

# Evaluation and Outcomes of Pre and Post-Surgery Treatment of Keloids with Radiotherapy



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## Abstract

**Background:** Keloids are challenging benign topic of radiotherapy. Presurgical and postsurgical electron radiotherapy improved treatment results and local recurrence rates were lower which is similar to the literature.

**Purpose of the study:** The aim of this study is to share our single center radiotherapy experience in different located keloids.

**Material methods:** 64 patients receiving image-guided RT (IGRT) for keloid at our department between September 2016 and January 2021 were assessed retrospectively. Inclusion criteria's were eastern cooperative oncology group performance status of 0-1, no previous RT history and connective tissue disease

**Results:** Local control rate after combined treatment was 88%. The patients who relapsed at the same location were retreated with surgery and no recurrence afterwards. Adverse events were analysed 3 monthly for all patients after combination treatment.

**Conclusion:** Combination therapy of keloid including presurgery and post-surgery radiotherapy with electrons was analysed with our 64-patient study. Radiotherapy is safe and effective method for keloids, and it should not be omitted because of recurrence pattern of keloid. Randomized and multicenter studies might be encouraged to shed light on this challenging benign disease.

**Keywords:** Keloid; Radiotherapy; Surgery

## Introduction

Keloids are immoderate proliferation of tissue throughout scars after skin trauma from spontaneously or heat, burn, acneoid inflammation, surgery. Hypertrophic scars convert into keloid. Patients have inflammatory reaction or moderate local pain. Keloids emerge in sternum or ear lobes mostly. The real etiology is still unknown but genetic and race susceptibility are studied. Typical location is earlobe after piercing. Some of the lesions are with huge volume and also painful. Treatment failure and recurrence is common. Treatment options are cryosurgery, dressings with pressure or silicone bandages. First line therapy might be intralesional injection. Verapamil, 5-fluorouacil or steroids can be injected in keloid lesions. 70 percent of patients have improvement and good response but half of all recur at 5 years according to the literature search. When injectional therapy fails, surgical excision might be discussed for improvement. Because 45-100 percent of patients recur after surgery, interferon or steroid injection before or after surgery is indicated. Radiotherapy is a viable option to prevent from recurrence if there is large lesion, unfavorable location or marginal resection. If lesion

treatment with surgery would result with functional impairment or etc., only radiotherapy should be delivered but the matured keloids reply minimally to this option. Ideal treatment is to give radiotherapy after surgical excision with reducing recurrence down to 20 percent. Within 24 hours after surgery, radiotherapy has to be given. 1 cm margin is added to the scar to compose a target volume. Shielding can be used for tissue protection of any. Dose per fraction, energy of electron, brachytherapy options might be discussed by experts in radiation oncology. 12-20 Gy in 3-4 fractions or 7.5-10 Gy single fraction radiotherapy are approved techniques with better cosmesis and low recurrence rates.

## Material and Methods

64 patients receiving image-guided RT (IGRT) for keloid at our department between September 2016 and January 2021 were assessed retrospectively. Inclusion criteria's were eastern cooperative oncology group performance status of 0-1, no previous RT history and connective tissue disease. Informed consent of all patients were obtained before the treatment, and the study was performed in compliance with the Declaration

of Helsinki principles. Planning CT images were acquired to delineate the critical structures and gross tumor volume, clinical target volume (CTV), and planning target volume (PTV) for all patients. GTV was keloid. CTV was established by adding 1 cm to the GTV. PTV was created by adding 0.5 cm to the CTV. IGRT plans were generated for RT with image guidance. Supine or prone positioning was used for treatment due to the location of keloid. Planning CT images with 5-mm slice thickness was acquired. The planning CT images were sent to the contouring station through network. Advantage Sim MD simulation and localization software (Advantage Sim MD, GE, UK) were used for the delineation of the organs at risk and treatment volumes. All RT plans were generated using Precise PLAN (Elekta, UK) treatment planning system. CTV coverage was maintained between 95% and 107% for all RT

plans. Dose-volume histograms were thoroughly assessed by the treating radiation oncologist and radiation physicist before treatment. All patients received 8 Gy per fraction within 24 hours before and after surgery. RT was delivered by synergy (Elekta, UK) linear accelerator with the capability of daily online set-up verification under image guidance with kilovoltage cone-beam CT (kv-CBCT) and (X-ray Volumetric Imaging [XVI], Elekta, UK). 6-18 mev electron energy was used according to the depth of keloid. All patients were treated after online verification of setup by the use of kv-CBCT and XVI. Statistical analysis Statistical Package for the Social Sciences, version 16.0 (SPSS, Inc., Chicago, IL) software was used for the data analysis with the level of significance set at  $P < 0.05$ . Age, gender, keloid location, follow-up time, adverse events and recurrence were comparatively assessed (Figure 1).



Figure 1: Earlobe keloid before and after treatment.

## Results

Table 1: Patient characteristics.

Number of patients	64
Age	Mean 44 (28-62)
Gender	Female-48(%75)
	Male-16(%25)
Location	Ear lobe (%60)
	Sternum (%20)
	Upper extremity (%10)
	Other (%10)
Local control rate	88%
Retreatment	%12 (resurgery)
Electron energies used	6-18 mev

Patient characteristics are shown in (Table 1). Of the total 64 patients, 48 patients (75%) were female, and 16 patients (25%) were male. The median age was 44 years (38-62). The median follow-up duration was 24 months (14-38 months). 60 percent of keloids were located at ear lobes of patients whereas 20% were at sternum, 10% were at upper extremity and 10% were at other locations. Local control rate after combined treatment was 88%. The patients who relapsed at the same location were retreated with surgery and no recurrence afterwards. Adverse events were analysed 3 monthly for all patients after combination treatment.

Grade 1 erythema was shown in 30 percent of all group whereas grade 2 erythema was seen in 15 percent of all. No grade 3 or 4 adverse effect were seen in this population. All patients were recommended to protect their location of keloid from sun and trauma.

## Discussion

Keloid treatment strategies are challenging and alter in various instates worldwide. There are so experienced centers such as Nippon Medical School. They treat 2000 keloid or hypertrophic scar yearly. Because they have many patients, they offer a prevention and treatment protocol for Japanese patients [1]. Recent up-to-date improvements favor the application of combination therapy. 35 patients were treated with laser following cryotherapy and steroid injection. No significant adverse effects were shown in follow-up period. Recurrence was only seen in one patient at all [2]. Behind the nonradiotherapeutic options, radiotherapy widely used in benign and malignant skin diseases more than a century. Intraoperative radiotherapy (Intrabeam) was used for 13 patients. Radiotherapy was delivered on days 0 and 3rd after surgery. None of all group had recurrence after 22.5 months follow-up [3]. New keloid incidence in Taiwan is around 30 000 annually and this benign disease is so familiar in Asian population. Overall recurrence was 32 percent with an 28 months follow-up. Adjuvant radiotherapy was applied after surgical excision to the patients. Feasibility and efficiency of radiotherapy is convincing but more available biological effective dose should be studied [4]. Combination of surgery and radiotherapy including external bema radiotherapy, intraoperative radiotherapy or brachytherapy offer better results. Optimum radiotherapy scheme is not clearly defined. 20 Gy in 5 fractions was used in 100 keloid cases postoperatively between 2009 and 2019. This hypofractionation concluded with safe and acceptable rates of recurrence and adverse effects [5]. Surgical monotherapy associates with high recurrence rates for the treatment of keloids. 50-80 percent of all may relapse in same location. 15-18 Gy electron beam in 3 fractions was used for the different sites of body keloids. Keloid recurrence was decreased to 10 percent in this center. Varying schemes might be individualized for the patients and the location [6]. One original case was presented by Liu et al. Giant anterior chest wall keloid was treated with multiple operations. Electron beam radiotherapy was delivered after 4th and 5th operation. No sign of recurrence was shown in 24-month follow-up. Adjuvant radiotherapy is also effective in giant keloids as a conclusion of this case report [7].

Combination therapy including surgery, postoperative radiotherapy and steroid-plaster therapy was applied in axillary keloid with abscess. Surgical excision following adjuvant radiotherapy was delivered for this 62-year-old patient. Steroid tape was used for 18 months for residual keloid and prevention of new lesion. No recurrence was observed in follow up period if this case [8]. Three fraction electron radiotherapy was delivered within 2 hours and after surgery to the keloid patients in a center by Liu et al. Local control rate was 86 percent at all. Median follow-up was 26 month for this study. Safe and effective

protocol was approved for especially ear lobe keloids by the researchers [9]. Different surgical method such as Z plasty and postoperative radiotherapy combination was used in 38 keloid patients in another study by Dohi et al. Upper arm keloids were studied between 2013 and 2016. 18 Gy in 3 fractions was used as a radiotherapy scheme. Only 5 percent recurrence was shown in this trial, and they successfully treated with concomitant steroid plaster and triamsinolon enjection for relapse [10]. Bulky keloids or recurrent disease might be treated with postoperative radiotherapy with electrons in 24-48 hours after surgery. 10 unresponsive keloid patients were delivered 20 Gy radiotherapy in a study by Pozzi et al. It was well-tolerated, and no major adverse events were seen in this group of patient [11].

## Conclusion

Combination therapy of keloid including presurgery and post-surgery radiotherapy with electrons was analysed with our 64-patient study. Radiotherapy is safe and effective method for keloids, and it should not be omitted because of recurrence pattern of keloid. Randomized and multicenter studies might be encouraged to shed light on this challenging benign disease.

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