

MEGAVOLT ELECTRON IRRADIATION IN THE TREATMENT OF RECURRENT CARCINOMA OF THE BREAST ON THE CHEST WALL

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In collaboration with the Massachusetts Institute of Technology, a constant potential electrostatic generator of the Van de Graaff type was employed in this department in 1951 for clinical use. It had a capacity of producing electrons with energies up to 4.5 MeV. The first patients were treated with total skin electron irradiation for generalized mycosis fungoides, and the response was impressive and encouraging (HARE et coll. 1953). This mode of therapy demonstrated efficacy in the control of superficial malignancies and showed that large field electron irradiation was no longer impossible or impractical. Since then megavolt electron irradiation has been used to treat over 1 000 patients with skin disease with this single therapy unit.

Because of inadequate depth penetration to sterilize regional lymph nodes, megavolt electron irradiation was never used as adjuvant therapy after mastectomy for carcinoma of the breast. However, an evaluation of its efficacy in treating recurrent carcinoma of the breast on the chest wall is underway. To date, more than 70 patients have been treated, and 69 of them have been followed long enough to be evaluated at this time.

Materials and Methods

The physical aspects and depth dose characteristics of the treatment apparatus have been described previously (TRUMP et coll. 1953). The source of the monoenergetic electrons is a constant potential electrostatic generator insulated in compressed gas. The

beam emerges in a vertically downward direction into air from the evacuated accelerator tube through an aluminum cone, the bottom of which is closed except for a slit 45 cm long and 1 cm wide. Electron energies ranged from 2.5 MeV to 3.5 MeV, depending on the thickness of skin involvement.

Treatment techniques for irradiation of the chest wall were similar to those for localized or generalized mycosis fungoides reported previously (FROMER et coll. 1961, SMEDAL et coll. 1962, LO et coll. 1979, 1981). All patients were treated while lying on a motorized couch traveling at a rate of 1.8 m/min. Lead and masonite boards were used to shield the uninvolved part of the skin. All treatments were administered during transit of the patient beneath the treatment cone. A single pass was sufficient to deliver the necessary daily dose of radiation to the unshielded portion of the skin making the treatment simple and well tolerated.

One man and 68 women with recurrent carcinoma of the breast on the chest wall were treated. Mean age at the time of electron irradiation was 56 years (range 32–88). With the exception of one patient, all had tissue confirmation of recurrent tumor. The irradiation field was generous enough to cover the entire chest wall of the involved side in practically every patient, and adequate margins were ensured when disease extended beyond the chest wall.

All patients were treated either on a 5 day per week or a 3 day per week schedule. Daily tumor

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doses ranged from 2 Gy to 4 Gy for most patients depending on size of treatment field and patient's tolerance, but 2 patients received 5 Gy per day, and one patient received 6 Gy twice. Median total tumor dose was 39 Gy (range 12–55). Because of the variation in dose and fractionation schemes through the years and because the lesions and reactions are cutaneous the ELLIS (1969) formula (nominal standard dose, NSD) may be an acceptable guide for this report.

Photon irradiation, either as postoperative adjuvant therapy or for recurrent disease, had been used previously in 53 patients. Of these patients, 8 had only received irradiation of the nodes but not of the chest wall.

Results

Within the first month after electron irradiation, 6 patients died and were not evaluated. Of the remaining 63 patients, 59 (94%) achieved a complete response, and 4 (6%) had a partial response. Three-year survival after electron irradiation was 28 per cent (19 patients), with a median survival time of 54 months (range 36 months to 12 years). All deaths were the result of disseminated metastatic disease.

Among the 59 complete responders, in 11 patients local chest wall recurrence developed from 5 months to 6 years after completion of the electron irradiation (Table 1). Retrospective analysis revealed that none of these 11 patients received a tumor dose with an NSD greater than 1400 ret (range 1120–1390). Of the remaining 48 complete responders who had permanent local control, 15 survived a minimum of 3 years. All of these patients received a tumor dose with an NSD greater than 1400 ret (range 1430–1850; Table 2). Six patients are currently living without evidence of local or distant disease at 2–12 years.

Concomitant hormonal therapy was administered only during the very early part of this series before the establishment of the multidisciplinary breast clinic at the Lahey Clinic. Six postmenopausal patients received concomitant estrogen, and 3 of them had subsequent local recurrence. Concomitant systemic cytotoxic chemotherapy was not instituted except in 6 patients who had disseminated disease and were considered terminal. Radiation therapy was used merely as a means of assured and rapid palliation of local symptomatic recurrent carcinoma on the chest wall.

Persistent skin ulceration was the only notable

Table 1

Recurrence after electron irradiation (59 complete responders)

	No. of patients
Survival <3 years	7/40
Survival >3 years	4/19
Total	11 (at 5 months to 6 years)

Table 2

Complete responders without recurrence

	No. of patients
Survival <3 years	33
NSD <1 400 ret	17
NSD >1 400 ret	16
Survival >3 years	15
NSD <1 400 ret	0
NSD >1 400 ret	15
Total	48

complication encountered. Ulcers developed on the chest wall in 4 patients after electron irradiation, but only 2 patients survived 2 months or longer. Both patients had previously been given photon irradiation; one had multiple courses in the past, and the other was a diabetic.

Discussion

The most common method of treatment of operable breast carcinoma today is mastectomy although conservative surgery followed by irradiation now appears to be as effective as standard mastectomy for early disease (CALLE et coll. 1978, BEDWINEK et coll. 1980, CLARK et coll. 1982). However, the survival advantage of adjuvant irradiation after mastectomy remains debatable (HØST & BRENNHOVD 1977, STJERNSWÄRD 1977), and its discussion is beyond the scope of this report. With or without postoperative chest wall irradiation, local recurrence will develop sooner or later in a small number of patients (FISHER et coll. 1970). In many of these patients, whether symptomatic or not, further treatment is usually necessary even though at times it is given for psychologic and emotional reasons.

The general policy in this multidisciplinary breast clinic has been to give local treatment for local

disease and to use one single therapeutic regimen at a time so the efficacy of that particular treatment modality can be evaluated. For patients in whom recurrent tumor develops on the chest wall from breast carcinoma, the recommended treatment is local irradiation when no distant metastasis can be demonstrated clinically. Local irradiation is also recommended when the patient has symptomatic local disease with known asymptomatic distant metastasis. The present results indicate that megavolt electron irradiation is an effective treatment modality and is safe even in patients who have had a previous course of photon irradiation. The rates of tumor response, survival, and complications are similar to those reported by others (LARAMORE et coll. 1978, ITO et coll. 1981) who used higher energy electrons. With a total tumor dose with an NSD greater than 1400 ret, it is almost certain that permanent local control would be achieved, although a slightly higher dose was recommended by CHU et coll. (1976). Systemic therapy, such as ablative surgery, hormonal therapy, or cytotoxic chemotherapy, can be reserved.

SUMMARY

Low megavolt electron beam therapy was used to treat 68 women and one man with recurrent carcinoma of the breast on the chest wall. Photon irradiation had been used previously in 53 patients. Of the 63 patients who survived 2 months or longer after electron irradiation, 59 (94%) achieved a complete response. Persistent radiation ulcers developed in only 2 patients (3%). No other late radiation complications were observed. Nineteen patients (28%) survived 3 years after electron irradiation, with a median survival of 54 months. In this group, disease eventually recurred in all patients who received a calculated NSD of less than 1400 ret; no disease recurred in the patients who received doses greater than 1400 ret. It is concluded that megavolt electron irradiation is effective in the treatment of chest wall recurrence from carcinoma of the breast and is safe even in patients who have had a previous course of photon irradiation.

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