, is a focal point of rhinopoiesis. The material to be used must have well-defined characteristics, to obtain an optimal result:

- It must maintain some adaptability during modeling process.
- It must provide rigid structural support, even considering it will be subject to gravity, postoperative edema and fibrosis.
- It can be fixed to one or two anchor points (by means of sutures or titanium mini plates)

Since graft stability is required, suitable structures must be found to secure the graft. At the cephalic portion of the L-strut, attachment occurs to nasal or frontal bones. Usually a titanium mini plate is used. At the caudal level of the L-strut, on the other hand, a housing is created in correspondence with the anterior nasal spine. At this level, fixation can be performed using a titanium miniplate or X-figure sutures. In the last scenario, it is better to use non-resorbable sutures, as they are more stable. The new positioned L-strut is also called "cantilever graft". A cantilever graft provides dorsal support where it is absent. This kind of graft is different from an onlay graft, which is placed in aid of a solid support already present. Finally, in case of entire septal reconstruction, it is also necessary to prepare the vomer, creating a groove that can accommodate the neo-septum.

Lastly, we want to remember the importance also of external and internal linings. The reconstruction of the external lining is very much based on the subunit concept (back, tip, alar lobules, soft triangle), having a predominantly aesthetic purpose. Instead, an internal lining as much vascularized and extended is essential to prevent exposure of the graft used to reconstruct the L-strut. In fact, this material is particularly delicate, especially from an infectious point of view. Adequate internal lining provides physical protection as well as nutritional support, which

drastically reduce the risk of post-surgery complications and therefore of graft loss. There are several possibilities to re-establish these two layers. Surely the paramedian forehead flap, possibly pre-laminated, provides the best option both in terms of skin texture matching and tissutal material for reconstructive purposes. This flap requires two surgical procedures, since after about 3-4 weeks from insetting, a second surgical step is required to section the pedicle and to remodel the flap. Another certainly valid option is the use of a free forearm flap, even pre-laminated. In addition to the greater difficulty and invasiveness of the intervention, however, the aesthetic result is worse. The skin of the forehead, in fact, undoubtedly offers a better result. The great advantage of a forearm flap is represented by the possibility of harvesting both soft and hard tissues, thus managing to have enough material for the reconstruction of all three layers. Haack S, Fischer H, Gubisch W. Lining in nasal reconstruction. Facial Plast Surg. 2014;30(3):287-299.

Surely the operator's experience plays a fundamental role in the choice of the techniques to be used. Clearly, the extent of the defect and the availability (or not) of the chosen graft will also influence the reconstructive planning. We will list below the most used techniques for L-strut reconstruction, explaining the advantages and disadvantages of each. What we recommend is to keep in mind the principles already listed, and then develop your own surgical strategy. Thornton JF, Griffin JR, Constantine FC. Nasal reconstruction: an overview and nuances. Semin Plast Surg. 2008;22(4):257-268.

Septal cartilage and bone

As we have seen, the septum is composed of a bony (perpendicular plate of the ethmoid) and a cartilaginous component (quadrangular cartilage). From a structural point of view, the septum differently affects the support. In fact, the posterior-caudal part of the quadrangular cartilage does not contribute significantly to the formation of the L-strut, so it can be harvested for reconstructive purposes. This cartilage is optimal as a columellar strut.

A second option is the use of the septal bone. In fact, a part of the perpendicular ethmoidal lamina or even of the vomer can be harvested. These are then positioned caudally, according to what is called the "exchange technique". Removal of septal cartilage or bone can also be done endoscopically.

Whenever possible, a septal composite pivotal flap is a valid option. It was described by Burget and Menick and it has the advantage that it can rotated while maintaining the bilateral supply provided by the septal branches of the superior labial arteries (Figure 2). Moreover, it can be combined with another type of graft to improve the reconstruction (Figure 3). The key-point is to leave the lower peduncles in place when performing the flap rotation. The residual defect can be replaced by a graft consisting of cartilage and / or bone residues (Figure 4). It is important to close the donor site with passing sutures, thus eliminating dead spaces and preventing the formation of a hematoma. A different septal composite pivotal flap can be based on the ethmoidal arteries. Burget GC, Menick FJ. Aesthetic Reconstruction of the Nose. 2nd ed. (Book MY, ed.).; 1994.

Duron J-B, Revol M. Nasal reconstruction. In: Plastic and Reconstructive Surgery. Chichester, UK: John Wiley & Sons, Ltd; 2015:390-406.

Rib cartilage and bone

Rib cartilage (Figure 5) is considered the best graft in case of large defects. In particular, the 9th and 10th ribs are considered the best ones, because they have less curvature and because it is possible to sculpt an excellent combined graft at the osteo-cartilaginous junction. Clearly, the bony component will be anchored to the frontal bones, while the cartilage component will be anchored to the anterior nasal spine (Figure 6). This graft is particularly useful to rebuild the cephalic portion of the L-strut (Figure 7,8,9). The graft, in fact, is sculpted across the osteo-cartilaginous junction, for a total length of about 4 cm, equally divided between the bony and the cartilaginous components. The former is then attached to the frontal bones, while the latter supports the tip and is attached to a columellar strut. Its dual nature guarantees greater rigidity, therefore reducing the possibility of deformation.

Another advantage of using the rib cartilage is related to the high amount of tissue provided. In fact, up to 10 cm of the rib can be removed (compared to a minimum surgical incision, of about 4-5 cm). This allows both to reconstruct the L-strut and to obtain cartilaginous grafts useful for providing further structural support.

When using the rib as a reconstructive graft, precise steps must be performed. First, the bony component must be modeled and then fixed to the nasal or frontal bones. Subsequently, once the bony component is fixed, the cartilage component of the dorsal graft is modeled. Finally, the

columellar strut is modeled and positioned, anchoring it to the dorsal graft (creating an adequate anterior septal angle) and to the anterior nasal spine with non-resorbable sutures.

The 6th rib can also be used, especially when only the columellar strut has to be reconstructed, thus having the possibility using an exclusively cartilaginous graft. Baker SR. Principles of Nasal Reconstruction. New York, NY: Springer New York; 2011.

Cranial bone

In case of concomitant coronal or hemicoronal surgical access, a cranial bone harvest may be a good choice to avoid further surgical accesses. It can be sculpted with a piezoelectric osteotome, and the removal is then finished with a chisel. Only the external cortex is needed, i.e., the lateral component of the calvarial diploe. The parietal bone is usually preferred because it is thicker (Figure 10).

Preoperative measurement of the residual defect is essential to correctly calibrate the osteotomy. Although the columellar strut is preferably reconstructed with cartilage tissue, it can also be reconstructed using cranial bone. In this case, an L-shaped design can be made directly at the level of the parietal bone (Video).

Since the diploe is very vascularized, it is preferable to place the patient in reverse Trendelenburg position to reduce bleeding during the harvesting procedure. After bone removal, the donor site can be left as it is or hydroxyapatite-based cement can be used to close the defect. Baker SR. Principles of Nasal Reconstruction. New York, NY: Springer New York; 2011.

Auricular cartilage

After septal cartilage, auricular cartilage is the second choice to assemble a columellar strut. Auricular cartilage graft essentially consists of concha cartilage (both concha cymba and concha cavum). The concha can be taken in its entirety, even bilaterally, and then cut and adequately shaped. Posterior access would be preferable, due to better esthetic outcomes at the donor site. Unlike quadrangular cartilage, however, conchal cartilage has a natural curvature and therefore

requires to be modeled. Usually, a longitudinal incision is performed, and the cartilage is folded in two and held straight with horizontal mattress sutures (Figure 11). Still using this plication technique, the auricular cartilage can be used as a dorsal onlay graft. In addition to not being straight, another disadvantage of auricular cartilage is represented by its relative weakness.

Also, when harvesting auricular cartilage, it is important to perform mattress sutures in the donor site, in order to reduce dead spaces and therefore limiting the possibility of post-operative hematomas. Baker SR. Principles of Nasal Reconstruction. New York, NY: Springer New York; 2011.

Osteo-myo-cutaneous radial forearm free flap

The free radial forearm flap is an all-encompassing option because it can be designed as an osteo-myo-cutaneous flap. This way it can ensure enough tissue for external and internal linings, as well as a bone graft needed for the L-strut reconstruction. Nonetheless, the risks of flap failure are much higher than loco-regional flaps' ones. Moreover, the skin match is way better in paramedian forehead flap. Baker SR. Principles of Nasal Reconstruction. New York, NY: Springer New York; 2011.

Others

Among the other options available, inorganic materials should be mentioned first. Among these for example we find the polydioxanone sulfate (PDS). It can be modeled as a lamina and used to reconstruct not only the L-strut, but the whole septum. The neo-septum thus created has the advantage of still having postero-caudal stability and therefore a lower possibility of a keystone dorsal area collapse.

On the other hand, materials such as Silastic, Gore-tex or Teflon are often extruded, and they do not integrate properly. The main problem related to inorganic materials is that they are much more prone to infections because they still are foreign bodies, although being biocompatible. A surgical approach is the only solution in these cases, with total removal of the infected material and a surgical toilet of the site.

The use of a total nasal prosthesis should not be underestimated. Especially at the beginning, it represents a valid alternative to the reconstruction of the nose with autologous tissues.

Finally, engineered tissues are of undoubted interest. In the future, in fact, it will be possible to recreate bony and cartilaginous materials (but also soft tissues) in the laboratory using bioengineering techniques, obtaining an optimal material for reconstruction. Particularly intriguing is the combination of these techniques with CAD-CAM (Computed-Aided Design Computer-Aided Manufacturing) technologies, in order to obtain an accurate result, tailored to the needs and aesthetic standards of the individual patient. Baker SR. Principles of Nasal Reconstruction. New York, NY: Springer New York; 2011.
Ethunandan M, Downie I, Flood T. Implant-retained nasal prosthesis for reconstruction of large rhinectomy defects: the Salisbury experience. Int J Oral Maxillofac Surg. 2010;39(4):343-349.

COMPLICATIONS

It is important to distinguish between short-term complications and long-term complications. Furthermore, the complications at the level of the reconstructive site and that of the donor site must be differentiated. Obviously, complications related to the reconstruction of the structural support will be taken into consideration. However, it should be considered that necrosis of the tissues and / or flaps used for the reconstruction of the internal and external linings can lead to a consequent loss of osteo-cartilaginous grafts. Therefore, proper management of these tissues must be kept in mind.

Infection is the main short-term complication to avoid because it might cause the extrusion of the graft used. Infection can develop both due to an incorrect choice of the graft (materials such as Silastic or Teflon do not integrate well) and to an inadequate internal lining (which does not provide sufficient vascular supply to the graft itself). In these cases, it will be necessary to replace the graft, along with a surgical toilet of the affected area. Broad-spectrum antibiotic coverage must also be guaranteed, followed by a target-therapy for the specific pathogen involved (often P. aeruginosa).

Epistaxis will also be among the most frequent short-term nasal complications. Any bleeding must be treated with medically, monitoring and adjusting the blood pressure and sedating any post-

operative agitation. If cauterization is necessary, it must be performed with great caution, in order not to compromise the internal and external linings.

In the long run, ineffective structural support can lead to what is called "saddle nose deformity" or "inverted V deformity". Surgical correction is mandatory. In some cases, it can be corrected by using onlay grafts. If insufficient, it will be necessary to completely rebuild the L-strut. However, it is important to consider the state of the internal and externa linings. Possible unaesthetic sequelae are short nose, hyper-rotation of the tip, and columellar retraction. They are mainly due to an impaired healing process. During the reoperation it is also possible to address deficit or alterations in these layers, as well as correcting the structural support.

Another long-term complication is nasal airway obstruction. It can be caused both by tissue hypertrophy and by abnormal scarring, resulting in the formation of a synechia. In both cases, the management is of surgical relevance, with tissue thinning and / or scar tissue debridement.

Finally, as we are speaking of reconstruction following oncological resection, disease recurrence can be considered among long-term complications in the nasal region. In this unfortunate case, a new demolitive operation will have to be planned, along with a new reconstructive strategy.

In addition to complications in the nasal region, complications related to the graft site must also be considered.

The development of crusts and a temporary nasal obstruction are common and temporary complications following the harvest of septal cartilage. Another possible sequela is that of a septal hematoma, which must be prevented by closing the dead spaces (as we have already seen). There is also a risk of postoperative hematoma in the auricular region, which is why the surgical access must be closed with mattress sutures. If a hematoma develops, however, drainage must be performed immediately, together with adequate antibiotic therapy. In fact, an hematoma deeply predisposes to infections (typically caused by P. aeruginosa).

When harvesting rib cartilage, care should be taken not to cause a pneumothorax. The risk of pneumothorax is lower if the 9th or 10th ribs are selected. Particular attention should also be paid to postoperative analgesia, as there might be a lot of pain at the donor site.

A rare complication of cranial bone removal is exposure of the dura mater, while the loss of cerebrospinal fluid can be more problematic and neurosurgical management is advised. Huizing EH, Groot JAM de. Functional Reconstructive Nasal Surgery.; 2015. https://www.wolterskluwer.com/en/solutions/ovid/functional-reconstructive-nasal-surgery-13680. Accessed March 11, 2022.

CONCLUSIONS

Different materials and techniques can be used to reconstruct the septum following oncologic demolition. Nonetheless, the key-point to focus on is the central role of the L-strut, which provides a fundamental structural support. The internal and external linings are important as well because they provide protection and nourishment to the neo-septum. Many grafts are available, each one with advantages and disadvantages, while no gold standard has yet been established.

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