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CASE REPORT / ПРИКАЗ БОЛЕСНИКА

Fascial turnover flap – an effective method to resolve cartilage exposure after autologous microtia reconstruction

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SUMMARY

Introduction Microtia presents a congenital ear deformity ranging from a minor and barely visible defect to a complete absence of the ear. Currently, there are three options for ear reconstruction: autologous costal cartilage, silicon prothesis, and prosthetic ear. Ear reconstruction with autologous costal cartilage is usually performed in two stages. During the first stage, the cartilaginous framework is fabricated and placed under the skin, in the anatomical position of the ear. In the second stage, the elevation of the frame is performed. During these procedures, complications such as vascular compromise of the skin envelope can occur. Cartilage exposure can lead to its resorption and distortion, leading to an unsatisfactory anatomical result, and this should be resolved as soon as possible. Cartilage exposure at the convex part of the frame is especially problematic. The goal of this paper is to show that fascial turnover flap is a safe method to deal with cartilage exposure as a complication.

Outlines of cases We present two patients with anotia and hemifacial microsomia. Both underwent autologous cartilage microtia repair. In both patients, the cartilage exposure at the convex part of the ear was revealed as a complication. Fascial turnover flap has been used to resolve this complication in both patients.

Conclusion Fascial turnover flap is a safe method to deal with cartilage exposure after microtia reconstruction with autologous cartilage.

Keywords: microtia; complications; necrosis; flap; fascial

INTRODUCTION

Microtia is a congenital malformation of the ear with multifactorial etiology that can be expressed as a minimal structural abnormality or a complete absence of the ear [1–6]. Microtia is dominantly unilateral, on the right side, and occurs more frequently in males [1, 2, 3]. Some ethnic groups (Hispanics, Native Americans, Andeans, and Asians) have a significantly higher incidence than others [2, 5]. There are different classification systems adopted for microtia [1, 2, 4, 5].

Management of the microtia includes: no treatment, autologous costal cartilage reconstruction, surgical reconstruction with a synthetic biocompatible porous polyethylene implant, and prosthetic ear placement [2–9].

Reconstruction with autologous costal cartilage graft is usually performed when a patient reaches 8–10 years of age [2–5, 8, 9]. At this age, adequate costal cartilage stock for reconstruction is achieved [8, 9]. The number of required stages (three to four stages) is reduced and now this procedure is mostly performed in two stages [3, 4, 5, 8].

A surgical classification scheme that is applicable to all types of microtia was introduced by Dr Françoise Firmin, who established her own two-stage autologous technique for microtia reconstruction [8, 9]. At the first stage, costal cartilage is harvested from the ipsilateral side through obliquely oriented skin incision with access to the fifth to ninth ribs [3, 5, 8, 9]. The constructed cartilaginous framework is placed in the previously prepared skin pocket [2, 3, 6, 8, 9]. The second stage is usually performed six months after the first operation, and during this stage the elevation of the ear is performed, followed by skin lining of the sulcus [2, 3, 4, 8, 9]. There are three types of skin incisions, three types of frameworks, and three different projection pieces according to Dr. Firmin's classification.

Skin incisions (in correlation with the location of the lobule and the types of framework required) are divided into type 1, type 2, and type 3 (a, b); frameworks are divided into the following: type I – includes base, helix, antihelix, antitragus, and tragus; type II – includes base, helix, antihelix, and antitragus; and type III – includes base, helix, and antihelix; and projection pieces (that can be added to provide stability and projection of the framework) are divide into PI, PII, and PIII [8, 9].

There are four types of second stage according to Dr. Firmin (type A, B, C, and D). Types A and B are modifications of Nagata's and Brent's technique, type C is rarely used, and type D is

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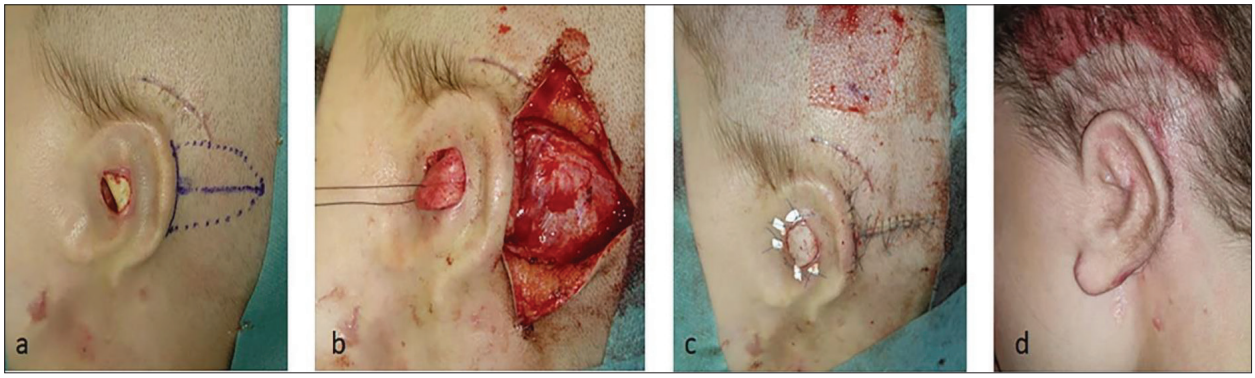

Figure 1. a: Skin necrosis at the central part of the antihelix projection after left side anotia; reconstruction with autologous cartilage; **b:** retroauricular fascial turnover flap, raised and rotated upward, placed over the cartilage; **c:** retroauricular fascial turnover flap fixed and covered with split-thickness graft; **d:** the definitive result after the second stage, with deformation of the middle antihelix

Dr. Firmin's own method, most commonly used in her practice (also known as the "tunnel" technique) [8, 9, 10].

Children who undergo high-density porous polyethylene implantation are candidates at a younger age, typically when three to five years old [2–6, 10]. The temporoparietal fascial flap (TPF) is used to cover the implant [2, 4, 10]. This procedure is used as an alternative to autologous costal cartilage graft for ear reconstruction [there is a higher rate of infection and extrusion (if TPF is not used) compared to autologous costal cartilage reconstruction] [5, 6]. The ear prosthesis is an alternative to surgical reconstruction and this procedure should be considered for some specific cases [4–7, 10]. The future of ear reconstruction is strongly influenced by bioengineering, and there are already papers confirming safety and stability of framework by using autologous cell-engineered chondrocytes [6, 11].

There is a high association between microtia and aural atresia [3, 4, 10]. Hearing should be closely monitoring through development [3, 10]. Ear reconstruction does not affect hearing, and atresiaplasty is usually performed after auricle reconstruction with autologous costal cartilage [4, 5, 10, 12]. Auricular reconstruction can be associated with minor or severe surgical complications [8, 13–18]. Only a few studies related to complications following ear reconstruction with autologous costal cartilage graft have been published [13–18]. These acute complications include donor site complications (pneumothorax from costal cartilage harvest), and recipient site complications such as infection (skin or cartilage), extrusion of cartilage framework, changes in framework size and migration of the frame [13–16]. In this paper we present our experience in treatment of skin necrosis and cartilage exposure following microtia reconstruction with autologous costal cartilage graft.

REPORTS OF CASES

Case 1

A 14-year-old female was admitted for ear reconstruction for left side anotia as a part of ipsilateral hemifacial microsomia. Excision of the preauricular sinus and preauricular appendices was performed prior the auricular reconstruction. According to Firmin surgical classification scheme, framework Type I was constructed, and placed subcutaneously using the 3b skin approach [6, 10]. Two drains close to the ear under continuous suction were used. Skin discoloration at the antihelix projection was spotted on the third postoperative day, followed by complete skin necrosis evident on the 13th postoperative day despite constant conservative treatment (gentle debridement and continuous application of antibiotic ointment or Vaseline gauze dressing) (Figure 1a). The decision to perform surgical treatment of the necrosis was made. Retro auricular fascial turnover flap was planned, raised, and rotated upward (Figure 1b). After performing the dissection between the frame base and antihelix, the flap was placed through and over the cartilage, and fixed (with care to prevent skin necrosis). Split thickness skin graft was placed over the flap (Figure 1c). The postoperative period was uneventful. The long-term result showed a slight deformation of the medial part of the antihelix (Figure 1d).

Case 2

A 13-year-old female was admitted for ear reconstruction for left side microtia. Clinically, only a small part of the lobule was present. According to the Firmin's surgical classification scheme, framework type I was constructed, and placed subcutaneously using type 3 skin approach, followed by two drains placed under continuous suction (Figure 2a) [10]. Skin necrosis was spotted on the seventh postoperative day at the central part of the antihelix projection (Figure 2b). Conservative wound treatment was immediately started but without success (debridement, antibiotic ointment treatment, and full-thickness graft placement). Cartilage exposure was definitive. Fascial turnover flap was raised and placed on the16th postoperative day by the same technique used for the first case (Figure 2c). Postoperative period was uneventful. Stitches were removed on the 14th postoperative day (Figure 2d).

The subjects' written consent was obtained, and the study has been approved by the competent ethics committee, and it conforms to the legal standards.

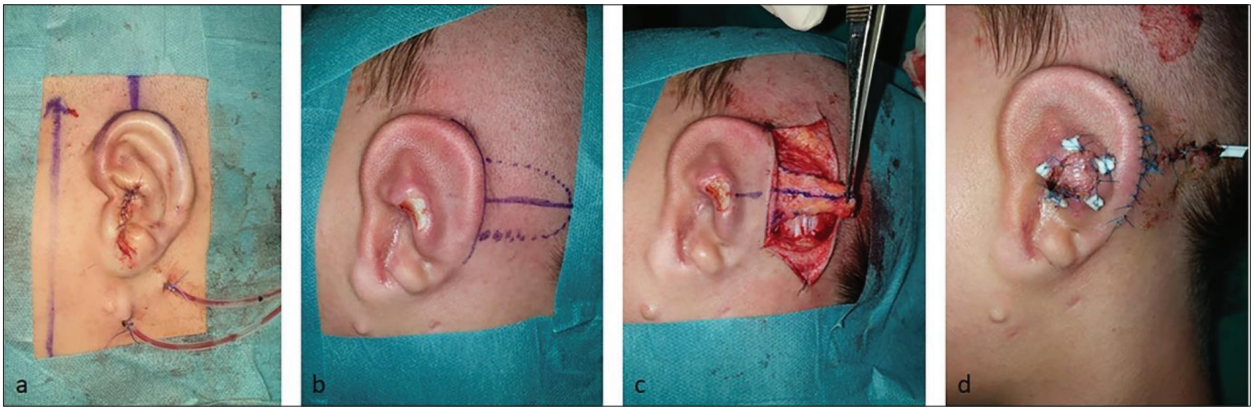

Figure 2. a: Intraoperative result after left-side anotia reconstruction with autologous cartilage; **b:** complete skin necrosis and cartilage exposure; **c:** retroauricular fascial turnover flap, raised; **d:** postoperative result with split-thickness graft placed over the flap

DISCUSSION

Microtia reconstruction presents an extremely demanding procedure [2, 3, 5, 8]. Surgeons involved in this subject need to have experience especially in reconstructive and ear surgery. It is very important that the surgeon undergoes training in harvesting of the framework before starting surgical treatment of ear deformities [8, 9]. During ear reconstruction surgery, even the smallest details can affect the final result, such as carefully harvesting the rib cartilage, choosing the adequate framework type, optimal skin approach, constant postoperative follow-up, and constant monitoring of drainage treatment, including autologous costal cartilage reconstruction, surgical reconstruction with a high-density porous polyethylene implant, and prosthetic ear placement [2–10, 12].

Auricular reconstruction with autologous cartilage should be performed at the age of 8–10 years [2, 5, 6, 8, 9]. During the past several decades, surgical technique for ear reconstruction has been significantly improved and the number of procedures has been reduced [2, 5, 8, 10]. Françoise Firmin created a surgical classification scheme applicable to all types of microtia, and she established her own two-stage autologous technique for microtia reconstruction [6, 8, 9, 10]. There are only a few published studies about complications after autologous microtia reconstruction [2, 6, 13–18]. The range of complications vary 0–33% (by some authors these rates range 0–72%, probably due to differences in experience with the procedure [14, 18]. Wound infection is the most common complication reported [18]. Complications can occur both at the donor (atelectasis, pleural tear, chest wall deformities) or the recipient site (infection, hematoma, skin necrosis, frame exposure, cartilage absorption, wire or suture extrusion, helix broken, keloids, etc.) [13–18]. Hair growth on the on the reconstructed auricle can be considered a minor complication, successfully solved by permanent hair removal. Fu et al. [13] stated that at the recipient site complications occur in 10% of patients after using Brent and Nagata technique for ear reconstruction, with or without meatoplasty. There are different techniques for treating complications, such as local flaps, TPF coverage with skin grafts, turnover fascial flap, etc., and the technique selection is based on the location involved [14, 15]. According to Dr. Firmin, cartilage exposure less than 3 mm can be treated conservatively (by some authors, the cartilage exposure less than 10 mm) [15]. In both of our cases, skin loss was less than 10 mm but we could not achieve wound healing with conservative approach. In both our cases, surgical treatment was necessary.

In our group of 33 patients with microtia (two bilateral) and three patients with traumatic ear amputations (38 reconstructions in total) that were operated on using the Firmin's technique, there were four cartilage exposures (10.52%). Two of them (5.26%) had the exposure of cartilage at the posterior part of the helix after skin graft necrosis (less than 3 mm), and we manage to resolve this by conservative treatment. Two patients (5.26%) had cartilage exposure at the antihelical region (near 10 mm), and both of them were resistant to conservative treatment. We used a fascial turnover flap and a skin graft to cover the cartilage, according to instructions of Dr. Firmin [8].

A "T" incision was made on the skin with short limbs along the helical rim of the framework and long limb posteriorly over the mastoid region. The fascial flap was harvested and elevated from the deep mastoid fascia. The fascial flap was turned over and placed through the tunnel of cartilaginous framework and then over the cartilage. The fascial flap was covered by a skin graft. In both cases the same surgical procedure was applied. The postoperative period was uneventful. In our opinion, the optimal period for the reconstruction of skin necrosis is between the 10th and the 15th postoperative day, when the necrosis demarcation is complete. A prolonged period of conservative treatment can lead to the loss of the anatomical appearance of the cartilage. Complications of the turnover fascial flap procedure include flap necrosis, skin graft necrosis, and frame distortion. The turnover fascial flap surgery followed by skin graft placement was performed successfully in both patients and the result of this approach was complete healing of the wound, with acceptable aesthetic result.

CONCLUSION

Turnover fascial flap is an effective method to resolve cartilage exposure after microtia reconstruction. The advantages of this technique are that skin incisions are placed along the lines for the incisions that will be performed during the second stage, there is no need for distant flaps, and the chondral frame stays anatomically preserved. Flap vascularization is reliable and it can be used for defects of high variety in size. This method is in our experience shown to be applicable for cartilage exposure at the convex parts of the ear. We strongly advocate turnover fascial flap for cartilage exposure after ear reconstruction.

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Conflict of interest: None declared.

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Фасцијални режањ – ефикасан метод за решавање изложености хрскавице после реконструкције микротије аутологном хрскавицом

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САЖЕТАК

Увод Микротија представља урођени деформитет уха који се може манифестовати као мали и једва видљиви деформитет па чак и као потпуно одсуство уха. Тренутно постоје три опције за реконструкцију уха и то коришћењем аутологне ребарне хрскавице, силиконске протезе и протезе. Реконструкција уха аутологном ребарном хрскавицом се обично изводи у две фазе. У првој фази се израђује хрскавични оквир који се поставља испод коже, у анатомску позицију уха. У другој фази се врши подизање оквира. Током ових процедура може доћи до компликација, као што је ослабљена васкуларизација кожног омотача. Излагање хрскавице може довести до њене ресорпције и изобличења, што доводи до незадовољавајућег анатомског резултата и то треба што пре решити. Посебно је проблематично излагање хрскавице на конвексном делу рама. Циљ овог рада је да покаже да је фасцијални обрнути режањ сигуран метод за решавање експозиције хрскавице као компликације.

Приказ болесникâ Представљамо два болесника са анотијом и хемифацијалном микрозомијом. Оба болесника су подвргнута реконструкцији микротије аутологном хрскавицом и код оба болесника је као компликација откривена експозиција хрскавице на конвексном делу уха. За решавање ове компликације коришћен је фасцијални обрнути режањ.

Закључак Фасцијални обрнути режањ је безбедан метод за решавање изложености хрскавице после реконструкције микротије аутологном хрскавицом.

Кључне речи: микротија; компликације; некроза; режањ; фасција