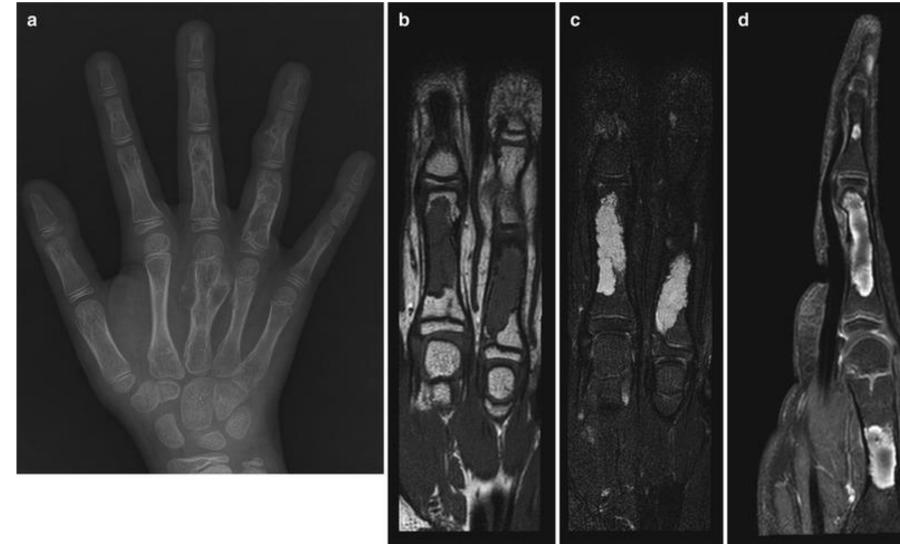


Introduction

Primary bone tumors are the sixth most common type of tumor diagnosed in children [1]. In the U.S., about 700 children are diagnosed with malignant bone tumors each year [3]. Distinguishing between benign and malignant tumors uses specific evaluations such as tumor margins, pattern of bone destruction, lesion location, the soft tissue around the lesion, and the matrix type. The earlier the tumor is found the best chance the patient has at survival. Diagnosing tumors in pediatric patients can be very difficult due to the fact of the vague symptoms and the difficulty of the child recognizing pain. Limping is a sign that should never be overlooked in a pediatric patient and should be examined for an early detection of a bone tumor. Radiography is the most valuable diagnostic tool for diagnosing bone tumors because it can demonstrate all the differentiating characteristic in a single examination, and it establishes tumor location as well [1]. Due to the fact that children are the most vulnerable to radiation it is essential that proper shielding methods as well as proper positioning and immobilization devices are used to reduce unnecessary radiation exposure.



Enchondroma

Cancer: Benign vs Malignant

Primary bone tumors are defined as tumors originating in a bone [3]. Tumors are classified as either benign (noncancerous) or malignant (cancerous) [1]. Differentiating between benign and malignant tumors is not always a straightforward process [1]. Different types of radiation modalities can help determine if a tumor is malignant or benign, but a biopsy is usually required to make the final diagnosis.

Tumors are classified by:

- bone destruction- assessed by radiographic appearance and provides clues for diagnosis
- lesion location- specific tumors tend to occur in certain places
- matrix composition- the matrix depends on the material produced by the mesenchymal cells of the tumor
- periosteal reactions- help determine benign tumors from malignant tumors
- peritumoral edema- also known as bone marrow edema
- Presence or absence of soft tissue mass-often indicates a malignant tumor
- tumor margins- helps determine malignant tumors from benign tumors

Imaging Pediatric Bone Tumors

Benign Bone Tumors in Pediatrics

Most bone tumors found in children are benign and include nonossifying fibromas, osteochondromas, aneurysmal bone cysts, Langerhans cell histiocytosis, giant-cell tumors of bones, and osteoid osteomas [1]. Radiography is the best modality for imaging benign bone tumors [1].

Nonossifving Fibroma

- Nonossifying fibroma (NOF) is the most common benign bone pathology in pediatric patients and often is an incidental finding [1]. NOFs are single lesions that resolve without treatment in most cases [1]. When patients start to develop symptoms it is a result of direct compression of surrounding tissue because of the lesion and weakening bone.
 - Diagnosing Modalities- NOF lesions present radiographically with a radiolucent center and have a sclerotic, easily defined margin [1]. A nonossifying fibroma that begins to develop hyperintensity on T2 sequences of MR imaging examination. As the tumor continues to progress it shows low signal intensity on both T1 and T2 sequences. Surgery is the treatment of choice when the patient is in persistent pain or when the tumor is more that 50% of the transverse diameter of the bone.

Osteochondroma

- An osteochondroma is a hard mass of cartilage and bone that generally appears near the growth plate (a layer of cartilage at the ends of a child's long bones) [6]. Osteochondromas usually present in the periosteum of the bone as a small cartilaginous nodule and are characterized as pedunculated.
 - Diagnosing Modalities- Radiography and MR imaging are used to diagnose osteochondromas. MR imaging is helpful for diagnosis because the thickness of the cartilage cap and typical bone marrow extending into the osteochondroma can be visualized [1]. MR imaging also can visualize soft tissue edema or focal bursal formation from friction that comes with joint movement [1]. Open or arthroscopic surgery is the standard treatment for lesions.

Osteoid Osteoma

- An osteoid osteoma is a benign, small tumor that grows I the long bones of patients. This pathology is characterized by a central osteoid nidus that is encompassed by reactive sclerotic bone and inflammation [1].
 - · Diagnosing Modalities- MR imaging, CT, and nuclear medicine bone scans are warranted examinations for a correct diagnosis [1]. Radiography demonstrates a radiolucent lesion that can have an area of focal calcification, but MR imaging can be helpful but not always diagnostic because surrounding bone marrow edema obscures the nidus and can lead to a misdiagnosis. T1-weighted MR images show low signal intensity and T2-weighted sequences show an increase in signal intensity, and postcontrast sequences show high contrast enhancement. CT imaging is ultimately the modality of choice identifying the nidus. Dynamic CT imaging of the lesion is recommended to differentiate OO from other pathologies, such as chronic osteomyelitis and Brodie abscess [1]. Nuclear medicine is another modality that helps diagnose OO. The physiologic uptake of the radiopharmaceutical seen with increased osteoblastic activity provides an accurate tumor localization [1].

Malignant Bone Tumors in Pediatrics

Malignant, or cancerous, bone tumors found in children include Ewing sarcoma, osteosarcoma, and chondrosarcoma [1]. The most common type of malignant tumor found in pediatric children are osteosarcoma. Radiography is the best modality for assessing malignant bone tumors.

Ewing Sarcoma

- Ewing Sarcoma is a cancerous bone tumor that may arise anywhere in the body. Affecting children and young adults, it usually originates in the long bones of the arms and legs, the pelvis, or the chest [4]. The tumor often develops in the diaphysis of long bones and presents with the moth-eaten appearance on radiography [1]. Symptoms range from pain, swelling, tenderness, or a fever.
 - Diagnosing Modalities- Contrast-enhanced MR imaging is invaluable in making a diagnosis because the contrast more clearly enhances the tumor, making it possible for the radiologist to distinguish between tumor and the surrounding marrow edema [1]. After complete surgical resection of the tumor a postoperative MR examinations are done, including a T1weighted-3D and a T2-weighted-3D sequence to ensure the whole tumor is gone

Osteosarcoma

- Osteosarcoma is the most common type of primary malignant bone tumor, is defined by the presence of malignant mesenchymal cells producing osteoid or immature bone [5]. Most often originates in long bones such as femur, tibia, or humerus. Symptoms include pain for months getting more constant and worsen over time.
 - Diagnosing Modalities-Radiography is required for diagnosing osteosarcoma, but MR is helpful in identifying skip lesions and neurovascular bundle involvement [1]. Detailed imaging of the lungs is required to evaluate for metastatic disease, and chest CT is more sensitive for detection than is radiography [1]. Osteosarcomas are unresponsive to radiation therapy, so treatment usually entails chemotherapy and surgical removal of the tumor



Ewing Sarcoma



Osteosarcoma

Conclusion

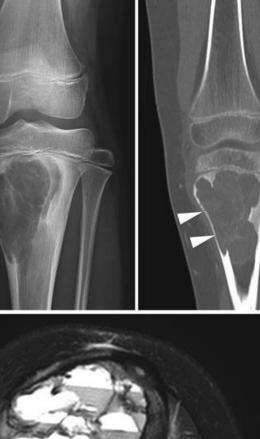
Primary bone tumors are common in pediatric patients and are the sixth most common type of tumor, cancerous or otherwise, diagnosed in children [1]. Several characteristics goes into evaluating bone lesions to determine whether the lesion is benign or malignant. These include tumor margins, pattern of bone destruction, periosteal reaction, presences or absence of soft tissue mass, lesion location, and type of matrix. In today's world, technology and research continue to develop and provide information about cancers. Because pediatric bone tumor patients have vague symptoms and difficulty articulating their symptoms or recognizing the cause of pain, children with complaints of vague pain and symptoms should be screened with diagnostic radiography for early detection [1]. CT and MR imaging also are vital for establishing tumor invasion and staging in malignant lesions [1].

Osteochondromatosis

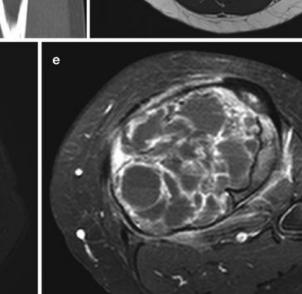


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Aneurysmal Bone

