Surgical Management of Auricular Defect Depending on the Size, Location, and Tissue Involved

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Purpose: Auricular reconstruction is a challenging surgical intervention that requires perfect surgical skills, exact planning, and esthetic knowledge. It is necessary to use a suitable method of reconstruction for each patient. From 10 years of experience, the authors have developed a general concept for auricular reconstruction.

Patients and Methods: Seventy-five patients (62 male, 13 female; age range, 8 to 92 yr; mean age, 65.9 yr) underwent partial to total auricular reconstruction. Tissue loss occurred from different causes: 19 cases of squamous cell carcinoma (25.3%), 18 cases of basal cell carcinoma (24%), 14 cases of Bowen disease (18.7%), 11 cases of malignant melanoma (14.7%), 7 cases of trauma (9.3%), 3 different malignant tumors (4%), and 3 cases of congenital deformity (4%).

Results: Defects smaller than one fourth the vertical auricular size (15 to 20 mm) could be treated by primary closure. A larger defect closed by this method caused visible deformity. In defects larger than one to three fourths the vertical auricular size (40 to 55 mm), a reversed retroauricular flap was used successfully if there was no contraindication or rejection. This flap can be combined with other flaps, depending on the flap location, size, and tissue involved. In defects exceeding three fourths the vertical auricular size, an implant-retained prosthesis was preferred.

Conclusion: The location and size of a defect, the medical condition of the patient, and the desired esthetic outcome play an important role in choosing the appropriate method. According to the authors’ experience, the only contraindications for the reversed retroauricular flap are medical condition, poor prognosis, and patient refusal.

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When considering the overall esthetics of the face, the ear is not the most defining part. However, even a small deviation in the symmetry, orientation, color, overall contour, and structural eminence of the ear can easily be noticed and detract from the overall esthetic image of the face. In some cases, this can lead to psychological dilemmas for the patient. Therefore, it is of the utmost importance when reconstructing the missing part of an ear to do so in an anatomically correct way so as to achieve the best esthetic outcome possible. There is no unique directive for ear reconstructions, but rather a multitude of available methods. These methods range from primary closure, to different local flaps,
to an ear prosthesis. Depending on the defect size, location, and tissue involved, simple primary closure using chondrocutaneous advancement flaps or modified techniques can be used. For reconstruction of larger defects of the ear, the retroauricular region is the principal donor site. The skin from this area, in addition to fascia and autogenous grafts (ear, rib, or septal cartilage) or allogeneic materials (porous polyethylene), can be used to reconstruct the ear. The authors previously introduced their alternative technique of using the retroauricular skin as an anterior pedicled flap. This flap, called a reversed retroauricular flap (RRF), enables the reconstruction of large auricular defects and is easy to perform with a straightforward postoperative follow-up. The RRF can be used as a full-thickness flap and has become the workhorse flap for auricular reconstruction in the authors’ department.

Despite the wealth of available methods for reconstruction of the ear, choosing the appropriate technique is not always evident. To simplify the decision-making process, the authors developed a concept of surgical treatment depending on the defect size, location, tissue involved, and the patients’ medical condition. They have been developing and applying this concept for the past 10 years, with satisfaction, and present their results in the present article.

**Patients and Methods**

This study was approved by the institutional review board of University Hospital RWTH-Aachen (Aachen, Germany) and all patients signed an informed consent agreement. Within a 10-year period, the authors included 75 patients (62 male and 13 female; 8 to 92 yr old; mean age, 65.9 yr) who underwent partial or complete auricular reconstruction in the authors’ facility in cooperation with the Department of Dermatology, University Hospital RWTH-Aachen. The defects were the result of tumor excision, trauma, or congenital deformities and affected the helix, antihelix, concha, scaphoid fossa, triangular fossa, or a combination these structures (Table 1). The defect vertical size ranged from 5 mm to complete loss of the auricle.

Depending on the defect size, location, aesthetic desire, and medical condition, patients were categorized into the following groups and the treatment procedure was planned accordingly:

1. Partial-thickness defects (n = 17)
   a. Anterior surface (n = 6): cranial or caudal pedicled preauricular flap, posterior pedicled retroauricular flap
   b. Posterior surface (n = 8): RRF
   c. No treatment (n = 3)

**Table 1. CAUSES AND LOCATIONS OF DEFECTS**

<table>
<thead>
<tr>
<th>Causes</th>
<th>Upper Third</th>
<th>Middle Third</th>
<th>Lower Third</th>
<th>Total</th>
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<td>6</td>
<td>19</td>
</tr>
<tr>
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<td>11</td>
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<td>18</td>
</tr>
<tr>
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<td>11</td>
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<td>3</td>
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<td>0</td>
<td>5</td>
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</tr>
<tr>
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<td>3</td>
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</tbody>
</table>

Total: 75

Abbreviations: BCC, basal cell carcinoma; CD, congenital deformation; MB, morbus Bowen; MM, malignant melanoma; OT, other tumors; SCC, squamous cell carcinoma; T, trauma.

2. Full-thickness defect (n = 52)
   a. Smaller than one fourth the vertical auricular size (15 to 20 mm; n = 16): primary closure or reductive surgery
   b. Larger than one fourth the vertical auricular size (n = 34): RRF
   c. No treatment (n = 2)
3. Larger than three fourths the vertical auricular size (40 to 55 mm; n = 6)
   a. Bone-anchored prosthesis using implant-retained or implant-carrying plating system (n = 5)
   b. No treatment (n = 1)

SURGICAL PROCEDURE

Depending on the defect size (Fig 1), the required skin area was marked retroauricularly (Fig 2A). The posterior triangle (I in Fig 2B) was incised and dissected in an anteriorly pedicled fashion to reconstruct the posterior auricular surface. After a healing period of 2 weeks, the anterior triangle (II in Fig 2C) was incised and folded forward to replace the anterior surface of the auricle. The healed posterior surface part of the flap was thinned out as much as possible. In addition, debulking of the anterior flap triangle (II) was performed and a cartilage graft was inserted, as required, if the wound closure was safe (Fig 2D). Any further refinement was performed in another setting after 3 to 4 weeks, as required.

Results

Six patients rejected any complex procedure and were satisfied with the outcome after initial treatment.
Deformities of the affected ear were obvious in these patients.

In patients with partial-thickness defects of the ear, satisfactory results were achieved using a posterior pedicled retroauricular flap or a pedicled preauricular flap for an anteriorly located defect and an RRF for a posteriorly located defect.

For full-thickness auricular defects, satisfactory results were achieved with primary closure or reductive surgery; however, this resulted in a slightly smaller ear (Fig 3). If defects were larger than one fourth the vertical auricular size (Fig 1) would be too noticeable compared with the contralateral ear (Fig 4). Therefore, the preferred choice was to replace the lost tissue with the RRF if the defects were larger than one fourth the vertical auricular size (Figs 5, 6). The size and outer contour of the ear, the tissue structure, and skin color were very pleasing; thus, scars or minimal surface irregularities were acceptable.

In patients with auricular replacement by prosthesis (n = 5), despite the pleasing esthetic appearance, implant-related problems, such as implant loosening and multiple skin irritations, occurred.

**Discussion**

The axis and vertical height of the auricle are important anthropometric and esthetic parameters that can convey information concerning age and gender. The average total ear height is about 6.5 cm. Any tissue loss exceeding one fourth the vertical auricular size (Fig 1) will affect anthropometric and esthetic parameters and require tissue replacement with similar tissue. In 1956,
reconstruction of a partial defect was introduced using a composite graft of the contralateral ear. Depending on the size of the graft, this method is not always reliable. Conversely, auricular reconstruction using local tissue as a posterior pedicled retroauricular flap has been used in many cases. This flap has since been modified many times and still plays an important role. This method, despite its many advantages, does not allow for tension-free adaptation of the flap into the recipient site and postoperative wound dressing is inconvenient and difficult. Common methods for defect closure are regional cutaneous or chondrocutaneous flaps. These flaps can be used in different modified forms and have specifically defined indications with limited use in larger defects. Some reconstructive techniques do not involve the helical rim.

Many investigators have suggested using pedicled regional cutaneous or myocutaneous tissue as random, arterial, or island flaps. All these flaps are useful for reconstructing smaller defects, although the outcome can be impaired by anatomic deviations and insufficient blood supply. For larger defects and complete loss of the auricle, more extensive surgical procedures have been developed using temporoparietal or mastoid flap fascia covered by local cutaneous flaps or skin grafts. The auricular framework then can be assembled from autogenous grafts, such as conchal, septal, and rib cartilage, or from alloplastic materials, such as porous polyethylene. Additional skin can be obtained by the use of expanders. These are more extensive methods that require many operative steps and require greater compliance by the patient. A decrease of

FIGURE 2 (cont’d). C, The front half (II) of the flap is elevated and prepared for reconstruction of the anterior surface of the ear. (Fig 2 continued on next page.)

the reconstructed auricle cannot always be avoided and requires correction. Therefore, prosthetic reconstruction has become increasingly popular.

During the past 10 years, the authors have treated more than 100 patients with auricular defects, many of which were closed primarily and did not require additional reconstructive procedures. Of these patients, 75 had larger defects that could not be treated by primary closure alone. The authors' treatment concept was planned according to the defect size and location, tissue involved, the underlying medical condition, and the desired outcome. For defects up to one fourth the vertical size, reconstruction was performed with good results by primary closure (Fig 3). A visibly smaller ear compared with the contralateral unaffected ear was acceptable. This method showed a very low complication rate and other investigators have proposed a similar approach for a similar defect size.

A defect larger than one fourth the vertical auricular size can be closed in similar fashion, but will lead to an obvious deformity (Fig 3). This was performed in limited cases depending on the morbidity of the patient, esthetic demand, and if extensive procedures were refused. For reconstruction of larger defects, the RRF was used alone or in combination with other surgical procedures. Reconstruction of the ear using the RRF is a simple and easy technique, which offers an excellent esthetic outcome and can be performed under local anesthesia in an ambulatory setting for nearly all types of defects, spanning all anatomic locations of the ear (helical rim, conchal bowel, and lobule; Figs 5, 6). Depending on the composition of the defect, cartilage grafts can be used as a framework. The flap can be designed so that the hairless skin

**FIGURE 2 (cont’d).** D, The flap is integrated and the lost tissue is completely replaced.
part is placed anteriorly. Disadvantages of the RRF are the multiple operative steps and the open wound surface, similar to other procedures. The RRF allows uncomplicated postoperative control of the visible wound surface. Because of its advantages, such as tension-free flap adaptation and excellent control of wound healing, the authors have increased their use of the RRF.\textsuperscript{21} This method has become the standard technique in the authors’ institution for the reconstruction of defects up to three fourths the vertical auricular size. Nevertheless, defects exceeding this size are difficult to replace by local flaps. The authors prefer replacing a lost ear with an implant-retained ear prosthesis. It provides good aesthetic results with minimum operative effort.\textsuperscript{37} The procedure also is becoming increasingly easier using the Epiplating System\textsuperscript{\textregistered} (Medicon, Tuttingen, Germany) and can be performed in an outpatient setting. Nevertheless, it is fraught with implant-related complications, such as peri-implantitis.\textsuperscript{38}

In the authors’ opinion, when choosing a technique for auricular reconstruction, the solution should consider factors, such as defect size, composition, medical condition of the patient, and the expectation of the aesthetic outcome. A simple reductive surgery is indicated if the defect is smaller than one fourth the vertical auricular size. Conversely, larger defects demand more extensive procedures. The RRF can be applied to replace full-thickness defects from one to three fourths the vertical auricular size, with a good cosmetic result. It provides easy wound care and primary closure of the donor site in concealed areas, in addition to a tension-free adaptation of the flap in the defect. There are no concerns about flap necrosis. For larger defects, the authors prefer bone-anchored ear prostheses.
FIGURE 5. A 75-year-old man after tumor excision and tissue replacement with a reversed retroauricular flap. A, Size of defect after tumor excision. B, C, D, Designing the flap, adaptation, and wound closure, respectively. (Fig 5 continued on next page.)

FIGURE 5 (cont’d). E, F, Follow-up 4 weeks after reconstruction.

FIGURE 6. An 82-year-old man after tumor excision of the ear lobe. A, Planning the flap so that it is slightly larger than the defect. B, Adaptation of flap. C, Follow-up 4 weeks after reconstruction.

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References


GUIDELINES FOR AURICULAR RECONSTRUCTION