Ear Keloids Treated with Postoperative Electrons: A Case Series

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Abstract

Multiple modalities exist for treating keloids ranging from surgical, medical, chemotherapeutic, and radiation therapy. Different techniques of radiation therapy have been used to treat keloids as an adjuvant to surgical excision. With this case series, we report our experience of using electron beam radiation therapy in this setting.

Materials and Methods

We retrospectively analyzed 16 ear keloids treated in 10 patients from January 2013 to October 2015 with surgical excision followed by electron beam to a dose of 10 Gy in two fractions over two consecutive days in immediate postoperative period. Patients were evaluated for recurrent lesions, cosmesis, and adverse effects.

Results

With a median follow-up of 78 months (range: 67–100 months), recurrent lesion was seen in five cases; a local control rate of 68.75% was seen. Median recurrence-free period was 67 months (range: 12–100 months). Acceptable cosmesis was seen in all cases and no acute or chronic adverse effects were seen.

Conclusion

The large follow-up period in our series establishes the role of electron beam radiation therapy in attaining long-term control in keloid patients. The lower total dose with higher dose per fraction used in our patients has acceptable control along with good cosmesis and absent adverse effects.

Introduction

Keloids are essentially a result of excessive pathological scarring, which, along with the cosmetic distress, may lead to pruritus and pain in certain patients.¹ Ear piercing is very common among females, which makes them susceptible to develop keloids over the ear as a tract is formed in the subdermal region following the piercing injury.² Due to the extensive prevalence of ear piercings in Indian females along with the increased susceptibility of keloids formation in pigmented populations,³ keloids are not an uncommon problem in the country. There exist no standardized guidelines for use of any treatment modality. Clinicians have tried using compression therapy, various surgical techniques, radiation therapy (RT), cryotherapy, topical and intralesional chemotherapy, intralesional steroids, and various types of lasers to treat keloids.⁴ It was in 1898 that RT in form of X-rays was used to successfully treat hypertrophic scars for the first time.⁵ Surgery followed by RT is commonly accepted as one of the standard treatments of keloids, with the addition of RT in the immediate postoperative period helping in decreasing the risk of recurrence.⁶ We retrospectively

Keywords

► keloids
► ear piercing
► electrons
► radiation therapy

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analyzed the cases of ear keloids treated with surgery followed by immediate postoperative electron beam RT in Indian females at our tertiary care hospital.

**Materials and Methods**

Sixteen different sites of ear keloids in 10 patients treated at our institute from January 2013 to October 2015 were analyzed retrospectively. The criteria followed for considering patients for electron beam RT treatment were patient age between 18 and 75 years, recurrence of keloid following at least one prior local therapy, and a signed consent following detailed discussion with treating radiation oncologist regarding efficacy and possible adverse effects of RT. Patients not fitting into the inclusion criteria were not treated with electron beam radiation and hence were not included in this study. All these patients had undergone surgical excision of the keloids followed by external electron beam RT to the postoperative site: 87.5% (14 sites in 8 patients) starting RT within 24 hours and the remaining 2 within 48 hours. All patients were treated with 10 Gy in two fractions, 5 Gy per fraction delivered over 2 consecutive days. All patients were reviewed in radiation oncology outpatient department after 03 months of RT. Telephonic interviews were carried out with all the patients up to May 2021. Data was collected from patient treatment and follow-up records and the telephonic interviews.

Prior approval of the institutional ethical committee was taken for analyzing these patients.

All patients were assessed for cosmetic outcome following RT, complications due to radiation, and long-term disease control in terms of recurrence of keloids.

**Results**

All patients in our series were females aged between 19 and 74 years at the time of treatment with median age of 27 years. Eight out of 10 patients were aged less than 45 years. Other patient characteristics are shown in Table 1.

As per the inclusion criteria, all patients had had a prior local therapy for keloid; and RT was used for the recurrent keloid following surgical excision. A standard fractionation schedule of 10 Gy in 2 fractions delivered over 2 days was used across all patient treatments. Direct en face fields conforming to cover the postoperative scar with adequate circumferential margins were used. About 93.7% sites (15 out of 16) were treated with 6 MeV electron beam, while 9 MeV beam was used to treat one site as per the treating physician’s discretion.

At the time of final interviews/follow-up, median time since treatment for 10 patients and 16 sites was 78 months (range: 67–100 months). Of the 16 sites treated, 11 (68.75%) did not have any recurrence of keloids nor needed any further form of treatment. Five sites saw recurrence of keloids at the irradiated site, all of them were seen between 12 and 36 months of follow-up, with four (80%) happening within first 24 months of follow-up. Three of the five recurrences were in patients treated for one site only; two were in patients treated for both ears, with the contralateral ear in both these patients not seeing any recurrence. No preponderance of laterality was seen in recurrences; 03 on right and 02 on left ear. Median recurrence free period for entire cohort was 67 months (range: 12–100 months). No relationship between post-RT recurrence and first treatment modality were observed. Age of patients with recurrent lesion ranged from 19 to 42 years; none of these patients had any comorbidity. In our series, only two patients were aged more than 42 years, both of whom had no recurrence. However, the number is too small to attach any significance to the same. None of the 10 patients reported any adverse effects due to radiation, either short or long term. Cosmesis achieved following radiation was also acceptable to all patients; no long-term effects in form of skin darkening or thickening were seen in our series of patients. Patients getting recurrence at the treated site were bothered by the keloids appearance rather than any adverse effects of radiation. Four patients were treated with intralesional steroids for the recurrent lesion, while the fifth patient decided against any treatment, as the recurrent keloids was stable and did not cause any severe symptoms.

Fig. 1 shows presurgical 03 weeks post-RT and 76 months post-RT image of youngest patient in our cohort.

**Discussion**

While keloids can develop at site on skin, ear is a common site among females owing to the injury caused by piercing. A study evaluating relationship between keloids formation and age of ear piercing showed that as age of ear piercing increases, risk of developing keloids also increases, more so in females with family history of keloids. Another study of 141 ear keloids found a possible correlation between ear keloids and metallic backs of earrings, which leads to a local

### Table 1: Patient characteristics

<table>
<thead>
<tr>
<th>Age</th>
<th>No of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 20</td>
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<tr>
<td>20–40</td>
<td>5</td>
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<tr>
<td>41–60</td>
<td>1</td>
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<tr>
<td>&gt; 60</td>
<td>2</td>
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</table>

<table>
<thead>
<tr>
<th>Number of sites treated</th>
<th>Sites treated</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Left ear</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Right ear</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Laterality</th>
<th>No. of patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left ear</td>
<td>7</td>
</tr>
<tr>
<td>Right ear</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
</tr>
</tbody>
</table>
neurogenic inflammation further leading to more frequency of keloids over posterior surface of the ear lobule.\textsuperscript{8}

As with other sites of keloids, multiple treatment modalities have been tried for treating ear keloids with an aim to achieve acceptable aesthetics and reduce chances of recurrence. One study evaluated liquid silicone gel application to postoperative site following excision of keloids tract using loup magnification technique. Authors studied results in 26 keloid excisions done in 22 patients. They reported a very good control rate with recurrence seen in only two patients, managed with intralesional triamcinolone.\textsuperscript{9} In a systematic review and meta-analysis done to evaluate efficacy of intralesional botulinum toxin, it was seen that that the toxin was significantly more effective than intralesional steroids or placebo. Authors in the analysis had used visual analogue scale, Vancouver scar scale, and scar width as comparison points, all of which showed statistically significant superior efficacy for botulinum toxin type A in treating hypertrophic scars and keloids.\textsuperscript{10} Another systematic review analyzed role of intralesional 5-fluorouracil (5-FU) either as a single agent or in combination with triamcinolone acetonide (TAC). In 18 eligible studies for the review, 482 patients’ data was evaluated; overall efficacy of 45 to 96\% for 5-FU was seen; however, a sizeable proportion of the studies had a follow-up of less than 1 year in the review. Authors concluded that while 5-FU alone may not perform better than TAC, TAC:5-FU combination may fare better than TAC alone.\textsuperscript{11} Cryo-therapy has been used for the treatment of both primary keloids and therapy-resistant keloids. One randomized controlled trial assessing its efficacy against excision followed by steroid or brachytherapy, however, had to be terminated prematurely due to inferior results. Brachytherapy following excision was seen to be superior to intralasional cryotherapy in terms of cosmesis as well as scar related symptoms of pruritus and pain. While excision with steroid injection was not statistically better than cryotherapy, it was seen to improve scar appearance.\textsuperscript{12} Another large systematic review, which included 25 studies, looked at efficacy of triamcinolone and RT as an adjuvant to control recurrences following surgical excision. While recurrence rates for steroid treatment and for RT were estimated at 15.4 and 14\%, respectively, no significant difference was seen between the two modalities.\textsuperscript{13}

RT in the form of teletherapy with electrons or superficial X-rays and brachytherapy as surface mold or interstitial has been used for the treatment of keloids for a long time, with its application significantly reducing the risk of recurrence post excision.\textsuperscript{14} While multiple studies show efficacy of radiation therapy; only a few of them have follow-up period as long as ours. The long-term follow-up while establishing the control rates also provides important information with regard to adverse effects like skin pigmentation and secondary cancers.

Superiority of brachytherapy versus teletherapy in terms of local control, however, is a debated topic with evidence available in favor of both modalities.\textsuperscript{15–17} A study reported outcomes of superficial high dose rate brachytherapy application with molds in immediate postoperative period in 80 patients, 90\% of which had ear keloids. Authors reported excellent control rates of 95\% after a mean follow-up of 22.18 months. Though all were grade 1, acute toxicity of epithelitis was seen in 15\% patients; and chronic hypopigmentation and fibrosis were seen in 27.5 and 22.5\% patients, respectively.\textsuperscript{18} A French study reported outcomes of electron beam and brachytherapy treatment retrospectively. In vast majority of the 116 scars treated with electron beam, 15 Gy was delivered in five fractions with control rates of 69\% at 2 years and 55\% at 5 years. While the total dose delivered in our institution was lower than this study, control rates were comparable in both cohorts, 75\% at 2 years and 68.75\% at 5 years in our cohort.\textsuperscript{19,20}

While surgical excision followed by RT is widely accepted as an effective modality to treat keloids, optimum fractionation schedule is still elusive. Doses have ranged from prolonged schedules of 20 Gy in five fractions\textsuperscript{19,20} to upcoming single-fraction schedules of 10 Gy in one fraction.\textsuperscript{21} Ogawa et al from Tokyo, Japan, have published their experience with different fractionation schedules through the years ranging from 20 Gy in four fractions to 8 Gy in single fraction. They advocate use of different fractionation schedules for different sites, with higher doses being used for sites with preponderance for recurrence, like anterior chest wall.
For ear lobes, the authors have reported their experience with 15 Gy in three fractions, 10 Gy in two fractions, and 8 Gy in one fraction. Over the years, the authors have been able to maintain acceptable local control rates while decreasing the total dose used to treat ear lobes in postoperative setting. 22 23

The authors from Japan, while describing various fractionation schedules used for different sites of keloids, also discuss effects of varying surgical modalities on keloid recurrence rates. Surgical procedures used by authors are wide excision, core excision, subcutaneous/fascial tensile reduction sutures, and z-plasties, with the latter ones being used for sites notorious for multiple recurrences, for example, anterior chest wall and suprapubic region. The authors attribute their improved control rates to newer surgical as well as RT techniques/fractionation schedules. 23

Comparison with other studies using external beam RT (electron and kv beam) is shown in Table 2.

A frequent point of concern on using RT for benign diseases is the risk of secondary carcinogenesis. A 2009 study evaluated the risk specifically in cases of keloids treated with radiation. Evaluation of studies published over a period of more than 100 years showed only five cases of carcinogenesis, leading the authors to conclude that the risk is very low, even more so when the surrounding critical organs like thyroid and breasts are adequately shielded. RT is an effective and acceptable form of treatment for keloids. 6

While retrospective nature and small sample size are shortcomings of our series, the potentially longest follow-up period as compared to other similar studies is an important factor in establishing the long-term efficacy and safety of this treatment modality. Electron beam with its inherent quality of high relative entrance absorbed dose forms an efficacious and acceptable way of treating such lesions, especially for centers without dedicated superficial X-ray machines. 25

### Table 2 Comparison of different studies using radiation therapy

<table>
<thead>
<tr>
<th>Sl. no.</th>
<th>Study author</th>
<th>Patients treated with radiation</th>
<th>No of sites treated</th>
<th>No. of ear keloids treated with electrons</th>
<th>Total dose/fractions</th>
<th>Mean/median follow-up period (mo)</th>
<th>Control rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hoang et al 15</td>
<td>108</td>
<td>236</td>
<td>Not specified (electron beam and kv beam used)</td>
<td>9 to 30 Gy in 1 to 10 #</td>
<td>42</td>
<td>81% at 3.5 years</td>
</tr>
<tr>
<td>2</td>
<td>Yossi et al 16</td>
<td>95</td>
<td>116</td>
<td>88</td>
<td>15Gy/ 5#</td>
<td>70</td>
<td>69% at 2 years 55% at 5 years</td>
</tr>
<tr>
<td>3</td>
<td>Rishi et al 19</td>
<td>22</td>
<td>40</td>
<td>11</td>
<td>20Gy/5#</td>
<td>35</td>
<td>91% at 3 years</td>
</tr>
<tr>
<td>4</td>
<td>Song et al 21</td>
<td>12</td>
<td>16</td>
<td>8</td>
<td>10Gy/1#</td>
<td>20</td>
<td>100% at 1.6 years</td>
</tr>
<tr>
<td>5</td>
<td>Chaudhry et al 24</td>
<td>36</td>
<td>36</td>
<td>0 (kv beam used)</td>
<td>18Gy/3#</td>
<td>67</td>
<td>97.3% at 5.6 years</td>
</tr>
<tr>
<td>6</td>
<td>Our study</td>
<td>10</td>
<td>16</td>
<td>16</td>
<td>10Gy/2#</td>
<td>78</td>
<td>68.75% at 6.5 years</td>
</tr>
</tbody>
</table>

### Conclusion

Our series of keloid patients provides evidence in favor of electron beam RT in attaining long-term control when delivered in immediate postoperative period. The lower total dose with higher dose per fraction used in our patients effectively deals with the bulk of keloids along with good cosmesis and absent adverse effects.

### Conflict of Interest

None.

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