

# AUTOLOGOUS EAR RECONSTRUCTION FOR MICROTIA – CASE REPORT

KHALID AL-FALAH<sup>1</sup>, DRAGOȘ ZAMFIRESCU<sup>2</sup>, MIHAELA CORLA<sup>3</sup>

<sup>1</sup>Clinical Emergency Hospital București

**Keywords:** microtia, reconstruction, autogenous costal cartilage

**Abstract:** Microtia is an uncommon pathology that is defined by a hypoplasia of the pinna. Multiple reconstructive surgeries have been developed. Nowadays, autologous rib cartilage reconstruction and Medpor implant reconstruction are the most widely used techniques. Total ear reconstruction for microtia depends on the degree of severity of hypoplasia. The goal is the reconstruction of an auricle with an appearance as close as possible to that of a normal ear. Even though the auricle is only a small part of the body, it is probably one of the most complex structures. That is why ear reconstruction is one of the most difficult tasks for a plastic surgeon. In this paper, we present a four-stage ear reconstruction in a case of a five-year-old girl with microtia.

**Cuvinte cheie:** microtia, reconstrucție, cartilaj costal autolog

**Rezumat:** Microtia este o patologie mai puțin comună ce se definește prin hipoplazia urechii externe. Mai multe proceduri reconstructive au fost dezvoltate. În momentul de față, reconstrucția cu cartilaj costal autolog cât și cea cu implant Medpor sunt cele mai răspândite tehnici. Reconstrucția auriculară totală în microtie depinde de gradul și severitatea hipoplaziei. Scopul este acela de a construi o ureche cu un aspect cât mai apropiat posibil de cel al unei urechi normale. Chiar dacă urechea este doar o mică parte a corpului, aceasta este probabil una din cele mai complexe structuri ale sale. Acesta este și motivul pentru care reconstrucția auriculară este una din cele mai dificile misiuni ale chirurgului plastic. În această lucrare vă prezentăm o reconstrucție auriculară în trei timpi la o fetiță în vârstă de cinci ani cu microtie.

## INTRODUCTION

Microtia is a pathological condition of the external ear, wherein an affected individual is born with a grossly misshapen or absent external ear. It is frequently associated with aural atresia, or the absence of normal ear canal, tympanic membrane, functional ossicles and conductive hearing component. Microtia is relatively uncommon, occurring in 5-10,000 live births.(1,3) It is more common on the right side than on the left, but it can be bilateral. Prenatal maternal lifestyle is not associated with microtia. In addition to the severe psychological effect of a grossly deformed ear, the child or adult with microtia has a moderately severe hearing loss. The patient routinely has an absence of the external ear (or pinna), an absent external canal and ear drum, as well as a small middle ear cavity with fusion of the small middle ear bones (ossicles) and an open (patent) eustachian tube, despite a normal inner ear. Total external ear reconstruction requires 3-4 surgical stages.(1,4,6) On the average, intervals of 2-3 months elapse between the surgical stages to optimize the healing process. Some surgeons favour a 1- or 2-stage procedure. Tanzer and Brent (1,2) advocated multistage reconstructions, which are currently favoured by most ear reconstruction surgeons.

- First stage - Rib cartilage harvesting with carving and sculpting into the shape of an ear and placement of sculpted framework under the skin pocket of the microtic ear;
- Second stage - Formation of the lobule;
- Third stage - Elevation of the ear with insertion of a postauricular skin graft;
- Fourth stage - Formation of the tragus with a skin/cartilage composite graft from the contralateral ear and full-

thickness skin graft for the conchal area from the contralateral ear.

## CASE REPORT

A 5-year-old girl presented to our clinic for reconstruction of a malformed left ear. She did complain of some hearing loss with difficulty in localizing sounds, but she was doing fairly well with normal language development. The rest of her history was negative. On physical exam, she had a grade III microtia with a 0.5 x 2cm vertical sausage-shaped skin remnant, with poorly organized cartilage in the superior aspect, and a well formed lobule inferiorly. No pit or external auditory canal opening was detected. The rest of her head and neck exam was otherwise unremarkable (figure no. 1).

**Figure no. 1. Preoperative appearance. a: left ear. b: right ear. The patient underwent total ear reconstruction with a three-stage method using autogenous costal cartilage**



Detailed preoperative planning was done before operation in order to establish the correct position and carving of the framework for the new ear. A pattern for the construct is

<sup>1</sup>Corresponding author: Khalid Al-Falah, Calea Florească, Nr. 8, Sector 1, București, România, E-mail: khalidutso@yahoo.com, Tel: + 4021 5992300  
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## CLINICAL ASPECTS

made by placing a large piece of X-ray film against the normal ear and tracing its anatomic landmarks. The template is then reversed and made several millimetres smaller to accommodate the thickness of the skin cover.

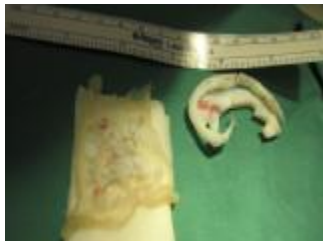
In the first stage, fabrication of the cartilage framework and its implantation were performed. At first a contralateral transverse incision was made over 6<sup>th</sup> intercostal space to expose the 6<sup>th</sup>, 7<sup>th</sup> and 8<sup>th</sup> costochondral cartilages (figure no. 2). A cartilage block was cut according to the pattern without disturbing the sincondrosis between the 6th and 7th ribs. Preserved perichondrium would grow and fill the donor space. Extreme precaution was taken not to injure the pleura during rib harvesting.

Meticulous technique was followed for sculpting the framework (figure no. 3). The inside edge of the helical rim and triangular fossa were marked out and excavation was done in scapha and triangular fossa until the cartilage was removed through the back of the framework. Edges of lobule, antitragus, antehelix, and posterior margin of the helical rim were carefully rounded towards the final shape. Pattern of helical rim was drawn on the 8th rib and carved accordingly. Helical rim piece was then fixed over the ear framework with 4-0 and 5-0 Prolene sutures. The rest of the rib cartilage removed and not used was cut into small pieces and put in a pocket formed by the rest of the perichondrium.

**Figure no. 2.** A slightly oblique chest incision is made over the sixth, seventh, and eighth ribs close to the sternum (on the side opposite the microtic ear). The cartilaginous portion of the eighth rib and the synchondrosis of the sixth and seventh rib are harvested according to a previously measured template. A small piece of extra synchondrosis of rib 6 is harvested for use during the third stage in unilateral cases



**Figure no. 3.** The pieces of the rib are carved, sculpted, and sutured together



The correct position of completed ear framework was marked out. A small incision is made anterior to the rudimentary ear cartilage. The rudimentary ear cartilage from the upper pole was removed and the framework is then placed in a subcutaneous pocket (figure no. 4). The rudimentary ear cartilage was banked in a retroauricular pocket. Two small silicon suction drain tubes were secured in place. Rolled petroleum gauze were put to hold the skin onto the framework but not very tightly as to compromise circulation. A bulky soft pressure dressing was given. The drain tubes were kept in place for 7 days in order to keep the skin onto the framework and to

avoid the risk of hematoma or seroma.

**Figure no. 4.** Photograph of the new framework inserted into a skin pocket under the microtic ear



The second surgery was performed 8 months after the first surgery. Skin incisions were made 2 mm outside of the posterior margin of the auricle and the framework was elevated with care not to expose the cartilage. The banked pieces of cartilage were then removed. A pocket was created under the ear framework and the ear was supported away from the head with the banked cartilage. Scalp skin was then undermined and advanced anteriorly to reduce the wound size. The skin defect behind the ear framework was covered with a full thickness skin graft from the right post-auricular position area (figure no. 5). Lobule rotation also was done for better positioning.

**Figure no. 5. a:** An incision is made behind the newly constructed ear, and the undersurface is undermined. The banked cartilage harvested from the first stage is then placed under the framework to provide support and elevation. This raw tissue is lined with a skin graft. **b:** day 4 after surgery. **c:** postauricular view day 4



The third surgery was performed after another 9 months after the second surgery in order to increase the projection and lobule rotation for a better aesthetic result (figure no. 6).

**Figure no. 6. a:** Posterolateral view after third surgery. **b:** lateral view after third surgery



The final dimensions were on the reconstructed ear: a length of 58 mm, a width of 36mm and a protrusion of 16 mm

and on the right ear a length of 55 mm, a width of 36mm and a protrusion of 15 mm. Also the positioning of the reconstructed ear and the shape were good (figure no. 7). There have not been any complications after the procedures and also the scar on the chest wall was fine.

**Figure no. 7. Aspect of the reconstructed ear two years after the first stage operation. a:anterior view. b: lateral view**



### DISCUSSIONS

Microtia denotes a congenital malformation of the external ear, ranging from a smaller ear to a severely malformed auricle, with a constricted, blind or absent external auditory canal. The microtic auricle consists of a disorganized remnant of cartilage attached to a variable amount of soft tissue lobule. It has an incidence of 1 in 5000 to 20000 births in the general population with a higher incidence in Hispanics and Asians. The incidence of microtia varies with the extent of the deformity. Severe abnormalities occur in approximately 1 in 7000 to 1 in 8000 births. The occurrence is estimated to be 1 in 4000 for Japanese and as high as one in 900 to 1200 in Javajo Indian. Microtia is nearly twice as likely in male as in females. The right-to-left-to-bilateral ratio is 5:3:1 with bilateral deformity occurring in only 10% of patients.

Most cases of microtia are sporadic, with a suspected multifactorial etiology. Less than 15% of cases are considered familial, with both autosomal dominant and recessive forms with variable expression and incomplete penetrance being reported in the literature. Other risk factors include maternal rubella, maternal use of thalidomide, isotretinoin, mycophenolate and some other teratogens exposure.

The embryology of the external ear allows a better understanding of the pathophysiology of microtia. The auricle begins to develop in the 5th week of inutero development from 6 hillocks. The first branchial arch gives rise to the first 3 hillocks that will form the tragus, the helical crus, and the helix. The second arch gives rise to the other three hillocks that form the antihelix, the scapha and the lobule. In between the first and second branchial arches, the first branchial cleft will form the external auditory canal. Progressively the forming auricle migrates from a ventromedial to a more dorsolateral position as the midface and mandibular processes grow and push it outward and upward.

Interruption in the proliferation or fusion of the hillocks at varying stages results in the different grades of microtia. Due to the intimate embryologic development of the auricle and the external auditory conduct, microtia is often associated with atresia of the external auditory conduct. It can also be associated with other malformations in around 15 to 60% of patients, especially in bilateral cases. Whether isolated microtia is the mildest form of the "Hemifacial microsomia" with Goldenhar syndrome being the most advanced stage, is still controversial (Bennun's theory). Syndromes with microtia are frequently associated with anomalies such as facial cleft, lip cleft, facial asymmetry, facial nerve paralysis, hearing loss in the opposite ear, urinary tract anomalies, hypospadias, cardiac defects, microphthalmia, polydactyly and vertebral anomalies.

There is no universally adopted classification system for microtia. A very popular grading system, the Muerman-Marx classification, assigns a grade from I to III based on the severity of the deformity. Grade I denotes a slightly smaller than normal ear with overall normal features. Grade II is a rudimentary and malformed auricle but with recognizable components. Grade III, the most common type, includes the classic "peanut" ear, which is severely attenuated with usually associated atresia of the external auditory conduct. Another commonly used classification system, proposed by Nagata categorizes microtia into either "Lobule-type microtic ears" or "Concha-type microtic ears", according to vestigial structures present.

Sir Harold Gillies first described total ear reconstruction with autologous costochondral cartilage in 1920. The basic technique of microtia reconstruction with autogenous rib cartilage was described by Tanzer in 1959. It usually requires a minimum of two and up to four or five staged surgical procedures. It has been since then subject to several modifications. The main drawbacks of this technique are the multiple procedures, donor site morbidity, post-operative pain, and variable results.

There are four elements needed to create the appearance of a "real" ear--a flaplike shape, a helix, a concha, and a lobule. A lack of these essential elements cannot be made up by the addition of small details. Position is also of prime importance. Three key dimensions of correct position include: 1) the inclination of the long axis of the pinna, 2) the level on the face (high or low), and 3) the distance from the orbit.

A variety of surgical strategies have been devised for the reconstruction of the external ear.(1-7) The stages depend largely on the severity of the patient's deformity; the size, position, and quality of the microtic elements; and the surgeon's preference. Tanzer (1) advocated a four-stage reconstruction. In the first stage, the lobular remnant was transposed transversely to its correct anatomic position. In the second stage, costal cartilage from the sixth, seventh, and eighth contralateral ribs, was implanted beneath the mastoid skin, using a V-shaped postlobule incision. The sixth and seventh costal cartilages were used for the base and antihelix, and the eighth costal cartilage became the helical rim. The carved cartilage elements were coapted with fine-gauge wire. In the third stage, the construct was elevated from the head by advancement of postauricular skin and placement of a retroauricular, full-thickness skin graft. The concha and tragus were later (fourth stage) created with composite contralateral ear and skin/cartilage grafts. Tanzer later modified this sequence by combining the lobular transposition and placement of the cartilage framework into one stage, prefacing this modification with the admonition that if extensive mobilization or surgical manipulation of the lobule is necessary, it is best to use four separate stages to avoid vascular compromise of the lobular element.

With the arrival of osteointegrated implants, prosthetic reconstruction became an alternative.(7) However, despite the benefit of a single operative procedure, prostheses eventually need to be replaced. Also, a thin temporal bone and a growing bone are considered major obstacles to the insertion of such implants in children. Failed autogenous reconstruction, severe soft tissue-skeletal hypoplasia and low unfavourable hairline have been proposed as relative indications for prosthetic microtia reconstruction.

The use of an alloplastic auricular framework has been considered as an alternative. Silicone was initially presented with great enthusiasm but revealed a high failure rate from implant exposure, and has been largely abandoned. Porous polyethylene framework (Medpor®) has recently been gaining a

considerable popularity in microtia reconstruction.<sup>(8)</sup> It is favoured for its minimal tissue reaction and its porosity, which allows soft-tissue in growth and better stability. Despite some early reports on porous polyethylene that showed a similar failure rate to that of silicone, the complete coverage of the implant with a temporoparietal fascia flap kept it as a very promising surgical reconstructive option. Another advantage of MedPor® reconstruction is that atresioplasty, when indicated, can be performed at any time and does not have to wait for the aesthetic component to be completed.

Total auricular reconstruction is one of the most challenging procedures and requires careful preoperative planning. Both the aesthetic and otologic aspects should be addressed. Several reconstructive options are available and proper patient selection and meticulous surgical technique result in excellent outcomes. Understanding the psychological issues faced by patients with microtia and providing education to the parents of these patients is fundamental to a successful microtia reconstruction.

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