Microtia Reconstruction
Autologous Rib and Alloplast Techniques

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KEYWORDS

• Microtia • Rib graft • Medpor • Porous polyethylene • Auricular deformity

KEY POINTS

- Microtia, or abnormal external ear development, is a relatively rare congenital condition that is more common in certain ethnic groups, in men, and in the right ear.
- Given the complex structure of the ear and the difficulty in creating the anatomic environment for a neo-appendage, reconstruction of the auricle has always been a unique and challenging problem.
- There is no universal consensus on grading microtia. The most common nomenclature is the Weerda classification, which involves classifying the microtic ear on scale of grade 1 (small with normal features) to grade 3 (mass of deformed tissue).
- Autogenous rib reconstruction involves at least 2 stages (typically more), is generally a more durable reconstruction, and is less prone to infection.
- Alloplastic porous high-density polyethylene reconstruction typically involves 2 stages, is generally more aesthetic, involves less morbidity, and can be done at a younger age.

Videos of microtia reconstruction accompany this article at http://www.facialplastic.theclinics.com/

OVERVIEW

Microtia, or abnormal external ear development, occurs in 1 in 4000 to 10,000 births. It has a higher incidence in Asian, Hispanic, and Native American populations, with some studies citing a statistically significant increased risk in children of multiparous mothers. There is also a higher risk in males versus females, and microtia more commonly affects the right ear.[1]

Embryologically, microtia is caused by malformation of the 6 hillocks that eventually join to form the auricle. During the sixth week of gestation, these hillocks form from the first and second branchial arches, eventually developing into the helix, lobule, tragus, and antihelix.[2] The concha and external auditory meatus are formed by the first branchial groove and, as such, can be affected independently of the other structures.

Reconstruction of the auricle is a unique and challenging problem faced by surgeons today. The complex structure of the ear, along with the inherent difficulty of placing a framework within a tight skin pocket, leads to a spectrum of results among the varying surgeons who have performed

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these procedures. Over the years, methods of treatment have evolved, with techniques becoming more refined, but the core concepts remain the same. In general, there are 2 potential reconstructive options: autogenous rib cartilage and alloplastic implantation.

HISTORICAL PERSPECTIVE

Reports of ear reconstruction attempts date back to the sixteenth century, with the first documented successful reconstruction reported by Johann Friedrich Dieffenbach in the mid-nineteenth century, using a folded mastoid flap to repair a traumatic defect. Pierce discussed the use of a cartilage graft in 1930, with Gilles first describing attempted microtia reconstruction with donor cartilage from a patient's mother in 1937. From this point forward, cartilage grafts (both human and bovine) gained favor; however, it was quickly noted that these grafts tended to soften and sag over time, with some ultimately resorbing or being rejected.

In 1943, Peer developed a technique whereby the auricle was prefabricated using costal cartilage fragments, which were fitted to a mold and stored in the abdomen for future implantation. There were issues surrounding the need for multiple operations, and that the structural integrity of the molded fragments could not withstand the deforming force of a tight skin pocket.[3] Tanzer described the subcutaneous placement of an autogenous cartilage graft framework in 1959.

The history of alloplastic auricular reconstruction is more recent. The use of alloplastic implantation for auricular reconstruction was initially attempted in the 1960s using silicone implants, but this reconstruction technique was fraught with complications, with a high incidence of implant failure, especially related to minor trauma or abrasions.[4,5] In 1990, Shanbhag and colleagues[6] first wrote of the feasibility of using porous high-density polyethylene (PHDPE) in a baboon animal model. Wellisz and colleagues,[7,8] in 1992, described the use of a prefabricated alloplastic implant for microtia reconstruction in humans, constructed from PHDPE, subsequently marketed in the United States under the trade name of Medpor PHDPE (Stryker, Kalamazoo, MI). This material proved to have many properties that are ideal for auricular reconstruction, and continues to be the alloplastic microtia reconstruction material of choice.

PATIENT ASSESSMENT

The grading of microtia suffers from the disagreement on a universally accepted standardized scale (**Table 1**). The most commonly referenced scale was originally described by Weerda and later refined by Aguilar. The Weerda classification is based on the severity of auricular deformity: grade I describes a small ear with normal features, grade II describes a rudimentary auricle with some recognizable components, and grade III refers to a mass of deformed tissue. The Nagata grading is based according to vestigial structures rather than a scale.[9]

Brent[10] uses 2 general categories to describe microtia: classical and atypical. Classical is used to describe a vestige resembling a "sausage-shaped

Table 1
Classification schemes

	Classical		Atypical	
Brent	Remnant vestige ("sausage-shaped appendage") Relatively normal lobule		All other types, including anotia, conchal remnants, vestiges with pits and grooves	
	Lobule Type	**Conchal Type**	**Small Conchal Type**	**Anotia**
Nagata	Remnant ear: + Lobule – Concha – Acoustic meatus – Tragus	Some: Lobule Concha Acoustic meatus Tragus Incisura tragus	Remnant ear: + Lobule + Small indent for concha	Complete absence of an auricle
	Grade I	**Grade II**		**Grade III**
Weerda/ Aguilar	Small ear: normal features	Rudimentary auricle: some recognizable components		Mass of deformed tissue