Radiologic Approach to Bone and Soft Tissue Sarcomas

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KEYWORDS

• Imaging • Radiology • Diagnostic evaluation • Bone lesion • Soft tissue mass • Sarcoma

KEY POINTS

- Diagnostic imaging plays an important role in the evaluation and treatment planning of patients with musculoskeletal tumors.
- Following a thorough history and physical examination, imaging examinations may be requested to evaluate a palpable abnormality; soft tissue mass; or clinical symptoms, such as pain and swelling.
- In some cases, the clinical presentation including patient age, symptomatology, and past medical history may suggest a specific diagnosis, although in most cases the clinical examination is nonspecific.
- Whether detected incidentally or in the setting of clinical symptoms, musculoskeletal neoplasms can often be accurately characterized utilizing appropriate imaging examinations.

Diagnostic imaging is a critical component of a multidisciplinary approach to the diagnosis and treatment of musculoskeletal neoplasms. Following a thorough history and physical examination, imaging examinations may be requested to evaluate a palpable abnormality; soft tissue mass; or clinical symptoms, such as pain and swelling. In some cases, the clinical presentation including patient age, symptomatology, and past medical history may suggest a specific diagnosis, although in most cases the clinical examination is nonspecific. With greater accessibility to and use of advanced imaging modalities, musculoskeletal tumors may be identified incidentally on studies

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performed for other reasons. In any of these scenarios, the initial objective of diagnostic imaging is confirmation of the presence of a musculoskeletal neoplasm versus an alternative explanation of symptoms, such as traumatic injury or infection. When a mass is present, initial characterization of the tumor as benign or malignant is based on features, such as size, margins, enhancement pattern, and internal homogeneity versus heterogeneity. After the initial assessment of benignity versus malignancy, further evaluation may provide for a more specific diagnosis based on tumor characteristics, such as anatomic location, morphology, pattern of growth, and intrinsic tumor composition. Ideally, a subspecialized multidisciplinary review of the clinical history, diagnostic imaging, and histopathologic findings at a tertiary cancer referral center would direct optimal patient treatment planning.[1–4]

This article discusses several important concepts in musculoskeletal tumor imaging and presents relevant imaging features of several common musculoskeletal neoplasms. A complete and thorough review of musculoskeletal tumor imaging is beyond the scope of this review, with numerous textbooks dedicated to the subject. In this article, we discuss the following:

- Imaging modalities most often used in the evaluation of musculoskeletal tumors including the advantages and disadvantages of each modality
- Our approach to the diagnostic evaluation of a newly suspected musculoskeletal neoplasm including determination of risk of malignancy
- An assessment of internal tumor composition allowing for a specific preoperative histopathologic diagnosis including features of several common soft tissue sarcomas
- Findings relevant to tumor staging and preoperative planning including response to neoadjuvant therapy
- Postoperative surveillance plans for local tumor recurrence following limb-salvage procedures

IMAGING MODALITIES

Several different diagnostic imaging examinations may be used in the initial evaluation of a suspected musculoskeletal neoplasm.[5–10] Each modality presents unique advantages and disadvantages as shown in **Table 1**. However, in most cases complementary information is provided by each study. For example, MRI provides greater soft tissue contrast than computed tomography (CT) and therefore often allows for better definition of internal tumor soft tissue composition/intrinsic elements of the tumor, whereas CT better demonstrates tumor mineralization than MRI. In another example, CT better depicts cortical bone involvement including pathologic fractures, whereas MRI better demonstrates medullary edema and bone marrow lesions including skip metastases not uncommonly seen in patients with primary bone tumors, such as osteosarcoma.

EVALUATION OF A NEWLY SUSPECTED MUSCULOSKELETAL TUMOR

Although a thorough clinical history and physical examination are important in the initial evaluation of a patient with a possible musculoskeletal neoplasm, symptomatology and physical findings are often nonspecific with significant overlap among presentations of neoplastic and nonneoplastic causes of musculoskeletal complaints.[11] Even when findings suggest the presence of a tumor, physical examination is often limited in differentiating benign and malignant neoplasms. As such, most patients with musculoskeletal symptoms are referred for diagnostic imaging. When imaging