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Aesthetic auricular reconstruction with autologous rib cartilage grafts in adult microtia patients

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Summary *Background:* Cartilage calcification is an important factor in aesthetic auricular reconstruction using autologous rib cartilage grafts in adults, a technique that involves difficult manipulation and unexpected absorption. As a result, artificial implants or prosthetics are considered for auricular reconstruction in adult patients despite the limitations of artificial material. In this article, we present our experience with auricular reconstruction using autologous rib cartilage grafts in adult microtia patients with reliable aesthetic results and minimal complications.
Methods: A retrospective chart review was performed for 84 microtia patients ranging in age from 21 to 56 (average: 29.9) years who underwent auricular reconstruction using autologous rib cartilage grafts from March 2001 to March 2013. To validate our acceptable reconstructive results, two independent observers performed postoperative photographic evaluation of two groups (adults and children) using non-inferiority tests in addition to patient questionnaires.
Results: The mean operation time for rib cartilage grafts was 3 h and 53 min, and the follow-up time for all patients ranged from 6 months to 8 years. Surgery-related complications occurred in only three cases. On objective photographic evaluation, the adult group was not inferior to the child group in auricular shape, location, or symmetry. The subjective patient satisfaction evaluation reported a high satisfaction rate.
Conclusions: As this study shows, aesthetic auricular reconstruction using rib cartilage grafts in adult microtia patients is possible even in cases with advanced cartilage calcification. Modification of the fabricating framework, well-preserved flap vascularity, and complete

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understanding of physiological aspects of rib cartilage are essential for aesthetic auricular reconstruction.

Introduction

The auricular reconstruction of microtia has presented a surgical challenge to plastic reconstructive surgeons due to the highly complex three-dimensional (3D) structures of ears and the difficulty in achieving the high aesthetic demands of patients. Autologous rib cartilage grafts are widely considered a standard modality for auricular reconstruction with favorable long-term results by many professional surgeons such as Tanzer,[1,2] Brent,[3–5] and Nagata.[6–10] The successful outcome of auricular reconstruction using autologous rib cartilage grafts depends on various factors, including the surgeon's ability to carve cartilage, adequate size and strength of rib cartilage, and the availability of sufficient healthy normal tissue and favorable blood circulation in the auricular region. To create the 3D framework with rib cartilage, physiological aspects of rib cartilage, including sufficient amounts of costal cartilage, are important factors.[11,12] In particular, calcification and the associated stiffness of cartilage with increasing age are also important factors that lead to difficult manipulation and unexpected absorption, resulting in poor surgical results.[11–13] Due to this, artificial implants or prosthetics are considered an option in adult patients; however, these methods are limited by complications such as extrusion and infection and the absence of long-term follow-up results.[14,15] To the best of our knowledge, there are few large published series on the use of autologous rib cartilage grafts in patients >20 years for auricular reconstruction, including objective evaluation and patient satisfaction with surgical results. In this article, we retrospectively reviewed a series of 84 adult patients (≥20 years) who had favorable outcomes using autologous rib cartilage grafts. An objective photographic grading system and patient questionnaires were used to validate our acceptable reconstructive results.

Patients and methods

Between March 2001 and March 2013, 84 microtia patients ranging in age from 21 to 56 (mean: 29.9; standard deviation (SD): 8.7) years were transferred to our institution for auricular reconstruction. All procedures were performed by a senior surgeon (K.S.O.) using autologous rib cartilage grafts. Patient characteristics such as age, gender, cause of deformity, side of deformity, classification, type of rib cartilage combination, and procedure were noted (Table 1). The 3D reconstructed rib computed tomography (CT) was performed preoperatively using a 64-slice multidetector-row CT scanner in the same manner as a previous study.[16] To measure the degree of cartilage calcification, we analyzed the chosen rib cartilage of each patient. The proportion of calcification was measured by manually outlining the calcification area and the cartilage area of each CT section using software (Aquarius iNtuition, Terarecon, CA, USA).

To evaluate the correlations for age and degree of calcification, we executed Spearman's correlation analysis using Statistical Analysis System (SAS) version 9.3 (SAS Institute, Cary, NC, USA). The *p*-values were considered to be significant at a level of 0.05. Postoperative photographs were used by two independent observers to evaluate aesthetic outcomes, including auricular shape and location, symmetry, and scar formation. Each item was graded as

Table 1 Patient characteristics.

Characteristics	Adult group No. of Patients (%)	Child group No. of Patients (%)
Age at surgery	21–30 years:55 (65.4) 31–40 years:18 (21.5) 41–50 years:8 (9.5) >51 years:3 (3.6)	8–10years:72 (72) 11–20 years:28 (28)
Sex		
Male	51 (60.7)	69 (69)
Female	33 (39.3)	31 (31)
Cause		
Congenital	71 (84.5)	97 (97)
Acquired	13 (15.5)	3 (3)
Affected side		
Right	43 (51.2)	52 (52)
Left	38 (45.2)	47 (47)
Bilateral	3 (3.6)	1 (1)
Classification		
Concha	16 (19.0)	30 (30)
Lobule	67 (79.8)	70 (70)
Anotia	1 (1.2)	
Types of rib cartilage combinations		
6,7,8 th	75 (89.0)	54 (54)
6,7,8,9 th	9 (11.0)	46 (46)
Procedure		
RCG and Elevation	47 (55.9)	69 (69)
TEI and RCG and Elevation	1 (1.2)	
RCG and TEI and Elevation	36 (42.9)	31 (31)

RCG, rib cartilage grafts.
TEI, tissue expander insertion.