Comparison of Microtia Reconstructive Surgery with Autograft Versus Homograft

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Background: Microtia is a congenital abnormality with low incidence but considerable morbidities. Reconstruction of the microtia deformity is a complex and difficult process that requires a proper planning. The primary technique of reconstruction employs patient's own rib cartilage. Irradiated homograft cartilages previously have been used in facial reconstruction but its application in microtia surgery has not been reported yet. This study is designed to compare the results of autograft versus homograft auriculoplasty.

Methods: Between 1992 – 2002, 23 patients underwent auricular reconstructive surgery by the senior author in our department. Autograft implantation was performed in one stage but homograft auriculoplasty was done in two stages.

Results: Auricular deformity was right-sided in 13, left-sided in 8, and bilateral in 2 cases. Implanted graft was autograft in 9 patients and homograft in 14 patients. During mean follow-up of 4 years, cartilage graft resorption was detected in two cases, one in autograft and one in homograft group (\( P > 0.05 \)). No postoperative infection was observed. Status of postauricular sulcus was optimal in 85.7% of homograft and 77.8% of autograft groups (\( P > 0.05 \)). The satisfaction score of the patients and/or parents was excellent in 66.7% of autograft and 92.9% of homograft groups (\( P < 0.01 \)).

Conclusion: Based on better satisfaction score, equivalent aesthetic appearance, and absence of complications such as scaring and pain on the chest wall, homograft auriculoplasty is an appropriate option for reconstructive surgery in patients with microtia.

Keywords: Autograft • homograft • microtia • reconstructive surgery

Introduction

Microtia is defined as small and abnormal auricle and occurs in approximately 1 in 7,000 – 8,000 of live births. Microtia deformity has right-ear predominance (right-to-left ratio of 3:2) and affects boys more than girls at a 2.5:1 ratio. Unilateral cases outnumber bilateral cases by a 4:1 ratio. While no specific chromosomal abnormality has been reported for microtia, several environmental and genetic factors have been claimed to be responsible for this deformity. Known teratogens such as isotretinoin, thalidomide, and maternal rubella can produce microtia with other abnormalities. A positive family history of microtia is reported in less than 15% of cases. No universal classification of microtia predominates; however, many authors have described some systems based on the degree of deformity and specific parts of formed auricle. One of the most frequently used classifications is Weerda classification. Weerda describes three types of microtia. Grade I microtia is characterized by a mild deformity with a slightly dysmorphic helix and antihelix. In grade II microtia, ear has all major structures to some degree, but repair requires cartilage or skin. The external auditory meatus is present but with stenosis. The grade III

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abnormality is characterized by few, if any, landmarks. If present, the lobule is usually positioned anteriorly.

Although auricle is a small part of the body, it contains the most complex three-dimensional external body structure. Thus, microtia reconstruction surgery is one of the intricate plastic surgeries, requiring combination of art and knowledge.9,11–13

The onset age for plastic surgery of microtia is controversial. Because the emotional impact of this deformity does not appear until the age of 7 to 10 years and auricle size reaches to 85% of adult size at the age of six, most surgeons prefer to perform reconstructive surgery between the age of 6 and 10.14,15

The technique of choice for microtia reconstruction has been the use of autogenous costal cartilage. However, porous polyethylene implants are also being used as a framework for auricular reconstruction.16–19 Homograft costal cartilage has been employed for reconstruction of facial defects with successful results,20 but there are not adequate clinical trials about the use of homograft costal cartilage for microtia surgery. This study was designed to compare the results of microtia reconstruction by autograft versus homograft costal cartilage.

Materials and Methods

Study population

Between September 1992 and December 2002, 23 patients who had grade III deformity of Weerda classification underwent auricular reconstructive surgery for microtia in our department by the senior author of this article. The patients were randomly divided in two groups, autograft versus homograft. In this retrospective study, required data were gathered from medical records and outpatient follow-up notes. At each follow-up, we completely examined the graft status of every patient. In the last visit, the patients and/or parents filled a questionnaire about their satisfaction from the surgery. The questionnaire contained three items including good, moderate, and no satisfaction. All data were entered to the database.

Preparing of the homograft cartilage

Homograft cartilage used in our study was taken from the patients operated for congenital thoracic deformities. All of these cartilages were preserved in 70% ethanol with sterile conditions. This alcoholic solution was changed every month in cartilage bank. All donor patients were checked by serologic and clinical tests for detection of any infectious disease.

Surgical technique

Although several techniques are being used for microtia reconstruction, we employed the following techniques in our operations:

A. Microtia reconstruction with autograft cartilage

This technique is a single stage-procedure that is initiated with fish-mouth incision of contralateral anterior thorax at the level of sixth to eighth ribs and followed by below-mentioned stages:

1) skin flap design for repair of postauricular sulcus, 2) harvesting cartilage block from synchondrosis between the sixth to eighth ribs, 3) shaping of harvested cartilage block according to template of contralateral normal ear with formation of helix, antihelix, concha, and tragus, 4) use of temporalis muscle fascia for covering of the shaped cartilage framework, 5) lobule transfer and creation of postauricular sulcus by prepared chest skin graft, and 6) advancement of postauricular skin into the postauricular sulcus for covering of the remained exposed area.

B. Microtia reconstruction with homograft cartilage

This technique is a two-stage procedure. The first stage included shaping of harvested homograft costal cartilage. Then an incision was made in the area of deformity behind the planned area of cartilage graft with subcutaneous dissection and creating adequate space for shaped costal cartilage. Shaped costal cartilage was placed in dissected subcutaneous area. Finally, vacuum drain was applied to the area for better adhesion of the skin into the designed furrows and curves in the auricle and covered by adequate dressings.

The second stage was performed 3 to 6 months after the first stage. This stage was performed in the following steps: 1) postauricular incision at the level of helix, 2) dissection of implanted cartilage from its surroundings with sparing of the connective tissue capsule, 3) lobule rotation and transposition of the lobule into the correct position, 4) fish-mouth full-thickness incision of shoulder skin, 5) repair of postauricular sulcus using the prepared skin graft, and 6) advancement of postauricular skin into the postauricular sulcus for
covering of the remained exposed area.

**Statistical analysis**

The data analysis was done by SPSS Software, version 12.0 (SPSS Inc., Chicago, IL, USA). Quantitative values were expressed as mean ± SD. Differences in characteristics between the groups were assessed by unpaired t-test for continuous variables and Chi-square test (or Fisher’s exact test if necessary) for discrete variables. \( P < 0.05 \) was considered significant.

**Results**

This study included 23 microtia patients with a mean age of 16.9 ± 7.2 years. There were 13 (56.5%) male and 10 (43.5%) female patients. Deformity was right-sided in 13 (56.5%), left-sided in eight (34.8%), and bilateral in two (8.7%) cases. These findings are summarized in Table 1.

Implanted graft was autograft in nine (39.1%) and homograft in 14 (60.9%) cases. The surgery was performed in one stage in nine (39.1%), two stages in 11 (47.9%), three stages in two (8.7%), and four stages in one (4.3%) cases. Postauricular skin graft was harvested from the chest in nine (39.1%), shoulder area in seven (30.4%), thigh in five (21.8%), and arm in two (8.7%) patients. Simultaneous canaloplasty was done in six (26%) cases.

Follow-up period was between 1 and 8 years (mean 4 years). During the follow-up period, postoperative cartilage graft resorption was seen in two (8.7%) cases (one patient in homograft and one patient in autograft group) and cartilage bending was seen in one case of homograft group. Two cases with homograft cartilage resorption and bending were reoperated using a new homograft cartilage. No postoperative infection was observed. Postauricular sulcus was in optimal status in 19 (82.2%) cases.

Adhesion was detected in postauricular sulcus of four (17.4%) patients (three cases with severe adhesion and one case with moderate adhesion). Adhesion was occurred in two cases of autograft and two cases of homograft groups \( (P > 0.05) \). In general, status of postauricular sulcus was optimal in 85.5% of homograft and 77.8% of autograft groups \( (P > 0.05) \). The patients and/or parents were satisfied in 66.7% of autograft, and 92.9% of homograft groups \( (P < 0.01) \) (Figure 1).

Results of auricular reconstruction with homograft cartilage and autograft cartilage are demonstrated in Figure 2.

**Discussion**

This study compared the results of microtia reconstructive surgery using autograft versus homograft costal cartilage in our center. This comparison involves technical differences, aesthetic appearance, satisfaction of the patients

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and parents, and postoperative complications. Surgery for microtia is one of the most difficult and time-consuming reconstructive surgeries.11, 12, 14 Nowadays, the most widely used procedures are Brent and Nagata techniques.12, 14, 21 – 23 In both techniques, autogenous rib cartilage is the source of cartilage graft. Brent’s technique has 3 or 4 stages.12, 14 In the first stage, three-dimensional auricular framework is created from patient’s own 6th to 8th costal cartilages and implanted in subcutaneous space. After a few months, lobule transfer will be done in the second stage. In the third stage, posterior portion of implanted cartilage will be released and repaired using thigh skin graft. In the fourth stage, tragus and deep portion of concha will be reconstructed.12, 14

Nagata’s technique is a two-stage procedure. In the first stage, cartilaginous auricular framework including tragus is formed from the 6th to 8th costal cartilage. Then this framework will be placed in subcutaneous space and lobule transfer will be done simultaneously. Six months after the first stage, posterior portion of cartilaginous framework will be freed and covered by flap of temporoparietal fascia and skin graft from posterior scalp.21 – 23

Chest wall donor-site complications are the main limitations of autograft reconstruction procedures.9, 11, 12, 14 Pneumothorax and atelectasis occur rarely but considerable pain or discomfort is the most important complication in immediate postoperative period.9, 11, 12, 14 Delayed scarring and chest wall deformity occurred in considerable number of operated patients.9 Hypertrophic scar is another important complication.

In our study, we have operated 14 cases of microtia with our technique of homograft auriculoplasty. We had one case of cartilage resorption and one case of cartilage bending and in two cases adhesions of postauricular sulcus were seen. Thus, we had ten cases with good results in homograft group.

Despite the impressive developments in tissue engineering, radiated homograft costal cartilage is still frequently used for reconstruction of facial deformity especially in the nose region.21 Homograft has its own problems. In almost all published reports, implanted cartilage irradiated with 3 to 4 million rad.24

Cartilage resorption is one of the challenging problems in homograft surgery.20, 24 In an animal study, progressive resorption of irradiated cartilage occurred but no significant resorption was observed in clinical studies.24

The other homograft-related problem is occurrence of abnormal bend. In the same study, abnormal bend occurred in all homografts and no difference was found between irradiated and non-irradiated grafts.24 However, no homograft bend was reported in another study with higher radiation dose.25 Postoperative homograft infection is negligible and easily managed by intravenous antibiotics and drainage.

This study revealed that microtia reconstruction
surgery with homograft cartilage is associated with low incidence of early and delayed complications and has shorter surgery duration. Surgical results and aesthetic appearance of reconstructed auricle were comparable between autograft and homograft auriculoplasty. It appears that improved clinical outcomes and satisfaction of the patients and parents.

References