

## RESULTS OF AURICULAR HELICAL RIM RECONSTRUCTION WITH POST-AURICULAR TUBE FLAP

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**The aim of the study** was to present our experience with post-auricular tube flap (ptf) and clinical evaluation of the results following auricular helical rim reconstruction with this technique in patients after trauma.

**Material and methods.** We analyzed the results in 12 patients who underwent three-staged auricular helical rim reconstruction with ptf following trauma in the Department of Plastic, Reconstructive and Aesthetic Surgery between 2005-2014. The patients were followed-up for at least 1 year. We evaluated early and long-term results after surgery including plastic surgeon's and patient's opinion.

**Results.** Postoperative results were satisfactory (very good) in 10 cases, both in the opinion of the plastic surgeon and patients. Transient venous congestion of the helix occurred in two cases (16.6%). This complication did not have any influence on estimation of the results after surgery. Delayed wound healing in the poles of the reconstructed helical edge, as well as non-aesthetic helical scars with imperfections of helical rim, were seen in another two patients (16.6%).

**Conclusions.** 1. Post-auricular tube flap reconstructions after helical rim trauma allowed for complete restoration of contour, size and orientation of the helix and the whole operated ear, which confirms the efficiency of the applied technique. 2. Reconstructive surgery with post-auricular tube flap in patients with auricular helical rim defects contributed to postoperative satisfaction in both patients and doctors' estimations.

**Key words:** auricular helical rim reconstructions

Reconstruction of the auricular helical rim undoubtedly remains a challenge for plastic surgeons, with regards to attaining good aesthetic outcome after surgery. Deformities of this localization are a consequence of trauma – bites, avulsions, lacerations, tumors excisions, rare burn injuries, which usually resulted in subtotal rim defects. Among several reconstructive methods of the auricular helix, post-auricular tube flap (ptf) appears superior to other techniques, as confirmed in numerous studies (1, 2, 3). Currently in the majority of patients operated with the tube technique the following donor sites are used: sternocleidomastoid, supraclavicular, the arm, auriculomastoid, and post or preauricular (4). Since Gillis has invented the tube flap in 1917, and

Filatow published results of effective it's application in lower lid reconstruction, than Pierce described it's use in pinna defects in 1930 (5). Later, the technique was popularized by Steffanoff, than Converse and Brent. Steffanoff introduced the tube flap based on the medial ear side and mastoid area, but also delayed tube reconstruction, after waltzing of the pedicle cephalic and then caudal pole to the margins of the helical defect (6). Converse and Brent, however, indicated supraclavicular region for tube flaps, apart from auricular cephalic sulcus, but tubes from this area should be allowed to mature before performing gradual migrations (7). In turn, Lewin described an adjacent flap of the mastoid region, in which the anterior margin was connected

with the corresponding edge of defect, but after flap's elevation the donor side required skin graft instead of primary donor site closure (8). Usually, retroauricular tube pedicle flap is transferred in three stages, but two stage reconstructions are also reported in some literature reviews. Sometimes, helix reconstruction can be improved with additional procedures such as the use of a rubber band, or if needed, cartilage autograft (9, 10). These operations should be properly planned to minimize the risk of complications and helix disfigurements, which may influence upon reciprocal asymmetry (in respect of size, contour, orientation) of the auricle after surgery compared with unaffected ear. Moreover, this method is not recommended in patients who underwent previous radiation therapy of hairy scalp in spite of rich vascularization of the postauricular area (11).

The aim of the study was evaluation of the results following posttraumatic reconstructions with the post-auricular tube flap in patients with partial ear defects.

#### MATERIAL AND METHODS

We analyzed 12 patients (8 – males, 4 – females), between 18-40 years of age, mean age 30.5 years, who underwent posttraumatic partial ear reconstructions with bi-pedicle ptf at the Department of Plastic, Reconstructive and Aesthetic Surgery between 2005-2014. Preoperative data included etiology (reason, mechanism) of the traumatic factor – bite (5), avulsion (4), laceration (3). Size of the defects ranged from 1-2.5 cm, and they did not include

a range of scapha in more than 0.5-0.7 cm. Other comorbidities present in our patients included diabetes mellitus (1 case), cardiovascular diseases (3) and nicotinism (6 cases). All individuals were operated under local anesthesia (Lidokaine with 1: 100,000 epinephrine), at 3 week intervals. Reconstruction consisted of three stages in all cases. After measuring the range of defect we outlined the retroauricular bi-pediced flap, of which the anterior margin was adjacent to the auricular cephalic sulcus on the mastoid region. The length of the flap was at each pole longer than the defect by 15 %, whereas the width ranged from 1.5-2 cm, depending on the helical rim defect size. After the flap had been raised at the level of subcutaneous tissue and tubed, the primary donor site closure was done. At the second stage the freed caudal limb was inserted (V-, Z-plasty) at the inferior pole of the helical edge. The cephalic limb was sutured to the superior pole of the defect at the next stage (fig. 1 A, B, C, D). All patients were seen in the out patient clinic after 3 months and after at least one year from surgery (fig. 2 A, B, C, D). We analyzed the results – early and long-term following partial ear reconstruction. Postoperative aesthetic results were subjectively graded by a plastic surgeon on the basis of physical examination (scale of satisfaction), as well as by the patients (scale of satisfaction).

#### RESULTS

Postoperative outcomes in the examined patients have been shown in tab. 1. Venous congestion (observed after stages 2 and 3) had

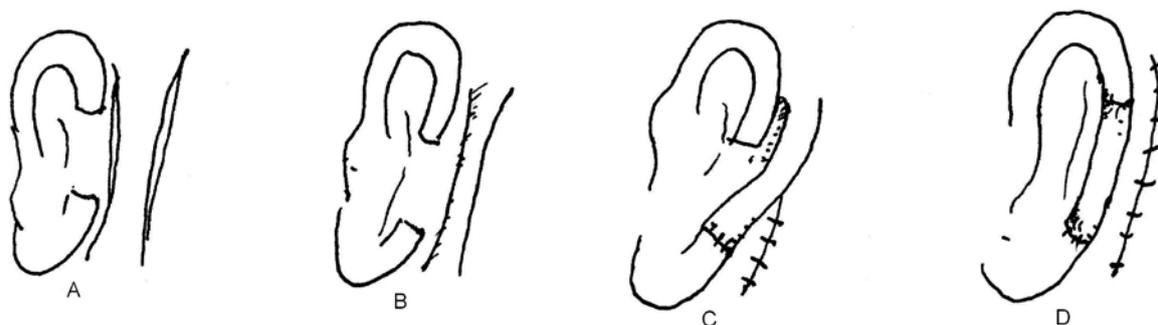


Fig. 1. Scheme of auricular helix reconstruction with post-auricular tube flap. A, B – incisions and suturing for raising tube pedicle, than tube pedicle flap raised on mastoid (retroauricular) skin, primary donor side closure, C – transfer of the cephalic limb, D – transfer of the caudal limb



Fig. 2. Patient with posttraumatic defect of the right auricular helix, at the age of 30 years. A, B, C, D – sequence of the right auricular helix reconstruction

Table 1. Results of helical rim reconstruction with post-auricular tube flap in the examined group

Postoperative complications of auricular helical rim reconstructions	Males	Females	Total
Venous congestion	1	1	2
Abnormal wound healing (helical rim)	2	0	2
Infection	0	0	0
Flap necrosis	0	0	0
Secondary flap's shrinkage	0	0	0
Non-aesthetic appearance of auricular helical rim scar after surgery (wide scar)	2	0	2
Imperfections of the reconstructed auricular helical rim	2	0	2
Non-aesthetic appearance of the donor site (wide scar)	0	0	0

a tendency to resolve in 3-4 consecutive days after surgery. In individuals with delayed wound healing of the superior (1) or inferior (1) pole of the reconstructed helical edge, non-aesthetic appearance of helical scar and small imperfections of the reconstructed auricular helical rim were noted. In the opinion of these patients these defect were insignificant and they did not want to undergo additional corrections. In the remaining cases, helical scars were aesthetic, and normal contour of the reconstructed auricular helical rim was preserved. Appearance of the donor site in all patients was satisfactory (linear, superficial, minor scar, even in color). Postoperative estimation by the plastic surgeon and patients has been shown in tab. 2. Evaluation was based on adopted standards (tab. 3).

## DISCUSSION

Restoration of the auricular helix continuity after trauma aims at obtaining good aesthetic results, as these defects are visible both from the frontal and lateral aspects. For the defects less than 3 cm, according to Antia, Buch procedure with helical advancement is suggested, and in cases of apparent asym-

metry as compared to the opposite ear, corrective wedge excision and setback for protrusive cases are advised. However, additional surgery in unaffected ear results in scarring, and patients usually are not willing to undergo such burdensome procedures. Moreover, bilateral operations of ears are connected with changing their size, as well as contour (11, 12). Although tube flap as a long-term technique is rarely used nowadays, it leads to the reconstruction of proper contour, size and orientation of the helix, which was confirmed in the results of other authors. Results in patients from our group, as of other studies, revealed that the best results of this technique can be obtained in reconstruction of small to intermediate helical defects (1, 9).

Thus, we decided to use the tube flap, and in the majority of cases real contour and shape, and in all patients the size and orientation of the reconstructed helical rim were preserved, which was reflected in postoperative satisfaction in both patients and doctors' estimations. These observations correspond with the apperceptions presented by other authors (1, 9). Retroauricular localization of this flap results in unconspicuous scar in the donor place and in aesthetic appearance of this area. For

Table 2. Postoperative evaluation by plastic surgeon and by patients

Postoperative estimation	Plastic surgeon		Patients	
	males (n=8)	females (n=4)	males (n=8)	females (n=4)
Scale of satisfaction				
Completely satisfied	6	4	6	4
Satisfied	0	0	0	0
Moderately satisfied	2*	0	2*	0
Slightly satisfied	0	0	0	0
Not satisfied	0	0	0	0

Patients with postoperatively confirmed

\* abnormal wound healing of the superior (1) or inferior (1) pole of the reconstructed helical edge, non-aesthetic appearance of helical scar and small imperfections of the reconstructed auricular helical rim

Table 3. Postoperative satisfaction surgery

Degree of satisfaction	Estimation standards
Completely satisfied	real contour, size, orientation of the reconstructed auricular helical rim
Satisfied	almost normal contour or, size, or orientation of the reconstructed helical rim
Moderately satisfied	apparent imperfections of the reconstructed auricular helical rim or change of its size or orientation
Slightly satisfied	abnormal contour of the reconstructed auricular helical rim, apparent change of its size or/and orientation
Nnot satisfied	additional surgical revision needed, abnormal helical rim shape, significant change of its size and orientation

larger defects a strut of cartilage is required. Taking chondrocutaneous grafts is connected with donor side scarring and morbidity, also unpredictable graft revascularization (in defects greater than 1.5-2 cm), which restricts qualification to this procedure. If the helical defect includes more than 1.5 cm of the scaphal cartilage, reconstruction requires cartilage graft to support the helix (1, 2).

The extent of defects in our individuals was not an indication for cartilage grafting. Moreover, other comorbidities in our patients – diabetes mellitus (8.3 %), cardiovascular diseases (25 %) and nicotineism (50 %) may additionally limit the number of eligible individuals for this surgery. We state that defect's features, but also the patient's age, systemic diseases and smoking should be taken into consideration in planning the auricular helix reconstructive technique, which should not be burdensome for the patient, and carry a small risk of surgical complications.

We did not experience any flap loss, observed also in other studies. Abnormal wound healing resulted in wide scar of helix and its imperfections, which occurred in rates similar to those reported by other authors. Ellabban, who introduced the double-pedicle close-flap, stated that reduction of surgical stages to two for the helical reconstruction also minimizes the risk of infection after surgery and reduces scarring (9).

Migration of delicate tube during staged procedure is connected with vascular failure. Some authors recommend to condition neovascularization through flap attachment with rubber band prior to the last stage (10). Other authors, to prevent vascular problems, suggest lengthening of the time interval between stages instead of using the tourniquet or other painful methods (4). The last method was not used in our patients.

Better final results after tube flaps are obtained after trauma, than in burn defects surgery, when the blood supply, and color as well as texture of the burned and normal skin vary (4). Thus in last cases, some authors advise to use a second flap to complete the reconstruction. Flap harvest from the mastoid skin has the benefit of sitting close to the defect,

thus providing superior color, texture, as well as minimal donor site morbidity. This technique, however, demands multiple stages to "waltz" the tube into the defect and the need for sufficient residual scapha for tube attachment, which may be destroyed. Large helical defects of more than 2.5 cm are a good indication, especially if unscarred, hairless retroauricular skin is present, but rim loss including greater than 1.5 cm of scaphal cartilage usually requires grafting (2).

Another problem are very early satisfactory results in single cases after using of combined staged island pedicle flap with tube flap in helix reconstruction following auricular cancer resection (Mohs surgery) (13). However, some patients presented with several recurrences after ear cancer excision and needed further surgery. In these cases primary Mohs technique was done. Usually, these lesions are more clinically aggressive than cutaneous cancers in other sites (14, 15). Thus, considering difficulty in complete extirpation of external ear cancers, the length of subsequent follow-up presented by the authors is too short (3 weeks after reconstruction) to evaluate final, long-term results of surgery (13).

Postauricular tube flap is a simple and effective surgical technique for the reconstruction of auricular helical rim of various origin. In reconstructive surgery after oncologic operations special attention should be paid to remove malignancies with histopathologically free margins.

## CONCLUSIONS

1. Post-auricular tube flap reconstructions after helical rim trauma allowed for complete restoration of contour, size and orientation of the helix and the whole operated ear, which confirms the efficiency of the applied technique.
2. Reconstructive surgery with post-auricular tube flap in patients with auricular helical rim defects contributed to postoperative satisfaction in both patients and doctors' estimations.

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