REPAIR OF NASOSEPTAL PERFORATION BY AN EXTERNAL APPROACH USING DIFFERENT GRAFT MATERIALS

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REPAIR OF NASOSEPTAL PERFORATION BY AN EXTERNAL APPROACH USING DIFFERENT GRAFT MATERIALS

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Abstract

Objectives: The current study aimed to compare among different graft materials (tragus perichondrium, human acellular dermal graft and inferior turbinate flap) used for the repair of the nasoseptal perforation by an external approach.

Patients and Methods: The study included 30 patients with traumatic nasal septal perforation located in the anterior cartilaginous part of the nasal septum. All patients underwent full history taking, complete clinical otorhinolaryngological examination including nasal examination by anterior rhinoscopy and rigid 0° endoscope to detect the actual size, extent of the septal perforation and to exclude the associated pathological lesions. The patients were divided into 3 groups: I, II and III according to the graft material used in the repair of the nasal septal perforation. Group I: included 10 patients in whom the repairs of the nasal septal perforation were performed by the use of tragus perichondrium graft, group II: included 10 patients in whom the repairs of the nasal septal perforation were performed by the use of human acellular dermal graft (AlloDerm) and group III: included 10 patients in whom the repairs of the nasal septal perforation were performed by the use of the inferior turbinate flap. One surgical approach, the external transcolumellar approach, was performed in all patients for repair of the nasoseptal perforation. Patients were examined twice weekly in the first month then twice monthly for the next 5 months, for the success of closure of the septal perforation and for the occurrence of any complication.

Results: The study included 30 patients, 19 males and 11 females with age ranged from 19 to 35 years. The size of the perforation ranged from 0.5x0.5cm to 2x2cm in each group. Small perforations (<1.5x1.5cm)
were reported in 21 patients (70%), while the large perforations (1.5 x1.5cm) were reported in 9 patients (30%). The Success rate in group I was 70%, 7 out of 10 patients, while in group II was 90%, 9 out of 10 patients and in group III was 80%, 8 out of 10 patients. Failure reported in 6 out of 30 patients, one patient out of the 6 failed had a perforation less than 1.5x1.5 cm and the remaining 5 patients had a large perforation. Stenosis of nasal vestibule was reported in 2 patients of group I, one patient in group II while not recorded in group III. Bleeding, unilateral nasal obstruction and synchia were reported in 2, 3 and 2 patients, respectively of group III. Marked crustations were also reported in few patients of group III.

**Conclusion:** The external transcolumnellar approach has many advantages, as it is easy, allows direct access and good exposure of the perforation and surroundings and permits a precise placement and stabilization of the grafts. The highest perforation closure rates were with human acellular dermal graft with the advantage of absence of donor site morbidity. The inferior turbinate flap and tragus cartilage graft also had a good closure rates but not superior to the human acellular dermal graft.

**Key words:** Nasoseptal perforation - External approach - Different graft.

**Introduction**

A nasal septal perforation is a through and through defect in any portion of the cartilaginous or bony septum with no overlying mucoperichondrium or mucoperiosteum bilaterally (Romo, et al., 2003). These defects in the cartilaginous areas of the septum, with direct communication between the two nasal cavities, leads to impairment of air flow and pressure which are often accompanied by a wide variety of symptoms. Patients seek medical advice when they develop symptoms which may be very troublesome (crusting, nose bleeding, cacismia) and may, in some cases, even impair nasal respiration (RE et al., 2006). Symptoms tend to be related to size and location; most symptomatic perforations are large and anterior. Posterior perforations tend to be less symptomatic secondary to humidification from nasal mucosa and turbinates (Romo and Toffel, 1998). The otolaryngologist has to identify the causes, which, in most cases, are iatrogenic or idio-
pathic (Teichgraeber and Russo, 1993).

Many surgical techniques are available for surgical repair of nasal septal perforations. The variety of techniques is evidence that no single technique is recognized as being uniformly reliable in closing all perforations (Friedman et al., 2003). Septal perforation repair surgery can be performed using either the "closed technique" or "open technique". The advantages of the former consist in the fact that it does not leave any external scar. Albeit, many Surgeons prefer the "open" technique, as it offers a wider operating field, thus allowing better access to the superior and posterior margins of the perforation (RE et al., 2006).

A number of different materials both autografts and allografts have been used as interpositional grafts for repairing of septal perforation (Ambro et al., 2003). The inferior turbinate flap for repair of nasal septal perforations of moderate size is a relatively simple technique that offers a success rate comparable to or better than most techniques. The major disadvantage is the requirement for a second-stage procedure to release the pedicle (Friedman et al., 2003). Temporalis muscle fascia or auricular conchal cartilage also requires a second-stage procedure. The acellular dermal graft is processed from human donor skin obtained from approved tissue banks. In processing, the epidermis is removed, and the remaining dermal layer is washed in detergent solutions to remove cellular components. After the tissue has been decellulaized, the acellular collagen matrix is then cryoprotected and rapidly freeze-dried by a patented process to preserve biochemical and structural integrity. This packaged acellular dermis can be stored under refrigeration for at least 2 years. Allograft should be soaked for a minimum of 10 minutes in physiologic saline using a normal sterile procedure yields a pliable collagen template for cell repopulation (Lee et al., 2000).

The current study aimed to compare among different graft materials (tragus perichondrium, human acellular dermal graft and inferior turbinate flap) used for the
repair of the nasoseptal perforation by an external (open) approach.

**Patients and Methods**

This study was conducted on 30 patients with nasal septal perforation attending Benha University Hospital outpatient clinic in the period from July 2004 to December 2006. The patients were divided into 3 groups: I, II and III according to the graft material used in the repair of the nasal septal perforation. Group I: included 10 patients in whom the repairs of the nasal septal perforation were performed by the use of tragus perichondrium graft, group II: Included 10 patients in whom the repair of the nasal septal perforation were performed by the use of human acellular dermal graft (AlloDerm) and group III: included 10 patients in whom the repairs of the nasal septal perforation were performed by the use of the inferior turbinate flap. The patients were selected with traumatic nasal septal perforation located in the anterior cartilaginous part of the nasal septum (Fig. 1). Cases with previously operated turbinate were excluded.

All patients underwent full history taking, complete clinical otorhinolaryngological examination including nasal examination by anterior rhinoscopy and rigid 0° endoscope to detect the actual size of the septal perforation and to exclude the associated pathological lesions.

After obtaining fully-informed written consent, all patients were operated upon under general anesthesia using the external trans-columnellar approach adopted by Alach (2003) in all groups.

Xylocain 1% with 1/200000 epinephrine was infiltrated into the labio-columnellar junction, membranous septum, the floor of the nose for homeostasis. An inverted V shaped incision was made at the columellar- philtrum junction (Fig.2). It was then extended posteriorly around the feet of the medial crura on both sides. Complete transfixion incision was made through the membranous septum just caudal to the remnant of the quadrilateral cartilage and extended along its whole length. The base of the columella was dissected free of the underlying labial
soft tissue. A 3/0 silk stay suture was secured through the soft tissue of the columellar flap and secured to the towel for retraction (Fig. 3). The caudal margin of the quadrilateral cartilage and the whole septum on both sides became well exposed. The margins of the perforation were trimmed all around. The mucosal flaps were carefully dissected and elevated starting anteriorly through the perforation on either side of nasal septum to expose the skeletal remnants superiorly, posteriorly, inferiorly and anteriorly.

**In group I and II:** The transfixion incision was extended on both sides along the floor of the nasal fossa as far laterally as possible to underneath of the inferior turbinate, then an anterior to posterior longitudinal incision was made paralleling the attachment of the inferior turbinate beneath it caudally as far as behind the level of the posterior edge of the septal perforation. The next step was elevation of bilateral septal mucoperichondrial-mucoperiosteal flaps starting from the transfixion incision at the caudal border of the remnants of the quadrilateral cartilage. Dissection was achieved on both sides, widely elevating the mucosa from the floor of the nasal cavities; so bilateral inferior advancement mucosal flaps were obtained from the floor of the nose that can be advanced superiorly and medially to cover the perforation. The flap must be totally mobilized to achieve maximum tension free for closure.

**In group I:** After dissection and removal of tragal cartilage with its attached perichondrium on both sides, (Fig. 4), the graft was placed as an interpositional graft in-between the free bipedicled mobilized mucosal flaps on both sides of nasoseptal perforation. (Fig. 5). Simple interrupted sutures were secured on both sides using 4/0 or 5/0 chromic sutures to close the flaps with sharp needle which pass in the flap only not the cartilage graft.

**In group II:** The graft material used in this group was an acellular human dermal graft (AlloDerm), (Fig. 6). The appropriate sized AlloDerm graft which must be larger than the perforation was rehydrated for 10 minutes in
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physiologic saline and placed in between the previously described freely mobilized bipedicled flaps to close the perforation on its both sides (Fig. 7). A continuous suture 4/0 or 5/0 chromic cat gut suture passes through not only the flaps, but also the graft.

In group III: In this group we used the inferior turbinate graft form one side, the technique used was that adopted by Friedman et al. (2003). The turbinate is harvested with the use of 0° and 30° endoscopes. The superior medial mucosa incision is made with a knife from the posterior margin to the pedicle (anteriorly) (Fig. 8). The flap is then completed with a scissor, going through the turbinate bone and lateral mucosa to a point just cephalic to the pedicle and extending to the posterior border (Fig. 9). The flap includes mucosa, submucosa, and a variable amount of bone. Any exposed bone from the flap or donor site is removed. The flap is rotated anteriorly and adjusted to fill the perforation. It was sutured with the edge of septal perforation in the same side (Fig. 10). The contralateral side was closed by unilateral freely mobilized bipedicled mucosal flaps. The incision site and the remaining upper half of the turbinate were visualized with an endoscope to control any bleeding points with cautery.

Silastic splints were placed in both sides and light Vaseline nasal pack were placed bilaterally in group I and II and unilaterally in group III. The packs were removed after 48 hours and the splint after one week. Postoperatively, the patients were examined twice weekly in the first month then twice monthly for the next 5 months. In group III, the pedicle was taken down under local anesthesia 3 weeks postoperatively.

Results

The study included 30 patients, 19 males and 11 females with age ranged from 19 to 35 years. The size of the perforation ranged from 0.5x0.5 cm to 2x2 cm in each group. Small perforations (< 1.5x1.5 cm) were reported in 21 patients (70%), while the large perforations (≥ 1.5 ≥ 1.5 cm) were reported in 9 patients (30%). The success rate with small perforations was 95.2% (20/21 of cases)
while those with large one succeeded by 44.4% (4/9 of cases). This difference in the success is of highly significant value as $P < 0.01$ (Table 1).

The success rate in group I was 70%, 7 out of 10 patients, while in group II was 90%, 9 out of 10 patients, and in group III was 80%, 8 out of 10 patients. The difference in the success rate among the 3 groups is of no statistical significant value as $P > 0.05$ (Table 2).

Failure reported in 6(20%) out of 30 patients; one patient out of the 6 failed had a small perforation less than 1.5x1.5 cm, while the remainder 5 patients had a large perforation. Figure (11) shows healed septal perforation with the use of tragus perichondrium graft. Fig. (12) shows healed septal perforation with the use of Alloderm and Fig.(13) shows healed septal perforation with the use of inferior turbinate flap.

Stenosis of nasal vestibule was recorded in 2 patients (20%) group I (Fig. 14), one patient (10%) in group II while in group III no cases were reported. Bleeding was reported in 2 patients of group III during excision of the pedicle, which was controlled by diathermy. Crusts in group I and II were minimal and washed out easily with normal saline while in group III crusts were marked and were in need for removal in every visit. Two patients of group III had unilateral synchia after release of the pedicle of the inferior turbinate. Nasal obstruction was reported 2 weeks postoperatively in 3 patients of group III which was unilateral (Fig 15).
Table (1): Shows the success rate according to the size of the septal perforation.

<table>
<thead>
<tr>
<th>Perforation size</th>
<th>Succeeded</th>
<th>Failed</th>
<th>Total</th>
<th>X2</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>Small (&lt; 1.5 x 1.5 cm)</td>
<td>20</td>
<td>95.2.0</td>
<td>1</td>
<td>4.8.0</td>
<td>21</td>
</tr>
<tr>
<td>Large (≥ 1.5 x 1.5 cm)</td>
<td>4</td>
<td>44.4.0</td>
<td>5</td>
<td>55.6.0</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>80.0</td>
<td>6</td>
<td>20.0</td>
<td>30</td>
</tr>
<tr>
<td>Test of Significance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table (2): Shows the success rate among the 3 groups according to the graft material used in repair.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Succeeded</th>
<th>Failed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No</td>
<td>%</td>
<td>No</td>
</tr>
<tr>
<td>I</td>
<td>7</td>
<td>70.0</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>9</td>
<td>90.0</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>8</td>
<td>80.0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>80.0</td>
<td>6</td>
</tr>
</tbody>
</table>

Chi-square: X2 = 1.25  P > 0.05
Fig. (1): Shows anterior large nasal septal perforation.

Fig. (2): Shows inverted V shaped incision at the columella-philtrum junction.

Fig. (3): Shows complete transfixing incision through the membranous septum freeing it from its attachment till the tip of the nose.

Fig. (4): Shows the dissection of a tragus cartilage graft.
Fig. (5): Diagram shows the graft is placed as an Interpositional graft inbetween the freely bipedicled mucosal flaps.

Fig. (6): Shows the packaged acellular human dermal graft.

Fig. (7): Shows allograft graft is placed in between the freely mobilized bipedicled mucosal flaps.

Fig. (8): Diagram shows the incision of inferior turbinate done with a scissor going through the turbinate, (1) Line of incision, (2) middle turbinate, (3) superior turbinate.
Fig. (9): Diagram shows, (1) The inferior turbinate flap rotated anteriorly, (2) the flap is opened to create a mucosal surface, (3) line of cleavage of the inferior binate from the lateral nasal wall.

Fig. (10): Diagram shows the inferior turbinate flap is sutured to the surrounded tissue. (1) The septum. (2) Inferior turbinate flap closing the septal perforation after excision of its pedicle.

Fig. (11): Shows healed septal perforation with the use of tragus perichondrium graft.

Fig. (12): Shows healed septal perforation with the use of human acellular dermal graft.
Fig. (13): Shows healed septal perforation with the use of inferior turbinate flap.

Fig. (14): Shows a case of repaired septal perforation complicated by unilateral vestibular stenosis.

Fig. (15): Shows a case of repaired septal perforation complicated by nasal obstruction due to bulky tissue graft used in repair (inferior turbinate).
**Discussion**

Surgical repair of nasal septal perforations is made difficult by the paucity of nasal mucosa available for use; this mucosa is often friable and damaged by vasculitis. Because it is based on mucoperichondrium and mucoperiosteum, the mucosa is not amenable to acute distention or expansion. Traditional methods for closure of septal perforations can be variably successful for small and anterior perforations or unreliable and unrealistic for large and more posterior perforations (Romo et al., 1999).

In our study we selected one approach which is the external transcolumnellar approach which has many advantages: easy, allows direct access to usually undisturbed dorsal septum, allows for better exposure to the surrounding portions of the perforation and all parts of the septum, permits a precise placement and stabilization of the grafts and affords binocular vision with two free hands for surgeon. This external transcolumnellar approach has been described by (Raman, 1990), (Kridel et al., 1998), (Aiach, 2003), and also by (Romo et al., 2003) each has used a different graft material for repair of the nasal septal perforation.

In our study regarding to the results of group I, seven patients out of ten have shown complete closure of nasal septal perforation with success rate of (70%). Failure reported in three patients, two had large size perforation and other one had small perforation and they were associated with infection and cartilage necrosis. Our results agreed with that reported by (Woolford and Jones, 2001).

In group II, the repair of the nasal septal perforation was performed by the use of human acellular dermal graft (AlloDerm). The AlloDerm has been in use for several years for skin grafting for the treatment of patients with acute burns and has been shown to increase dermal matrix (Wainwright et al., 1996). Also used in the repair of Frey syndrome by (Uttam et al., 2003). The use of AlloDerm to resolve different medical problems confirm that this material has many advantages: absence of donor site morbidity, thick, easy...
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to be placed and sutured and gave more substance to the repaired defect. Its dermal matrix is incorporated into the surrounding tissues and because the graft is acellular it doesn’t elicit an immune response.

The success rate in group II was 90%, nine patients of ten showed complete closure of the perforation. one case only failed due to the size of the perforation which was large (2 x 2 Cm). Our results agreed with (Russel et al., 1998). they showed eleven patients of twelve had successful outcomes with complete closure of their perforation the remaining patient had an acceptable result but incomplete closure; his initial perforation of 3 cm was reduced to 0.5 cm. making him asymptomatic after surgery. Our results also coincide with that reported by (Romo et al., 2003), (Ayshford et al., 2003) and (Kyung et al., 2008).

Although, of the good healing results, we faced more than a complication in this group: Bleeding on release of the pedicle of the inferior turbinate, excessive crustations, and nasal obstruction which attributed to the bulky graft material and adhesions occurred between the inferior turbinate graft and its raw base on the lateral wall of the nose. However this technique has many advantages; the key advantages of the inferior turbinate flap are abundant vascularity, wide arc of rotation, combined skeletal and epithelial support and ease of development and insertion.

Another important advantage is that it uses respiratory tract mucosa, which allows the repaired septum to achieve physiological normalcy. Other methods that use skin grafts or buccal mucosa
grafts may be effective in closing the perforations but leave the patient with a dry nose that continue to crust because skin normally sheds and normal respiratory tract mucosa is not present (Kriedel, 1998). The major disadvantage is the requirement for a second stage procedure to release the pedicle and the subsequent possible bleeding. The abundance of tissue that makes it a reliable flap is also a disadvantage because the flap may have enough bulk to cause partial obstruction of the airway. Another disadvantage is that one surface is not epithelialized and must heal by secondary intention (Friedman et al., 2003). But in our study to avoid this disadvantage we covered this contralateral side by a unilateral free mucosal flap.

**Conclusion**

The external transcolumnellar approach has many advantages, as it is easy, allows direct access and good exposure of the perforation and surroundings and permits a precise placement and stabilization of the grafts. The highest perforation closure rates were with human acellular dermal graft with the advantage of absence of donor site morbidity. The inferior turbinate flap and tragus cartilage graft also had a good closure rates but not superior to the human acellular dermal graft.

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