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Chondrocutaneous Bilateral Advancement Flap with Postoperative Radiation Therapy for a Helical Rim Keloid

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Abstract Keloids can be recalcitrant, and a well-planned treatment strategy is essential. Multiple ear piercings have recently become popular, particularly among younger age groups. Management of keloids that develop after piercing of the ear cartilage may be particularly problematic. Helical rim keloids are difficult to excise because of the complex, three-dimensional, cartilaginous structure of the helix and its thin and tightly adherent covering layer of skin. The chondrocutaneous advancement flap introduced by Antia and Buch may be a useful reconstructive option for a helical rim keloid after marginal loss of a segment of the helix as a result of trauma, a burn, or excision of a malignant tumor. However, this technique is limited to wounds that involve only the helix. In this technical note, we describe the use of a chondrocutaneous bilateral advancement flap with postoperative radiation therapy to treat a more invasive and relatively large keloid on the scapha. This technique is straightforward and safe in terms of preserving the blood supply. The addition of adjuvant radiation therapy can help to decrease the risk of recurrence and preserve the morphological structure of the ear and patient satisfaction.

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Keywords Helical rim keloid · Chondrocutaneous bilateral advancement flap · Postoperative radiation therapy

Introduction

Keloids can be recalcitrant, and a detailed and appropriate treatment plan is essential. Recently, multiple ear piercings have become popular, especially in the younger age groups. The management of keloids that develop after ear piercing is becoming a concern.

Surgical or laser-assisted keloid excision is known to have a recurrence rate of up to 100% [1]. The effectiveness of over-the-counter dressings and ointments alone for keloids is very limited [2]. Therefore, a multimodal treatment approach is likely to be necessary. One option is excision and a course of corticosteroid injections. Intralesional corticosteroids in addition to surgical excision significantly lower the risk of recurrence [3, 4]. Another approach is excision followed by radiation therapy, which can also decrease the recurrence rate [1]. Both of these treatment approaches include excision of the keloid, so an appropriate excision technique is essential. However, unlike keloids on the ear lobe, keloids on the helical rim are difficult to excise because of the complex, three-dimensional, cartilaginous structure of the helix and its thin and tightly adherent covering of skin.

In this article, we describe a new technique, namely, use of a chondrocutaneous bilateral advancement flap followed by adjuvant radiation therapy, which can be used to treat a helical rim keloid.

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Materials and Methods

We applied this technique in three patients with moderately severe keloids on the helical rim.

Technical Description

The keloid is removed with a minimal normal skin margin. An incision is then made through the skin and cartilage inside the antihelix on the anterior side of the ear to raise a chondrocutaneous bilateral advancement flap (Fig. 1a). The length of chondrocutaneous flap can be changed according to the tension of the wound. On the posterior side of the ear, the surrounding skin is undermined on the perichondrium, while the skin on the medial surface is left intact (Fig. 1b). The perichondrium is closed with 4–0 polydioxanone sutures. The suturing becomes possible after longitudinal incision of the auricle along the antihelix. Normally, the skin on the posterior side of the auricle is excessive and needs to be trimmed. The wound is then closed with 6–0 nylon (Fig. 1c, d). A Penrose drain is usually placed on the posterior side of the auricle to remove fluid from the wound site. Radiation therapy is delivered 3–4 days postoperatively when the surgical site has stabilized. Concretely, 20 Gy is delivered as 5 Gy per fraction on days 3–4 after surgery. The sutures are removed on postoperative days 7–10.

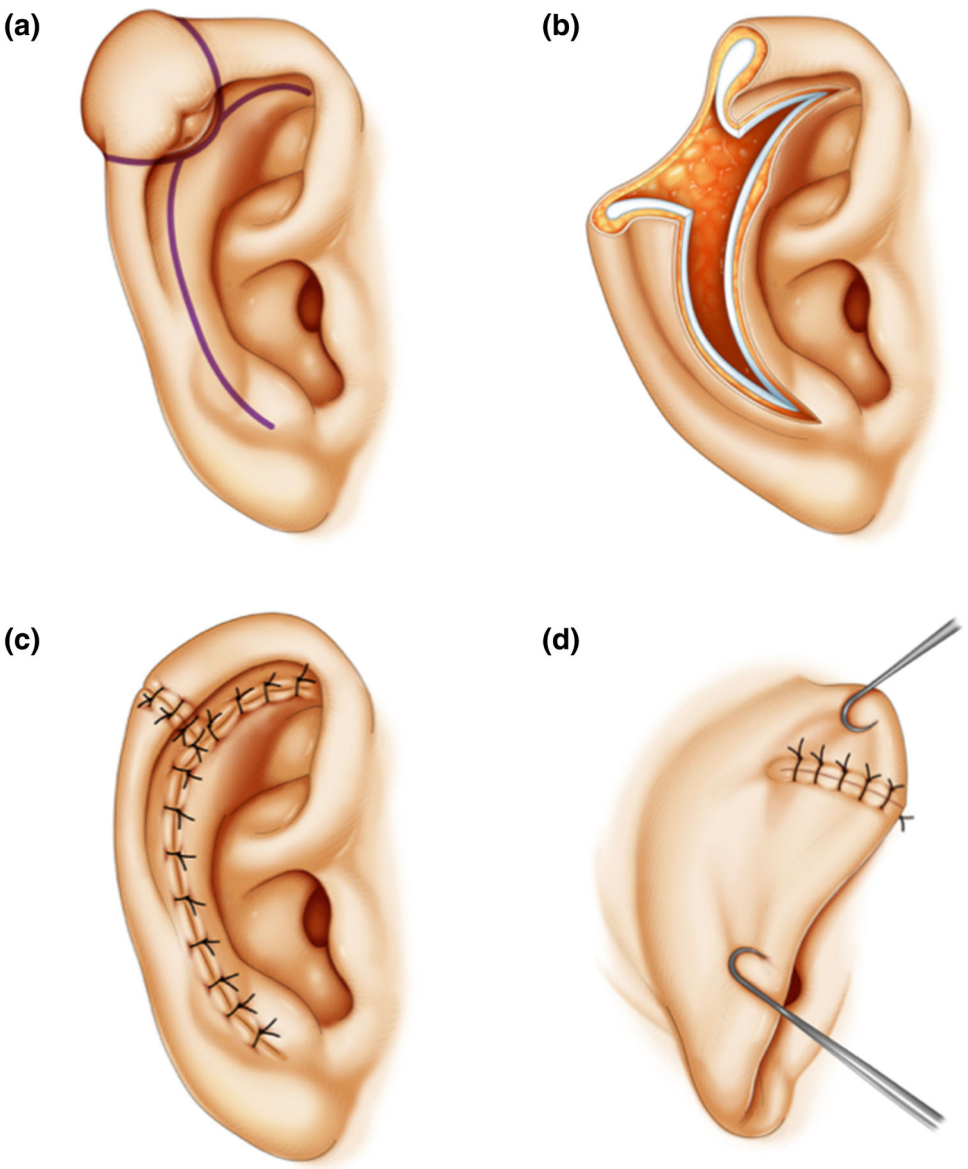

Fig. 1 Schematic drawing of the surgical technique for a chondrocutaneous bilateral advancement flap. **a** The keloid is removed with a minimal normal skin margin. An incision line is marked through the skin and cartilage inside the antihelix on the anterior side of the ear. **b** The keloid is removed, and the longitudinal line is incised. On the posterior side of the ear, the surrounding skin is undermined on the perichondrium. The bilateral chondrocutaneous advancement flap is raised. **c**, **d** The wound is closed from anterior to posterior using 6–0 nylon

Results

All of the patients achieved decent auricular shape correction, preserving anatomical structures (Figs. 2, 3). No recurrence was observed at 80.7 months average follow-up (range 75–87 months). The average of the width of the excised keloid was 20 mm (range 18–23 mm). The proportion of the width of the excised keloid to the length of the ear helix (excluding the ear lobe) was on average 0.215 (0.200–0.240).

Discussion

Many surgical methods, including wedge excision, *Z*-plasty, the *V–Y* flap, and the keloid fillet flap, can be used to treat keloids of the ear lobe, whereas total or intralesional excision is the only option for keloids of the helical rim. The core excision method introduced by Ogawa et al. [5] is classified as an intralesional excision technique and is an effective and reliable treatment for most auricular keloids. However, some keloids are large and may extend to the scapha, with the mass protruding to the anterior and

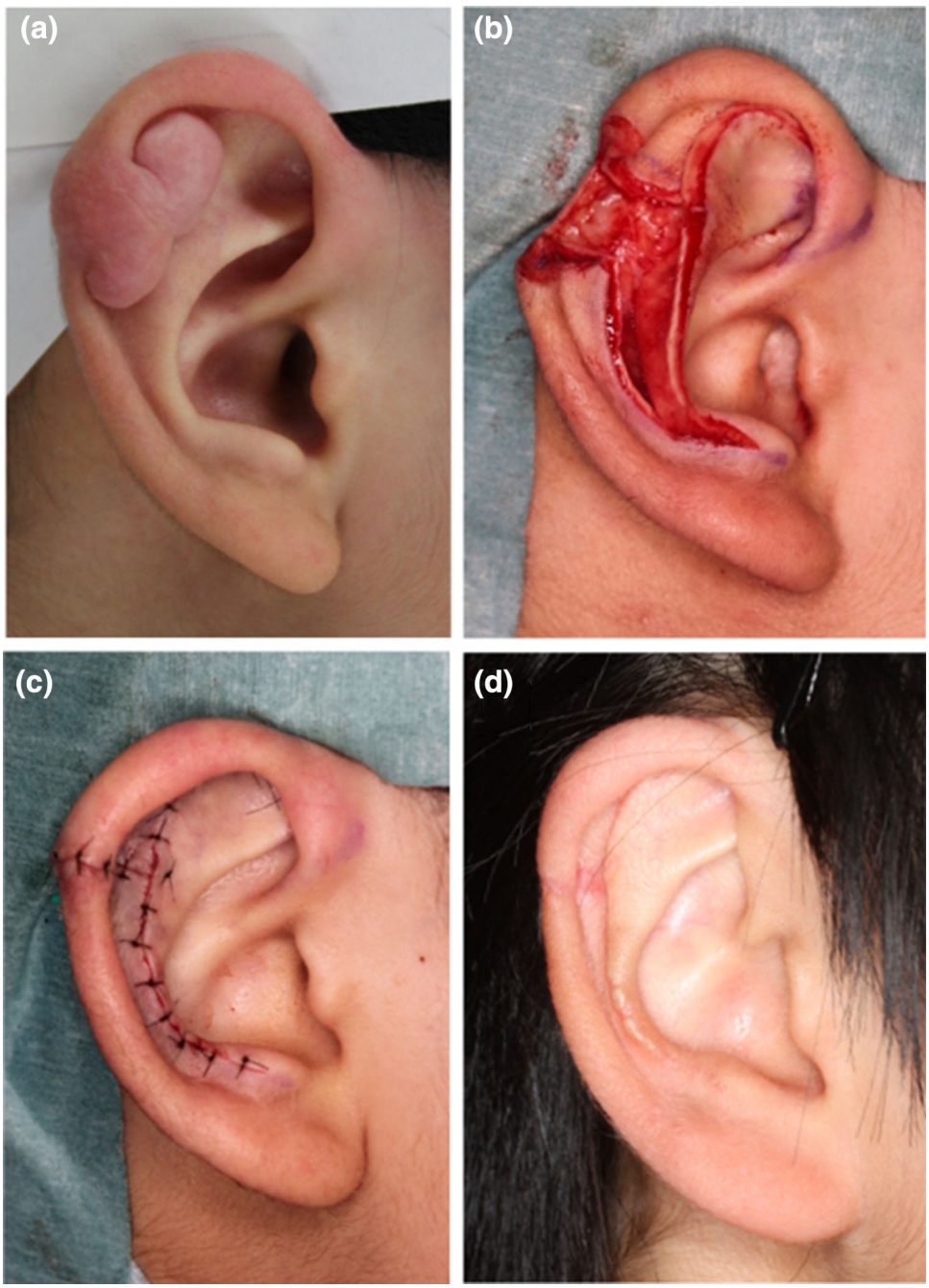

Fig. 2 Clinical appearance in a 13-year-old female. **a** A comparatively large helical rim keloid is present on the right ear. The width of the excised keloid was 19 mm. The proportion of the width of the excision to the length of the ear helix was 0.204. **b** A bilateral chondrocutaneous advancement flap is raised. **c** Appearance immediately after the procedure. **d** Appearance at 9 months postoperatively

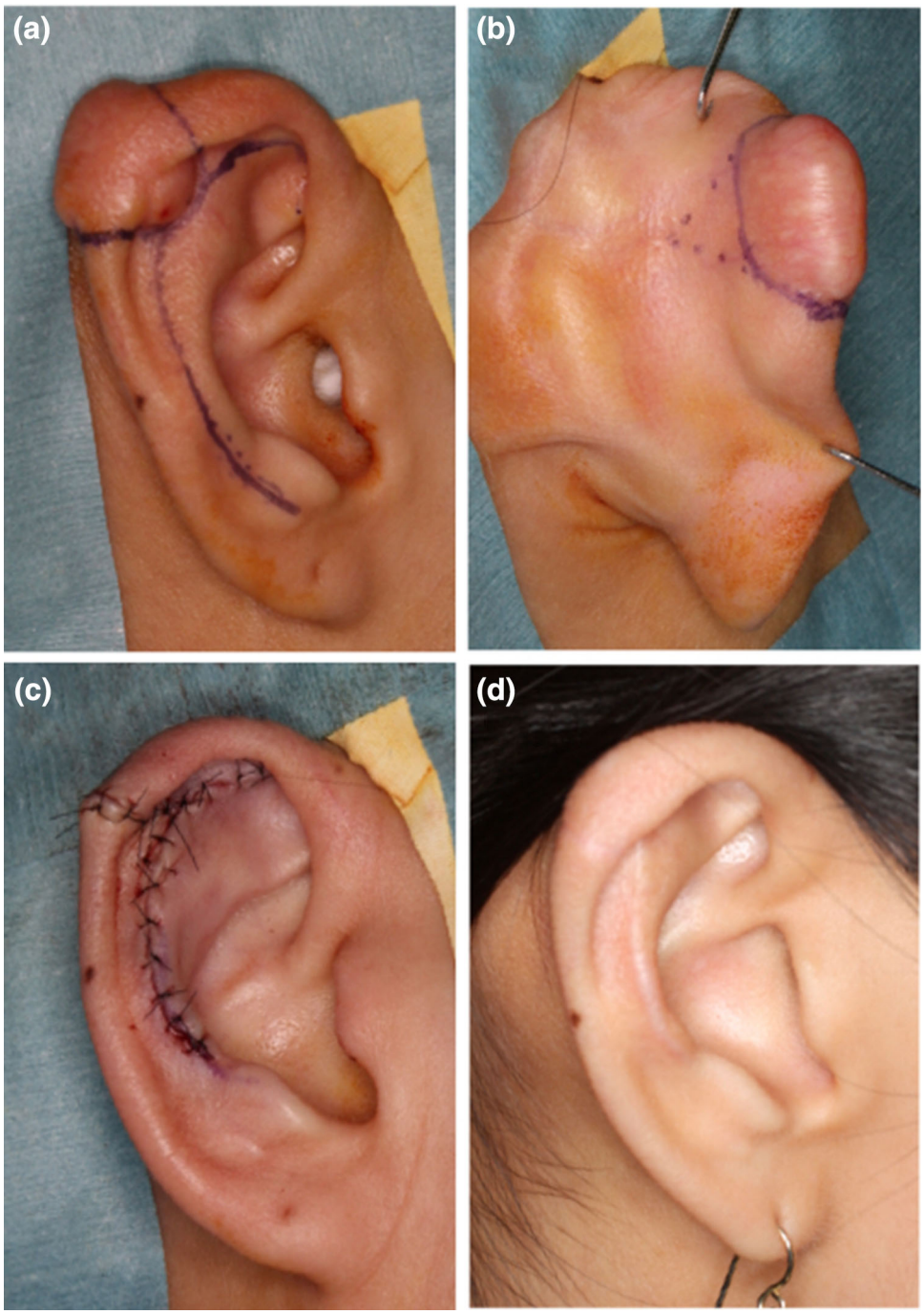

Fig. 3 Clinical appearance in a 27-year-old female. **a** A bilateral chondrocutaneous advancement flap is designed. The width of the excised keloid was 18 mm. The proportion of the width of the excision to the length of the ear helix was 0.200. **b** Design of a bilateral chondrocutaneous advancement flap at the posterior side of the ear. **c** Appearance immediately after the procedure. **d** Appearance at 15 months postoperatively

posterior sides of the auricle. It is sometimes hard to distinguish the collagen tissue of a keloid from the perichondrium of the auricle, so total excision, including resection of the auricular cartilage, is necessary for such keloids. However, it has recently been reported that high tension on the dermis could generate a keloid or hypertrophic scar [6]. Therefore, the tension on the dermis should be checked carefully.

The chondrocutaneous advancement flap was introduced by Antia and Buch [7] as a treatment for marginal loss of a segment of the helix as a result of trauma, a burn, or localized excision of a malignant tumor. We have adapted this technique for excision of a keloid and repair of the defect. The wound remaining after total excision of a helical rim keloid can be closed without high tension by simultaneously resecting the auricular cartilage. The chondrocutaneous bilateral advancement flap could be used in patients with a relatively large defect extending beyond the helix in which the wound dimensions exceed the limits for wedge excision and primary closure. On the other hand,

it is difficult to apply this method to a quite large keloid extending beyond the antihelix. Keloids are generally considered to be benign lesions, and the novel flap described here addresses both safety and esthetic concerns.

Surgical or laser-aided excision alone is known to have a recurrence rate of up to 100% [1]. Therefore, adjuvant therapy is essential. The present evidence suggests that intralesional steroids, mitomycin C, bleomycin, pulsed dye laser therapy, silicone compression, and radiation are effective adjuvant strategies [8]. External radiotherapy, for example, has been used to treat keloid tissue for at least 100 years. Surgery with adjuvant radiation therapy as a treatment for keloids has been reported to have a success rate of 67–98% [1] and a recurrence rate of less than 10% [9]. One review suggested that postoperative radiation therapy consisting of 10–20 Gy delivered as 5 Gy per fraction produced the best efficacy and safety results in adult patients with keloids [10]. According to Kal et al. [11] who calculated the biologically effective doses (BEDs) for the various irradiation regimens using the linear quadratic concept, the recurrence rate decreased as a function of the BED when the radiation dose was above 10 Gy. The recurrence rate was less than 10% at a BED higher than 30 Gy. At our institution, 20 Gy is delivered as 5 Gy per fraction on days 3–4 after surgery; when the α/β value is set to 10, this is equivalent to the BED of 30 Gy used by Kal et al. [12]. Although the positive adverse effect rate is dose dependent, a total dose of 20 Gy in four fractions is acceptable regarding morbidity. In addition, it is reported that the risk of fatal tumors induced by this dose fraction is negligible [13].

It is important when treating a keloid that adjuvant therapy is started as soon as possible after surgery. Ogawa et al. [5] started radiotherapy on postoperative days 1–3. Flap surgery enables prompt initiation of adjuvant therapy. The chondrocutaneous bilateral advancement flap is safe and allows a well-planned schedule of postoperative radiation therapy even if the keloid is large and invades the scapha of the auricle. This technique could be a treatment option for a comparatively large helical rim keloid.

Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

Informed Consent All patients provided written informed consent.

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