

# Role of Electron Beam Therapy in the Management of Keloids: A Tertiary Institute Experience

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**Background and Aim:** Keloids are debilitating fibrous skin proliferations with a high recurrence rate after surgical treatment. Postoperative radiotherapy (PORT) is a well-tolerated adjuvant treatment to reduce the risk of recurrence, but the optimal regimen for this combined treatment remains unknown. The aim of this study was to evaluate the efficacy of combining surgical excision and immediate PORT.

**Materials and Methods:** We retrospectively reviewed the records of patients with keloid lesions treated with adjuvant PORT in the period 2013 to 2019 at Chalmeda Anand Rao institute of medical sciences (CAIMS) cancer hospital and research institute, Karimnagar. Main outcomes were the cosmesis, including the patient and observer scar assessment scale satisfaction scores.

**Results:** 14 patients with keloids were eligible. No major complications were observed. The overall patient and observer satisfaction rate was excellent.

**Conclusion:** Surgical excision combined with immediate electron beam PORT is an effective and easy treatment with good esthetic results and an acceptable modality of treatment. It should be considered for patients with persistent keloid formation after failure of other treatments and those at high risk of relapse.

**Keywords:** Keloid, scars, radiotherapy, intralesional excision, scars correction.

## INTRODUCTION

Keloids, hard masses on the surface of the skin, are difficult to handle and prone to expansion and recurrence.

<sup>[1]</sup> They are also accompanied by itching and are disturbing for the patients.<sup>[2]</sup> Although the years of clinical practice and numerous research studies have made great achievements in understanding the mechanisms, preventing, and treating keloids, there are still no satisfactory, particularly effective prevention and control

strategies. The main methods for treating the disease include local injection of glucocorticoids, surgical resection, cryotherapy, radiation therapy, and compression therapy.<sup>[3, 4]</sup> However, the problem of recurrence of keloids still cannot be completely solved, and it has become a difficult problem for doctors and patients.

Since its discovery, X-ray radiation has been widely used in the treatment of skin diseases. Radiation therapy uses

radiation to irradiate tissue, generate secondary electrons in the body, and cause ionization, which inhibits cell division and proliferation by directly or indirectly impacting DNA strand and breaking its molecular chains.<sup>[5]</sup> Rapidly dividing and proliferating cells are sensitive to radiotherapy.

Radiotherapy is considered one of the most effective treatments for keloids.<sup>[6,7]</sup> It can be performed preoperatively or postoperatively or can also be given alone. Postoperative radiotherapy has been demonstrated to be able to reduce the recurrence of keloids and to be safe.<sup>[8,9]</sup>

A relatively novel photon therapy apparatus, electron beam, has been used in the treatment of breast cancer<sup>[10]</sup>, brain cancer<sup>[11]</sup>, rectal cancer<sup>[12]</sup>, and vertebral metastases<sup>[13, 14]</sup> because of its small size, light weight, ease of transportation, and low operating room protection requirements. As electron beam uses low-energy rays, patients require less protection and sustain minimal damage to tissue surrounding the target area. The system is therefore ideal for treating superficial lesions like keloids. In this study, we assessed its efficacy in patients with keloids.

## MATERIALS AND METHODS

Fourteen patients with keloids underwent radiotherapy using the electron beams from 2013 to 2019. The 6 MeV electron beams were delivered using Clinac IX Linear accelerator.

Inclusion criteria were (i) clinical diagnoses, and excision in the last 24-48 hours (ii) the patient agrees to this treatment.

The exclusion criteria were (i) pregnancy and lactation, (ii) contraindications to radiation therapy, (iii) incomplete data, and (iv) lack of willingness to participate.

We obtained informed consent from all patients. This work was approved by the Institute ethics committee, CAIMS, Karimnagar. During the follow-up, patients were asked to have an outpatient visit at 1 month, 3 months, and 6 months and annually after treatment. Recurrence is defined as pain, pruritus from the scars, clinically visible a mass, or significant recurrence of the lesion. Our technical staffs recorded these details following a strict protocol.

## RESULTS

The electron beam group has a total of 8 females and 4 males, with an age range of 14-37 years of 38 years. Sites included were Ear (7) Fig 1, cheek (1), mandible (1), neck (1), scapula (1) chest (1) forearm (1) and gluteal regions

(1). The causes of the keloid lesions include piercings (7 cases of ear), burns (chest and forearm), surgical trauma (gluteal region), and abrasion scars (other cases). All the 14 patients had newly diagnosed keloids.

All patients received Radiotherapy 24-48 hours after surgery using 6MeV electrons to a dose of 12Gy in 4 fractions with no gap. Its reference depth was 0.5 mm below the skin. The field size was A-06 (applicator 6X6). The clinical data of all patients and the details about the technical delivery of electron beams are displayed in Table 1.

**Reactions:** only Erythema was seen in 3 patients.



**Figure : 1 A case of Keloid (Earlobe) being treated with radiotherapy**

## DISCUSSION

After surgical excision alone an unacceptable high rate of keloid recurrence occurs. We examined the use of ortho voltage therapy for postoperative prophylactic treatment of keloids. Despite the negative view of postoperative radiotherapy expressed in the review by Leventhal et al.<sup>[10]</sup>, there is a reasonably strong body of literature<sup>[11]</sup> supporting postoperative radiotherapy for keloids opposed to surgery alone.

As for keloids an important issue is that radiotherapy has to be delivered in a maximum of 10 days irrespective of fractionation. For this reason we treated in 4 days (3Gy per fraction with a total dose of 12Gy).

In our patients negligible acute and late toxicities have been observed in agreement with literature data on this topic. A risk in the use of radiation therapy to treat benign lesions is the occurrence of radiation-induced cancers.

Table 1: Patients characteristics

S.No	Name	Age/sex	Site	Energy	Field Size	Dose/No #	Start date	End date
1	Patient 1	18 / F	Fore arm	6 E	A-06	1200cGy/4#	28/6/2013	01/7/2013
2	Patient 2	16 / F	chest	9 E	A-10	1200cGy/4#	16/6/2014	19/6/2014
3	Patient 3	30 / F	Ear	12 E	A-06	1200cGy/4#	11/6/2015	14/6/2015
4	Patient 4	37 / F	Right Ear	6 E	A-06	1200cGy/4#	04/4/2015	04/7/2015
5	Patient 5	16 / F	Ear	6 E	A-06	1200cGy/4#	02/12/2015	05/12/2015
6	Patient 6	32 / M	Neck	6 E	A-15	1200cGy/4#	07/12/2016	10/12/2016
7	Patient 7	28 / M	Rt Mandible	6 E	A-15	1200cGy/4#	28/12/2016	31/12/2016
8	Patient 8	17 / F	Both Ear Left & Right	6 E	A-06	1200cGy/4#	21/6/2017	24/6/2017
9	Patient 9	14 / M	Gluteal region	6 E	A-06	1200cGy/4#	13/4/2018	16/4/2018
10	Patient 10	34 / F	Ear (both) Left & Right	6 E	A-06	1200cGy/4#	08/5/2018	11/5/2018
11	Patient 11	17 / F	Left cheek	6 E	A-06	1200cGy/4#	02/7/2018	05/7/2018
12	Patient 12	43 / F	Left scapula	6 E	A-06	1800cGy/4#	10/7/2018	13/7/2018
13	Patient 13	29 / M	Left Ear	9 E	A-06	1200cGy/4#	17/9/2019	20/9/2019
14	Patient 14	24 / F	Right, Left Ear	6 E	A-06	1200cGy/4#	03/12/2019	06/12/2019

However, only few studies<sup>[8]</sup> report on radiation-induced tumours (i.e. Fibrosarcoma, basal cell carcinoma, thyroid carcinoma and breast cancer) in keloids patients treated with irradiation. However, we suggest that radiotherapy for keloids should be delivered with appropriate protections, especially in children.

## CONCLUSION

Keloids are benign lesions characterized by recurrence. They may be aesthetically large and may provoke functional limitations with remarkable entity. This aspect justifies the use of ionizing radiation after surgical excision. The post-operative electron beam is well tolerated with aesthetic results guaranteed with minimal side late complications.

## CONFLICT OF INTEREST:

The authors declared no conflict of interest.

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