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Efficacy and the toxicity of the interstitial high-dose-rate brachytherapy in the management of recurrent keloids: 5-year outcomes

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ABSTRACT

PURPOSE: Recurring keloids are a clinical challenge. Interdisciplinary treatments are required in most cases. Owing to the wide variety of concepts, the optimal treatment regime remains unclear. Our clinic established a protocol of perioperative interstitial high-dose-rate brachytherapy with three fractions of 6 Gy and achieved an excellent 2-year local control rate of 94% (In search of the optimal treatment of keloids: Report of a series and a review of the literature). This report is an update on our long-term results of prospective study. Twenty-nine patients were included with a median followup of 5 years.

METHODS AND MATERIALS: From 2009 to 2015, 29 patients with 37 recurrent keloids were treated with perioperative interstitial high-dose-rate brachytherapy; 3 patients had been previously treated with adjuvant external beam radiotherapy and presented with recurrences in the pretreated area. Brachytherapy was given in three fractions with a single dose of 6 Gy in 5-mm tissue depth and covered the scar in total length. Followup visits were scheduled at 6 weeks, 3 months, 6 months, 1 year, and annually thereafter. Therapeutic outcome was assessed in terms of recurrence, acute and late complications, and cosmetic results.

RESULTS: No procedure-related complications occurred. Improvement of keloid-related symptoms was noticed in all patients after treatment. After a median followup of 49.7 months (range: 7.9−91.9 months), three keloid recurrences and two hypertrophied scars were observed.

CONCLUSIONS: Our results suggest that brachytherapy may be advantageous in the management of high-risk keloids, even after failure of external beam radiotherapy and other treatment procedures. Our three-fraction treatment schedule reduces the treatment period to 2 days and is therefore convenient for the patients.

Keywords: Keloid; Recurrent Keloid; Radiotherapy; Brachytherapy

Introduction

Postoperative radiotherapy is widely used to reduce keloid recurrences (1−3). However, different irradiation methods, the delivered dose, and the fractionation influence the treatment effect and side effects (4). Previous published data showed an excellent local control rate of keloids after treatment with surgery and interstitial high-dose-rate (HDR) brachytherapy, which ranged from 6% to 12% (3, 5−8). Moreover, the interstitial HDR brachytherapy is able to deliver conformal radiation exactly in the scar and is therefore advantageous for the irradiation of long or irregular scars.

Our clinic has used perioperative ^{192}Iridium interstitial brachytherapy for the treatment of recurrence keloids since 2009 and established a treatment protocol with three fractions of 6 Gy (9). This report is an update on our long-term results of this prospective study.

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Methods and materials

From February 2009 to July 2016, 29 patients consisting of 11 males and 18 females with 37 recurrent keloids were treated with the interstitial brachytherapy. The median age of the patients was 47 years (range: 20−80 years). The patients had already undergone two or more pretreatments, which included surgical resection, Y-laser, cryosurgery, and silicone sheets or gels. Three patients had undergone scar resection plus adjuvant external radiation therapy and presented with recurrences in the pretreated area. Two of these patients were given electron beam therapy with the dosages of 10 × 2 Gy and 4 × 3 Gy, respectively. Another patient was treated with photon beam therapy with a dosage of 15 × 2 Gy. Relapses did not occur on these 3 patients until 4 weeks, 26 months, and 5 years, respectively.

After local excision of the keloid, a tube applicator was implanted 5 mm beneath the skin surface (Fig. 1). The brachytherapy technique used was described previously (9). The target area covered the entire wound and was treated with a total dose of 18 Gy in three fractions within 36 h of resection. Dose prescription was in 5-mm tissue depth.

Brachytherapy was planned for two cases with Varian Eclipse BrachyVision, version 10.0.42. One was on the helix, and the other was with multiple-catheter implantation. Catheter reconstruction and dosimetry on dose points, where the prescription was given to the skin, were calculated under the CT-based three-dimensional conformal plan. The HDR ^{192}Iridium-remote afterloading system (GammaMedPlus; Varian Medical Systems, Palo Alto, CA) was used, and the source step distance was 0.5 cm.

After the brachytherapy was completed, the tube applicator was removed, and a pad was used to cover the wound for 1 day.

Followup visits were scheduled at 6 weeks, 3 months, 6 months, 1 year, and annually thereafter. Therapeutic outcome was noticed in terms of recurrence, acute and late complications, and cosmetic results in the treatment area. Symptoms like itching and pain were classified on a 0−10 numerical rating scale (0 represents no itching and pain, whereas 10 represents the worst itching and pain). Variation more than 3 points on classification means there is a change of symptoms.

Results

The median followup time after the adjuvant brachytherapy was 49.7 months (range: 7.9−91.9 months). The 5-year Kaplan−Maier estimated local control was 92%. Twenty-seven patients had pretherapeutic symptoms such as itching and pain. Improvement of the symptoms was observed in all patients. *In situ* keloid recurrences were observed in 3 patients (8.1%) at the last visit. Two other patients (5.4%) experienced hypertrophied scars. The pretherapeutic symptoms were completely resolved on all patients without recurrence.

No acute complications such as acute bleeding, infection, or erythema were observed. Delayed wound healing was the most frequently observed side effect. Seven patients (18.9%) had a wound healing time of more than 2 weeks. Three patients (8.1%) had pigmentation abnormalities. The pigment changes occurred in the form of the catheter as hyperpigmentation on the Caucasian patient but hypopigmentation on the patient with African origin (Fig. 2). Two patients experienced telangiectasias.

Discussion

Keloids result in cosmetic deformities as well as physical symptoms like itching, stiffness, scar contracture, tenderness, and pain. Effective treatment like postoperative

Fig. 1. Implantation of a single tube for interstitial brachytherapy after the resection of a thoracic keloid.

Fig. 2. Result after 6 months: excellent response of the therapy with a complete regression of the symptoms (pruritus and pain), discrete hypopigmentation.