Auricle

7

The auricle (pinna) together with the external acoustic meatus constitutes the external ear. It is a morphologically unique, highly variable in size and shape structure and a predominant feature of the face.

7.1 Anatomy of the Auricle

The auricle consisted of an elaborate cartilaginous skeletal structure that is covered by a cutaneous investor, which conforms to its shape.

The convex and concave elements of the cartilaginous framework are responsible for the configuration of the auricle and correspond to the landmarks of the auricle (Fig. 7.1).

7.1.1 Skin and Subcutaneous Tissue

The skin that covers the auricle is very thin with minimal subcutaneous tissue. It attaches to the underlying cartilage and exhibits surgically important differences between the lateral and cranial (medial) surfaces of the auricle. The skin of the lateral surface firmly adheres to the perichondrium with reduced mobility, and the subcutaneous tissue is scant (Fig. 7.2). The attachment of the skin to the cartilage increases as it passes across the concha to continue into the external auditory meatus.

At the cranial surface of the auricle, the skin is thicker and less adherent to the perichondrium, with greater mobility, and more subcutaneous tissue is present (Fig. 7.3). The lobule contains no cartilaginous structure and consisted solely of skin and subcutaneous fatty tissue.

7.1.2 Muscles

The musculature of the external ear includes extrinsic and intrinsic muscles. The extrinsic muscles are three very thin fans of muscle fibers that form the auricularis anterior, auricularis superior, and auricularis posterior muscles (Fig. 7.4). They are encompassed by the temporoparietal fascia and connect the auricle to the scalp and the skull (see Chap. 2). The anterior and posterior ligaments reinforce the attachment of the external ear to the skull.

The intrinsic muscle group includes the helicis major, helicis minor, tragicus, antitragicus, transversus auriculae, and obliquus auricular muscles. These muscles are highly variable and often underdeveloped. Seldomly, they can be seen grossly as very thin and scattered muscle fibers. All of these muscles are innervated by the temporal and the posterior auricular branches of the facial nerve.

7.1.3 Vascular Anatomy

The arterial supply of the auricle is provided by a rich anastomotic network that is formed by branches of the posterior auricular and the superficial temporal arteries (Fig. 7.5). The posterior auricular artery has been found to be the dominant blood supply for the auricle (Park et al. 1992; Imanishi et al. 1997; Pinar et al. 2003).

The superficial temporal artery gives rise to three small branches that travel to the anterior part of the lateral auricular surface. These branches are the superior, middle, and inferior auricular arteries and are distributed to the anterior and lateral aspects of the auricle. The superior auricular artery enters the helical root and continues along the margin of helix ("helical artery") and communicates with the posterior auricular artery forming an arterial arcade ("helical arcade") (Song et al. 1996; Moschella et al. 2003; Erdmann et al. 2009).

The posterior auricular artery after branching from the external carotid artery ascends and divides into the occipital and auricular branches. The auricular branch courses along the retroauricular sulcus passing beneath the posterior auricular muscle and gives off three branches to the cranial surface of the auricle. These branches further

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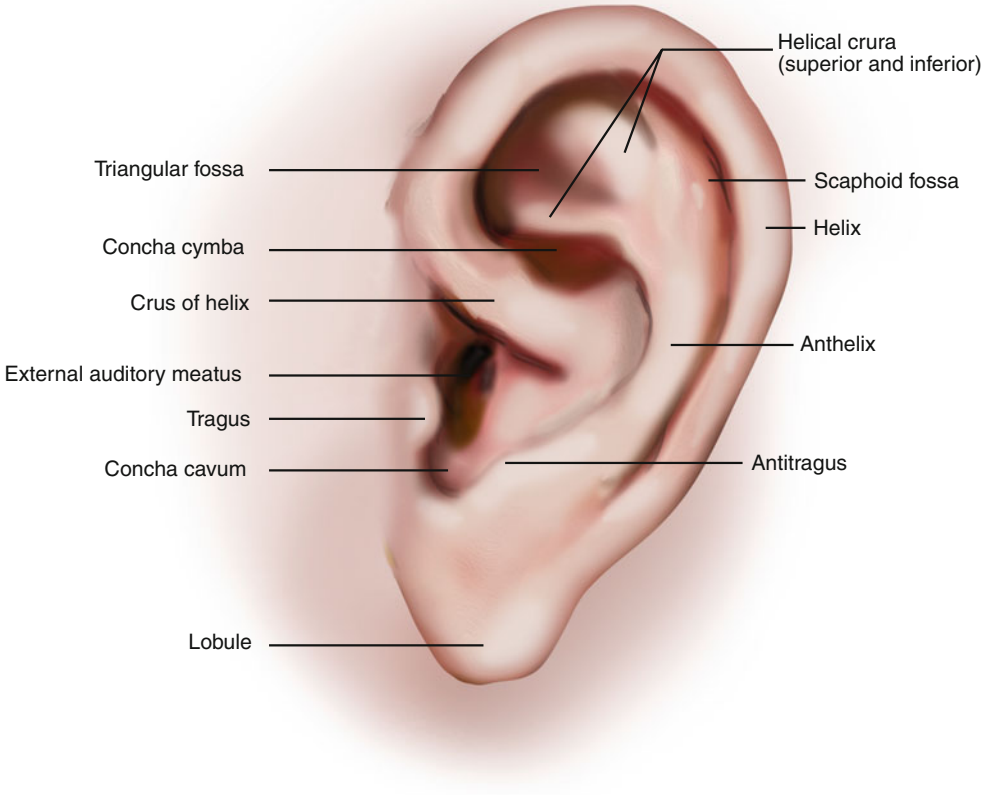


Fig. 7.1 Topographic landmarks of lateral surface of auricle

subdivide giving off twigs that run to the free margin of the helical rim and pass round it to the lateral surface and others that penetrate the cartilage reaching also the lateral surface. Through these perforators the posterior auricular artery participates in a great degree in the vascularization of the lateral surface of the auricle. Park et al. (1992) found out that major perforators of the posterior auricular artery appear at the anteroauricular surface at the triangular fossa, the cymba cocha, the helical root, the cavum cocha, and the earlobe.

Venous drainage of the auricle accompanies the arterial supply. The posterior auricular veins drain into the external jugular vein, while the anterior auricular veins drain into the superficial temporal and posterior facial veins.

7.1.4 Sensory Innervation

The auricle is innervated from the great auricular nerve, the lesser occipital nerve, and the auriculotemporal nerve (Fig. 7.6).

The great auricular nerve (C2, C3) after emerging from Erb's point ascends toward the lobule and at a level approximately to the lower pole of the parotis divides into an anterior and a posterior part (see Chap. 8). The posterior branch travels behind the ear lobule and innervates the postauricular skin and most of the helix, antihelix, and lobule.

The lesser occipital nerve (C2, C3) also emerges at Erb's point and ascends along the posterior margin of the sternocleidomastoid muscle (see Chap. 8). At the postauricular region, it gives off branches that supply the skin of the superior and medial posterior auricle and helix.

The auriculotemporal nerve (from the mandibular division of the trigeminal nerve), after it exits to the cheek, ascends in front of the auricle together with the superficial temporal artery and vein (see Chap. 5). It gives off branches to the external acoustic meatus and the anterior portion of the auricle (tragus, crus of the helix, and the anterior part of the helix).

Small areas on both aspects of the auricle and the concha probably are innervated by the facial nerve and the auricular branch of the vagus nerve (Standring 2008).

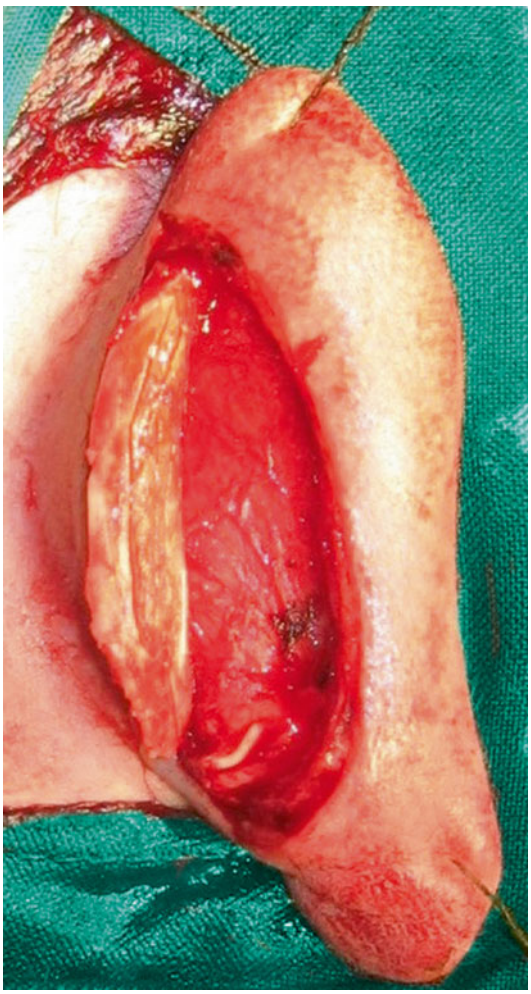


Fig. 7.2 The skin of the lateral surface of the auricle is almost devoid of subcutaneous tissue

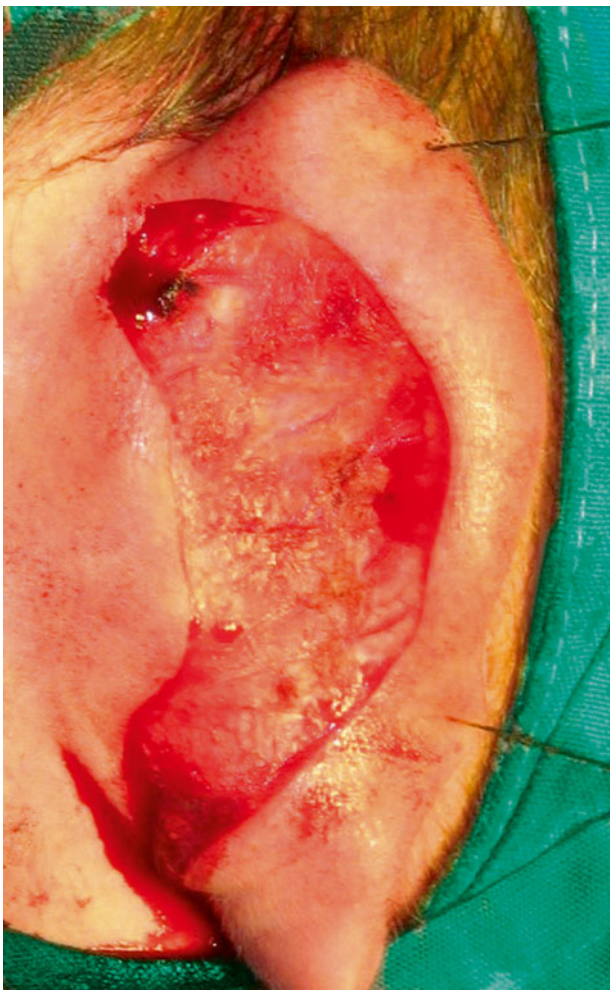


Fig. 7.3 At the medial surface of the auricle, the skin is thicker and more subcutaneous tissue is present

7.2 Flaps Derived from the Auricle

Only a few simply designed flaps can be derived from the auricle, and these are provided to reconstruct small defects of the auricle itself.

7.2.1 Auricular Skin Flaps

The auricular skin can provide under certain circumstances small flaps, based on the general flap principles, to reconstruct small defects of the auricle. The most useful one is the rotation auricular skin flap. Bilobed flaps derived from the posterior auricular surface have been also described (Vergilis-Kalner and Goldberg 2010).

A small auricular rotation skin flap is presented in the following case. The patient had a pyogenic granuloma at the skin of the external surface of the auricle (Fig. 7.7a). The excision of the lesion resulted in a small skin defect (Fig. 7.7b). Given that the skin of the auricle, especially in its lateral surface, is firmly adherent to the perichondrium with almost no mobility; even for a small defect, a flap is needed for reconstruction. In this case the only rotation flap that can be used is the one that is based inferomedially (Fig. 7.7c–e).

7.2.2 Chondrocutaneous Helical Rim Advancement Flap

The method of advancing the helical rim as a chondrocutaneous flap was first described by Antia and Buch (1967) as a single-stage method to close helical rim defects. In its initial design, the helix is freed from the antihelix by an incision in the helical sulcus through the anterior skin and cartilage. The

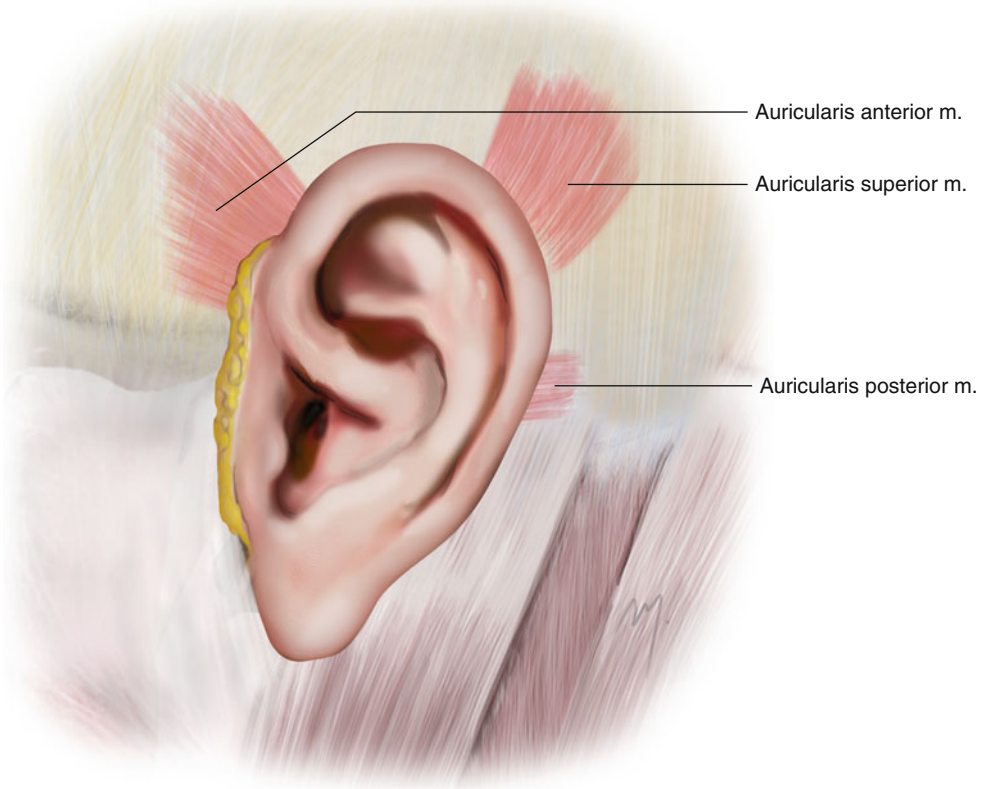


Fig. 7.4 Extrinsic auricular muscles

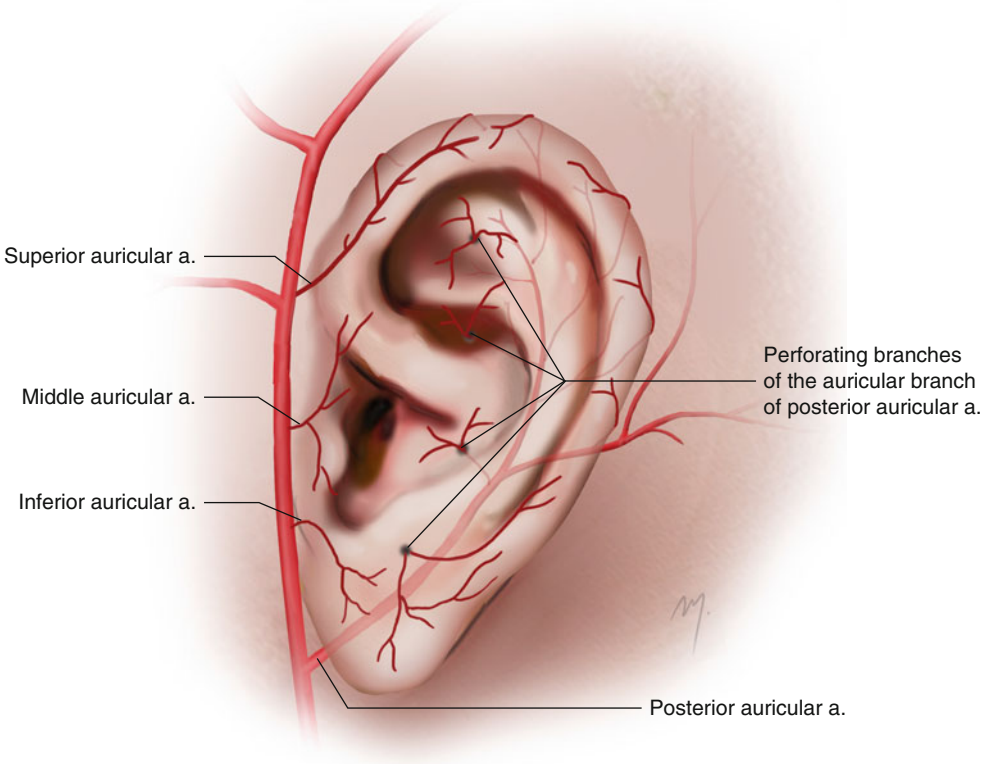


Fig. 7.5 Arterial vascularization of the auricle

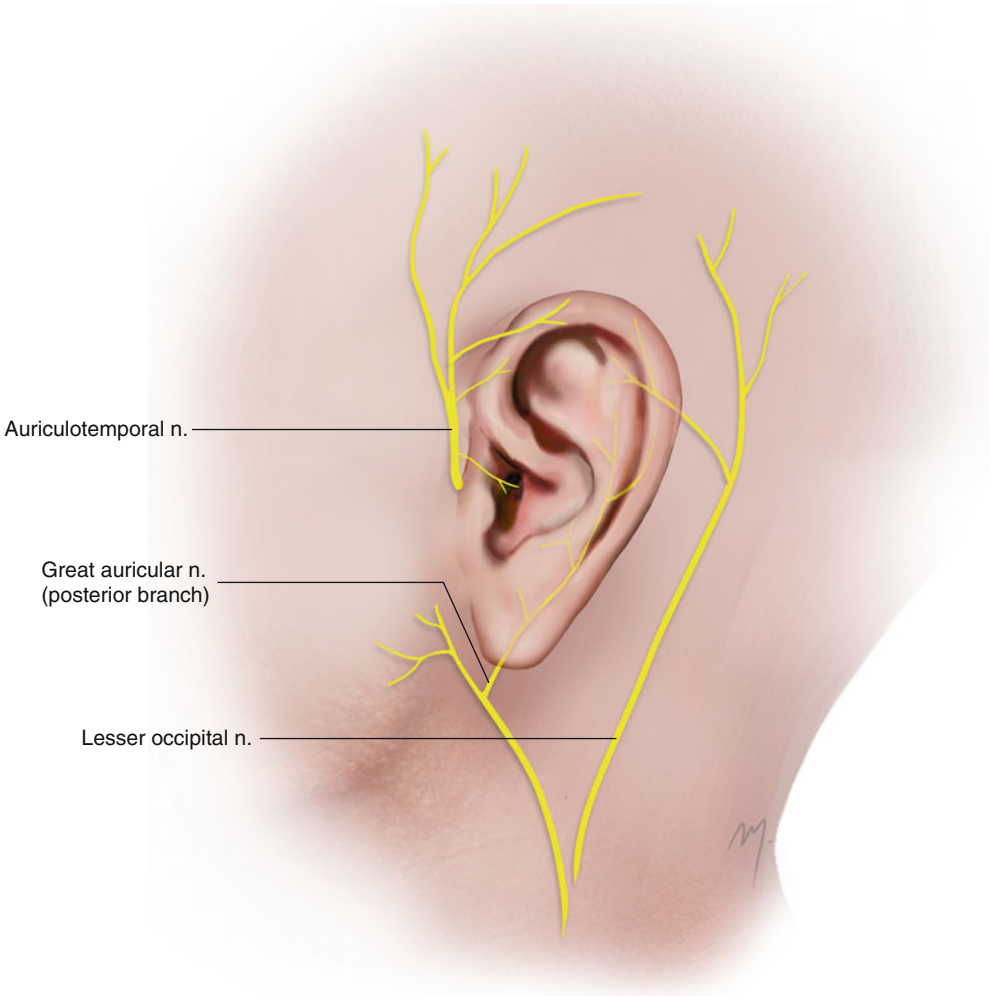


Fig. 7.6 Sensory innervation of the auricle

flap is then advanced to the rim defect, maintaining its continuity with the posterior skin. As the posterior skin is left intact, the flap is mainly and widely pedicled on the posterior skin.

Given that almost 70 % of the auricle defects are located at the rim, the chondrocutaneous helical rim advancement flap is a widely used flap both with its original design and with various modifications (Majumdar and Townend 2000; Butler 2003; Krunic et al. 2006; Skaria 2008; Medeiros et al. 2009). Jackson (1985) has simplified the original design by freeing the helix completely from the antihelix performing the helix rim incision through the full thickness of the pinna as a through and through incision. This places the flap based solely on its attachment at the ear lobule. Such a case is presented in the following.

The patient in Fig. 7.8a exhibits a basal cell carcinoma of the helical rim located at the transition from the mid to the upper third. Excision lines and a chondrocutaneous helical rim advancement flap, based on the artery of the lobe, were outlined (Fig. 7.8b, c). Even though the helix is completely freed from the antihelix, setting the flap on a narrow pedicle seems risky despite that the flap is reliable. It is perfused through the earlobe arterial network that is formed from the inferior auricular branch of the superficial temporal artery and the lobular perforator of the posterior auricular artery. It cannot be considered an axial flap so it must not be very long. If this flap is designed very long to reach defects of the upper helical third, distal necrosis may occur.

The lesion was excised in rectangular shape, in safe margins, including skin and cartilage (Fig. 7.8d). A full-thickness incision, through the anterior skin, cartilage, and postauricular skin, was made along the anterior helical sulcus. The flap was raised including all the cartilage and skin thickness of the helix (Fig. 7.8e).

The flap was prepared up to the level of antitragus, and a small Burow's triangle was excised at its base (Fig. 7.8f).

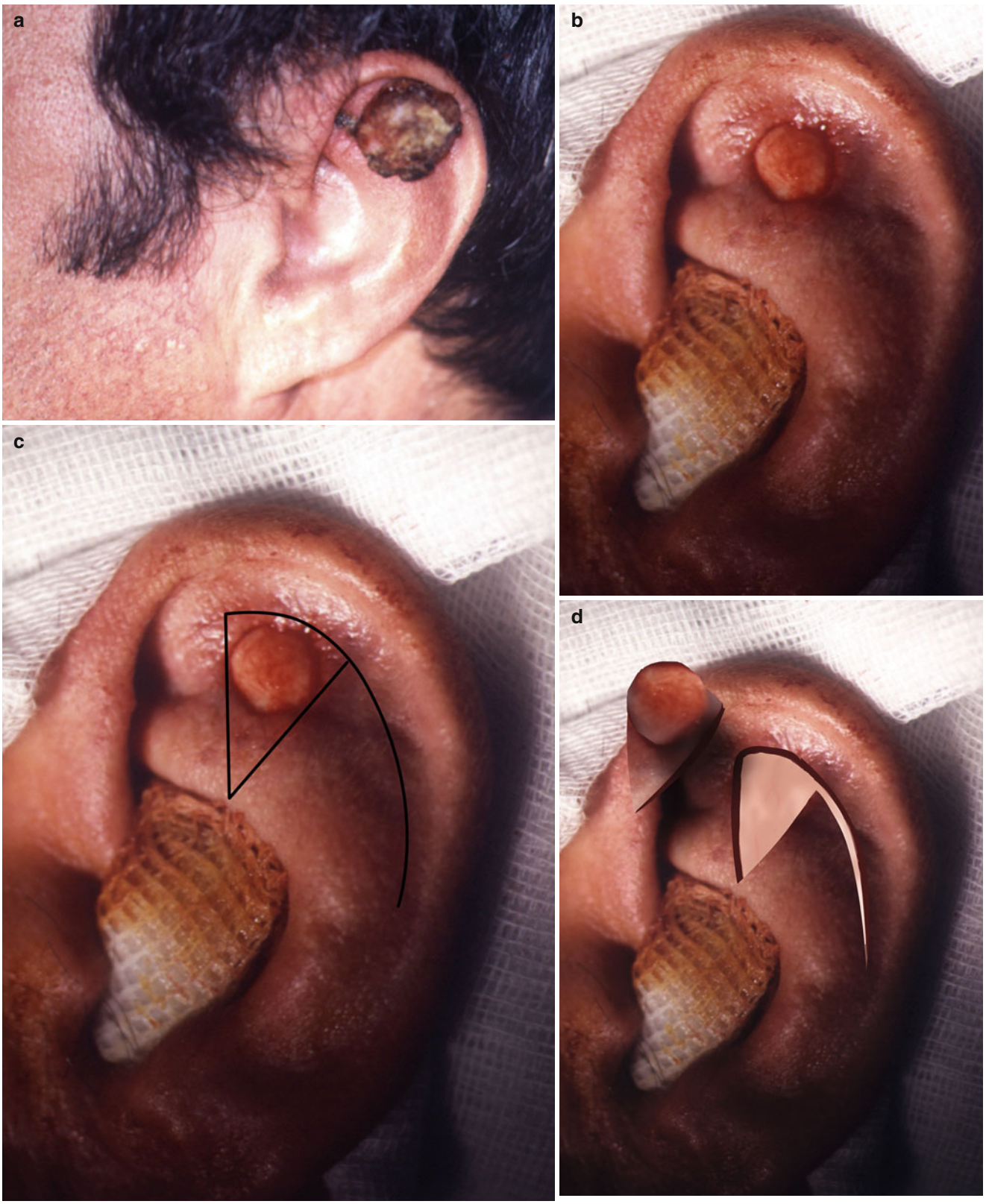


Fig. 7.7 (**a**–**e**) Auricular rotation skin flap

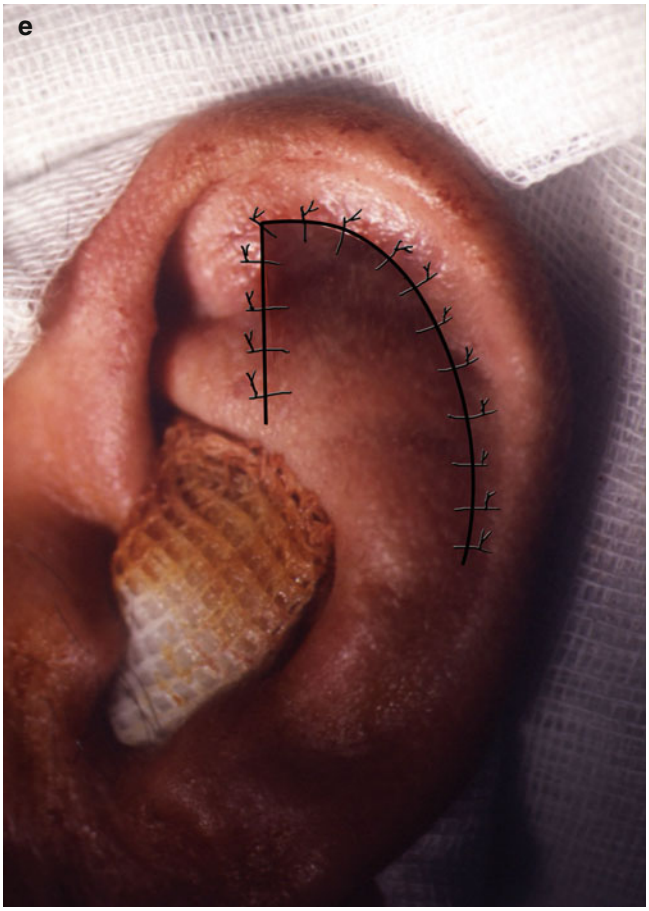


Fig. 7.7 (continued)

The flap was advanced to the recipient site without tension (Fig. 7.8g). The cartilage and skin of both the anterior and posterior surfaces of the auricle were sutured (Fig. 7.8h, i). The flap healed well without any sign of tip necrosis and reconstructed fully the helix (Fig. 7.8j, k).

7.2.3 Postauricular Subcutaneous Pedicle Island Flap

Postauricular skin can be transferred to the anterior auricle as an island subcutaneous pedicle flap. The skin is derived partly from the back of the auricle and partly from posterior to the sulcus. The skin is fully detached except the zone at the cephalic-auricular sulcus where it remains attached to the subcutaneous tissue, which becomes its pedicle. The skin island is turned around, as the subcutaneous pedicle becomes its hinge resembling a "revolving door" and is brought to the defect. The donor site is closed primarily.

Although it is much easier to transfer skin by this flap to the concha resurfacing conchal defects, with meticulous dissection and mobilization of the pedicle, the skin island can reach even slightly more anterior defects as in the case demonstrated (Fig. 7.9a–e).

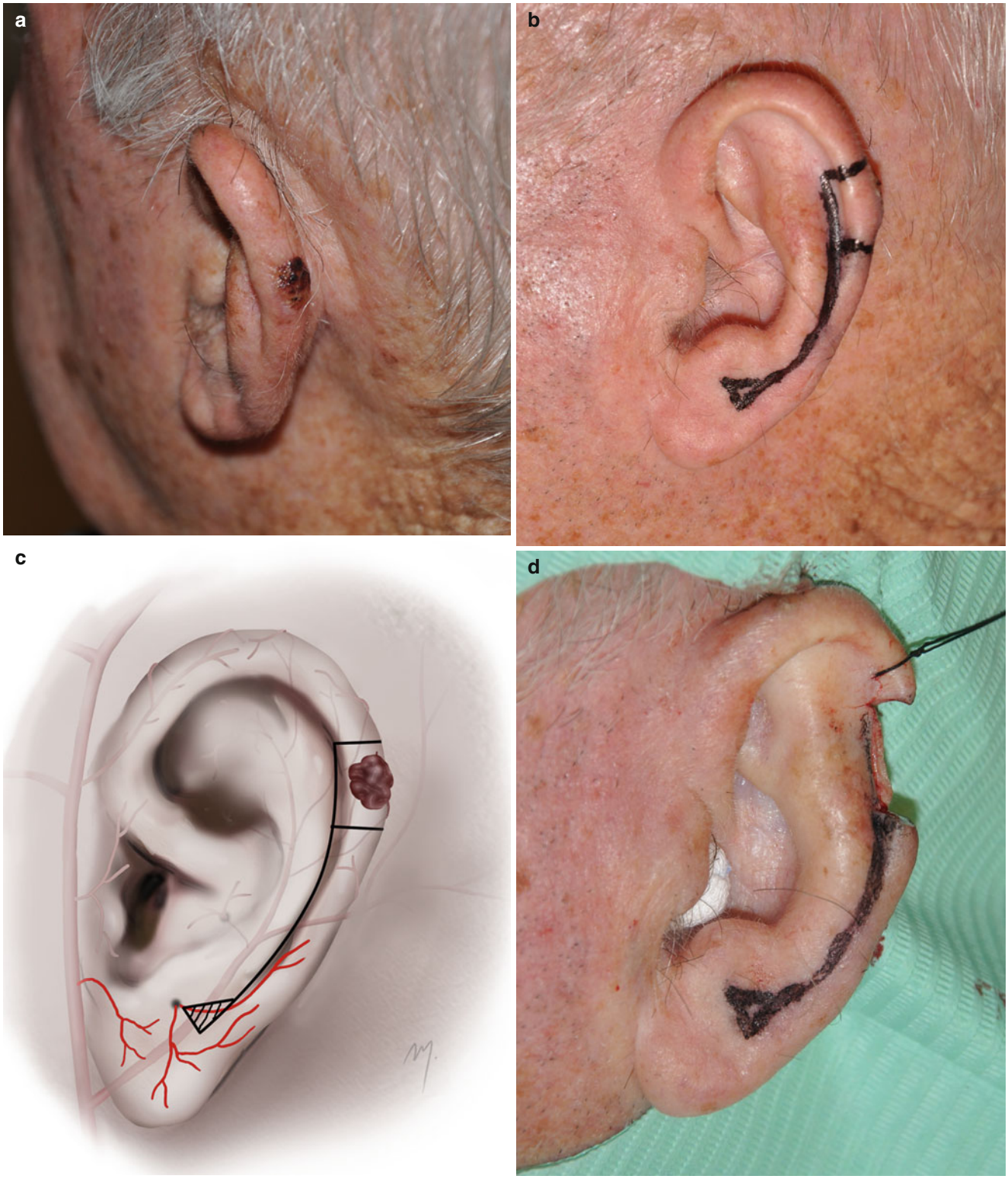
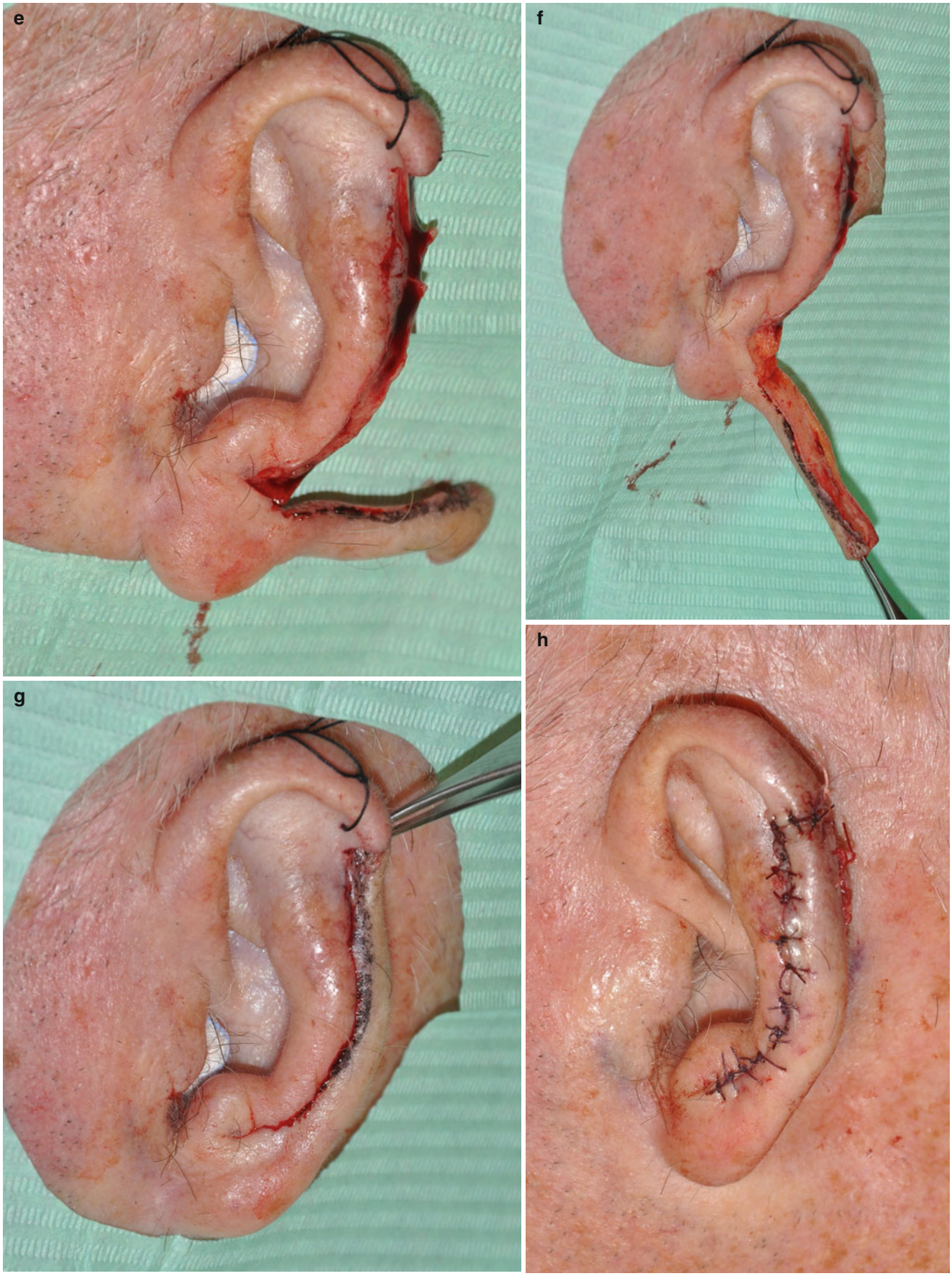


Fig. 7.8 (**a**) Basal cell carcinoma located at the helical rim. (**b**, **c**) A chondrocutaneous helical rim advancement flap is outlined. (**d**) The lesion excised. (**e**) The flap was raised as a chondrocutaneous unit that includes both skin and cartilage of the helix. (**f**) Flap fully mobilized. (**g**) Advancing to recipient site. (**h**, **i**) Flap sutured in position. Skin is sutured in both outer and inner surfaces of the auricle. (**j**) Early postoperative result (10 days). No necrosis occurred. (**k**) Late postoperative result



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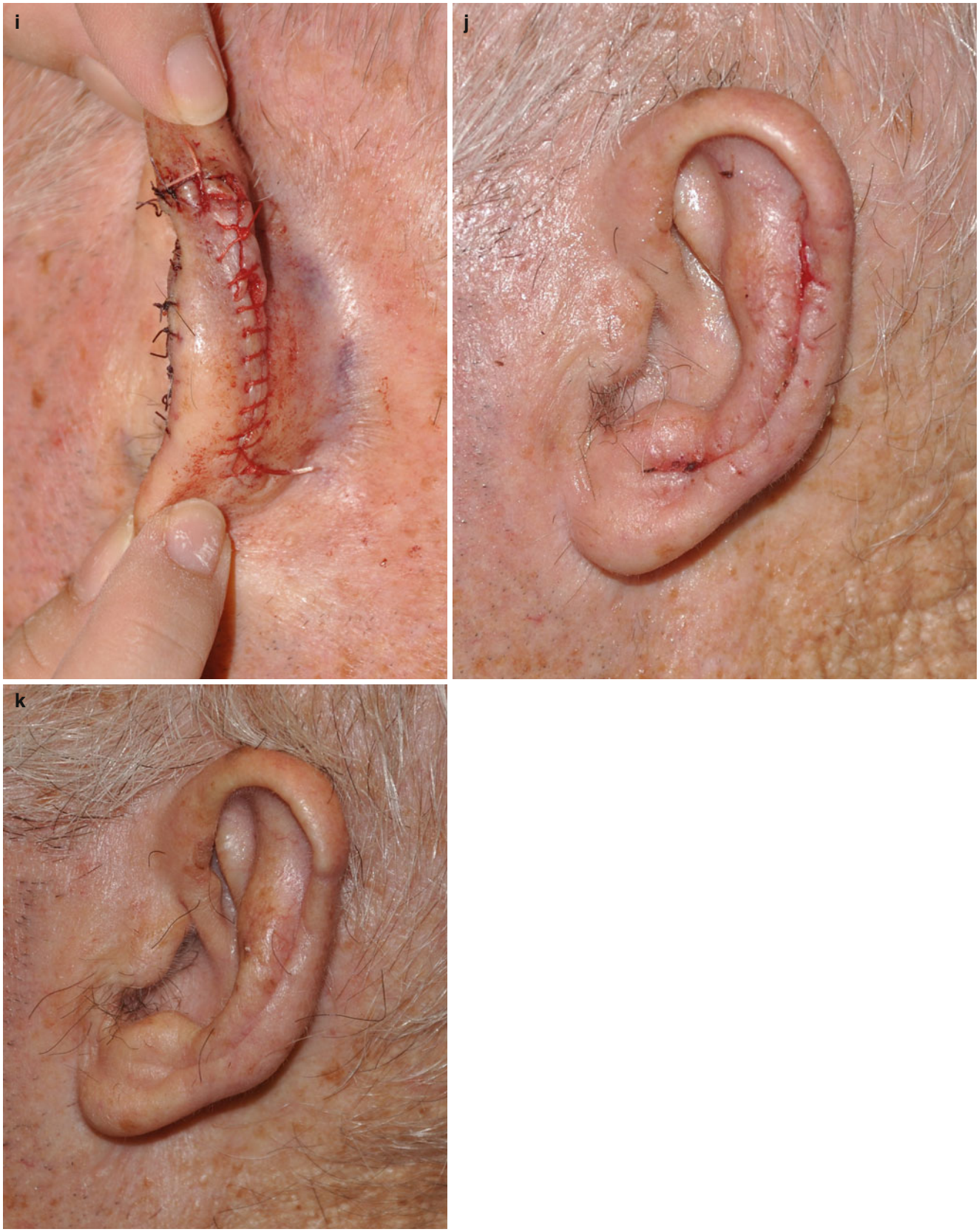

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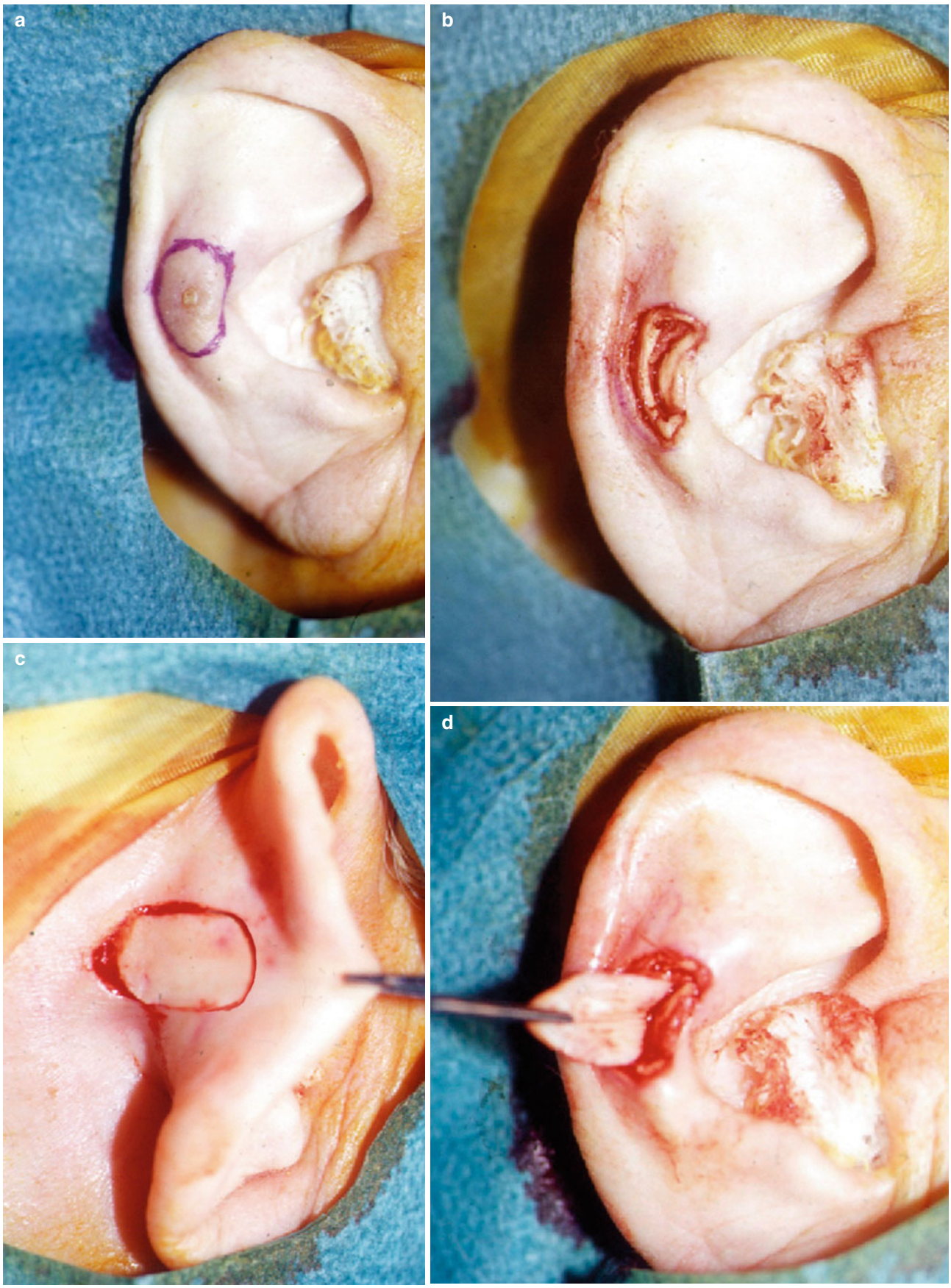

Fig. 7.9 Postauricular subcutaneous pedicle island flap (With kind permission from Dr. Ioannis Tsamis). (**a**) Resection margins of the lesion outlined. (**b**) The defect after resection. (**c**) Postauricular subcutaneous pedicle island flap outlined. (**d**) Flap tunneled. (**e**) Flap sutured in place

Fig. 7.9 (continued)

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