

Costal Cartilage Graft in Augmentation Rhinoplasty

Muhammad Saeed

Abstract

Objective: This study was carried out to see merits and demerits of autologous costal cartilage graft in augmentation rhinoplasty. **Study Design:** Prospective. **Setting:** Study was carried out in the department of ENT Allied Hospital Faisalabad from Sep 2007 to Sep 2012. **Material And Methods:** The majority of patients were admitted through ENT outpatient department. The data was collected on the basis of history, physical examination, investigations, photography, management and follow up. Total 60 patients suffering from saddle deformity of nose 40 males (67%) and 20 females (33%) between 16 years to 50 years of age were included in the study. The majority of patients were from 3rd decade of life (80%). The

duration of deformity in majority of patients was within 2 years (70%). Majority of patients belonged to the lower class (80%). In all the patients indication for augmentation rhinoplasty was cosmetic (100%). In all patients autologous costal cartilage graft was used (100%). The etiological factor for saddle deformity in majority of cases was trauma (50%). The donor site temporary morbidity was 12% as compared to other complications. Overall success rate was 100%. Revision surgery was not done in any case (0%). **Conclusion:** The autologous costal cartilage graft has excellent outcome in augmentation rhinoplasty with minimal complications. **Key Words:** Augmentation rhinoplasty, autologous costal cartilage graft

INTRODUCTION

The rhinoplasty is an operation planned to reshape the anatomic features of the nose in to a new more pleasing relationship with one another and the surrounding facial features¹. The rhinoplasty consists of septoplasty, tip remodeling, hump removal, narrowing of nose with osteotomies and final correction of subtle deformities². For rhinoplasty good practical knowledge of the anatomy is necessary.

The results achieved in rhinoplasty are directly related to the surgeon's ability to elucidate how subtle change in the bony and cartilaginous support of the nose will change its appearance³. Thus any rhinoplastic surgeon requires thorough and sophisticated knowledge and understanding of the normal and pathologic anatomy of the nose.

The cartilaginous septum and maxillary bone crest form the main support of the lower two thirds of the nasal dorsum if there is insufficient cartilage to give support either due to absence or fibrosis of the cartilaginous part of the septum nasal saddling to various degrees will result. Nasal saddling is therefore commonly seen after septal haematoma, septal surgery or trauma and if haematoma is infected nasal collapse

is almost inevitable. Immediate grafting is advocated by some but in most instances grafting of the dorsum is deferred until the degree of saddling is evident. Loss of septal support for the nasal dorsum although resulting mainly from trauma may follow many of chronic inflammatory conditions which involve cartilage such as sarcoidosis, tuberculosis and syphilis.

Malignant granuloma may also damage septal cartilage and lead to nasal dorsum collapse some degree of saddling may also be of familial or racial characteristic. Proper and standardized preoperative and postoperative photographs are essential in rhinoplasty⁴. In addition to examination of the patient and its correlation with clinical experience and artistic judgment photographs are the best practical means for correct analysis. Photographs are essential for medical record and for medico legal purpose.

The photograph views which are commonly taken include frontal view, right and left lateral views, basal view, and oblique view. There is a wide variety of graft materials available for nasal augmentation which are successfully used. A surgeon's success with one or other implant material will determine his preference.

To be successful one must have a working knowledge of all the implant materials available. Each portion of the nose has different characteristics that may require different augmentation material. The grafts commonly used in augmentation rhinoplasty include iliac crest bone, costal cartilage, septal cartilage, auricular cartilage, sialastic prosthesis. Autologous graft has considerable advantages over allografts. It does not induce immune response and has a very much lower rate of infection and extrusion.

Finally the psychology⁵ of the patient should be kept in mind to avoid conflicts over the post operative appearance of nose.

MATERIAL AND METHODS

It was a prospective study conducted upon 60 patients suffering from saddle deformity of nasal dorsum in the department of ENT Allied Hospital Faisalabad from Sep 2007 to Sep 2012. The patients were admitted and detailed history, clinical examination, routine investigations and special investigations including photography were carried out. Standard Performa was prepared dually filled for each patient. Only those patients were included in study who were suffering from saddle deformity of nasal dorsum and were available for follow up and those patients who were unfit for surgery and those cases operated some where else were excluded from the study. All the patients were operated for augmentation rhinoplasty using costal cartilage graft from 6th rib. The follow up of cases was carried out from 6 months to 36 months.

RESULTS

A total of 60 patients suffering from saddle deformity of nose 40 males (67%) and 20 females (33%) between 16 years to 50 years of age were studied. The majority of patients were from 3rd decade of life (80%). The duration of deformity in majority of patients was with in 2 years (67%). Majority of patients belonged to the lower class (80%). In all the patients indication for augmentation rhinoplasty was cosmetic (100%). In all patients autologous costal cartilage graft was used (100%). The etiological factor for saddle deformity in majority of cases was trauma (50%). The donor site morbidity was 10% as compare to other complications. Overall success rate was 100%. Revision surgery was not done in any case (00%).

Table-1
Duration of deformity at the time of presentation
N = 60

No	Duration in Years	Patients Number	Percentage
1	0 – 2 Y	40	67%
2	3 – 5 Y	10	17%
3	6 – 8 Y	05	08%
4	> 8 Y	05	08%
5	Total	60	100%

Table-2
Indications for augmentation rhinoplasty **N = 60**

No	Indication	Patients Number	Percentage
1	Cosmetic	60	100%
2	Nasal obstruction	00	00%
3	Total	60	100%

Table-3
Nature of autologous graft used for augmentation rhinoplasty **N = 60**

No	Graft nature	Patients Number	Percentage
1	Costal cartilage graft	60	100%
2	Total	60	100%

Table-4
Etiology of saddle deformity in patients **N = 60**

No	Etiology	Patients Number	Percentage
1	Trauma	30	50%
2	Infection	10	17%
3	Familial / congenital	00	00%
4	Sub Mucus Resection	20	33%
5	Total	60	100%

Table-5
Complications of **N = 60**

No	Complication	Patients Number	Percentage
1	Resorption of graft	00	00%
2	Infection	00	00%
3	Pneumothorax	01	02%
4	Margin show	01	02%
5	Graft extrusion	00	00%
6	Keloid formation	05	08%

DISCUSSION

To obtain aesthetically pleasing results, ensure patient satisfaction, and minimize complications the rhinoplasty surgeon must possess a thorough knowledge of nasal anatomy and ideal facial aesthetic proportions. The surgeon must be familiar with all types of graft material and the current methods to correct nasal deformities⁶. Autogenous grafts offer advantages over alloplasts in that they do not elicit immune response in the recipient site this causes lower rate of infection, tissue reaction and extrusion of the implant^{7,8}.

Autogenous cartilage offers certain considerable advantages over other grafts that the tissue feels more natural, they are easy to mould and have a low index of resorption⁹.

When compared with Caucasian noses, the typical Asian nose appears to be relatively small and flat and has poor tip definition. Therefore the main concept of rhinoplasty for Asians is augmentation rather than reduction⁵. In selecting the dorsal implant material skin thickness should be considered¹⁰.

Costal cartilage graft is used in more extensive deformities⁶. It has disadvantages of incurring significant donor site morbidity such as scarring of chest wall and possible complication of pneumothorax therefore it is used mainly when other source of cartilage is insufficient^{11,12}.

The results of the costal cartilage graft when used in augmentation rhinoplasty are satisfactory for the patient and resorption rates are not high enough to change the Shape of the nose¹³.

The seventh rib is the ideal rib graft by virtue of its safe location and over all size for grafting and it provides the greatest overall available length (90.7 mm, right; 89.6 mm, left) and thickness (17.6 mm right; 17.5 mm, left) therefore it is advocated as the ideal choice for augmentation rhinoplasty¹⁴. Preferably the central portion of the rib should be taken for reconstruction. When cartilage harvest is performed in the above manner, donor site morbidity is minimized without limiting aesthetic results. The key seems to be preservation of intact costal cartilage on three sides, limiting harvest to the central portion only. This central portion is straight and much less prone to warping than the cartilage toward the periphery. When harvesting costal cartilage for rhinoplasty the above technique allows for sufficient graft tissue while

decreasing donor site morbidity and minimizing warping¹⁵. Osseous cartilaginous onlay rib grafts provide an ideal scaffold for dorsal nasal augmentation and restoration of nasal airway in patients with collapse of the nasal framework due to a saddle deformity, history of trauma, or history of multiple septorhinoplasties. The graft has excellent viability, lacks potential for long-term warping, achieves bony fusion to the nasal bones, and allows surgical molding of the cartilaginous tip¹⁶. The nasal reconstruction with costal cartilage is indicated in severe saddle nose deformities. It is a comparatively reliable surgical procedure yielding satisfying results even in patients with severe deformities and unfavorable recipient site conditions¹⁷. The costal cartilage graft become the graft of choice when substantial amounts of cartilage are required^{18,19}. In our study the success rate of costal cartilage graft was 100% and failure rate was 00% whereas the study of C.S Mura Kami, T.A Cook and R.A Guida the success and failure rate of costal cartilage graft in augmentation rhinoplasty was 78% and 22% respectively²⁰.

In the study conducted by Cervelli L et al the success and failure rate of costal cartilage graft was 94% and 6%. respectively²¹.

In our study the frequency of costal cartilage graft resorption was 00% which is also proved by the study conducted by Vogt PM, Gohritz A et al²² and Won Tb, Jin Hr²³.

In the study conducted by Baek RM, Eun SC, Heo CY, Min KH et al the saddle deformity was the result of trauma in 16 patients, post-rhinoplastic deformities in 7, and congenital deformities in 5 patients as compare with our study in which it was trauma in 30 patients, Sub Mucosa Resection 20 patients Infection 10 patients²⁴.

Carved costal cartilage autografts are commonly used for nasal augmentation in saddle nose deformities. One major disadvantage of these carved grafts is postoperative warping. To prevent warping of costal cartilages, we used the "edge-on" technique. The inferior border of the cartilage is rotated 90 degrees to become the convex dorsum. No cartilage is trimmed or carved, and hence the intrinsic stress forces within the graft are not disturbed^{25,26}.

In a study conducted by Moon Bj, Lee Hj, Jang Yj the use of autologous costal cartilage in rhinoplasty was found to be associated with a relatively high

complication rate and relatively poor aesthetic outcomes²⁷ but this was not seen in our study.

To improve the outcome of patients under going cartilage harvest, efforts must be made to reduce further pain and donor-site morbidity. Reconstruction of the donor site with spare cartilage should be attempted where possible to improve the contour defect of the donor site. Refinements in the methods of cartilage harvest or donor-site reconstruction may achieve this in the future²⁸.

The autologous costal cartilage is the most reliable means of reconstruction that can be used in augmentation rhinoplasty and it is, by far, the most used by the majority²⁹.

CONCLUSION

The autologous costal cartilage graft has excellent outcome in augmentation rhinoplasty with minimal complications, the graft can be easily reshaped due to soft nature of cartilage and there is no risk of absorption which is associated with bone grafts.

The only major complication associated with autologous costal cartilage graft is pneumothorax which can be prevented by adopting good surgical technique.

REFERENCES

1. John Jacob Ballenger, James B, Snow JR. Otorhinolaryngology Head and Neck surgery 15th edition 1996; 1:33.
2. John Jacob Ballenger, James B, Snow JR. Otorhinolaryngology Head and Neck surgery 15th edition 1996; 1:35
3. Anderson J Surgery of the nasal base. Arch otolaryngol 1984 ; 110: 349 – 57
4. Schwartz & Tardy Standardized photo documentation in facial plastic surgery 1991; 7: 1 - 12
5. Bittle RM Psychiatric evaluation of patients seeking rhinoplasty. Otolaryngol Clinics of North America 1975;8:689
6. Peter A Kreymerman. Rhinoplasty, Augmentation Division of Plastic Surgery, Cleveland Clinic Foundation Jul 25, 2008
7. Sajjadian A, Rubinstein R, Naghshineh N. Current status of grafts and implants in rhinoplasty: part I. Autologous grafts. PlastReconstr Surg. 2010; 125: 40-9.
8. Sepehr A, Alexander Aj, Chauhan N, Gantous A. Detailed analysis of graft techniques for nasal reconstruction following Wegener granulomatosis. J Otolaryngol Head Neck Surg. 2011; 40: 473-80.
9. Sajjadian A, Rubinstein R, Naghshineh N. Current status of grafts and implants in rhinoplasty PlastReconstrSurg 2009 Nov 11
10. Jang YJ, Yu Ms. Rhinoplasty for the Asian nose. Facial Plast Surg. 2010; 26: 93-101
11. Wang Td Nasal dorsal augmentation. HNO. 2010; 58: 907-11.
12. Tung DH, Choi SH, Moon HJ et al. A cadaveric analysis of the ideal costal cartilage graft for Asian Rhinoplasty. PlastReconstrSurg 2004; 114: 545 – 50.
13. Song C, Mackay et al. Use of costal cartilage grafts in Negroid rhinoplasties Ann PlastSurg 1991; 7: 201 – 9
14. Yilmaz M, Vayvada H, Mola F. Dorsal nasal augmentation with rib cartilage graft long term results and patient satisfaction. J CraniofacSurg 2007; 18: 1457-62
15. Jung Dh, Choi SH, Moon HJ A cadaveric analysis of the ideal costal cartilage graft for Asian rhinoplasty Plast Reconstr Surg 2004; 114: 545-50
16. Lee M, Inman J, Ducic Y. Central segment harvest of costal cartilage in rhinoplasty. Laryngoscope 2011; 121: 2155-8.
17. Christophel JJ, Hilger PA. Osseocartilaginous rib graft rhinoplasty: a stable, predictable technique for major dorsal reconstruction. Arch Facial Plast Surg. 2011; 13: 78-83.
18. Riechelmann H, Rettinger G. Three-step reconstruction of complex saddle nose deformities. Arch Otolaryngol Head Neck Surg. 2004; 130: 334-8.
19. Defatta RJ, Williams EF 3rd. The decision process in choosing costal cartilage for use in revision rhinoplasty. Facial Plast Surg 2008; 24: 365-71.
20. Moshaver A, Gantous A. The use of autogenous costal cartilage graft in septorhinoplasty. Otolaryngol Head Neck Surg. 2007; 137: 862-7.
21. Cervilli V, Bottini DJ, Gentile P. Reconstruction of the nasal dorsum with autologous rib cartilage. Ann PlastSurg 2006; 56: 256-62.
22. Vogt PM, Gohritz A, Haubitz M, Steiert A. Reconstruction of nasal deformity in Wegener's granulomatosis: contraindication or benefit? Aesthetic Plast Surg. 2011; 35: 156-61.

-
23. Won TB, Jin HR. Immediate Reconstruction with Autologous Cartilage after Removal of Infected Alloplast in Revision Rhinoplasty. *Otolaryngol Head Neck Surg.* 2012 Aug 29.
 24. BaekRM, EunSc, HeoCy, Min Kh. Rhinoplasty using rib chondro-osseous graft in Asian patients. *J Craniofac Surg.* 2010; 21: 1122-5.
 25. Al-Qattan MM. Augmentation of the nasal dorsum with autogenous costal cartilage using the "edge-on" technique. *Ann Plast Surg.* 2007; 59: 642-4.
 26. Kim DW, Shah AR, Toriumi DM. Concentric and eccentric carved costal cartilage: a comparison of warping. *Arch Facial Plast Surg.* 2006; 8: 42-6.
 27. Moon BJ, Lee HJ, Jang YJ. Outcomes following rhinoplasty using autologous costal cartilage. *Arch Facial Plast Surg.* 2012; 14: 175-80.
 28. Uppal RS, Sabbagh W, Chana J, Gault DT. Donor-site morbidity after autologous costal cartilage harvest in ear reconstruction and approaches to reducing donor-site contour deformity. *Plast Reconstr Surg.* 2008; 121: 1949-55.
 29. Boudard P. Autologous cartilaginous grafts in septorhinoplasties *Rev LaryngolOtolRhinol (Bord).* 2006; 127: 31-6.

AUTHOR

- **Dr. Muhammad Saeed**
Associate Professor of ENT
PMC/ Allied Hospital Faisalabad