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CLINICS IN
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Ear reconstruction

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The three-dimensional structure of the external ear makes this one of the most elegant body parts. The rigid structure of the cartilage along with its elastic nature is a testament to its unique properties—properties that make it very difficult to reproduce. The challenge of matching the flexibility of an ear while maintaining its rigidity and skin covering is the bane of reconstructive surgeons.

Since the advent of recorded procedures, the replacement of ears has remained a daunting task. Maternal cartilage, donor cartilage, Vitallium trays, Silastic implants, and tissue-engineered cartilage have all been tried *in vivo* or in the laboratory. The overwhelming strength of the skin envelope has caused most of these techniques to fail, and the biologic principles in tissue rejection/acceptance have been a limiting factor in the success of ear reconstruction.

In clinical settings, tissue-engineering constructs, although promising, have not provided a strong enough framework to be covered by skin while maintaining long-term shape. In addition, the current constructs have not been able to reproduce a person's own cells in tissue culture and ultimately create a framework that is nonantigenic for use in the same donor. Current tissue-engineering techniques use bovine cartilage in cell culture, which is prepared in some form

for implantation into an animal that is not able to mount an immune response. Furthermore, the constructs prepared in this manner have not been able to withstand the pressure of the overlying skin. This is the conundrum facing all plastic surgeons: the perfect replacement for total or partial loss of an ear.

Cancer resection of the ear can range from total to partial, and can involve only skin or skin and cartilage, as well as temporal bone, fascia, and hair-bearing skin. The reconstruction of the ear must take into account all of the concomitant defects that exist. The reconstruction of the entire temporal bone and ancillary structures of the region is beyond the scope of this article. However, the surgeon must be able to incorporate these procedures into his reconstructive ladder when the need exists. Reconstruction of ancillary structures of the region may include the use of free flaps or composite free flaps, if necessary. Brent has beautifully described this in the reconstruction of a hairline using contralateral temporal parietal fascia with hair-bearing skin. The armamentarium of the modern plastic surgeon makes it possible for surgeons to deal with large-scale losses of the ear and the surrounding integument using many complex methods that were not available to earlier generations.

The structure of the ear (Fig. 1) is quite complex and the areas most affected by cancer are the helix and scapha. This cancer can involve one site or a combination of sites. Cancer involving the conchal bowl as an isolated site is rare, and often goes unnoticed until late, resulting in large resections involving the external canal and temporal bone. The lobule is even less involved in limited cancer resections. It is best to

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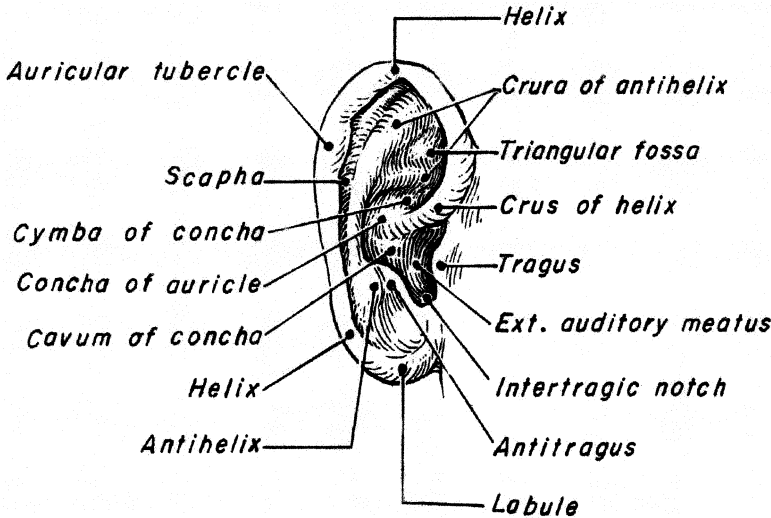


Fig. 1. Normal anatomy. (From Brent B. The face, part 2. Reconstruction of the auricle. In: McCarthy plastic surgery, vol. 3. New York: WB Saunders; 1990. p. 2095.)

address the reconstruction by looking at the defects in a progressively complex fashion.

Skin

The simplest resection is, of course, a resection of skin only. This type of resection involves skin of the scapha or the helix. Often basal cell carcinomas can be excised if there is no cartilage invasion and the lesion is relatively small. Squamous cell carcinoma also can include skin only, provided that the lesion is caught early and the depth is shallow.

Cartilage resection in these cases should not be performed, the perichondrium should be preserved, and the defect should allow for the use of a skin graft that is properly shaped and stented to allow for good healing. Primary closure is not the first choice in a skin-only resection (Fig. 2).

Skin and cartilage

The next level of defect includes resections of skin and cartilage. In the case of helical rim defects that include cartilage resection, primary advancement and closure is an excellent method. Other well-published options include the preauricular flap, the postauricular flap, the conchal bowl rotation of Davis (Fig. 3), and

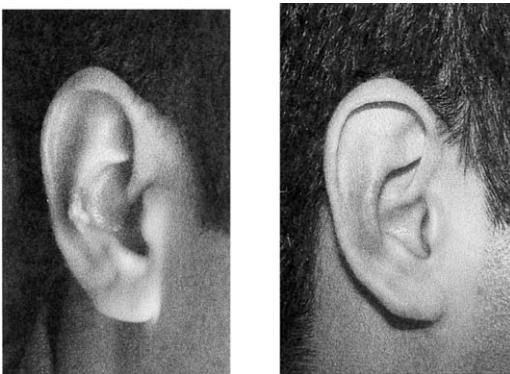


Fig. 2. Closure of defect with skin graft.

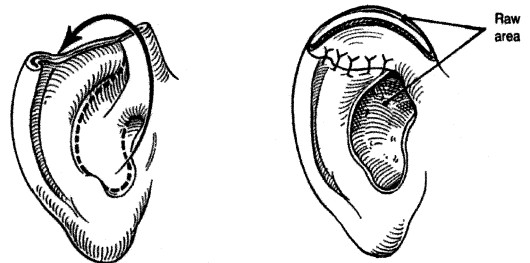


Fig. 3. Conchal bowl rotation by Davis. (From Brent B. The face, part 2. Reconstruction of the auricle. In: McCarthy plastic surgery, vol. 3. New York: WB Saunders; 1990. p. 2144.)

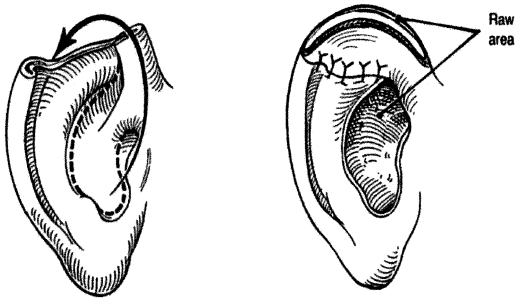


Fig. 4. Single Antia-Buch. (From Brent B. The face, part 2. Reconstruction of the auricle. In: McCarthy plastic surgery, vol. 3. New York: WB Saunders; 1990. p. 2144.)

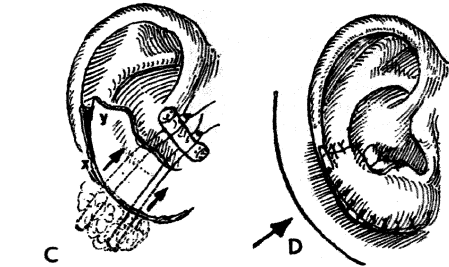
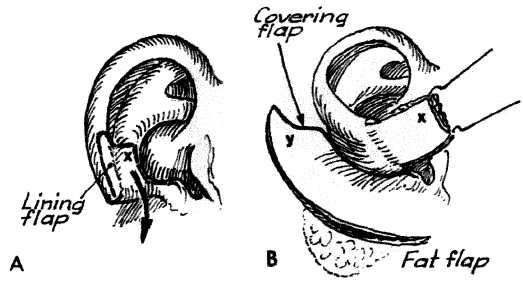


Fig. 7. (A-D) Earlobe reconstruction by Davis. (From Brent B. The face, part 2. Reconstruction of the auricle. In: McCarthy plastic surgery, vol. 3. New York: WB Saunders; 1990. p. 2143.)

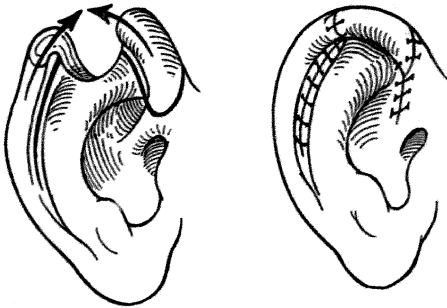


Fig. 5. Double Antia-Buch. (From Brent B. The face, part 2. Reconstruction of the auricle. In: McCarthy plastic surgery, vol. 3. New York: WB Saunders; 1990. p. 2144.)

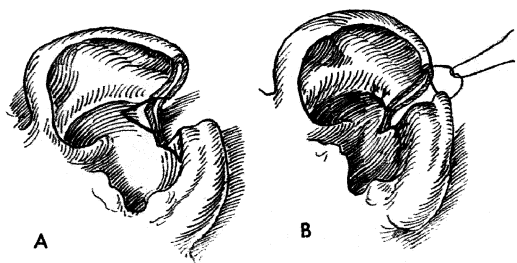


Fig. 6. (A,B) Stellate excisions to allow for primary closure. (From Brent B. The face, part 2. Reconstruction of the auricle. In: McCarthy plastic surgery, vol. 3. New York: WB Saunders; 1990. p. 2146.)

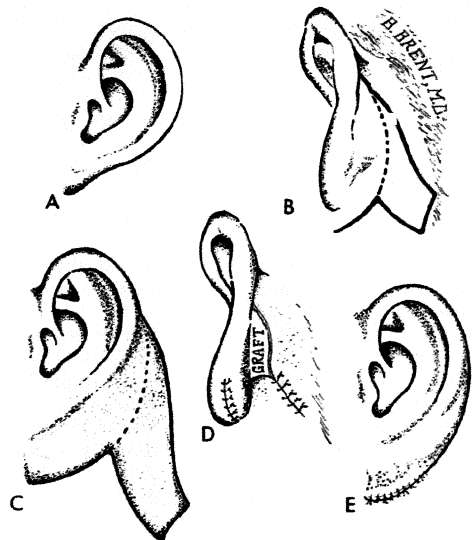


Fig. 8. (A-E) Double-lobed postauricular flap by Brent. (From Brent B. The face, part 2. Reconstruction of the auricle. In: McCarthy plastic surgery, vol. 3. New York: WB Saunders; 1990. p. 2145.)

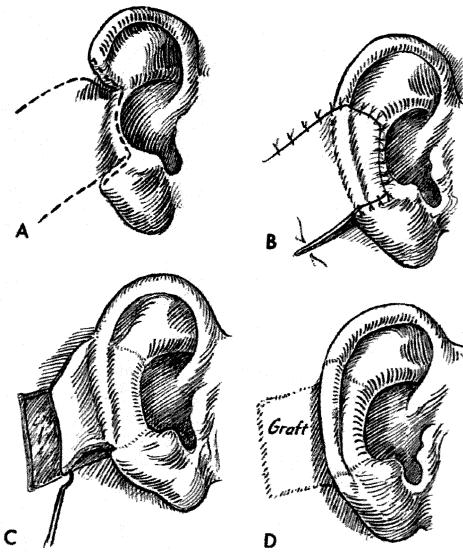


Fig. 9. (A–D) Use of posterior mastoid skin by Dieffenbach. (From Brent B. *The face, part 2. Reconstruction of the auricle*. In: McCarthy plastic surgery, vol. 3. New York: WB Saunders; 1990. p. 2137.)

the well-designed Antia-Buch advancement as either a single (Fig. 4) or double (Fig. 5).

Scaphal resections usually will involve the helix and occasionally the conchal bowl. This reconstruction is handled best by stellate excisions that allow for closure in a primary advancement (Fig. 6). Conchal bowl resections can be handled by the use of a skin graft alone, even in the face of cartilage resection. The segmental loss of parts of the auricle must be repaired by allowing the ear to retain its shape even if smaller in size.

Finally, the partial loss of an earlobe can be reconstructed by the use of the remaining skin or local flaps. However, the total loss of an earlobe cannot be reconstructed by skin alone, because inevitably, there will be shrinking and loss of shape. The best techniques are the Davis flap (Fig. 7) or the double-lobed postauricular flap of Brent (Fig. 8). The reconstruction should include the use of cartilage to maintain shape and size.

Skin and cartilage—loss greater than 50%

When the resection involves several of the individual components of the ear, the difficulty in obtaining an adequate reconstruction is magnified, and the need for tissue to be “brought in” is present. This usually involves cartilage—either free or in a composite graft. If there is less than 1.5 cm, the composite graft is the best, because it brings cartilage and skin together. Larger defects involving cartilage require the use of free cartilage, which presents three problems: how is the cartilage to be shaped, how is it to be nourished, and how is it going to be covered?

The use of autogenous cartilage is the best choice for this, and many sites fill this donor need, including the septum, costal cartilage, and even cartilage from the contralateral ear. Skin coverage requires a nourished bed, which can be obtained from two sources. A temporal parietal fascia (TPF) flap is the best means of accomplishing coverage. The second alternative is to use the posterior mastoid skin; which can be done in stages by (1) banking the cartilage in the proper position, (2) splicing the auricle to it, and (3) elevating both as a unit (Fig. 9).

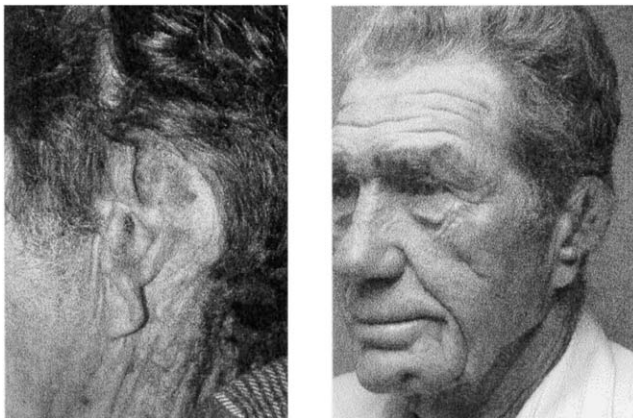


Fig. 10. Full reconstruction with autogenous framework and TPF flap.

Total reconstruction

When the entire auricle is gone, a full autogenous framework is required, which necessitates a TPF flap. This flap can be used as a turndown flap or, if the fascia is missing, a contralateral free TPF. Other choices include the radial forearm fascial free flap and the dorsalis pedis fascial free flap. These types of reconstruction can be rewarding, but are extremely difficult to master (Fig. 10).

The use of the Medpor implant (Porex Surgical, Inc., College Park, GA) is growing, as is the number of complications associated with its use. Medpor often gives an excellent early result; however, the long-term value has yet to be determined. Late-onset infections from trauma and insect bites still can be damaging in much the same way as with silicone implants. The Silastic implant seemed so promising that it took almost 15 years to reach the conclusion that it was not an acceptable material for long-term reconstruction. Medpor remains experimental and the reliability of this ear reconstruction method has yet to be determined. There are many damaged patients with deformed ears as a result of the “silicone bandwagon.” Ultimately, the role of the plastic surgeon is to cause no harm, and this motto should be the guide in all treatment.

Summary

The ear is one of the most difficult areas to reconstruct. Experience with and knowledge of various methods are tantamount to a successful outcome.

Acknowledgment

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Further readings

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