Upper and middle third auricular reconstruction with a peninsular conchal flap

Fikret Eren¹, Bilge Kagan Aysal¹, Cenk Melikoglu², Sinan Oksuz¹

ABSTRACT

Background: Traumatic or iatrogenic full thickness auricular defects can be reconstructed in many ways. The defects exceeding 2 cm require challenging reconstruction techniques. The reconstruction options for those should include anterior and posterior skin envelope repair with cartilaginous content. Providing color and texture match, while maintaining anatomic landmarks, should be considered. The outcomes of patients in which we used a peninsular conchal axial pattern flap (PCF) to reconstruct the composite defects of the auricle were outlined in this case series.

Materials and Methods: Five patients with different etiologies were evaluated and operated with PCF between March 2012 and January 2015. The ages of the patients ranged from 21 to 91 years with a median age of 80. The mean follow-up period was 16.8 months. In PCF, the conchal subpart of the auricle was elevated as an axial pattern composite flap relying on the anastomotic connections between the superficial temporal artery and the posterior auricular artery. Donor sites were left to secondary healing. The statistical assessment was carried out with the Mann-Whitney U test.

Results: The median age of the patients was 80 (21-91) years. The median percentage of flap survival was 100.00. The median operation duration was 92.00 minutes. Donor site epithelialization was 21 and 20 days in the first two patients, with a median of 20.5 days. In the latter three patients, a silver-containing dressing material was used prophylactically to suppress contamination by skin bacteria, which led to a decrease of the length of healing time to a median of 11.00 days, with a range of 3.00.

Conclusion: PCF offers a one-stage procedure and can be used in the reconstruction of defects of the auricle exceeding 2 cm. The use of axial pattern peninsular conchal flap is recommended to all of our colleagues.

Key words: Middle third auricle reconstruction, peninsular conchal flap, upper third auricle reconstruction

Introduction

The auricle is the external and visible part of the human face, which leads to two important concerns: [1] Due to the position and location of the ear, the auricle receives UV light during a person’s lifetime, which increases the risk for developing skin malignancies, and [2] reconstruction of auricular defects requires meticulous attention to maintain the aesthetic appearance of the patient.

Approximately 5-8% of all skin malignancies occur in the auricle [1,2]. Squamous cell carcinomas (SCCs) are encountered more frequently than basal cell carci-
nomas (BCCs) compared to other skin locations [1-3]. Excision of the tumors from the auricle are frequently performed at the full-thickness level, involving the anterior skin, the cartilage and the posterior skin envelope, causing composite defects.

When the tumors are located at the upper or the middle third of the auricle, where the auricle has cartilaginous content, the full-thickness excisions lead to cartilaginous loss and reconstruction therefore requires cartilaginous repair. This repair can be achieved by using cartilage grafts from the contralateral auricle, nasal septum or the ribs [4] and many surgical techniques have been developed to reconstruct the skin envelope.

The ideal surgical technique to reconstruct the auricle involves color and texture matching, while maintaining anatomical landmarks, especially with the helical rim and one-stage operations.

In this paper, we describe the outcomes of patients in which we used a peninsular conchal axial pattern composite flap (PCF) to reconstruct the composite defects of the upper and middle third of the auricle.

Materials and Methods

In this study, 5 patients with different etiologies were evaluated and operated upon. The ages of the patients ranged from 21 to 91 years, with a median age of 80 and mean follow-up period was 16.8 months. The patients were all operated upon by the same surgeon under local anesthesia at the Gulhane Military Medical Academy, Haydarpasa Training Hospital, Plastic and Reconstructive Surgery Department, between March of 2012 and January of 2015.

The length of the auricular defect, the position of the defects on the auricle, the partial or full failure rates of flaps, venous congestion occurrence and duration, overall percentage of flap survival, operation time and donor site epithelialization time were evaluated (Table 1). No exclusion criteria were used in this study.

Surgical Procedure

The peninsular conchal flap, a procedure developed by D’Agregorio et al. [5], was used in this study. In this procedure, a circular incision line was planned on the conchal dome in the middle third of the auricle. The flap tissue involved a suitable size for the defect. When planning a circular incision, the superomedial part of the circle, corresponding to the 9 and 12 positions of a clock, was preserved in which the pedicle enters to the flap tissue. Nourishing vessels originate from the network between the posterior auricular artery and the superior auricular branch of the superficial temporal artery, which is considered as a reliable blood supply by the authors who developed the procedure [5]. The posterior auricular artery was ligated and cut at the inferomedial border of the PCF, with care taken to preserve the posterior auricular artery segment within the flap tissue, which serves as a connection to the superficial temporal artery and helps to nourish the flap tissue (Figure 1).

The composite flap tissue was elevated as a full-thickness flap, including the anterior skin envelope, the conchal cartilage and the posterior skin envelope on the pedicle that enters the flap tissue from the superomedial direction, as mentioned above. After the elevation of the flap, the posterior third of the auricle containing helical and antihelical folds became an inferiorly-based full-thickness flap, which was sutured to the mastoid region, leaving a composite defect at the conchal subpart. The donor sites were left to secondary healing.

To cover the upper portion of the PCF, a posterior

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<th>Table 1. Summary of data of study patients.</th>
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<td>Resolution of venous congestion (days)</td>
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<td>Flap survival (percent)</td>
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<td>Donor site healing (days)</td>
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skin envelope was planned that was larger than the anterior skin envelope. For helical restoration, a random pattern superior-based preauricular skin flap was elevated, rotated and brought to the upper portion of the PCF tissue in the same operation.

**Statistical Analysis**

In addition to descriptive statistics, such as median and range (with mean and standard deviation), the Mann-Whitney U test was applied. The Mann-Whitney U test was used to compare the data of the donor site healing times. Results were evaluated using a 95% confidence interval and the significance level was measured as \( p < 0.05 \). SPSS version 21 (IBM Corporation, USA) and Excel 2010 (Microsoft Corporation, USA) were used for analysis. The statistical analysis was outlined in Table 2.

**Results**

The median age of the patients was 80 (21-91) years. The median duration of venous congestion was 5.00 days, with a range of 4.00, and the mean duration of venous congestion was 4.40 days, with a standard deviation of 1.52. The median percentage of flap survival was 100.00, with a range of 10.00, and the mean percentage of flap survival was 98.00, with a standard de-

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<td>Duration of venous congestion (days)</td>
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<td>Flap survival (percent)</td>
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<td>Operation time (minutes)</td>
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*Mann-Whitney U Test*
The median operation time was 92.00 minutes, with a range of 15.00, and the mean operation time was 92.40 minutes, with a standard deviation of 5.59 (Figures 2-7).

Donor site epithelialization was 21 and 20 days in the first two patients, with a median of 20.5 days. In the latter three patients, a silver-containing dressing material was used prophylactically to suppress contamination by skin bacteria. With the use of a silver-containing dressing material, the median donor site healing decreased to a median of 11.00 days, with a range of 3.00. Comparison of the values of donor site healing of the first two patients with the latter three patients was not statistically different (p value = 0.08).

**Discussion**

Auricle injuries may present as superficial or full-thickness losses in clinical practice. Full-thickness losses can be classified into six categories: upper third losses, middle third losses, lower third losses, partial losses, total losses and lobular losses [6]. When considering a reconstruction option, one should keep in mind that the reconstructed tissue involves color and texture matching, as well as maintaining anatomical landmarks, especially the helical rim. If possible, one-stage operations are preferred.

Reconstruction of the defects in the upper third of the auricle up to 2 cm in length may be performed with primary suturation, helical advancement flap, preauricular flap or Banner flap. Out of these techniques, an ipsilateral composite chondrocutaneous conchal flap on the anterior pedicle of the crus helix was developed by Davis [7]. Nearly 30 years later, Daggregorio et al. [5]...
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developed a full-thickness chondrocutaneous conchal flap resembling the original flap proposed by Davis. This newer procedure was called the peninsular conchal flap. The peninsular conchal flap has an advantage over the Davis flap because the posterior skin envelope is also included in the composite flap tissue.

In a commentary [8] to the original study [5], it is clearly stated that defects exceeding 2 cm in length can be reconstructed with two options: [1] Using a two-stage operation in which a cartilaginous graft is placed in a well-vascularized bed in the first stage and the vascularized tissue is brought into the defect site in the second stage, or [2] Using a conchal flap with either an axial pattern or a random pattern. The PCF is an example of the latter.

The peninsular conchal flap is an axial pattern flap which supplies blood-flow from the posterior auricular artery and superior auricular branch of the superficial temporal artery. In the original study, the reliability of the rich vascular anastomotic network between the superficial temporal artery and the posterior auricular artery at the post-auricular region located near the helical root was expressed based on a cadaver study. Another important point is that the lateral skin supplies blood from perforators in a retrograde fashion and strict attention is required when dissecting the posterior auricular artery that has to be divided and very cautiously raised.

In this case series, all the patients had auricular defects exceeding 2.5 cm in length. This long length forced us to select a reconstruction option from the local advancement flaps. To perform a one stage operation, a PCF would be the ideal procedure. Five patients, 4 of whom were older than 72 years of age, tolerated the operations well. All of the operations were performed under local anesthesia and no perioperative complications occurred, including patient intolerance. The mean time for the operations was 92,40 minutes, which can be considered as acceptable.

After elevation, the PCF could easily reach the upper third pole of the ear, which makes the PCF an ideal option for reconstruction of the upper third of the auricle. Four of our patients had defects in the upper third pole and no tension at the suture lines occurred, which can be accepted as an indication that the PCF has no difficulties in reaching the upper pole of the ear. One
of the patients, who had a defect in the middle third of the auricle, was reconstructed using PCF without a problem.

The most important complication observed in our patients is postoperative venous congestion. All of the patients had a self-limiting venous congestion limited to the anterior skin envelope (Figure 8), which healed spontaneously. The mean time for the resolution of the venous congestion was 4.40 days, with a standard deviation of 1.52. Two patients had superficial epithelial loss due to venous congestion, which re-epithelized without a partial or full flap loss. One patient had a 10% flap loss due to the venous congestion.

In our opinion, one disadvantage of the original procedure is the inclusion of a larger amount of posterior skin envelope in the flap tissue. In the original study, composite flap tissue was elevated with a larger posterior skin compared to the anterior skin. The excessive upper part of the posterior skin was rolled anteriorly to restore the helical rim, which is among the key aesthetic elements of the pinna. After the elevation of the PCF, the border between the antihelical fold and conchal region is sutured primarily to the mastoid region, increasing the amount of posterior skin involvement, which could lose auricular projection after suturing to the mastoid region. To overcome this possible problem in our patients, a random pattern superior-based preauricular skin flap was elevated, rotated and tubed to restore the helical rim. The postoperative outcomes were impressive and no deterioration in PCF perfusion occurred when the preauricular random pattern flap was used in the same operation.

The donor sites of the patients were epithelialized uneventfully. No problems were encountered concerning spontaneous epithelialization, but using prophylactic dressing materials containing silver on the donor site decreased the recovery time. The mean time of epithelialization was 20.5 and 10.67 days, with or without using silver-containing materials, respectively. Although this change was not statistically significant (p=0.08), a decrease in epithelialization time was observed clinically.

**Conclusion**

The peninsular conchal flap is an axial pattern composite rotation flap that has an anterior skin envelope, conchal cartilage and a posterior skin envelope and may be used in the reconstruction of defects of the auricle exceeding 2 cm in length.

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**Conflict of interest statement**

The authors have no conflicts of interest to declare.

**References**