Reconstruction of the Nasal Valve

Davide J. Bottini, MD, PhD, Pietro Gentile, MD, Alessia Arpino, MD, Giuseppe Dasero, MD, Valerio Cervelli, MD

Rome, Italy

The authors present their experience with reconstructive nasal valve surgery, evaluating the effects related to the use of a composite graft, which is a graft made of skin and cartilage, or mucosa and cartilage, and to the transposition of mucocartilaginous flaps. A sample of 15 patients (12 women and three men) selected among 452 cases treated with functional and aesthetic rhinoplasty at the Department of Plastic and Reconstructive Surgery of the ''Tor Vergata'' University of Rome was analyzed. Patients were between 25 and 50 years of age, with a mean age of 40 years, and were treated with secondary rhinoplasty for valvular stenosis. Of these patients, 12 had functional problems of the internal and external nasal valve, and three had internal valve stenosis. In our sample of 15 patients, respiratory symptoms improved at short- and long-term follow up. In all cases, a good aesthetic result was obtained. The patients were not satisfied with the aesthetic result in only three cases as a result of enlargement or asymmetry of the external valvular area. In 11 cases, an ''open tip'' rhinoplasty was performed with a retroauricular skin–cartilage composite graft to correct internal–external valvular stenosis. In all the cases of internal valvular stenosis (three patients) and in one case of internal–external valvular stenosis, a transposition of mucocartilaginous flaps with a section of the mucosa of the upper lateral cartilage was performed.

Key Words: Reconstruction, nasal valve, composite graft

The nasal valve, which is essential for respiratory functions, is the part of the nasal airways where the caudal part of the upper lateral cartilage reaches the septum to form a 10° to 15° angle.[1] Anatomically, it is divided into an external nasal valve, which is made up of the lateral crus of the alar cartilages, the skin, the subcutaneous layer, and the columella; and an internal nasal valve. The latter is located in the passage between the alar cartilages and the upper lateral cartilages.[2] The functionality of the nasal valve, especially the internal one, is largely influenced by the nasal skeleton, which is important for the maintenance of the patency of the airways.[3]

Nasal valve collapse is the result of various causes. One of the most important is the failure of the lateral structures of the nose during rhinoplasty. Other causes include trauma and congenital flaccidity of the upper lateral cartilage. The malfunctioning of the valve is responsible for nasal obstruction and respiratory difficulties, generating problems of both static and dynamic nature.[4]

The authors present their experience with reconstructive surgery of the nasal valve, evaluating the effects related to the use of a composite graft, which is a graft made up of skin and cartilage, or mucosa and cartilage, and to the transposition of mucocartilaginous flaps.

Patients and Methods

A sample of 15 patients (12 women and three men), selected among 452 cases treated with functional and aesthetic rhinoplasty at the Department of Plastic and Reconstructive Surgery of the ''Tor Vergata'' University of Rome, was analyzed. Patients were between 25 and 50 years of age, with a mean age of 40 years, and were treated with secondary rhinoplasty for valvular stenosis.

Of these patients, 12 had functional problems in the internal and external nasal valve, and three had internal valve stenosis. Of the first group of patients, 11 were treated with the use of a composite graft, and one with section and opening of the upper lateral cartilages with transposition and repositioning of mucocartilaginous flaps. The latter technique was used to correct internal valvular stenosis in the second group of patients.

The preoperative study was carried out through a complete clinical examination of the nasal pyramid and of the nasal cavities through anterior rhinoscopy, a photographic examination in three projections

From the Department of Plastic and Reconstructive Surgery, University of Tor Vergata, Rome, Italy.

Address correspondence and reprint requests to Valerio Cervelli, MD, Via l'Aquila n 7, Roma, Italy; E-mail: valeriocervelli@virgilio.it

(frontal, lateral, three fourths, and axial) and through x-rays of the facial skeleton. In addition, in the more complex cases, a high-resolution computed tomography scan with three-dimensional imaging for a better view of the anatomic structures has been performed.

Postoperative follow up took place after 2 and 5 weeks and 3, 6, and 12 months, and then annually, for a minimum of 1 year and a maximum of 7.

Clinical Report

A 33-year-old woman came to our attention with a marked nasal valve stenosis, which was more evident at the level of the right valve (Fig 1), 1 year after a cosmetic rhinoplasty operation performed by another surgeon. The patient reported almost total nasal airway obstruction, especially during inspiration. Clinical examination showed, besides the external valvular stenosis, raising of the nasal tip, a deficit in the projection of the supratip, deviation of the columella, and hypertrophy of the nasal tip. At anterior rhinoscopy, a residual deviation of the nasal septum and valvular stenosis of both nasal fossae became evident. The patient underwent a surgical operation with the use of a ''skin–cartilage composite graft.'' The graft obtained from the left ear was positioned straddling the cartilaginous dorsum, suturing the skin on the mucosal side with reabsorbable stitches, and fixing the cartilaginous portion to the cartilage of the nasal dorsum with nonabsorbable sutures. The retroauricular area was chosen as the donor site.

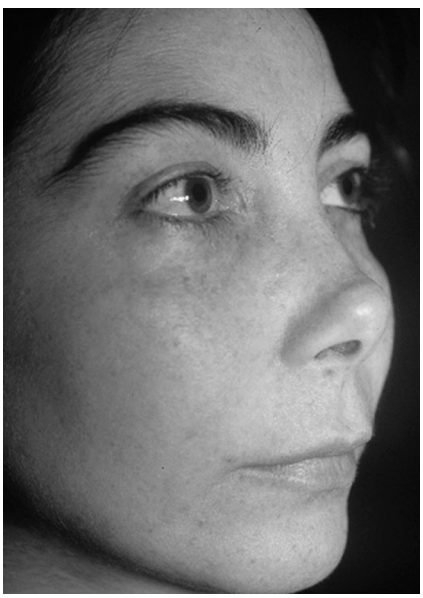

Fig 1 Preoperative image in a three-fourths view from the right. Marked stenosis of the external valve.

Fig 2 Postoperative image in a three-fourths view from the right. Improvement of the lateral projection.

The postoperative course occurred without any problems, and both aesthetic and functional results were satisfactory to the patient. The postoperative follow up confirmed excellent aesthetic results (Fig 2) and good correction of respiratory functionality.

Results

In our sample of 15 patients, respiratory symptoms improved at short- and long-term follow up. In all patients, a good aesthetic result was obtained characterized by a visible improvement of the vertical deficit of the supratip with correction of the tip projection and harmonization of the lateral and frontal projections of the nose. The patients were not satisfied with the aesthetic result in only three cases as a result of enlargement or asymmetry of the external valvular area.

Discussion

The aim of nasal valve reconstruction is the anatomic and functional correction of the superior airways. The main surgical techniques include the use of ''composite grafts''(Figs 3 and 4) made up of skin and cartilage, or mucosa and cartilage, and ''spreader grafts.''[5] The latter, described by Sheen,[6] are a type of graft that are placed between the septum and the lateral cartilages.

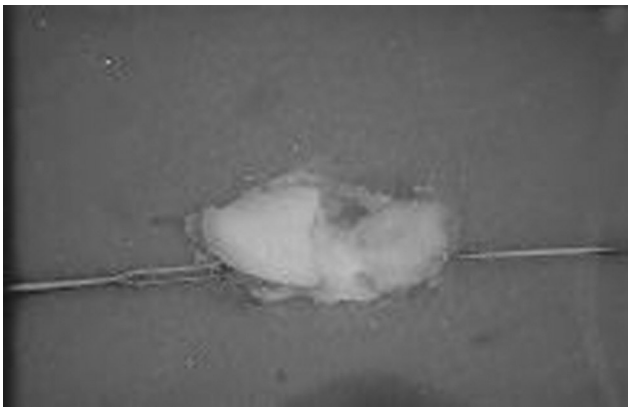

Fig 3 Original composite graft.

They allow the separation of the mobilized upper lateral cartilages and the most caudal part of the frontal apophysis from the nasal septum. Spreader grafts are made up of a small bar of cartilage (generally from the septum) attached to the sides of the dorsal margin of the quadrangular cartilage. A spreader graft exhibits the following relationships: medially, it is in contact with the cartilaginous tissue of the septum, and laterally, it rests on the septal perichondrium. It is mandatory that it is contained in the integral extramucosal space. Therefore, correcting the collapse of the lateral walls while keeping them apart permits the widening of the internal nasal valve, thus correcting the patency of the nasal airway spaces. Better results were obtained in this study by the use of composite grafts.

These grafts provide a functional support to the lower part of the lateral cartilages which, in most cases, collapse because of excessive resection during previous surgical operations (the cartilages collapse during inspiration)[7] giving support to the external nasal valve. They are implanted through what is known as ''open tip'' access, which permits a wide exposure of the dorsum, a broad view of the osteocartilaginous structures to be reshaped, and also allows the nonabsorbable sutures that are not exposed on the surface (to avoid them being touched from the outside) to perfectly stabilize the graft.

All this is possible only with this type of access; otherwise, we would risk distorting the grafts with poor results in the postoperative period and in the long term. It is important that the grafts are well attached so to minimize their movement given that their reabsorption is caused by mobility. From a biologic point of view, the graft nourishes itself through imbibition thanks to the establishment of new microvascular bridges between itself and the receiving bed. Therefore, if the graft is not stable, the irroration will not be perfect over time and dehydration and reabsorption could occur. Unlike cutaneous transplants, composite transplants have a receiving bed only along the perimeter, where the margins are in direct contact with the defect, and therefore, the revascularization and take of the transplant pose serious limitations to the size of the transplant used for reconstruction.

In most cases, a composite graft that is more than 5 mm from the vascular bed is at risk of necrosis. Nevertheless, surprising success has been achieved, which can be explained by the fact that highly vascularized tissues, like the nose and the ear (the most frequent donor sites), contain a proportionally denser network of endothelial channels than other tissues.[8]

This characteristic facilitates the imbibition of fluids from the receiving tissues, which maintain the hydration of the graft, until the vascular connections and the vascular growth toward the interior of the transplanted tissue establish the final revascularization of the graft. Like in the case of skin grafts, stereomicroscopic observations on humans show how after a period of 48 hours, vascular flow in composite grafts can be observed. The flow gradually expands inside the graft in the following days. The conclusion that seems to emerge from what we have said is that the larger the surface of contact between the composite graft and the receiving bed, the more rapid the revascularization of the graft will be. In this study, however, even better results were obtained with a graft that we define as ''precise,'' that is, not too small that could impede its insertion nor too big that could cause early mobility and reabsorption or retraction of the graft itself. If one plans not to use the open tip access, then the receiving bed must be extremely precise and

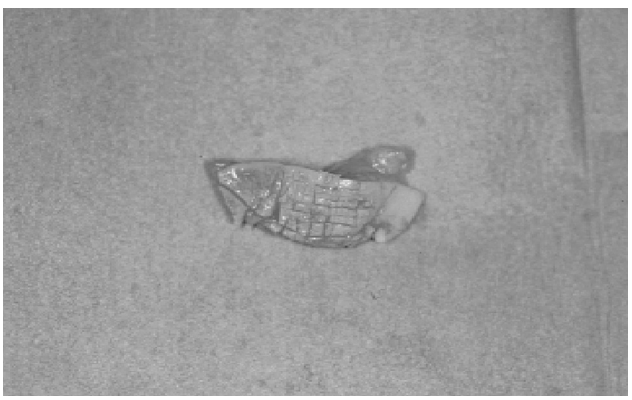

Fig 4 Composite graft after treatment.

perfectly shaped on the graft to avoid movement given that stabilizing sutures cannot be placed. In this case, one should make an intranasal incision, which must be smaller than the graft and which must thus enter with force and stay put (otherwise, the graft will come out of the incision in the postoperative phase). As we previously mentioned, the most frequent donor sites are the nasal septum and the retroauricular area. The first is ideal for its consistency, for its abundance, and because a fragment can be removed without affecting its mechanical stability. It is not used only when it is not available. In this case, the tissue is obtained from the retroauricular area, which represents the second choice, because since it is curved, it must be straightened and is therefore not easy to shape. Skin and cartilage grafts obtained from this area[9] are also used because retroauricular skin positioned inside the nasal structure undergoes metaplasia and becomes mucosa. Moreover, the skin does not need contact with the osseous structure, and this increases the probability of success of the take.

As for the technique of transposition of mucocartilaginous flaps, better results can be achieved for internal valvular stenosis, whereas results are not as satisfactory for internal–external valvular stenosis.[10] In fact, in our experience, because this method has been applied in only one case of internal–external stenosis (still in the follow-up phase), it should not be considered statistically significant; the method is therefore still in a phase of study while we expect to experiment with it in more cases.

CONCLUSION

In 11 cases, an ''open tip'' rhinoplasty was performed with a retroauricular skin cartilage composite graft to correct internal–external valvular stenosis. The graft was placed in the supratip area with the skin turned toward the mucosal side and the cartilage toward the nasal dorsum. In all the cases of internal valvular stenosis (three patients) and in one case of internal–external valvular stenosis, a transposition of mucocartilaginous flaps with section of the mucosa of the upper lateral cartilage was performed.

REFERENCES

1. Bruintjes TD, van Olphen AF, Hillen B, et al. A functional anatomic study of the relationship of the nasal cartilages and muscles to the nasal valve area. Laryngoscope 1998;108: 1025–1032
2. Cardenas-Camarena L, Guerrero MT. Use of cartilaginous autografts in nasal surgery: 8 years of experience. Plast Reconstr Surg 1999;103:1003–1014
3. Marquis CJ. Chirurgia Plastica Ricostruttiva, principi e tecniche nella correzione, ricostruzione e trapianti, vol 2. 1991; Department of Plastic Surgery, Instituti Ospedalieri Verona, Italy.
4. Furlan S. Trattato di Tecnica Chirurgica, XII/2. 2003; Department of Plastic Surgery, Instituti Ospedalieri Verona, Italy.
5. Gunter JP, Rohrich RJ. Correction of the pinched nasal tip with alar spreader graft. Plast Reconstr Surg 1992;90:821
6. Ulloa-Gregori AO, Montemayor-Jaurequi MC, Villareal-Cardenas JA, et al. Use of the nasal Smas to reconstruct defects of the tip, alae, columella, or septum. Plast Reconstr Surg 1999;104:631
7. Kasperbauer JL, Kern EB. Nasal valve physiology: implications in nasal surgery. Otolaryngol Clin North Am 1987;20: 699–719
8. Rees TD, La Trenta G. Chirurgia Plastica Estetica, vol 1. 2001; Department of Plastic Surgery, Instituti Ospedalieri Verona, Italy.
9. Straatsma BR, Straatsma CR. The anatomic relationship of the lateral nasal cartilage to the nasal bone and cartilaginous nasal septum. Plast Reconstr Surg 1955;8:443–455
10. Akcam T, Friedman O, Cook TA. The effect on snoring of structural nasal valve dilatation with a butterfly graft. Arch Otolaryngol Head Neck Surg 2004;130:1313–1318