Modification in Brachytherapy Catheter Inset in the Keloid Bed

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Abstract

Background: Keloids are troublesome for both patients and surgeons who encounter recurrent lesions. Patients often seek newly developed treatments in hopes of alleviating the pain and manifestations associated with this condition. Surgery alone is generally ineffective and requires adjuvant therapies, one of which may be brachytherapy.

Case presentation: We introduced a modification in catheter placement following surgical excision of keloids. In the two presented cases, after lesion removal and closure of the deep cavity up to the subcutaneous tissue, the wound margins were closed while leaving a limited route for the catheter to prevent its displacement. The skin was then closed. The results of immediate post-surgical brachytherapy for keloids were highly encouraging.

Conclusions: Brachytherapy following surgical keloid excision yields significant results. This combination needs more concise catheter inset especially in subcutaneous field.

Keywords: Keloid Scar, Radiation, Brachytherapy

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Introduction

Keloids cause unpleasant sensations such as pain or pruritus and pose aesthetic challenges for patients. They also exhibit complex histologic manifestations [1]. The association between trauma and keloid formation is not well defined. Any imbalance between the anabolic and catabolic phases of scar formation can result in pathologic scars, with keloids being one such example. Notably, their incidence ranges from 6% to 16% in African populations and may follow an autosomal dominant inheritance pattern [2].

Psychological and clinical problems cause clients to seek available treatments delivered by medical caregivers, including compression therapy, various surgical techniques, radiation therapy (RT), cryotherapy, topical and intralesional chemotherapy, intralesional steroids, and different laser modalities [3]. The unknown nature of the etiologic basis of keloids makes their treatment a dilemma among physicians, leading to different results. Catastrophes after surgery alone have led to the use of other treatments alongside surgery. Radiation for the scar is one of the accepted adjuvant therapies. Innovation in scar radiotherapy has led to advancements like brachytherapy. During radiotherapy, inhibition of pro-inflammatory cytokine cascades and excessive production of fibroblasts can occur [4,13].

The energy is delivered by implanted catheters in the keloid field. We noticed that the position of the catheters has a significant effect on the final scar and therapy. We made some minimal adjustments and achieved more success with less recurrence compared to previous results**,** and we want to share our experience in this article.

Case presentation

A 25-year-old woman had an ear piercing about two years ago. Gradually, she underwent changes in auricular contour, and a keloid appeared on her helix and antihelix (Fig. 1). The treatment plan consisted of surgical excision followed by brachytherapy. The lesion was completely excised, and the dead space was closed with a 4-0 absorbable suture. Finally, a catheter was placed just beneath the skin in the

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treatment field and secured to prevent displacement (Fig. 2). The rationale for this approach was based on the efficacy of brachytherapy within millimeters of the catheter.

The patient received three high-dose protocols of brachytherapy, and the catheter was removed easily. The final aesthetic result was acceptable without any recurrence (Fig. 3). Sometimes, patients need more.

catheters in large lesions to have more efficacious brachy therapy (Fig. 4)

The result was interesting without recurrence after months (Fig. 5)

Discussion

As monotherapy with excisional surgery is associated with high recurrence rates (45%-100%) and often results in the formation of larger keloids than the original lesions, current emphasis is on combination therapy [5,12,14].

Brachytherapy has gained a valuable role in the treatment of keloids, with a recurrence probability of 15% compared to 23% for external radiotherapy which carries potential systemic toxicities [4]. Its efficacy depends on several factors.

Brachytherapy can be broadly categorized into interstitial and surface subtypes, with the interstitial type further divided into low-dose and high-dose regimens based on radiation quantity and delivery duration [6]. For this technique, hollow catheters are inserted into the surgical bed to facilitate radioactive material delivery through the wound.

The therapeutic radiation effect is limited to a few millimeters from the catheter. Consequently, in large lesions, even minor catheter displacement may compromise treatment efficacy. This rationale underlies our approach of creating a confined subdermal pathway for catheter placement.

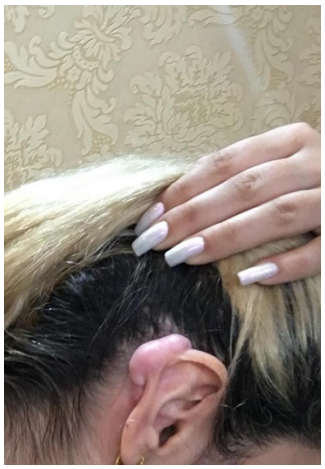

Fig.1: Ear keloid following piercing

Fig. 2: Placement of catheter following excision just below skin

Fig. 3: Aesthetic result following ear keloid combined treatment by surgical excision and brachytherapy

Fig. 4: Large ear lobe keloid excision and placement of 3 brachytherapy catheter

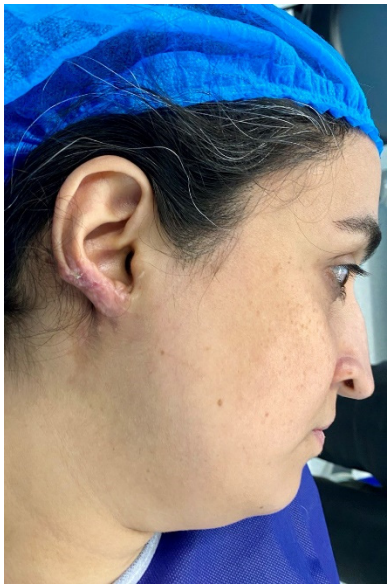

Fig. 5: keloid cure after combined surgery and brachytherapy

In extensive keloids requiring multiple excisions, the resulting wound bed may be particularly large. Under such circumstances, catheter displacement could lead to radiation delivery to non-target areas, potentially increasing recurrence risk. Therefore, following lesion excision, we close dead space with absorbable sutures, maintaining only precise catheter pathways. This technique ensures secure subcutaneous catheter fixation while minimizing displacement risk.

Sobec et al. (2013), in their review article on ear keloids, demonstrated that postoperative radiation carries no carcinogenic risk. They reported a protocol using 10 Gy delivered in two fractions over two days for earlobe keloids, finding no associated malignancy concerns [2]. This evidence supports the safe use of radiation as an adjuvant treatment for keloid scars.

Strnad et al. (2018) emphasized the importance of image-guided catheter placement (via CT or ultrasound) to ensure precise positioning in breast cancer patients, as catheter dislodgment may compromise outcomes. Their work established multi-catheter techniques for primary breast cancers and proposed practical insertion guidelines [7]. We maintain that image-guided precision is equally crucial for keloid brachytherapy, where catheter stability directly impacts treatment quality. Any unintended catheter movement must be prevented to ensure optimal results.

Pankaj et al. (2022) conducted a retrospective study of patients receiving radiotherapy after keloid

excision, demonstrating that lower total doses with higher dose-per-fraction regimens can achieve both satisfactory cosmetic outcomes and minimal adverse effects [8].

Sun et al. (2021) evaluated 67 patients with ear keloids treated using a combined approach of surgery, radiotherapy, and triamcinolone acetonide injections. Their findings support triple therapy as the preferred management strategy for auricular keloids [9]. Hung et al. (2022) subsequently confirmed the efficacy of this multimodal approach in their study [10].

We maintain that brachytherapy offers distinct advantages over traditional radiotherapy, particularly in terms of reduced complication rates.

van Leeuwen et al. (2015) conducted a comprehensive systematic review evaluating keloid treatments, particularly surgical excision followed by radiation therapy. Their analysis began with 3,546 articles, narrowed to 207 relevant studies, and ultimately included 33 articles for evaluation. The authors concluded that excision with adjuvant radiation should be considered a "last resort" for recalcitrant, large keloid scars only after failure of nonsurgical treatments. However, they emphasized the need for more rigorous studies to establish evidence-based treatment guidelines [11].

All keloid treatment modalities should be recognized by healthcare providers. Multidisciplinary approaches are widely accepted due to their demonstrated benefits: lower recurrence rates and superior aesthetic outcomes. Among these, postoperative brachytherapy represents one of the most effective options. Importantly, secure catheter fixation in the treatment field enhances outcomes by ensuring precise radiation delivery.

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