Radiation-Associated Malignant Tumors of the Chest Wall

Roderich E. Schwarz, MD, PhD, and Michael Burt, MD, PhD

Background: Malignant postirradiation cancers of the chest wall are uncommon, and data concerning results of treatment are sparse. We assessed patient characteristics as well as prognostic factors of these tumors compared with those arising de novo and analyzed treatment results of both groups.

Methods: Records of 361 patients with primary malignant tumors of the chest wall admitted to our institution between 1949 and 1989 were reviewed retrospectively. Previous radiotherapy to the site of the tumor was noted with latency period and dose. Survival was calculated via the Kaplan-Meier method, and comparisons of survival were made by log-rank analysis.

Results: In 351 patients with primary malignant tumors of the chest wall, 21 lesions (6%) arose in an irradiated field. Eighty-eight patients had chondrosarcoma (age range 5–86 years, median 49; male:female [M:F] ratio 1.3:1), two cases of which arose in an irradiated field; 38 patients had osteosarcoma (age range 11–78 years, median 42; M:F ratio 1.5:1), 11 cases (29%) of which arose in an irradiated field; 149 patients had soft-tissue sarcoma (age range 1–86 years, median 38; M:F ratio 2:1) seven cases (5%) of which arose in an irradiated field; 52 patients had Ewing's sarcoma (age range 2–39 years, median 16; M:F ratio 1.6:1) no cases of which arose in an irradiated field; and 24 patients had a solitary plasmacytoma (age range 37–75 years, median 59; M:F ratio 2.4:1) one case (5%) of which arose in an irradiated field. Prior radiotherapy had been performed for Hodgkin's disease (n = 8), breast cancer (n = 5), and various other indications (n = 8). The maximum radiation dose administered ranged from 1,250 to 9,500 cGy (median 4,140). The latency period from previous irradiation to diagnosis ranged from 2 to 19 years (median 7). The primary therapy of all radiation-associated tumors was resection, except for three patients. There was no significant difference in survival between those malignant chest wall tumors arising in an irradiated field compared with those arising de novo.

Conclusions: Twenty-nine percent of patients with primary osteosarcoma and 2–5% of patients with primary chondrosarcoma, soft-tissue sarcoma, or plasmacytoma of the chest wall seen at this institution have a tumor arising in the field of prior irradiation. Because the outcome after operative therapy appears to be similar, these patients should be offered identical treatment to those whose tumors arise de novo.

Key Words: Chest wall tumors—Radiation-associated neoplasms—Thoracic surgery.
MATERIALS AND METHODS

A computer search of medical records at our institution from 1949 to 1989 was performed. Only patients with primary tumors of the chest wall were included in this analysis. Sternum, ribs, clavicle, scapula, and soft and connective tissue were considered structures of the chest wall. Of 418 patients with primary chest wall neoplasms seen during this time interval, sufficient clinicopathologic data were available in 149 patients with soft-tissue sarcomas, 88 with chondrosarcomas, 38 with osteosarcomas, 52 with Ewing’s sarcomas, and 24 with solitary plasmacytomas (n = 351, 84%). Of these, patients with a history of prior irradiation to the area of the chest wall were noted. Patient characteristics, type and intensity of prior irradiation, treatment, and outcome were analyzed. Only lesions with a history of radiation exposure of at least 2 years before diagnosis and occurrence within the field of irradiation were considered to be radiation-associated. All pathologic diagnoses had been confirmed through the Memorial Hospital Department of Pathology.

Local recurrence was defined as the reappearance of the neoplasm at the site of previous definitive therapy. A recurrent neoplasm was defined as metastatic only when clearly discontinuous from (e.g., not involving structures or tissue located at the site of) the primary lesion.

Survival was calculated from the time of first diagnosis by the method of Kaplan and Meier (8). Differences in survival were determined by log-rank analysis (9). Frequency data were analyzed by χ² or Fisher’s exact test (10). Significance was defined with a p value of ≤0.05.

RESULTS

Of 351 patients with primary chest wall cancer, 21 had a history of radiotherapy to the site of tumor growth (6%). These lesions were considered radiation-associated. In the remaining patients, chest wall tumors were considered to have arisen de novo. Of 52 patients with a diagnosis of Ewing’s sarcoma (age range 2–39 years, median 16; male:female ratio 1.6:1), none arose in an irradiated field (Table 1). For all other diagnostic cohorts, radiation-associated as well as de novo lesions were compared.

Soft-Tissue Sarcomas

Of 149 patients with chest wall soft-tissue sarcomas (age range 1–86 years, median 38; 100 males, 49 females), seven (4.7%) had a history of radiotherapy to the area. In this group, the age range was 22–63 years (median 54). Five patients presented with an indolent chest wall mass, one with a painful mass, and one with pain only. Duration of symptoms before diagnosis ranged from 0 to 10 months (median 1). The latency period from prior irradiation to sarcoma diagnosis ranged from 3 to 13 years (median 4, mean 6.5) (Table 1). Radiation dose to the chest wall (unknown in one patient) ranged from 1,250 to 6,000 cGy (median 3,750). Reason for irradiation in all patients was an underlying malignant process (breast cancer, n = 3; Hodgkin’s disease, n = 3; lymphoma, n = 1). Histologic findings in this group included malignant fibrous histiocytomas (n = 3), fibrosarcoma, liposarcoma, desmoid tumor, and malignant peripheral nerve tumor (n = 1 each). Three sarcomas were low grade lesions, and four were high-grade lesions. All patients underwent resection. Three patients received postoperative brachytherapy with ¹⁹²Ir implants and doses of 3,000–4,500 cGy, of which two had microscopically positive resection margins. One patient received additional postoperative chemotherapy. Three patients experienced minor postoperative complications (fluid collection, n = 2; cellulitis, n = 1). One patient with a pathologically negative resection margin developed a local recurrence. Two patients with systemic metastases subsequently died of their disease. Overall 5-year survival for patients with radiation-associated chest wall soft-tissue sarcomas was 57%, compared with 65% for de novo soft-tissue sarcomas (statistically no significant difference, p = 0.76) (Fig. 1). The median survival in both cohorts had not been reached.

Osteosarcomas

Of 38 osteosarcomas of the chest wall (age range 11–78 years, median 42; 23 males, 15 females), 11 arose in a field of prior irradiation (29%). In this group, there were seven males and four females. Ages ranged from 15 to 71 years (median 38). All patients presented with a painful mass. The latency period since prior radiation ranged from 2 to 15 years (median 7, mean 7.3) (Table 1). The dose of prior radiation was 2,700–9,500 cGy (median 4,500, mean 4,980). Underlying conditions requiring irradiation included breast cancer (n = 3), Hodgkin’s disease (n = 3), cystic hygroma, rhabdomyosarcoma of neck, thymoma, and lung cancer (n = 1 each). One patient received radiation for a recurrent shoulder tumor of unknown histologic specifications. In addition, two patients had received systemic chemother-