Radiation Therapy for Soft Tissue Sarcoma

Indications and Controversies for Neoadjuvant Therapy, Adjuvant Therapy, Intraoperative Radiation Therapy, and Brachytherapy

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KEYWORDS

• Radiation therapy • Brachytherapy • Intraoperative radiation therapy • Sarcoma

KEY POINTS

- Radiotherapy is an effective treatment of soft tissue sarcomas.
- Randomized trials show that radiation therapy in combination with surgery increases local control compared with surgery alone; no statistically significant differences in survival were observed in these small studies.
- In large national cancer databases, treatment of high-grade soft tissue sarcomas with adjuvant radiation therapy is associated with a 10% improvement in survival.
- Preoperative radiotherapy doubles the risk of a wound complication, whereas postoperative radiotherapy increases the risk of late effects, such as fibrosis, edema, and joint stiffness.

INTRODUCTION

For more than 100 years, radiation therapy has been a mainstay of cancer therapy because of the exquisite ability of ionizing radiation to kill cancer cells.[1] Historically, even though James Ewing used short-term tumor response to radiation therapy to

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help differentiate Ewing sarcoma from osteosarcoma, short-term changes in the size of a tumor following radiotherapy do not accurately quantify its efficacy. For some cancers (including soft tissue sarcoma), if they do not dramatically shrink following radiation therapy, clinicians may surmise that they are radiation resistant. However, this misconception is not consistent with clinical trials of radiation therapy in which the end point is local control. As discussed in this article, randomized clinical trials show that radiation therapy improves local control after surgery to a similar extent as surgery for breast cancer or rectal cancer. Therefore, radiation therapy is an effective modality for treating patients with soft tissue sarcoma.

PATIENT EVALUATION OVERVIEW

Because radiation therapy is an effective therapy for soft tissue sarcoma and can be integrated with surgical resection before, during, or after surgery, it is critical that a radiation oncologist experienced in treating sarcomas evaluates patients at the time of initial diagnosis. The 2015 National Comprehensive Cancer Network (NCCN) guidelines for the management of soft tissue sarcomas state that, "prior to the initiation of therapy, all patients should be evaluated and managed by a multidisciplinary team with expertise and experience in sarcoma."[2] Except for the rare clinical scenario in which a soft tissue sarcoma is causing progressive neurologic deficits or life-threatening bleeding, there is almost always sufficient time for evaluation by a radiation oncologist, facilitating a multidisciplinary consensus treatment plan before definitive surgical resection.

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SURGERY ALONE

For extremity soft tissue sarcomas, the goals of local therapy include maximizing local control and function. Therefore, most patients with extremity soft tissue sarcomas undergo limb-sparing surgical resection. Limb-sparing surgery by surgeons experienced in soft tissue sarcoma resection achieves local control in approximately two-thirds of patients.[3] In a setting in which limb-sparing surgery would not lead to a functional extremity, amputation without radiation therapy is an established treatment option. When limb-sparing surgery can lead to a functional extremity, surgery alone may still be the optimal local therapy, particularly in the clinical setting in which local recurrence is unlikely to lead to the development of metastases or loss of limb function. Soft tissue sarcomas in this category include small (<5 cm), low-grade tumors, particularly those superficial to the fascia. If a tumor with these clinical features recurs after surgery alone, salvage therapy including radiotherapy and surgery is likely to lead to a functional limb. Data supporting this approach come from a retrospective series from the Dana Farber Cancer Institute, concerning 74 patients with soft tissue sarcoma of the extremity or trunk with a median tumor size of 4 cm, of which 54% were low grade. These patients were treated with function-sparing surgery alone (ie, no radiotherapy) and the 10-year actuarial rate of local control was 93%.[4] All of the sarcomas with a histologic resection margin of at least 1 cm achieved local control with surgery alone.