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Re-Irradiation with Conformal Electron Beam Therapy for Recurrent Breast Cancer

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Abstract

Patients with recurrent breast cancer involving the chest wall, who have been previously irradiated, present a clinical challenge. Pulsed reduced dose rate external beam radiotherapy has been shown to reduce recurrences with an acceptable rate of toxicity including chest wall soft tissue and rib necrosis [1]. For patients presenting with a breast cancer recurrence in close proximity to the skin surface, our treatment center has modified the technique by using electrons passing through customized wax bolus milled by a commercial compensator manufacturer (decimal, Sanford, FL).

Keywords: Breast cancer; Radiotherapy; Photon; Electron beam therapy; CT scan; Clinical tumor; Oligore current disease; Compensator

Introduction

Three breast cancer patients with locally recurrent disease on a previously irradiated chest wall presented for evaluation. All had received previous chest wall radiotherapy to a dose of 5040cGy using high energy tangentially-directed photons, followed by as much as a 1600cGy electron beam boost to the mastectomy scar or tumor bed (4MeV electrons were utilized dosed to the 90% isoodose line with a 1cm bolus; effective depth of penetration was 1cm). At a median disease-free interval of 18 months (range 12-30 months), patients presented with oligorecurrent disease involving the chest wall only. Staging labs and radiographs indicated no evidence of hematogenous metastases. All patients underwent a gross total resection of all visible disease prior to receiving radiotherapy, and pathological margins were reported as no tumor on ink.

Materials and Methods

The patients were treated using electron compensators with a reduced dose-rate technique. The electron compensators were designed to precisely match the patient's CT based surface contour. The compensators were milled from hard wax based on a computer-generated specification which incorporated gantry angle, tumor size, position on the chest wall, and depth required for tumor coverage. The wax density was 0.92g/cc and heterogeneity calculations were applied to the treatment planning. Treatments were delivered using 10-12MeV electrons prescribed such that the 90% isodose line covered the deepest extent of the clinical tumor volume. Thirty-eight fractions of 120cGy were delivered twice daily with a 6 hour inter-treatment interval for a total dose of 4560cGy. An effective dose rate of 5cGy/minute was achieved by breaking up each treatment into 10 sub-fractions with a delay between each sub-fraction; the linear accelerator used could generate a dose rate of no less than 400cGy/minute. Each sub-fraction delivered 12cGy with a delay of 2 minutes and 24 seconds between beam-on times over the course of 24 minutes.

Results

Table 1 illustrates the details regarding each of the three patients treated in this manner. Patients were treated over the course of 4 weeks without interruption. With a median follow up of 24 months (range 24-29 months), there have been no observed recurrences in the treatment field. Skin toxicity was significantly less that would be expected based on our prior experience, as well as that in the literature, with conventional standard dose and dose-rate radiotherapy [2,3]. One patient developed fibrosis of the axillary fold and one had slight erythema. No moist desquamation, skin or chest wall necrosis was observed.

Table 1: Summary of patients receiving reduced dose rate compensated electron beam therapy.

Pt	Dx	Prior RT	Conformal e Beam	Notes
PA	2000; bilat mst	2000; 50Gy L cw, sc, axilla	4560cGy 10MeV BID	29 mos disease free
	2009; T4, ER/Her +ve	2009; 45Gy L sc		fibrosis without pain
CW	1997; TxN1 lump	1998; 5040cGy breast, axilla	4560cGy 10MeV BID	24 mos disease free
	2009; R mst for recur		1600cGy scar boost	minimal erythema only
PM	2006; T1N1 lump	2006; 5040cGy breast	4560cGy 12MeV BID	24 mos disease free
	2009; mst for cw recur	1400cGy scar boost		no acute toxicity

Conclusion

This case study of three patients demonstrates that reduced dose rate electron beam therapy, using customized wax-based compensators, results in excellent local control and tolerable morbidity in patients receiving as much as 112Gy for an isolated chest wall recurrence of breast cancer.

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