Case Report

Surface brachytherapy in Skin Cancer with High Dose Rate Remote After Loader: An Experience from NCHRC

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ABSTRACT

HDR brachytherapy for skin cancer, such as basal cell carcinoma and squamous cell carcinoma, provides an alternative treatment option to surgery or, in recurrent cases. This is especially relevant for cancers on the nose, ears, eyelids or lips. Surface mould brachytherapy is delivering ionizing radiations via a carrier device known as mould.

At NCHRC we have treated 5 patients with skin cancer by surface brachytherapy. We prepared different source carrier of mould (thermoplastic sheets, wax sheets and both) that is designed to provide constant and reproducible geometry for source positioning. Total volume ranging from 4cc to 10 cc was treated with total dose of 40.5Gy in 9 Fractions (twice a week) was prescribed at 0.5cm depth. 3 to 5 applicators were used at 0.5 to 1cm distance as per required to cover treatment area. Patient's treatment was evaluated on routine treatment and follow-up after one month post treatment and every 3 months for a year.

Skin reactions were found after 2 to 3 fractions of treatment. We followed up the patients after 1st & 6th months of treatment. After treatment we have achieved complete response without any major complications.

Surface mould brachytherapy is a very effective treatment for treating carcinoma of skin where difficult curve surfaces are involved.

Keywords: Brachytherapy, HDR, Skin cancer

Introduction

The incidence of skin malignancy has been increasing at present. Basal cell carcinomas (BCC) incidence comprises 65-70% followed by Squamous cell carcinomas (SCC). Variety of options are available for treating skin malignancy, which include topical therapy (such as Imiquimod), cryotherapy, curettage, surgical resection and radiotherapy (both external beam radiotherapy techniques as well as brachytherapy).

Brachytherapy (BT) is a method of treatment in which sealed radioactive sources are used via remote afterloader to deliver radiation at a short distance by interstitial, intracavitary or surface application. With this mode of therapy, a high radiation dose can be delivered locally to the tumor with rapid dose fall-off in the surrounding normal tissue.[1]

Radiotherapy is also a good alternative if preservation of functional structures is not possible with surgery. Brachytherapy might be a better therapeutic option due to its intrinsic advantages, including high radiation dose concentration into the tumor and rapid dose fall-off at target periphery with optimal sparing of normal tissues in short course of treatment.

Mould brachytherapy uses sealed source held in a fixed arrangement by a custom-made mould placed at a distance from the surface. It is usually used to treat superficial lesions of skin, mouth or vagina.

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There are 5 centers in Nepal providing radiotherapy services to the entire population at present, whilst brachytherapy facilities are provided by 4 centers only.

The purpose of this paper is to share the experience from a tertiary cancer center in Nepal regarding the use of surface brachytherapy using 192Ir based HDR surface mould for the treatment of skin malignancies.

Methods

A retrospective review of 5 patients treated with surface mould 192Ir based HDR brachytherapy at Nepal Cancer Hospital and Research Center (NCHRC), Nepal from July, 2017 to April, 2019 was performed. Approval for this study was obtained from the Institutional Review Board (IRB).

Patient Preparation

Patients were informed about the procedure of surface brachytherapy, its benefits, risk and side effects during and after radiotherapy. Once patient were ready for the radiotherapy, written consent were taken from patient and patient's visitor.

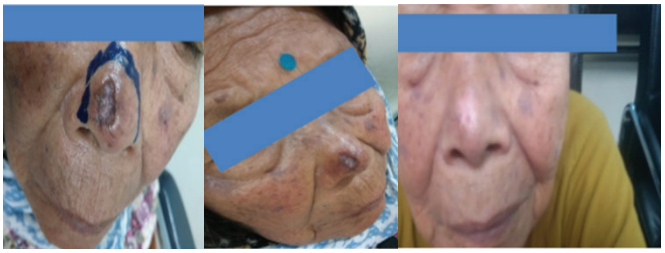

Figure 1 : Pre-treatment and post teatment images

We prepared source carrier of mould (thermoplastic sheets, wax sheets and/or, both) that is designed to provide constant and reproducible geometry for source positioning. For surface mould brachytherapy we used flexible implant tube single leader 350mm. As we have 200mm interstitial source guide tube with locking mechanism (connector catheter), we converted the length into 200 mm by using "length cutting gauge for 6 French implant tubes 200mm"which was then connected properly with 200 mm source guide tube.

Area to be treated was marked on skin taking into consideration clinical findings pre-surgery, diagnostic images, clinical findings post-surgery and surgical excision scar with 1 cm margin in each side. Applicator was embedded in the Wax sheets and/or thermoplastic sheets with interval of 5mm of each other. 3 to 5 applicators were used at 0.5cm distance as per required to cover treatment area.

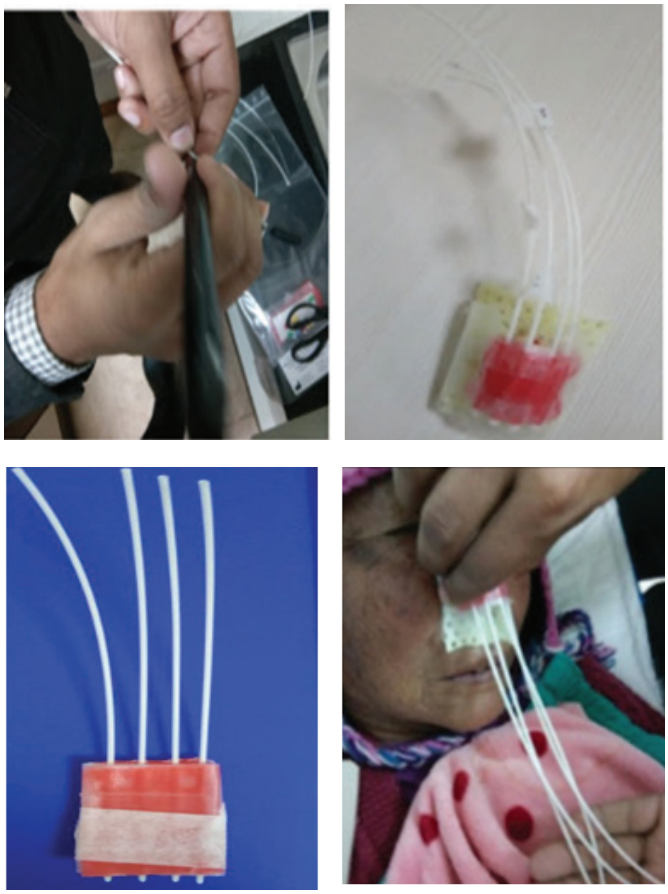

Figure 2 : Preparation of source carrier mould made up of wad with embedded exible implant tube and thermoplastic sheets

All patients underwent CT based planning. The target area was marked clinically using radio-opaque wire. CT images with 1mm slice thickness were taken and images were transferred to TPS for contouring and planning. Based on the radio-opaque wires placed by the treating oncologist at the time of the planning CT scan including the tumour bed with 1 cm margin, the clinical target volumes were delineated on the axial CT images. This was defined as the clinical target volume (CTV). No expansion for planning target volume (PTV)

was generated. Total dose 4050 cGy in 9 fractions (twice a week) was prescribed at 0.5cm depth. CTV volumes with 2.95 cc to 10.22 cc were planned at 0.5 cm depth and dose coverage was found to be 100% at surface and 90% at depth. To verify the plan dummy fire were performed for confirmation.

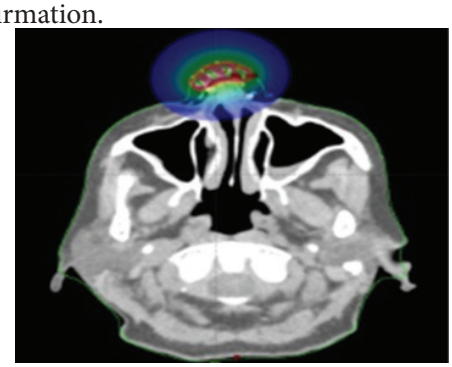

Figure 3 - CT hased planning and dose distribution

Treatment was done twice a week for total 9 fractions. Routine clinical assessments were done during treatment for side effects and reactions. Patients were monitored and communicated with audio video intercom. Patients were treated on outpatient basis. Patients were evaluated clinically before each session during treatment. The first follow-up was after one month post treatment and every 3 months for a year.

Results

Total 5 patients were treated with surface mould 192Ir based HDR brachytherapy at NCHRC from July, 2017 to April, 2019. Our patients ranged from age 43 to 93 years (Median: 75 yrs) with male to female ratio of 3:2. Brachytherapy was offered in adjuvant setting for close or positive margin in 4 patients and radical intent in one patient (not considered for surgery due to age). Size of tumor ranged from 0.2cm to 3.5cm with variable treatment site like forehead, tip of nose, infra orbital region, earlobe with remarkable irregular surface. None of the patients had Grade ≥3 skin toxicities. All patients were disease free at assessment at 3 months of completion of treatment. We have median follow-up of 31 months (14-37 months). Mild Hypopigmentation was noted in a single patient. No major late toxicities were noted and an excellent cosmetic outcome was observed. We had local control rate of 100% and no distant failure was noted.

Discussion

Surface brachytherapy is an important modality for treatment of skin malignancies, which has good local control rates and excellent cosmetic and functional outcomes. Interest in brachytherapy is increasing because of the introduction of newer delivery systems such as electronic brachytherapy and high dose rate after-loading systems. We reviewed our institutional experience with this technique and report complete response in all patients. We found no significant toxicities and treatment was well tolerated.

Indications for post-operative radiation include positive margin or residual disease not amenable for surgery, recurrence after prior negative margin resection and gross perineural spread that is clinically or radiologically apparent.

Various risk factor associated with local recurrence or metastasis size and location of tumor, border, degree of differentiation, perineural and lymphatic involvement, depth of invasion, neurological symptoms, rate of growth, immunosuppression status of patient, prior history of radiation or chronic inflammatory process.

Recommended Brachytherapy schedules for surface mould and flaps ranges from 3 Gy - 5 Gy per fraction ; 8 – 18 fractions, 2-3 times a week, total dose 40- 60Gy or even higher doses per fraction, once a week. In this study we prescribed 40.5 Gy in 9 fractions.

Gauden et al.prospectively followed 200 patients with 236 skin lesions treated with 36 Gy in 12 fractions using surface brachytherapy. Patients were evaluated regularly for toxicity and cosmetic results, and the LC was 98% (232/236) with a median follow-up of seven months. Moderate toxicity was noted and 88% of the patients had good/excellent cosmesis, with hypopigmentation noted in 13 cases (5.5%) and no telangiectasia.

Rio et al.performed a retrospective analysis of 97 skin carcinomas (88 BCC, 9 SCC) of the nose, periorbital areas, and ears from 40 previously untreated patients (group 1) and 57 patients who had undergone surgery (group 2). The average dose was 55 Gy (range: 50–65 Gy) in group 1 and 52 Gy (range: 50–60 Gy) in group 2. The local control was 92.5% in group 1 and 88% in group 2 (median follow-up 55 months). Authors have concluded that brachytherapy provided good local control and cosmetic results for facial, peri-orificial skin carcinomas that pose problems of surgical reconstruction.

Surface brachytherapy can pose late toxicities. According to one study done by Kalaghchi et al., of 60 patients

treated radically or adjuvant, 6.7% rate of grade 3-4 acute toxicities at three months post-brachytherapy, and one patient with late grade 3-4 toxicity were noted which resolved at two years after treatment completion . In this study, brachytherapy was overall well tolerated, with no grade 3-5 acute or late toxicities.

Conclusions

Surface mould brachytherapy is a very effective treatment for treating carcinoma of skin where difficult curve surfaces are involved. It is very well tolerated with good local control, excellent cosmetic outcome and no Grade ≥3 toxicities.

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