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CORR Insights

CORR Insights®: Developing an Evidence-Based Followup Schedule for Bone Sarcomas Based on Local Recurrence and Metastatic Progression

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Where Are We Now?

Creativity and flexibility are expected for the surgical management of bone sarcomas, but we should not expect those same qualities for our approach to sarcoma surveillance after the surgery is complete. Cipriano and colleagues address an unanswered question within orthopaedic oncology: "How frequently do I need to obtain followup imaging on my patients?"

In the office we routinely discuss treatment options for sarcoma and provide our patients with data to support our treatment recommendations. We then move to the next room and examine patients who are months or years removed from their surgery, and we advise them to return in 3 months, 6 months, or 1 year with new imaging studies that can include radiographs, MRI, CT, positron emission tomography (PET) CT, bone scan, or a combination of several studies. Very few of these patients ask what data we have to support surveillance recommendations. Oncologic societies such as National Comprehensive Cancer Network, National Cancer Institute, and European Society for Medical Oncology provide general guidelines for local and systemic surveillance, but even terms like "chest imaging" lack specificity [1, 2]. While this gives the orthopaedic oncologist some autonomy for medical decision making, it fails to address the unintended consequences such as radiation exposure, rising healthcare costs, unnecessary subsequent testing for false-positive results, and patient anxiety related to the aforementioned effects.

Cipriano and colleagues refine the existing guidelines based upon tumor grade, with low-grade tumors receiving a less-aggressive surveillance plan and high-grade tumors following a more-intensive surveillance plan. Their research provides Level-3 recommendations that include less-frequent chest imaging for low- and intermediate-grade sarcomas and

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suggests that a shorter period of total surveillance for low-grade bone sarcomas is appropriate without adverse impact on overall survival. These recommendations favor less-cumulative radiation exposure to patients.

Evidence exists that healthcare providers do not appreciate the amount of radiation associated with tests ordered on a daily basis [4]. A chest radiograph exposes a patient to approximately 0.14 mSv, whereas the radiation from a chest CT is 8 mSv to 10 mSv [3]. How many of us disclose to our patients that we have ordered the equivalent of 500 chest radiographs in order to obtain a CT scan for routine surveillance? Although the perceived overall risk for secondary malignancy is low, modest evidence supports an increased risk of cancer in patients with protracted exposure to 50 mSv to 100 mSv [5]. Puri's Trial for Optimal Surveillance in Sarcomas [6] provides Level 1 evidence that chest radiograph is not inferior to chest CT at a median followup of 42 months for detecting pulmonary metastases, and 3-year overall survival rates were similar in the chest radiography and chest CT cohorts. Despite this knowledge, many of us continue to order CT scans—why?

Where Do We Need To Go?

The research of Cipriano and her colleagues highlights the need for further analysis of several issues directly related to patient imaging: (1) Radiation safety and cumulative lifetime exposure, (2) cost versus benefit to the patient of advanced imaging, and (3) advantages and disadvantages of newer technology such as PET CT. Traditional methods of scientific research could answer these questions, but the ultimate question to answer is more difficult to structure by such methods: "Am I making a difference in my patient's outcome?"

The considerations with advanced imaging extend beyond cumulative radiation exposure and include the risk of contrast administration and rate of false-positive results. Previous research has found a false-positive rate of 30% in abdomen and pelvis CT in soft-tissue sarcoma surveillance with a high rate of invasive procedures and subsequent advanced-imaging studies [8]. We should critically analyze existing data to establish a risk-benefit profile of advanced imaging techniques and develop specific chest surveillance imaging guidelines and recommendations for evaluation of subcentimeter pulmonary nodules [7]. As the global utilization of CT scans continues to increase, so will the number of incidentally found pulmonary nodules [5, 7]. Can we say it is best practice to repeat scans every 3, 6, or 12 months?

In accordance with the United Nations Scientific Committee on the Effects of Atomic Radiation strategic plan for 2014 to 2019, we should "increase awareness … with regard to levels of exposure to ionizing radiation and the related health and environmental effects as a sound basis for informed decision-making on radiation-related issues" [9]. As advocates for our patients, we should routinely discuss the risks and benefits of advanced imaging so our patients can be actively involved in treatment and surveillance plans. An important concept for patients and parents of our pediatric patients to understand is that more tests are not necessarily better patient care. We can leverage our existing knowledge and application of medical technology to maximize the number of recurrences detected per examination performed while exercising responsible stewardship of resources.

How Do We Get There?

In a subspecialty where the sound of hoof beats conjures up images of zebras rather than horses, randomized clinical trials involving patients with rare bone sarcomas are a considerable challenge. An initial approach to the many unanswered questions suggested here could include a multicenter and

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multinational retrospective analysis of surveillance patterns in bone sarcomas to establish a baseline of the current state of practice. What proportion of sarcoma centers utilize radiographs compared with CT? If we assume a noninferiority theory across groups stratified by age and histologic grade, we would expect to see similar rates of local and distant relapse and overall survival regardless of surveillance-imaging modality. With baseline data across multiple centers, we can then propose a revised prospective surveillance plan with emphasis on conventional radiographic followup while incorporating the frequency of imaging as outlined by Cipriano and colleagues. Because disease-free survival and overall survival rates have remained stable for primary bone sarcomas, we can compare subsequent survival rates with historical rates to ensure no changes occur with implementation of a new surveillance plan. Other endpoints include cost, cumulative radiation exposure, and patient satisfaction. We can use this information in our practices to provide data-driven recommendations to our patients. Instead of ascribing to the way it has always been done we can use the data to create best practices so that we can provide safe and optimal care for our patients.

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