



ORIGINAL RESEARCH PAPER

Radiotherapy

PERIOPERATIVE IMAGE-GUIDED HDR INTERSTITIAL BRACHYTHERAPY IN EXTREMITY SOFT TISSUE SARCOMAS-A SINGLE TERTIARY CANCER CENTRE STUDY-SOUTH INDIAN DATA

KEY WORDS: HDR-peri operative brachytherapy; extremity soft tissue sarcoma; Recurrent STS; image-guided brachytherapy

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ABSTRACT

OBJECTIVE/AIM: To report our oncological outcomes and the late radiation induced toxicities with *image guided* HDR brachytherapy in extremity soft tissue sarcomas.

METHODS & MATERIALS: From August 2007 to April 2015, thirty one cases were retrieved and 20 cases were analyzed (14 primary and 6 recurrent).The follow up period was between 13 months and 93 months. The inclusion criteria for HDR brachytherapy were as follows:1.high grade tumor 2. low grade tumor >10cms 3.recurrent tumor 4.positive /close margins.All patients underwent image guided (CT-based) planning and were delivered 3-3.5 Gy/fraction *6/7, twice daily. Three weeks later, patient received EBRT(45-54Gy).Median follow-up was 48 months.

RESULTS: There were 2 cases of local failure within the radiation field. The local control rate was 90%.Among the late complications, 10 % (2/20 patients) developed RTOG Grade II restricted joint movements. One patient developed Grade IV radiation dermatitis (non healing ulcer).Fifty percentage of patients developed Grade I myalgia & 15% (3/20) had Grade II myalgia(NCI-CTCAE v4.0)

CONCLUSION: Image guided perioperative HDR brachytherapy provides reasonable local control rates in extremity soft tissue sarcoma with acceptable complications even in recurrent cases

INTRODUCTION:

Extremity soft tissue sarcomas are the most common site for soft tissue sarcoma (STS) accounting to approximately 60% of STS (lower extremity, 45%, upper extremity, 15%) [1]. These tumors account for <1% of all adult tumors and 15% of pediatric tumors. [3] As per hospital-based cancer registry, TMH, Mumbai, Maharashtra, India in the year 2001, the most common STS was spindle cell sarcoma. [2] During the past 12 years, immunohistochemistry (IHC) has been a very helpful ancillary technique for exact categorization of the various STSs, namely synovial sarcoma, malignant peripheral nerve sheath tumor (MPNST), epithelioid sarcoma, dermatofibrosarcoma protuberance, to name, but a few.

In our series also the most common histology was spindle cell sarcoma. We present this data from a single south Indian tertiary cancer institute-regarding image guided perioperative HDR brachytherapy in extremity soft tissue sarcomas (STS).

OBJECTIVE OF THE STUDY:

The goal of this retrospective study from our institution is to evaluate the outcomes and toxicities of image guided interstitial perioperative high dose rate (HDR)brachytherapy in achieving good local control rates & permitting function preservation of extremities.

METHODS & MATERIALS:

From August 2007 to April 2015, thirty one cases were retrieved from our medical records department and 20 cases were analyzed (14 primary and 6 recurrent). Eleven cases were not included either due to lack of sufficient medical information or lost to follow up. The Inclusion criteria for HDR brachytherapy were as follows: 1.high Grade tumor 2.low grade tumor >10cms 3.recurrent tumor 4.positive /close margins. The follow up period was between 13 months and 93 months. Median follow-up was 48 months.

Image guided HDR Brachytherapy Procedure:

After removal of the tumor by the surgeon (figure-1), the radiation oncologist inserts the interstitial needles parallel/perpendicular to the long axis of the tumor bed with 1-1.5 cm spacing in between which is replaced by plastic catheters(Fig. 2).

Figure- 1: Immediate postoperative view of forearm soft tissue sarcoma revealing the tumor bed



Figure-2: interstitial implant performed with 7 catheters with equal spacing and fixed by buttons



When the neurovascular bundle or bone was very close to the tumor bed, an effort was made to keep the distance at a minimum of 0.5 cm between catheters and the critical structures. All patients had a single planeimplant. The surgeon then placed drains and proceeded with wound closure. All patients underwent image guided (non contrast CT-based) planning on the 5th postoperative day. The images were transferred to the treatment planning system and planning was performed using BRACHYVISION software version 6.5. The prescription point was usually between 0.5 and 1 cm from the source axis depending on the distance to the critical structure and the step size was 5 mm.Clinical target volumes[CTV-T] were contoured and total dose of 18-24.5 Gy was delivered at high dose rate[HDR] using Iridium-192 radioisotope source at 3-3.5 Gy per fraction, twice daily with a minimum gap of 6 hours between fractions using VARISOURCEiX remote after loader (Varian medical systems). Catheters were removed on the last day of brachytherapy treatment. Three weeks later, patient received external beam radiation therapy (EBRT) for a dose of 45-54Gy.

RESULTS:

The most common histology was high grade spindle cell sarcoma in our series. The local control rate was 90%. There were 2 cases of local failure within the radiation field. Both patients expired due to distant metastasis (lung was the site of metastasis in both cases). Among the late complications, 10 % (2/20 patients) developed RTOG Grade II restricted joint movements. One patient developed Grade IV radiation dermatitis (non healing ulcer till date). Fifty percentage of patients developed Grade I myalgia & 15% (3/20) had Grade II myalgia (NCI-CTCAE v4.0) .Soft tissue fibrosis was noted in 10% of the cohort (2/20).

CONCLUSION:

Immediate postoperative image guided HDR brachytherapy in extremity soft tissue sarcomas , both primary & recurrent, provides better local control rates with acceptable late complications.

DISCUSSION:

Extremity STSs have a multi modality approach including surgery, radiotherapy and/or chemotherapy. Brachytherapy is an essential component of treatment in selected cases reducing loco regional recurrence and improving overall survival [8,9] . The advantages of brachytherapy include (1) high radiation dose to the immediate tumor bed, (2) more effective delivery of radiation (less hypoxic and higher biological dose) and (3) relative sparing of overlying skin and surrounding normal tissue. Experience with HDR brachytherapy for adult STS is limited and more investigation is required in this field. Crownover and Marks reported HDR experience with 10 patients having atleast a 1 year follow-up [10]. There was no local recurrence and no excessive acute or late sequelae of treatment. They suggested that HDR brachytherapy is an attractive alternative to the LDR technique. More recently, Gustavo A Viani et al, [13] suggested excellent local control with tolerable side effects in the pediatric population by HDR brachytherapy with/without EBRT. Another subset that is included in our cohort are the recurrent soft tissue sarcomas. Brachytherapy is definitely a reasonable alternative in these who would have received surgery and EBRT in the primary setting. D. Nori et al, suggest that function preserving resection followed by temporary tumor bed implant is a good alternative for recurrent STSs. [12] HDR brachytherapy has many advantages in comparison with LDR.

There is minimal concern about radiation exposure to caregivers. Especially, HDR treatment is convenient with younger children because of the greatly reduced treatment time of only a few minutes and minimal duration of immobilization.

However, the biggest advantage of HDR is *optimization* and manipulation of dose gradients. The inclusion criteria for brachytherapy are as per the American Brachytherapy Society (ABS) consensus guidelines for sarcoma brachytherapy [7] and they are as follows : 1. high grade tumor 2. low grade tumor >10cms 3. recurrent tumor 4. positive /close margins. Our South Indian results are similar in terms of oncological outcome (local control rate) to the other Indian data published by Tata Memorial Hospital, Mumbai [4] and All India Institute of Medical Sciences, New Delhi [5] and also similar to the Japanese series [11] and MSKCC study [9]. In terms of toxicities, only long term side effects were analyzed as our study is a retrospective one. The toxicities were in terms of *chronic dermatitis, joint movement (as some of the extremity lesions were close to the joint), soft tissue fibrosis and myalgia* graded by either RTOG or NCI CTCA v4.0 systems. In our cohort, 10 % (2/20 patients) developed RTOG Grade II restricted joint movements. One patient developed Grade IV radiation dermatitis (non healing ulcer till date). Fifty percentage of patients developed Grade I myalgia & 15% (3/20) had Grade II myalgia (NCI-CTCAE v4.0) .Soft tissue fibrosis was noted in 10% of the cohort (2/20). No peripheral neurotoxicity was reported.

List of Abbreviations Used

STS-soft tissue sarcomas
 CT- computer tomography
 NCI-CTCAE v4- National cancer institute -common terminology
 Criteria for adverse events version 4

EBRT-External beam radiotherapy
 HDR-high dose rate

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