Microtia Reconstruction

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Epidemiology

- Occurs 1 in 7,000 to 8,000 infants
- Occurs more often in right ears
- Occurs more often in males
- Higher incidence in Hispanics and Asians than in blacks and whites
- Fewer than 15% with positive family history
- Associated with other congenital malformations
Embryology of Auricle

From *The Ear comprehensive otology*:

**FIG. 7.** Hillock formations in an 11-mm embryo. (From Anson-Donaldson J, Duckert LG, Lambert PR, Rubel EW, eds. *Surgical anatomy of the temporal bone*. New York: Raven Press, 1992:56, with permission.)

**FIG. 8.** Progress of embryonic fusion of the hillocks to form the adult auricle. **A:** Six weeks of gestation. **B:** Adult auricle with corresponding numbers on the derived part. (From Anson-Donaldson J, Duckert LG, Lambert PR, Rubel EW, eds. *Surgical anatomy of the temporal bone*. New York: Raven Press, 1992:56, with permission.)
Anatomy of auricle

From *The Ear: Comprehensive Otology*:

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External ear anatomy

- **Muscles:** 3 extrinsic and 6 intrinsic

- **Sensory:**
  - Posterior portion: greater auricular nerve and lesser occipital nerve
  - Anterior portion: auriculotemporal nerve, anterior branch of greater auricular nerve and Arnold’s branch of vagus nerve

- **Vascular:**
  - Posterior auricular artery
  - Superficial temporal artery
Anatomical Relation
Classification of Microtia

- Many classification systems
- Grade I, II, III:
  - Grade I: all anatomic subunits present but misshapen
  - Grade II: anatomic subunits either deficient or absent
  - Grade III: classic “peanut ear” and anotia
FIG. 1. Dysmorphic ear anomalies result from abnormal intrauterine positioning that causes pressure on the developing auricle.

FIG. 6. Class II deformities are constricted and small. These ears lack anatomic subunits.

FIG. 9. Class III (microtia) deformities have an inferior fibroadipose lobule and a nubbin of cartilage in the superior remnant.
History of microtia reconstruction

- Dr. Tanzer 1959: 1\textsuperscript{st} article on auricular reconstruction with autogenous rib cartilage, 6 stages procedure
- Dr. Brent 1974: 4 stages procedure, foremost authority on auricular reconstruction
- Dr. Nagata 1985: 2 stages procedure
Surgical planning

- **Timing:**
  - 47.2% operated at age 6-7, 21.1% operated at age 8-10 per Dr. Brent
  - Nagata operated at age 10 and chest circumference at least 60 cm (confirmed with x-ray)

- Otologic surgery is in general planned after the auricular reconstruction surgery
  - Increased interest in atresia correction
Brent technique

Four stages:
- Stage I: fabrication of the auricular framework with contralateral costal cartilage
- Stage II: lobule transposition
- Stage III: framework elevation
- Stage IV: tragus reconstruction
Brent technique
Brent technique: stage I
Stage II
Stage IV
Alternative methods for tragus reconstruction
Long term result from Brent technique
Criticism

- Number of stages required
- Lack of definition of the conchal bowl, the intertragic notch, and the contour of the antitragus
- Effacement of the postauricular sulcus due to contraction of the skin grafts
Nagata technique

- **2 stages:**
  - Stage I: fabrication of auricular framework from ipsilateral costal cartilage, tragus reconstruction, and lobule transposition
  - Stage II: framework elevation
Nagata technique: stage I
Stage I: framework
Stage I: implantation and lobule transposition
Stage II: elevation of framework
Criticism

- High rate of flap necrosis (14%)
- Significant anterior chest wall deformity
- Unnaturally thick ear
- High extrusion rate may be due to use of wire sutures (8%)
- Universally used temporoparietal fascia flap
Complications

- **Ear reconstruction site:**
  - Exposure of the framework
  - Resorption of the framework

- **Cartilage donor site:**
  - Immediate problem: pneumothorax, atelectasis
  - Delayed problem: anterior chest wall deformity, scarring
Alloplastic reconstruction

- **Silicone:**
  - Good initial result
  - Poor long term result secondary to implant exposure
  - Minor trauma can cause implant failure

- **Medpor:**
  - Good short term (2 years) result in combination of temporoparietal fascia flap
Prosthetic reconstruction

- Osseo-integrated anchoring device: approved extraoral use by FDA in 1995

- Indication:
  - Failed autogenous reconstruction
  - Sever soft-tissue/skeletal hypoplasia
  - Low or unfavorable hairline
  - Acquired total or subtotal auricular defect, usually in adults

- Prosthesis changes every 2 to 5 years
- Meticulous hygiene at skin/implant interface
- Preclude future autogenous reconstruction
Tissue engineering

- Cao et al. transplanted bovine chondrocytes onto a scaffold and implanted in mice
- Need a scaffolding strong enough to maintain its shape and not causing extrusion
- Human auricular chondrocytes multiply well in vitro and have the ability to form new cartilage
Tissue engineering
More long term result photos are available at:

- www.earsurgery.com (Dr. Brent home page)
- www.microtia.jp (Dr. Nagata home page)