

## Outcome of Seventh Costal Cartilage Graft in Augmentation Rhinoplasty

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### ABSTRACT

**Objective:** To assess the outcome of autologous seventh costal cartilage grafts used in augmentation rhinoplasty

**Patients and Methods:** This descriptive study was conducted at the Department of Ear, Nose, Throat, Lady Reading hospital Peshawar from January 2008 to December 2009. These patients were admitted through outpatient department. The data was collected on the basis of history, physical examination, photography, and augmentation of saddle nose deformity with seventh costal cartilage graft. All procedures were carried out under general anesthesia. These patients were followed for two years.

**Results:** Our study included 28 patients constituting 21 males and 07 females, with male to female ratio of 3:1. The age of the patients ranged from 17-50 years. Most of the patients presented in their 3<sup>rd</sup> decade of life (42.85%). Trauma was the most common cause in 67%. Indication for augmentation in all patients was cosmetic (100%). In all patients seventh costal cartilage graft was used (100%). Overall success rate was 89%.

**Conclusion:** Augmentation rhinoplasty with seventh costal cartilage graft improves the cosmetic appearance of the nose as they are easy to harvest, easy to mould and have low rate of resorption.

**Keywords:** Rhinoplasty, Augmentation, Saddle nose, Autologous seventh costal cartilage graft

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### INTRODUCTION

Nose is the central aesthetic structure of a face and constitutes the most prominent projection in facial geometry<sup>1,2</sup>. This makes it more vulnerable to traumatic injuries in day to day life<sup>3</sup>. The cartilaginous nasal septum and maxillary bony crest supports the middle and lower third of the nasal dorsum. Its absence or fibrosis due to different causes leads to depression of nasal bridge, depressed nasal tip, deviated nasal septum and collapse of the internal nasal valve; however the mucoperichondrial lining remains intact in most cases<sup>4</sup>. The repair of saddle nose deformity is challenging owing to the complex nature of structure and shape of nasal Osseocartilaginous framework which are very important for normal breathing and cosmetic results<sup>5</sup>. Augmentation of saddle nose deformity is carried out to improve nasal aesthetic appearance, respiratory function, mental wellbeing and confidence<sup>6</sup>. Augmentation of saddle nose with cartilage graft was first used by Robert Fulton Weir in 1892 and then by Josef and Sheen in 1931 and 1975<sup>7</sup>. The most frequent causes of saddle nose deformity are accidental nasal trauma, excessive septal resection, septal abscess, and chronic nasal inflammatory diseases such as tuberculosis, sarcoidosis, Leprosy,

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Syphilis and Wegener granulomatosis<sup>8,9</sup>. Some degree of nasal saddling can be a feature in some particular race or a family, however cosmetic rhinoplasty is not offered in childhood as this procedure is carried out in adults who should be self-motivated with realistic expectation<sup>6</sup>. The ethnic Asian; Mestizo; and Black nose often requires dorsal nasal augmentation<sup>7</sup>. Various autogenous and alloplastic materials have been used for dorsal nasal augmentation.<sup>10</sup> The most commonly used autogenous materials are rib bone, iliac crest cancellous bone, calvarial bone, turbinate bone, costal cartilage, auricular conchal cartilage, septal cartilage and alloplastic materials are silicone, silastic, Gore-Tex<sup>11</sup>. Auto grafts are better than allografts in that they are readily available, feel more natural, easily harvested and sculpted and have a low index of resorption<sup>12</sup>. It does not induce immune response and has a very much lower rate of infection, rejection, and extrusion of graft<sup>10</sup>. The aesthetic and long-term functional outcomes of autogenous grafts are superior and the complication rates are low<sup>13</sup>. Nasal septal cartilage graft is easily harvested at the time of surgery. It can be shaped and used in many layers thickness. However it is not helpful in gross saddle nose deformity<sup>14</sup>. Conchal cartilage is commonly used in mild to moderate saddle nose because of its characteristic shape, elasticity and strength. It can be harvested without any cosmetic

change to the pinna as long as the antihelical fold is not transgressed and scar at the donor site is barely visible. This cartilage graft with one side or both sides of perichondrium and even from both ears can be used to augment the nasal dorsum. However its usefulness is limited because of its softness and asymmetric nature and it tends to return to its initial appearance due to cartilage memory<sup>15</sup>. The fifth or sixth costal cartilage grafts are mostly used in more extensive saddle nose deformities and for firm structural support when other source of cartilage is insufficient and unavailable. The results are satisfactory and resorption rates are not high enough to change the shape of the nose<sup>16</sup>. However it has disadvantages of significant donor site morbidity such as scarring of chest wall, pneumothorax and neuralgic pain<sup>17</sup>.

The seventh costal cartilage was found to be ideal because of its shape, location and overall size for graft. The seventh rib is situated over the abdominal cavity due to which the risk of pneumothorax is insignificant. The internal thoracic artery and vein descend in close apposition behind the first to sixth ribs but begin a course medial to the ribs inferior to this position and therefore vascular injury during seventh rib harvesting is unknown. The seventh rib provides the greatest overall available length (90.7mm, right; 89.6mm left) and thickness (18.5mm, right; 17.5mm left). The 3-cm incision that was used has healed favorable in almost all cases without scarring of chest wall. The seventh rib cartilage is advocated as the ideal choice for augmentation rhinoplasty because it is easy to harvest with minimal donor site morbidity, excellent texture, provide adequate amount of graft which is easy to shape and can be fixed in the recipient site with relative ease. It has a very much lower rate of infection, extrusion, resorption and having long term survival<sup>11,13,17</sup>.

## PATIENTS AND METHODS

This descriptive study was conducted upon 28 patients at the Departments of Ear, Nose, Throat, Leady Reading Hospital Peshawar from January 2008 to December 2009. All patients with saddle nose deformity were admitted through outpatient department. All patients suffering from saddle deformity of nasal dorsum were included in the study. All cases of saddle nasal deformities below 16 years, unfit for nasal surgery and those cases operated somewhere else were excluded from study. All patients with saddle nose deformity underwent augmentation with autologous seventh costal cartilage graft. All procedures were carried out under general and local infiltrative anesthesia with 2%

xylocain with adrenalin in a concentration of (1:200000) in donor and recipient areas and were covered by prophylactic antibiotics. The antibiotics were Inj. augmentin (Amoxi-clav) 1.2 gm intravenously trice a day for 2 days and then orally for 8 days to prevent infection of the recipient and donor sites. Open technique of transcolumellar rhinoplasty approach and seventh costal cartilage graft was used in all these cases. An oblique 3cm incision was made over the broadest expansion of the seventh costal cartilage. The anterior rectus sheath and the rectus abdominis muscle were dissected and separated exposing the underlying perichondrium. A larger section of rectangular block was excised than is required with the help of a knife. Cartilage graft with intact perichondrium may cause warping. To avoid this warping central core of cartilage with trimming equal portion on each side of the graft was used. The smallest transcolumellar incision was made in the midline of the columella carefully and then small subperiosteal pockets were created in nasal dorsum and in columella separately to receive grafts. Cartilage grafts were placed separately subperiosteally in the nasal dorsum pocket and anterior to the medial crura of alar cartilage in columellar pocket which does not join the dorsal pocket. A more pleasing, natural nose is achieved with this technique than with an L-shaped graft in which the dorsum and the columella are joined by a type of joint. The donor and recipient sites incisions were sutured with 4/0 vicryl and prolene. After satisfactory placement of the graft, the nasal cavity was packed loosely with antibiotic impregnated cream for 48 hours to support the cartilage graft. Externally, the nose was firmly fixed and immobilized with steri strips and plaster of Paris cast for 7-10 days to maintain the graft correct position and to protect it from external trauma. The nasal packing was removed on the second day and patients were discharged after 72 hours. Patients were advised to come after 7-10 days for stitches and plaster of Paris cast removal and assessment of surgical areas. Patients were advised to avoid excessive sun exposure, touching, scratching of the grafted area for at least six weeks. These patients were followed at one month, three month, six month, one year and two years intervals.

## RESULTS

Our study included 28 patients with saddle nose deformity constituting 21 males and 07 females, with male to female ratio of 3:1. The age of the patients ranged from 17-50 years. Most of the patients presented in their 3<sup>rd</sup> decade of life [42.85%] (Table 1). Trauma dominated among the causative factors

for saddle nose deformity (85.71%) and rest of causes shown in Table 2. None of those suffering from chronic nasal inflammatory conditions sought surgical treatment for their deformities. All 28 patients (100%) wanted augmentation of the saddle nose deformity to improve cosmetic appearance of the nose. Augmentation of nasal dorsum was done in all 28 patients with seventh costal cartilage graft. In 10 patients (35.72%) grafts were also placed in columella to augment nasal tip. Out of 28 patients 15 patients (53.57%) also had a blockage of the nasal airway in addition to cosmetic problem which was corrected by septoplasty. Four patients (14.28%) had minor postoperative nasal deformities, however they had not requested neither required revision surgery. Two patients (7.15%) had recipient site infection in the immediate postoperative period which was treated conservatively. One patient (3.57%) had recurrence of dorsal site depression treated by revision surgery. Table 3 gives details of postoperative complication. The rate of graft resorption and extrusion with all the autologous costal cartilage grafts were 0%. Overall success rate with seventh costal cartilage was 89%. There were no significant long term donor sites complication like scar, pain and paresthesia.

Table 1: Age-wise distribution of the patients (n=28)

| Age (years) | No. | %     |
|-------------|-----|-------|
| 17 -20      | 5   | 17.86 |
| 21 – 30     | 12  | 42.85 |
| 31 - 40     | 7   | 25.00 |
| 41 - 50     | 4   | 14.29 |

Table 2: Frequency of causative factors (n=28)

| Cause                         | No. | %     |
|-------------------------------|-----|-------|
| Accidental trauma             | 17  | 60.71 |
| Nasal septal surgery          | 7   | 25.00 |
| Septal abscess                | 4   | 14.29 |
| Chronic inflammatory diseases | -   | -     |

Table 3: Frequency of complications

| Complication                               | No. | %    |
|--|-----|------|
| Desired hight of nasal dorsum not achieved | 1   | 3.57 |
| Slight deviation of nasal dorsum           | 1   | 3.57 |
| Slight deviation of columella              | 1   | 3.57 |
| Nasal dorsum irregularity                  | 1   | 3.57 |
| Recurrence of nasal dorsum depression      | 1   | 3.57 |
| Recipient site infection                   | 2   | 7.15 |

## DISCUSSION

Nasal augmentation is always challenging for the rhino plastic surgeon.<sup>18</sup> Its mid facial location and the relationship between convexities and concavities of nasal subunits make it impossible to hide any sort of deformity without a proper reconstruction.

Reconstructive technique or a combination of them must be selected according to the size of the saddle nose deformity and graft availability.<sup>19</sup> The rhino plastic surgeon must be familiar with all types of graft materials and the current methods to correct saddle nose deformities to achieve good cosmetic results, better patient's satisfaction and minimal complication.

Our study was based on augmentation of saddle nose deformity with seventh costal cartilage graft in all 28 patients due to its high success rate. The seventh rib is the ideal rib graft by virtue of its safe location, shape and overall size for grafting and it provides the greatest overall available length and thickness.<sup>17</sup> In our study the success rate of costal cartilage graft was 89% and failure rate was 11%. Where as in the study conducted by Cervelli et al<sup>19</sup> the success and failure rate of costal cartilage graft was 94% and 6%. While Tahir<sup>6</sup> and Saeed<sup>20</sup> used costal cartilage graft for repair of saddle nose deformity obtaining 66% and 100% success rates. The problems with costal cartilage graft harvesting are pneumothorax, chest pain, scar and warping of graft.<sup>21</sup> However, we have not encountered these donor site problems with seventh costal cartilage graft harvesting because of using small incision, separation of overlying muscle and central core of cartilage with crosshatching. This is in agreement with results reported by Jung DH and colleagues.<sup>17</sup> We encountered recipient site problems in only 3 patients (11%) in the form of recipient site infection (7%) and recurrence of nasal dorsum depression (4%). In the study of Elahi et al<sup>22</sup> one patient suffered recipient area infection and two recurrence of dorsal depression with no report of graft extrusion or contour irregularities in total of 67 patients. While in study of Cakmak<sup>24</sup> one patient suffered recipient site infection and minor graft warping in 3 patients in total of 20 patients and Riechelmann<sup>24</sup> study show one graft extrusion and minor dorsum irregularities in 8 patients in total of 43 patients. Male patients dominated (3:1) our study because they are more prone to trauma, which is in agreement with the reports of Ahmad et al<sup>25</sup> 3:1, Stephen<sup>26</sup> et al 3:1 and Hussain et al<sup>27</sup> 6:1. The reasons of high prevalence of nasal deformity in men are due to his involvement in physically hard activities and violence. The main causes for saddle nose deformity in our study were iatrogenic and accidental trauma comparable to national and international studies.<sup>6,7</sup> The more susceptible age group (42.85%) was 3<sup>rd</sup> decade of life. These findings are consistent with the results of the study done by Stephen et al<sup>26</sup> (15-40 years) and Green<sup>28</sup> (15-30 years). It is because this age group belongs to adolescence period, which is the age of dangerous behavior causing to nasal trauma and saddle nose deformity.

## CONCLUSION

Augmentation rhinoplasty using a seventh costal cartilage graft improves the cosmetic appearance of the nose and its balance with other facial unites as they are easy to be obtained with low donor site morbidity, easy to mould and have a low index of infection, rejection, extrusion and resorption.

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