

Bardach's triple-legged rotation flap as single-staged 3D helical upper-third reconstruction: A technical note

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SUMMARY

Background. Reconstruction of the helical upper-third is often technically demanding, especially when the defect is huge and the ear is severely deformed. The aim of this short communication was to present an alternative technique to rebuild this difficult task, using a modification of the Bardach's three-legged rotation flap for scalp closure.

Methods. To achieve the flap design, we raised the retro- and supraauricular tissue with the Dieffenbach's postauricular advancement flap. The Gillies' V-Y advancement flap helped to develop the preauricular flap, and the Mustardé's otoplastik technique was used to reduce the gap between the resected ear cartilage and the temple.

Conclusion. This flap technique appears simple and quick; thereby, it can be used as a single-staged reconstruction alternative in aging patients with multiple comorbidities.

Key words: Bardach's rotation flap, ear reconstruction, Dieffenbach's advancement flap, Gillies' V-Y advancement flap, Mustardé's otoplasty.

INTRODUCTION

Reconstruction of the helical upper-third is often technically challenging, especially when the defect is huge and the ear is severely deformed. The aim of this paper was to present an alternative technique to rebuild this difficult task, using a modification of the Bardach's three-legged rotation flap for scalp closure.

CASE REPORT

An 87-year-old Caucasian woman who was referred from an outside dermatologist, presented to our head and neck centre with histopathologically-confirmed squamous

cell carcinoma (SCC) of the right ear (Fig. 1). Her medical history had positive results for gout, hypertension and chronic heart failure with Karnofsky index of 60%. The tumour was apt to radical excision. Surgical pathology examination demonstrated a 16×28 mm partially ulcerated, moderately differentiated SCC with 8-mm tumour depth (UICC classification: pT3, L0, V0, G2, R1). Because of the patient's age and her clinically-sound outcome, the ward resident perceived misinterpretation and sent the patient home instead of planning for re-excision of the R1 area.

Two months later, the tumour recurred with secondary infection (Fig. 2). Empiric treatment with ampicillin/sulbactam 3 g i.v. thrice a day was given for 4 days until the infection healed. The microbiological result revealed an infection from *Staphylococcus epidermidis*, which responded well to the antibiotics. After the clearance of the infection, the patient underwent 2 serial re-excisions until the absence of tumour was histopathologically proved (UICC classification: rpT1, L0, V0, Pn0, G2, R0). Sonographically, neck lymph node metastasis was not found.

On the fifth operation day, a consultant maxillofacial surgeon (P.P.) was called for helping the operating otolaryngologist in reconstruction of the large ear defect. The patient lost the right helical upper-third, including Darwinian tubercle, ascending and superior parts of helix, superior crus of antihelix and scapha as well as triangular fossa (Fig 3). Because of the patient's age with multiple underlying diseases, we planned a single-staged repair

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rather than complex reconstructions, e.g. cartilage transplantation from ribs or nasal ala, or pedicled flaps. We modified the Bardach's triple rotation (pinwheel) flap (also known as the "Isle of Man flap" or "Mercedes flap" due to its similarity to the Viking sun symbol on the Isle of Man crest and the three-pointed star logo of Mercedes, respectively) (1, 2) to cover this three-dimensional defect under local anaesthesia. In lieu of 3 curvilinear incisions, we used:

1) the Dieffenbach's postauricular advancement flap (3)

to raise the retroauricular and temporal flaps,

2) the Gillies' V-Y advancement flap (4) to develop the preauricular flap,

3) the Mustardé's ear lifting technique: the antihelix fold was cranially and medially moved and anchored to the temporal fascia with a mattress suture, (5) to reduce the wide gap of the resected ear cartilage (Fig. 4).

Approximately 25 minutes, the defect was primarily closed with a postauricular rubber drain inserted (Fig. 5). Two days later, the drain was removed and the patient could be discharged without evidence of complications. The patient has been closely followed up by her dermatologist hitherto.

DISCUSSION

Auricular reconstruction is always a challenging task. A handful of surgical techniques have been created and documented in the literature. They range from simple closure to staged complex reconstructions, e.g. with a costal or conchal cartilage framework and skin pocket, or use of additional skin expander before reconstruction. In this technical note, we presented another simple technique for rebuilding a large upper helical defect. Because of the patient's age and multiple procedures (one excision, one defect coverage and two re-excisions), staged complex reconstructions should be avoided.

Local flaps remain the mainstay of postresection cutaneous reconstruction because of their simplicity (2).



Fig. 1. Clinical picture showing the ear tumour at the first presentation in our department



Fig. 2. Clinical picture showing tumour recurrence with secondary infection with *S. epidermidis*

Historically, the single rotation flap was developed to repair scalp defects, especially from war injuries, prior to the double and triple-legged rotation flaps. The single rotation flap was first reported by Gillies in 1944 (4), while Argamaso primarily mentioned the V-Y-S flap: a double advancement flap using available tissue on opposing sides of the defect, in 1974 (6). The Argamaso's flap is created with two curvilinear incisions on opposite sides of a roughly circular or elliptical defect. All incision lengths are usually around four times of the defect size. Each flap is undermined with tenotomy scissors or fingers, and then advanced, rotated and fixed 90° from its incision point. The two flaps can be of equal or unequal length depending on the available surrounding tissue. The final closure forms a curving zigzag scar, resembling an "S" (or a "Z", so that this flap is also called the O-to-Z flap) (7). Two decades later, Bardach introduced the three-legged rotation flap, which adds an additional curvilinear incision to the Argamaso's flap, creating ca. 60° among the incisions (1, 2). This triple pinwheel flap can simply and effectively serve the essential purpose of immediate expedient coverage of the defect and primary closure of the donor area, permitting distribution of tension over the surrounding tissue of the upper helix away from the suture lines (2).

Contrary to the majority of facial skin defects with 2 horizontal axes (x- and z-axes) and 4 quadrants in 2 dimensions, the helical upper-third appears three-dimensional: 2 horizontal axes (x- and z-axes) and 1 vertical

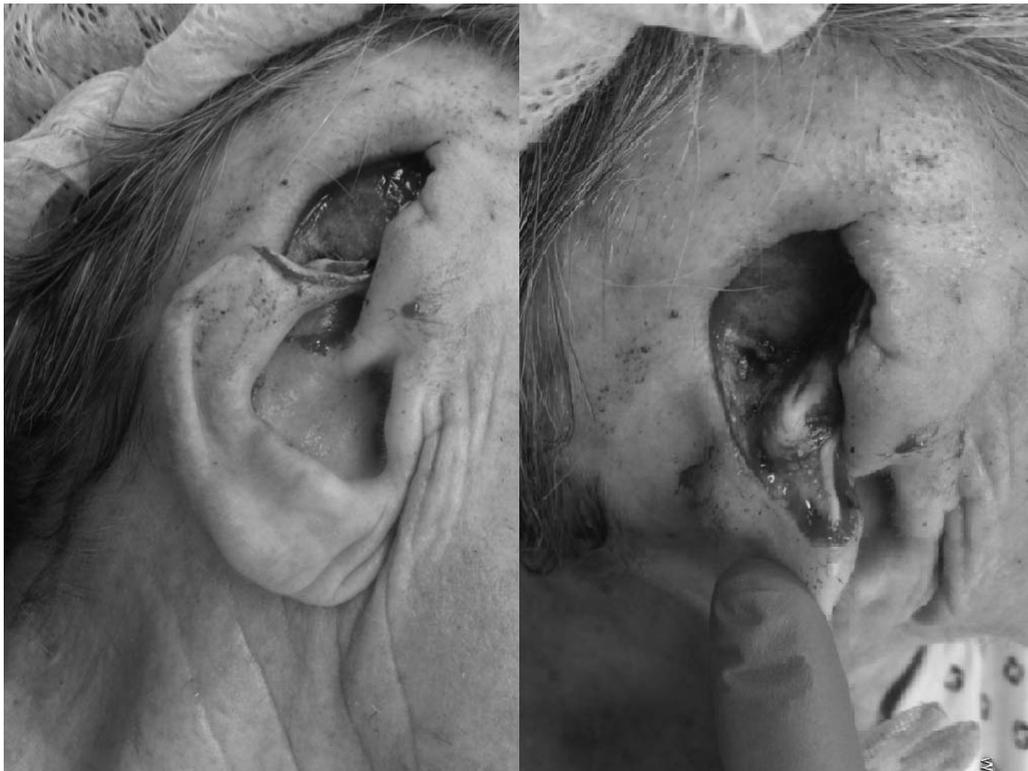


Fig. 3. Clinical picture showing the defects after one excision and two re-excisions before the reconstruction

axis (y-axis), which divide the rectangular coordinate system at this area into 8 octants in 3 dimensions (Fig. 4). The three-legged rotation flap for the upper helix is therefore unique. To create the first two legs of the flap and to achieve good mobility of the inelastic retro- and supraauricular scalp tissue, the Dieffenbach's flap was used and must comprise an adequately thick flap layer of scalp. The supraperiosteal plane over the skull bone and the suprafascial plane over the temporal fascia should be employed as a guide for gaining the desired flap thickness. Very often, the supraperiosteal plane is easily dissected or undermined with fingers with very minimal bleeding risk (3). Based on the geometric analysis of the Argamaso's and Bardach's flaps, the acute-angle flap design provides less closing tension than the wide-angle flap design (1, 2, 6, 7). However, the originating angles of the Dieffenbach's flap are usually obtuse (probably 120°) and the wide-angle flap design is consequently inevitable. With this regard, we therefore reduced the gap and angle between the most lateral helical rim and the temple using at least one mattress suture with PDS 2/0 or 3/0, as described by Mustardé in 1963 (5). A retroauricular rubber drain is also recommended in order to reduce postoperative haematoma and the risk of infection. The last portion of the Bardach's flap for the helical upper-third is to raise the preauricular tissue as the third leg of the flap. To be safe from the facial nerve and parotid gland and to prevent Frey's syndrome, the SMAS should be followed during flap harvesting (8). To tighten each

leg of the flap, we used Vicryl 2/0 and 3/0 and Ethilon 4/0 was used to close the skin.

The commonly mentioned helical upper-third reconstruction technique with auricular reduction was described by Tenta and Keyes in 1981 (9). Because this method was originally used for correction of macrotia, it requires anterior or anteromedial transposition of the helix to the temple and obviously changes the helical size. Other possible reconstructive techniques are the use of transposition or pedicled flaps, which mandate 2 reconstruction

stages with an at least-3-week interval apart (10, 11). The Bardach's flap bears one similar advantage to other local flaps: the recruitment of local tissue that is matched in colour and texture, with the additional convenience of quick and easy dissection and reliability (2). However, the patients undergoing this flap for helical reconstruction also suffer from anthropometric changes of the ear (form, size and position), and thereby, become problematic to daily wearers of eyeglasses. For general details of external ear reconstruction, we refer interested readers to reviews by other authors (9-13).

Last but not least, it is also noteworthy, based on the latest German Clinical Practice Guideline (valid from 30 June 2019 to 29 June 2024), (14) that risk factors of local recurrence and regional metastasis of cutaneous SCC include:

- 1) clinical tumour thickness >20 mm.,
- 2) infiltrative tumour in level III, IV or V,
- 3) poorly differentiated (G3),
- 4) perineural invasion,
- 5) tumour localisation at ears and vermillion (red zone) of the lower lip,
- 6) immunosuppression,
- 7) histopathologic tumour thickness >6 mm,
- 8) desmoplasia.

Current scientific data suggested that the last two factors are the most poorly prognostic factors. In addition to scalp, temple, nose and cheek, the ears and vermillion of the lower lip are also considered the high-risk locations

associated with local recurrence and regional metastasis of cutaneous SCC (14). However, our patient has multiple comorbidities with Karnofsky index of 60%; thereby, a locally invasive approach was applied, i.e. radical tumour excision with sonographic investigation for neck node metastasis instead of radical surgery with prophylactic neck dissection and tumour staging with computed tomography. Until now, there has been neither recurrence nor metastasis.

CONCLUSION

Large auricular defects often require

particular attention and meticulous treatment planning. In this case, we applied a combination of local flaps to solve this problem. The retro- and supraauricular tissue with the

Dieffenbach's postauricular advancement flap was used with the aid of the Gillies' V-Y advancement flap and the Mustardé's otoplastik technique. This combined flap technique appears simple and quick; thereby, it can

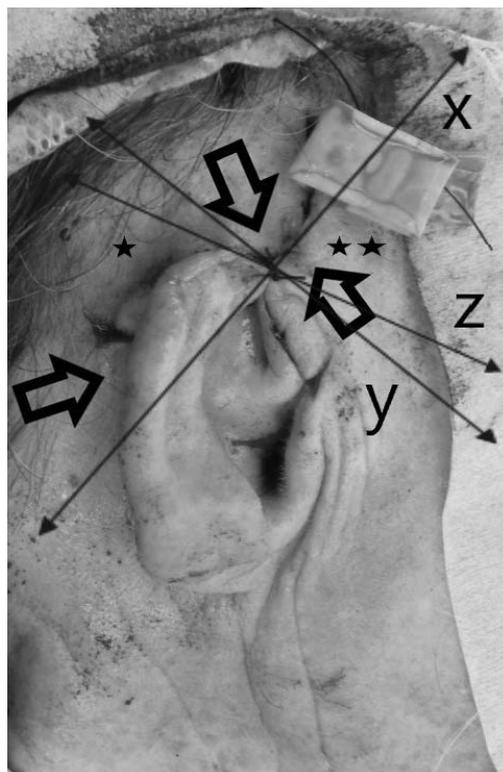


Fig. 4. Intraoperative picture showing the flap design and geometry of the flap. Note: one star is at the Dieffenbach's flap and two stars are at the Gillies' flap.



Fig. 5. Immediately postoperative result of the flap and a retroauricular rubber drainage

be used as a single-staged reconstruction alternative in aging patients with multiple comorbidities.

STATEMENT OF CONFLICTS OF INTEREST

The authors indicate full freedom of manuscript preparation and no potential conflicts of interest as regards the report.

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