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Aesthetic Plastic Surgery

Retrospective Analysis

Autologous Cartilage Graft Rhinoplasties

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Abstract
Background: The authors report their experience with autologous graft rhinoplasties.
Methods: Data were collected retrospectively, with selection of only autologous grafts from 2,000 rhinoplasties performed at the Plastic and Reconstructive Department of the University of Rome Tor Vergata.
Results: A total of 62 patients from January 1995 to January 2005 were selected. Most of the patients were treated with the "open tip" technique, whereas 9.7% had a classic endonasal approach. Follow-up evaluation was performed with outpatient visits at 2 and 6 weeks, then at 3, 6, and 12 months. Good aesthetic results were obtained for 93.5% of the patients, and 83.7% had complete satisfaction.
Conclusion: Autologuos cartilage graft rhinoplasty is an affordable technique easy to learn that widens possibilities of interventions for nasal pyramid reconstruction.

Key words: Autologous cartilage graft—Nasal pyramid reconstruction

Nasal pyramid reconstruction, performed for both aesthetic purposes and correction of posttraumatic distortion, always has involved a debate about what materials should be used, but without clear guidelines or indications.

In the beginning, a vast variety of grafts were used for augmentation rhinoplasties, and autologous cartilage (septum, pinna, and rib) seemed to be the preferred choice because of its low resorption and complication rates [1,17]. In recent decades, some authors have preferred synthetic materials over autologous grafts because of their immediate availability, lack of donor-site morbidity, better adaptability, good immediate results, and low costs. A long list of these materials exist. Among these materials, polyamide mesh (Supramid Mesh) first and expanded polytetrafluorethylene (Gore-Tex) later were considered "new miracles of modern chemistry" [2,3,5,9,10,12]. Despite their recognized advantages, synthetic materials raise important concerns about infections, extrusions, displacements, and long-term results [14].

In this report, we present 62 patients selected from all the rhinoplasties performed at the Plastic and Reconstructive Department of the University of Tor Vergata in Rome. The aim is to analyze our 10 years of experience with autologous cartilage graft rhinoplasties.

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Materials and Methods

We followed the CONSORT criteria for the development and description of this study [11]. All autologous grafts were selected from the total pool of rhinoplasties performed at the Plastic and Reconstructive Surgery Department of the University of Rome Tor Vergata in Rome. The exclusion criteria specified all other rhinoplasties.

We subsequently classified the study patients into four groups according to graft origin: group 1 had auricular cartilage grafts; group 2 had septal cartilage grafts; group 3 had costal cartilage grafts; and group 4 had composite grafts (septal and auricular).

Preoperative investigations began with a careful history of the patients seeking nasal surgery and an

Table 1. Patient distribution according to cartilage graft

Group	No. of treated patients	%Total patients
1 (auricular cartilage graft)	36	58
2 (septal cartilage graft)	10	16
3 (costal cartilage graft)	6	10
4 (composite graft)	10	16

Table 2. Patient satisfaction rates

VAS score	Group 1 n (%)	Group 2 n (%)	Group 3 n (%)	Group 4 n (%)	Total n (%)
8–10 (maximum satisfaction)	30 (83.3)	7 (70)	1 (6.25)	2 (20)	40 (65)
4–7 (medium satisfaction)	6 (16.6)	3 (30)	4 (66.6)	7 (70)	20 (32)
0–3 (low satisfaction)	0	0	1 (6.25)	1 (10)	2 (3)

VAS, visual analog scale.

Table 3. Complications rate and comparison with the literature data

	Group1	Group 2	Group 3	Group 4	Total (%)
Infection	—	—	—	—	0
Bleeding	—	—	—	—	0
Lower lid hematoma	—	—	—	—	0
Graft displacement	—	1	—	—	1.61
Resorption	—	1	—	—	1.61
Skin necrosis/graft exposition	—	—	—	—	0
Nasal obstruction	—	—	1	1	3.22
Surgical review	—	1	1	1	4.83

examination of other coexisting medical problems. A physical examination of the external and internal nose was the next step. During the first visits, we collected photographs of all the patients in frontal, lateral and oblique positions for control of the postoperative aesthetic results. When breathing complaints coexisted, x-ray of facial bones was requested on an outpatient basis. Computed tomography (CT) scans were necessary in cases of sinus pathology or complex malformations, previous surgery, or traumas (i.e., Le Fort fractures).

All 62 patients had undergone surgery by the same surgeon. The techniques used were the open (Rethy method) and closed endonasal [13] procedures. Postoperative follow-up evaluation included outpatient visits at 1, 2, and 6 weeks, then at 3, 6, and 12 months.

We recorded all postoperative infections, bleedings, lower lid hematomas, graft displacements, graft resorptions, skin necrosis and/or graft exposures, postoperative nasal obstructions, and the necessity for additional surgery. Furthermore, we asked patients during outpatient visits or phone calls to quantify their degree of satisfaction on a visual analogic scale (VAS) from 0 (minimal satisfaction) to 10 (maximal satisfaction) 1 year after the operation. We divided their satisfaction rates into three groups: 0–3 (low), 4–7 (medium), and 8–10 (maximal).

Results

We selected 62 patients from a pool of 2,000 rhinoplasties performed from January 1995 to January 2005. These patients comprised 59 women (95.2%) and 3 men (4.8%) ages 18 to 62 years (average, 31 years). The reported complaints included a nonaesthetic nose with only partial obstruction symptoms (40 patients), posttraumatic deformities (flattening or deviation) (18 patients), and deformities attributable to other causes (congenital or previous operations) (4 patients). A total of 48 patients (93.5%) were treated with the open technique, and 4 patients (6.5%) were treated with the closed endonasal technique.

The patients were grouped according to the harvesting site of the cartilage graft, as reported in Table 1. All the patients treated with the closed technique received a septal cartilage. Table 2 shows patient satisfaction rates. Most of the patients in groups 1 (83.3%) and 2 (70%) were highly satisfied (VAS, 8–10) with the procedure and its aesthetic/functional results. In groups 3 and 4, most of patients had only a medium degree of satisfaction. The VAS scores in Table 2 have been tested using the chi-square test combining groups 3 and 4 (combining was necessary to achieve an accurate chi-square test). This confirmed that group 1 was quite different from the last two groups in terms of VAS scores (a highly

Fig. 1. Group 1 patient. Preoperative.

Fig. 2. Group 1 patient. Postoperative.

significant chi-square was obtained; $P < 0.001$). Table 3 displays recorded complications.

A second operation, consisting of an autologous revision rhinoplasty, was required for three patients. Two had residual nasal obstructions, and one experienced graft displacement. There was only one case of partial resorption that did not cause aesthetic problems.

We present three average cases, one for each site of cartilage harvesting (auricular, septal, or costal) randomly selected from the pool of 62 patients. These cases are representative of the clinical activity in our center.

Case Reports

Case 1: Auricular Cartilage

The auricular cartilage case, shown in Figs. 1 and 2, involved a 37-year-old man who experienced an iatrogenic fall of the nasal pyramid. He also complained of a left side obstruction, as shown on CT scan, with evidence of contralateral turbinate hypertrophy. In June 2003, he underwent open tip rhinoplasty with an auricular graft. In July, we observed good aesthetic and functional results.

Case 2: Septal Cartilage

The septal cartilage case, shown in Figs. 3 and 4, involved a 36-year-old woman with a dorsal nasal deformity because of a primary aesthetic rhinoplasty. In January 2003, she underwent surgery using the open tip technique and a septal graft. In February and July, we observed good aesthetic and functional results.

Fig. 3. Group 2 patient. Preoperative.

Case 3: Costal Cartilage

The costal cartilage case, shown in Figs. 5 and 6, involved a 25-year-old professional boxer with multiple traumas, which caused the fall of both the nasal

Fig. 4. Group 2 patient. Postoperative.

septum and the tip and a nasal–labial fold deformity. In March 2001, the patient underwent surgery using the open technique and a costal graft. In May and July 2001, good results were observed. The graft was still in place without resorption.

Discussion

Despite the fact that autologous cartilage grafts were the first materials used in nasal pyramid reconstruction [1,17], in the past decades, surgeons have favored synthetic grafts. The advantages of immediate availability, no morbidity of the donor site, adaptability, good immediate results, lower costs, and no need for intensive surgical training soon made the synthetic graft a favorite surgical choice for nasal pyramid reconstructions [2,3,5,9,10,12]. Despite these known advantages, it is important to remember that synthetic materials are foreign bodies to the receiving host with consistent problems of infection, extrusions, movements, and long-term results [14].

Three factors must be considered in the choice of the graft material to be used: biocompatibility, patient selection, and long-term results. Biocompatibility is an important matter. Surgeons have a long list of available alloplastic materials including ivory, paraffin, gold, silver, and synthetic materials. Synthetic materials, especially Supramid Mesh (S. Jackson, Alexandria-Virginia) and Gore-Tex (Gore and Associates Inc., Flatstaff, Arizona) have been the preferred choice of most surgeons. In 1974, Beekhuis [2] considered polyamide mesh (Supramid Mesh) a

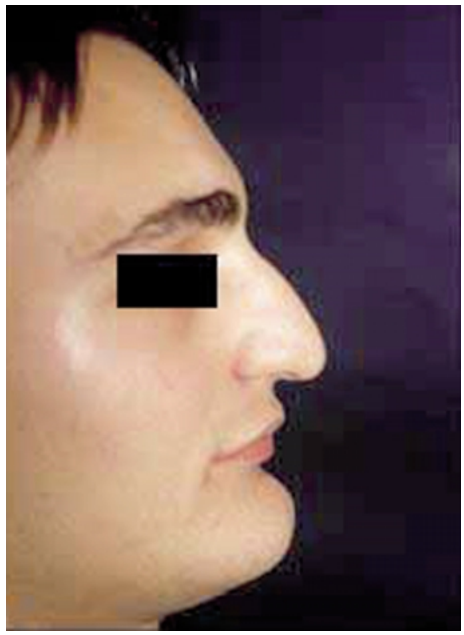

Fig. 5. Group 3 patient. Preoperative.

Fig. 6. Group 3 patient. Postoperative.

"miracle of modern chemistry" for dorsal nose enhancement. Many articles supported this product even when early problems of biocompatibility appeared. After 10 years, almost all surgeons reported the histologic disappearance of polyamide and abandoned it. In fact, it had been replaced by Gore-Tex [10,12].

The second consideration is patient selection. Besides primary rhinoplasties for Asian patients seeking a Western aesthetic nose, surgeons need grafts for

Table 4. Indications for donor cartilage donor related to the area to be reconstructed

	Advantages	Disadvantages
Septum	• Easy harvest • Present in the surgical field (no separate donor-site morbidity) • Straight (good for certain purposes, such as a columellar strut)	• May be deficient • Straight (less desirable as batten graft)
Auricle	• Easy harvest • Relatively abundant • Curved nature ideal for certain purposes	• Separate donor site • Curved (less desirable for some purposes)
Rib	• Large volume (abundant, even for significant augmentation) • Distant donor site (2-team approach possible) • Reliable	• Donor-site morbidity • Warping possible

Table 5. Donor graft choices for nasal reconstructions

Anatomic site to be reconstructed	Auricular cartilage	Type of cartilage used Septal cartilage	Costal cartilage
Dorsum		X	X
Tip	X	X	
Columella	X	X	X

dorsal reconstruction of secondary rhinoplasties. In these cases, the possibility of a poor blood supply in the recipient area is always present. In fact, it is important to remember that grafts are placed in a subdermal, not a subcutaneous, plane, and that the dorsum of the nose has its thickest skin at the bone–cartilage junction with virtually no subcutaneous fat. Furthermore, the transverse muscle ends with the aponeurosis, leaving no muscle coverage for blood supply. Finally, scar tissues from a previous rhinoplasty can be consistent. All these factors reduce the vascular supply to the area and increase the probability of graft failure [7]. For all these reasons, silicon grafts have given good results in primary but not secondary rhinoplasties (42% of failures) [8].

The last consideration is the long-term result over a 10 year period. Schuller et al. [15] reported that irradiated cartilage had early complications in 5.5% of cases, late complications in 2% of cases, and partial resorption in 1.4% of cases during 3 years of follow-up evaluation. Welling et al. [18] reviewed 42 of 107 patients after 10 years of follow-up and demonstrated that despite complete graft resorption, some patients maintained satisfactory facial contours with fibrous tissue replacement of cartilage [18].

According to many authors, autologous cartilage represents an excellent material as a first choice for reconstruction of the dorsum [1,6,16,17]. Its general advantages are elasticity, resistance, easy moldability to its final shape, good vitality even with a poor blood supply, and a minimal resorption rate. Furthermore, every different type of donor cartilage has specific advantages and disadvantages that make this graft a versatile material (Table 4) [4]. Despite this, autologous cartilage grafts have a few peculiar disadvantages such as difficulty harvesting big amounts, poor resistance to infections, and displacement.

All these considerations led us to present this study. We analyzed our 10 years of rhinoplasty experience and found 62 autologous graft patients selected from a pool of 2,000 rhinoplasties performed in a tertiary care center. This study aimed to establish the validity and feasibility of this technique, and to suggest indications for selection of donor cartilage grafts as they relate to the patient's clinical conditions.

Our results clearly show that most of the patients in our experience were treated with an open technique: in primary rhinoplasties because it was easier to perform and more versatile than the endonasal approach for the tip, and in cases of secondary rhinoplasty because we needed the best possible exposure of the operating field. The most frequent site for donor cartilage was the auricle because this site always provides sufficient amounts of graft material even for difficult aesthetic purposes, especially in Asian or African patients seeking an occidental nose. Septal cartilage is the best choice for simple rhinoplasties, but quite often it is not sufficient when large amounts are necessary or when the nose has already undergone surgery. We seldom used costal cartilage because of the risks for pneumothorax requiring the availability of an intensive care unit in the hospital.

Patient assessments of results were quite high for auricular and septal cartilage grafts, and less so for costal and composite grafts. This probably is attributable to our use of costal cartilage for a few difficult selected cases or for cases of secondary rhinoplasties in which aesthetic results could not be as good as those for simpler rhinoplasties, even if performed with a correct technique.

On the basis of our practice, we advise the use of auricular cartilage, alone or in combination (composite grafts), for tip and columella reconstruction, and in cases requiring large amounts of cartilage.

Costal cartilage (9th to 11th ribs) should be used for the dorsum and columella, but only in selected cases in which a considerable amount of cartilage is required and septal or auricular cartilage is insufficient. Septal cartilage grafts can be used for all sites of reconstruction (dorsum, tip, or columella) in simple primary rhinoplasties (Table 5).

We believe, according to our 10 years of experience, that autologous cartilage graft rhinoplasty, an affordable technique that is easy to learn, widens the possibilities for interventions used in reconstruction of the nasal pyramid. This technique is valuable when used not only as a first choice technique, but also to correct the complicated cases of synthetic graft failures. Obviously, learning the technique requires training in a tertiary care center, and even if performed by an experienced surgeon, it is not completely free of complications.

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