

Outcomes of dorsal nasal augmentation using costochondral graft

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Abstract

Objective: To assess functional and aesthetic outcomes in patients having undergone dorsal nasal augmentation with costochondral graft in a tertiary care setting.

Method: The single-centre, retrospective, observational study was conducted at Shifa International Hospital, Islamabad, Pakistan, and comprised data of patients who underwent dorsal nasal augmentation using costochondral graft between January 1, 2018, and December 31, 2022. Aesthetic outcomes in terms of patient satisfaction were assessed using Facial Appearance, Health-related Quality of Life and Adverse Effects scores. Data was analysed using SPSS 26.

Results: Of the 46 patients, 28(61%) were males and 18(39%) were females. The overall mean age was 28.39±9.13 years. Dorsal nasal deficiency occurred secondary to congenital causes in 12(26.1%) patients, trauma 19(41.3%) and prior surgery 15(32.6%). Postoperative complication rate was 7(15%); 3(6.5%) had recipient site infection and 2(4.3%) had rib graft resorption. Besides, 1(2.2%) patient reported pain 2 months postoperatively and 1(2.2%) had hypertrophic scarring. Patient satisfaction with the outcome was noted in all the 10 parameters analysed. Most commonly reported problem was that the nose was 'looking thick/swollen' by 12(26.1%) patients, but the issue resolved during 1-year follow-up.

Conclusion: Costochondral graft was found to be an ideal material for dorsal nasal augmentation, with high patient satisfaction rate.

Keywords: Costal cartilage, Patient satisfaction, Rhinoplasty. (JPMA 74: 1104; 2024) DOI: <https://doi.org/>

Introduction

Nose is an integral component of the general aesthetic appearance of an individual. It also plays a central role in the respiratory system. Any discrepancy in its size and shape can have a great psychological and physiological impact on a person.¹ The nasal dorsum is the widest and the most prominent subunit of the nose, and even a minute abnormality in its appearance is easily detected.² Deformities or deficiencies of the nasal dorsum can be attributed to various aetiologies, including trauma, congenital, and defects associated with previous surgeries.³

Dorsal nasal augmentation rhinoplasty aims at restoring not only the aesthetic appearance of the nose, but also the nasal patency.¹ Restoring the osteocartilagenous framework of the dorsum of the nose is a challenging task.^{3,4} It can be achieved by using various alloplastic and autologous materials.^{1,3} Alloplastic materials, like silicone and polytetrafluoroethylene, have been associated with infection, extrusion, exposure and long-standing pain.^{3,5,6} Autologous grafts, on the other hand, are more resistant to infection.⁷⁻⁹ Sources of autologous cartilage grafts include nasal septum, concha and rib.^{5,6} Septal and conchal grafts

are easy to harvest and result in minimal donor-site morbidity. However, they provide very limited amount of cartilage which is usually not sufficient to restore the cartilage framework in severely deficient nasal dorsum.^{6,7} Costal cartilage grafts possess greater structural strength and provide a larger volume of graft that can reconstruct even the most severely deficient nasal dorsum and tip.^{1,6}

The South Asian nose possesses certain unique characteristics, like thick skin, shorter length and greater width.^{6,10} These qualities necessitate the usage of sturdy, large-volume grafts. Septum and conchal grafts are unable to provide enough material for augmentation in such cases.¹⁰ Costochondral grafts provide the ideal material for reconstructing the nasal dorsum and tip in such patients.^{7,10} The use of costochondral graft, however, is associated with various complications, both locally, like warping and resorption, and at the donor site, like pneumothorax, infection, scar and chronic pain.^{7,11} However, these complications can be reduced with certain modifications in the technique of costochondral graft harvesting, and, hence, enable plastic surgeons to use rib grafts to provide optimal aesthetic results.^{3,6,11,12}

The current study was planned to assess using Facial Appearance, Health-related Quality of Life and Adverse Effects questionnaire (FACE-Q) score¹³ functional and aesthetic outcomes in patients having undergone dorsal nasal augmentation with costochondral graft in a tertiary care setting.

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Materials and Methods

The single-centre, retrospective, observational study was conducted at Shifa International Hospital, Islamabad, Pakistan, and comprised data of patients who underwent dorsal nasal augmentation using costochondral graft between January 1, 2018, and December 31, 2022. After approval from the institutional ethics review board, data was retrieved using convenience sampling technique from both the electronic and manual medical records.

Data included was related to patients aged >18 years who who had deficient nasal dorsum secondary to trauma, congenital and iatrogenic causes, underwent dorsal nasal augmentation using costochondral graft only, and were followed up for at least 1 year. Data was excluded for patients who underwent dorsal nasal augmentation using conchal or septum grafts, patients who suffered from deficient nasal dorsum secondary to oncological resection, patients who suffered from body dysmorphic disorder, and cases with shorter follow-up record.

Prior to the surgical intervention, informed patient consent was obtained, including the permission to share images for research publication purposes (Figure 1-2). History regarding any nasal trauma and prior surgical procedures



Figure 1 A: Preoperative image of a 28-year-old patient who presented with history of septoplasty trauma leading to dorsal nasal deficiency. Droopy tip was visualised and a reverse C-shaped deformity was seen.



Figure 1 B: Postoperative image of costochondral graft for correction of dorsal deficiency. Tip elevation was achieved and dorsal aesthetic lines were redefined.



Figure-2 A: Preoperative image of a 35-year-old patient with congenitally deficient nasal dorsum, with nasal obstruction on the right side.



Figure 2 B: Postoperative image after costochondral graft insertion. Significant improvement was seen in dorsal projection and nasal patency.

was taken. Clinical assessment was performed about the skin quality, depression of nasal dorsum, tip projection, nasal length, width of the nose and nasal deviation. Functional evaluation of the nose regarding breathing difficulty, septal deviation and sinusitis was done. The donor site was assessed for any prior scars or congenital deformities of chest.

All procedures were performed under general anaesthesia (GA). Length of bony and cartilaginous portion of the nasal dorsum and tip was measured prior to harvesting the rib graft. Mostly, open rhinoplasty technique was utilised, ut in patients who required modification of the nasal tip, However, closed rhinoplasty approach was used. Costochondral graft from the 6th/7th rib was harvested, and air leak test was done to rule out any pleural damage during the harvest. The donor site was closed in layers and a catheter tube was placed in the wound for local anaesthetic infiltration postoperatively for pain relief. Any septal deviation seen was corrected.

The harvested costochondral graft was designed to form 2 articulating structures that resembled the letter 'L'. This framework provided both dorsal and caudal support to the nose. Most of the harvested grafts were composed of bony rib with a cartilaginous cap approximately 1 cm in size,

which was used for the nasal tip. Cartilage was more resistant to erosion^{14,15} and could be easily carved to accommodate the columellar strut graft. A small groove was carved into the cartilaginous portion of the dorsal graft, allowing the columellar strut to nicely fit and articulate with the lower edge of the dorsal graft. The columellar strut was positioned between the medial crura dorsally and fixed to the anterior nasal spine caudally. The bony portion of the rib graft was secured onto the nasal dorsum using a screw in order to avoid displacement.

Internal nasal packing and external nasal splint were placed at the end of the procedure.

In order to evaluate outcomes from the perspective of patient satisfaction, the patients were required to fill out a questionnaire based on FACE-Qscore^{13,16} for rhinoplasty. It evaluated satisfaction with nasal appearance both before and after surgery. The questionnaire had 10 questions, and each was scored 1-4, ranging from 'very dissatisfied' to 'very satisfied'. Postoperatively, an additional questionnaire was filled based on adverse effects on the nose. Each component was scored 1-4 ranging 'no difficulty in breathing' to 'extreme difficulty in breathing'.

Surgical outcomes were assessed based on the rate of rib graft resorption, displacement of graft, infection of graft and donor-site complications, like infection, pneumothorax, hypertrophic scar and pain.

Table-2: Adverse effects on the nose.

	Not at all		A little		Moderately		Extreme	
	Before Surgery n (%)	After Surgery n (%)	Before Surgery n (%)	After Surgery n (%)	Before Surgery n (%)	After Surgery n (%)	Before Surgery n (%)	After Surgery n (%)
Difficulty breathing through your nose	29 (63.04)	38 (82.61)	8 (17.39)	6 (13.04)	8 (17.39)	2 (4.35)	1 (2.17)	0%
Tenderness	39 (84.78)	41 (89.13)	5 (10.87)	2 (4.35)	2 (4.35)	2 (4.35)	0%	1 (2.17)
Skin of your nose looks thick or swollen	28 (60.89)	34 (73.91)	13 (28.26)	8 (17.39)	4 (8.70)	3 (6.52)	1 (2.17)	1 (2.17)
Unnatural appearing bumps or hollows on your nose	38 (82.61)	36 (78.26)	5 (10.87)	9 (19.57)	3 (6.52)	1 (2.17)	3 (6.52)	0%

Data was analysed using SPSS 26. Data was presented as frequencies and percentages, and as mean±standard deviation, as appropriate.

Results

Of the 46 patients, 28(61%) were males and 18(39%) were females. The overall mean age was 28.39±9.13 years. Dorsal nasal deficiency occurred secondary to congenital causes in 12(26.1%) patients, trauma 19(41.3%) and prior surgery 15(32.6%). Patient satisfaction with the outcome was noted in all the 10 parameters analysed (Table 1).

Adverse effects, including difficulty breathing through the

nose, tenderness, thickness/swollen appearance, and unnatural bumps/hollow on the nose, were noted (Table 2).

Postoperative complication rate was 7(15%). There were 3(6.5%) patients who had recipient-site infection. All of them were conservatively managed and rib graft was salvaged with local wound care, but 1(2.17%) of them had an infection at screw insertion site for which he underwent removal of the screw under local anaesthesia. Besides, 2(4.3%) patients had rib graft resorption, 1(2.2%) reported pain 2 months postoperatively and 1(2.2%) had hypertrophic scarring. None of the patients suffered from graft migration and warping (Table 3).

Table-1: Facial Appearance, Health-related Quality of Life and Adverse Effects Questionnaire (FACE-Q) scores for patient satisfaction.

	Before surgery	After surgery
	Somewhat/very satisfied n (%)	Somewhat/very satisfied n (%)
Overall size of your nose	6 (13.04)	42 (91.30)
How straight your nose looked	8 (17.39)	41 (89.13)
How well your nose suited your face	9 (19.57)	41 (89.13)
The length of your nose	8 (17.39)	41 (89.13)
The width of your nose at bottom(nostril to nostril)	8 (17.39)	41 (89.13)
How the bridge of your nose looked	8 (17.39)	40 (86.96)
How the tip of your nose looked	9 (19.57)	35 (76.09)
The shape of your nose in profile(side view)	9 (19.57)	38 (82.61)
How your nose looked in photos	9 (19.57)	39 (84.78)
How your nose looked from every angle	10 (21.74)	41(89.13)

Table-3: Postoperative complications.

Recipient site complications	n (%)
Infection	3 (6.52)
Graft migration	0
Graft resorption	2 (4.35)
Warping	0
Donor site complications	
Infection	0
Seroma	0
Pain	1 (2.17)
Pneumothorax	0
Scarring (keloid/hypertrophic scar)	1 (2.17)

Discussion

In the current study, FACE-Q scores of the patients showed improvement in scores in all parameters of 'satisfaction with nose' component. In literature review, there was no study available that compared FACE-Q scores of patients who underwent dorsal nasal augmentation using costochondral grafts, hence, the findings could not be compared.

The most significant adverse effect encountered was 'skin of your nose looking thick/swollen' 12(26.09%), which was similar to other rhinoplasty studies.¹⁷⁻¹⁹ This subset of patients reported resolution of postoperative oedema after a further 6 months 10(83.33%). The patients reported reduced difficulty in breathing through the nose, which was attributable to correction of nasal valve collapse and septal deviation correction intraoperatively. There was a slight improvement in unnatural appearing bumps/hollow on the nose. The complication rate in the study was 7(15.22%), and 3(6.52%) patients suffered from nose infection, which was less than 10% reported earlier.^{20,21} The lower infection rate can be attributed to gentamicin infiltration of the dissection pocket and submersion of the rib graft in gentamicin solution²² prior to insertion. Furthermore, the harvested rib graft was fabricated in the form of a single block of bone with a cartilage cap. In studies where multilayered stacked cartilage grafts were used, there was disturbance of the nutrient-waste exchange diffusion essential for graft survival leading to infection.²¹ Graft-site infection was managed with incision and drainage, and using topical and systemic antibiotics that led to rib graft salvage. One patient with infection at screw site underwent removal of the screw under local anaesthesia, and the infection was resolved.

Besides, 2(4.35%) of the patients had graft resorption and had to undergo revision surgeries. This rate was comparable to another study (4.6%).²¹ Resorption rate was higher than a few other studies (<1%)^{23,24} Causes of resorption were attributed to infection with methicillin-resistant staphylococcus aureus (MRSA) and severe facial scarring/trauma which compromised the blood/nutrition supply to the graft leading to resorption in the current study.

No warping was seen in any patient compared to rates of 3% to 26.1% reported in literature.^{8,11,21,22,24} The absence of warping in the study can be due to the handling techniques of the harvested cartilage, which included harvesting ribs with a longer straight portion, submersion of graft in gentamicin solution for 30-45 minutes and observing for maximal warping,²² concentric cartilage carving technique taking out the peripheral portion of the graft more prone to warping and using the central portion for augmentation^{3,4} and rasping both the nasal bone and

the costochondral grafts to facilitate adherence of the contact surfaces.

None of the current patients suffered from graft migration/displacement, which was consistent with literature reporting rates of displacement <1%.^{8,23,24} The low rates of graft migration were due to the creation of a tight dissection pocket in the nose for rib graft placement, rasping of the nasal bone in order to allow better bony union between the roughened edges of the perichondrium of the costochondral graft and nasal bone, and screw fixation of the bony portion of the graft which stabilised it.

Donor-site complications encountered were chronic pain in 1(2.17%) patient and hypertrophic scarring in 1(2.17%). The low incidence of acute and chronic pain was comparable to the rates reported in literature (0.2-1%).^{8,23} Factors leading to less pain included intraoperative muscle sparing dissection and approximation of muscle layers,⁸ and postoperative bupivacaine infiltration of the donor site.

The rate of hypertrophic scarring (2.17%) was similar to reported rates of 2.9%.^{8,23,24} Optimal postoperative scarring was achieved by excising macerated wound edges at the donor site, and meticulous closure of the dissected tissue layers.⁸

No postoperative seromas were seen at the donor site, with rates of 0.6% being reported in literature.⁸ The obliteration of dead space by layered closure of muscle and fascia ensures a low rate of seroma formation.

The occurrence of iatrogenic pneumothorax in the current study was nil compared to reported rates of upto 2%.^{8,21,23,24} The current study ensured avoidance of pneumothorax by meticulous dissection for graft harvesting and leaving posterior perichondrium of harvested rib intact to avoid pleural tears.

The current study has limitations as it had a small sample size from a single centre.

Conclusion

Dorsal nasal augmentation using costochondral graft produced satisfactory results in terms of patient satisfaction and long-term outcomes. The low donor-site morbidity and complication rate made it as a better alternative to prosthetic materials.

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Conflict of Interest: None.

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Author Contribution:

AK: Accountable for all aspects of the work.

MR: Design, acquisition, supplying data of patients, data interpretation, drafting, revision and final approval.

SUR, IK: Concept and design, data acquisition and final approval.