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## Seeding of osteosarcoma in the biopsy tract of a patient with multifocal osteosarcoma

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Received: 23 November 2004  
Revised: 23 December 2004  
Accepted: 7 January 2005  
Published online: 9 March 2005  
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**Abstract** We report a case of multifocal osteosarcoma in a 7-year-old boy who developed iatrogenic seeding of tumor along the biopsy tract. The results of the plain radiograph, CT, and histopathological correlation are presented.

**Keywords** Osteosarcoma · Needle biopsy · CT · Musculoskeletal tumor

## Introduction

There are many methods of obtaining pathological tissue from musculoskeletal tumors, including excisional biopsy, incisional biopsy, intraoperative frozen section, core needle biopsy, and fine-needle aspiration. Even though it is an unusual possibility, growth of the tumor in the biopsy tract can occur. Davies et al. [1] reported a case of recurrent osteosarcoma in a biopsy tract in an 18-year-old male who had right knee osteosarcoma. Radiographical detection of seeding in the biopsy tract is rare. Our case indicates that imaging can be a useful technique in diagnosing such a complication.

## Case report

A 7-year-old boy presented at another hospital with a 6-week history of limping and discomfort in his left lower extremity. The pain involved the left hip, anterior thigh, knee, and lower leg. He had no fever, fatigue, or weight loss. On physical examination, no mass was palpable in the region of the left hip and thigh.

Initial conventional radiograph showed a homogeneous sclerotic lesion involving the left proximal femoral diaphysis, a 1.5-cm sclerotic lesion in the right proximal femoral metaphysis, adjacent to the growth plate, and a faintly sclerotic lesion in the left iliac crest (Fig. 1). On CT scan, a sunburst periosteal reaction was



**Fig. 1** Initial plain radiograph of the pelvis and both hips demonstrates sclerosis of the left proximal femoral metaphysis (*short black arrow*) and a sclerotic area in the medial aspect of the right femoral metaphysis (*long black arrow*). There is a faintly sclerotic lesion in the left iliac crest (*white arrow*)

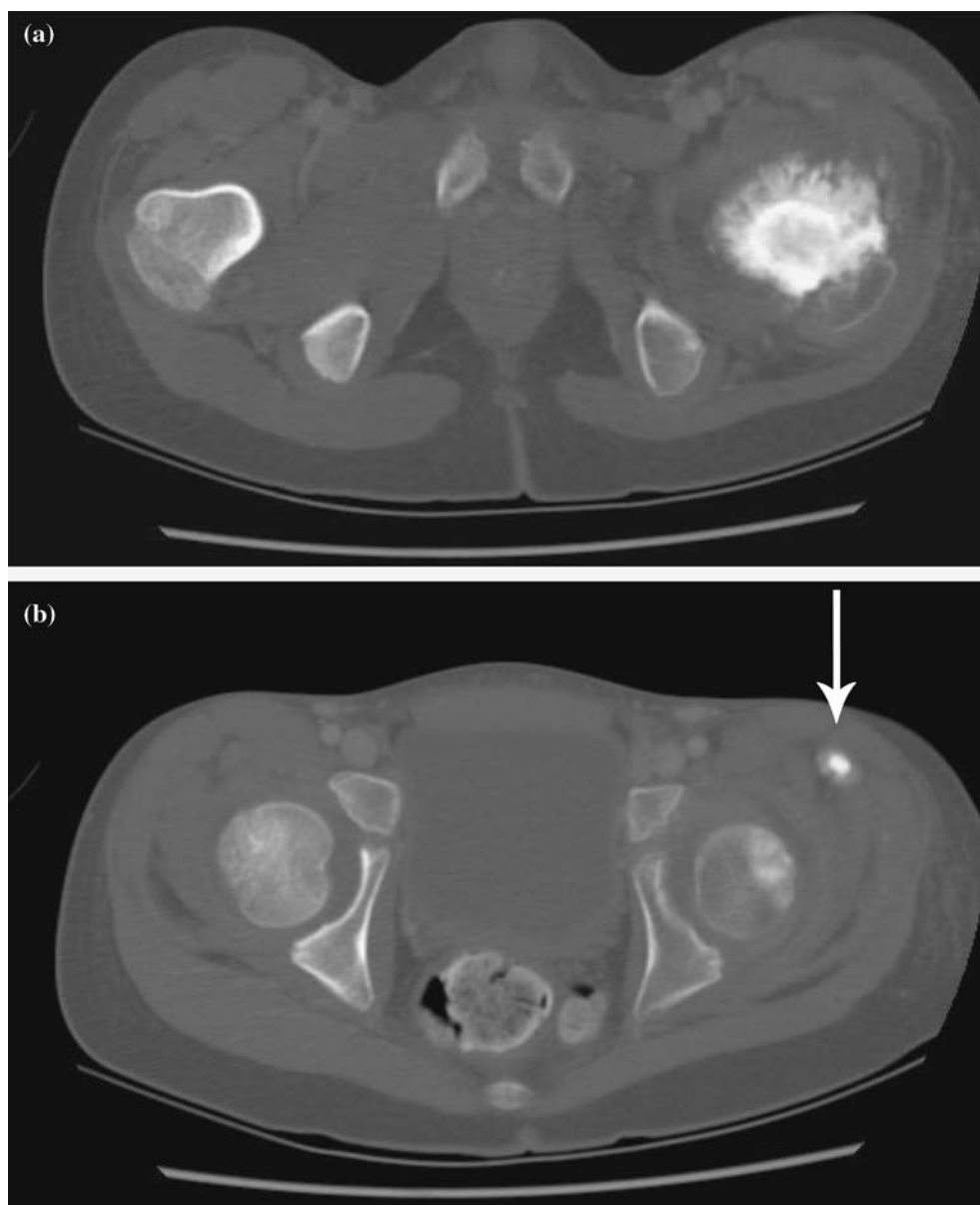
seen adjacent to the left proximal femoral lesion. There were also two other sclerotic lesions. One was in the right medial proximal femoral metaphysis, 1.5 cm in the greatest diameter, located very close to the epiphyseal plate, and the second lesion was a small faintly sclerotic lesion, 0.7×1.7 cm, in the left iliac crest. MRI showed all of the lesions to be hypointense on both T1-weighted and T2-weighted images, a finding that represented infiltration of tumor in the same areas as demonstrated on the CT scan. The MRI showed that the lesion in the proximal left femur extended from the proximal physis to the mid-diaphyseal region, 13 cm in craniocaudal length. No extraosseous component was seen. At an outside hospital, the boy underwent incisional biopsy that was non-diagnostic for malignancy. He was considered to have multifocal osteomyelitis and received 10 weeks of antibiotic treatment, but did not improve.

He then was referred to our hospital and underwent repeat incisional biopsy of the proximal left femoral lesion, and the pathological section revealed osteosarcoma. On admission, laboratory studies showed elevated alkaline phosphatase and normal white blood cell count, platelet count and erythrocyte sedimentation rate. The immediate follow-up plain radiograph showed a dense sclerotic lesion at the left proximal femur with a sunburst periosteal reaction. There was a new small, spherical calcified mass, 1 cm at the greatest diameter,



**Fig. 2** Anteroposterior view of the pelvis taken 2 days after the second incisional biopsy shows interval increase in size of the lesions in both proximal femora. In addition, there is a small round, calcific nodule (*black arrow*) in the soft tissue lateral to the left femoral epiphysis and a sclerotic lesion in the left iliac crest (*white arrow*). This was less apparent on the prior initial radiograph

**Fig. 3** CT examination. **a** A single axial CT image of the pelvis taken on the same day as the radiograph in Fig. 2 shows a sunburst periosteal reaction at the proximal left femur **b** The higher cut CT image from the same study as shown in Fig. 3a shows a spherical ossified mass (white arrow) anterolateral to the left femoral head. This was pathologically proved to be a focus of osteosarcoma seeding along the biopsy tract

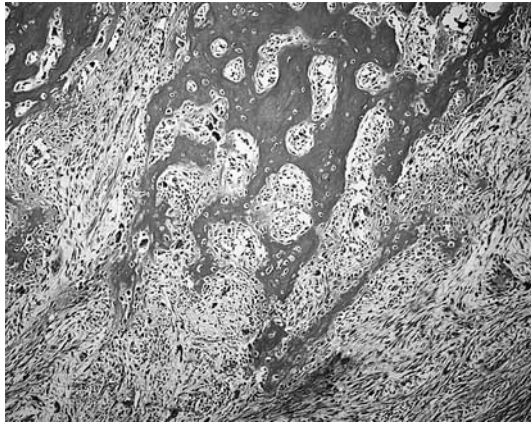


located in the soft tissue immediately anterolateral to the left greater trochanter (Fig. 2). On CT scan, the left femoral lesion was the same length, but the extent of the sunburst periosteal reaction had increased since the prior examination (Fig. 3a). A spherical calcific mass was seen anterolateral to the greater trochanter (Fig. 3b). Multiple foci of air bubbles and a bone defect from the incisional bone biopsy were also seen. A bone scan ( $^{99m}\text{Tc}$ -MDP) showed increased uptake in all lesions described, with additional increased uptake in the left scapula. This new scapular lesion was confirmed by a chest CT scan to be a non-expansile, dense sclerotic lesion of the left glenoid ridge.

After the diagnosis was confirmed, the patient started a course of chemotherapy that included intravenous

doxorubicin hydrochloride (adriamycin) and cisplatin, followed by high-dose methotrexate. An MRI performed a month later showed progression of the left proximal femoral lesion. The chemotherapy regimen was empirically switched to etoposide and ifosfamide. The patient continued to receive this regimen for 4 months without obvious improvement based on clinical examination and follow-up MRI. Chemotherapy was changed to a third alternative regimen, irinotecan and vincristine.

He seemed to respond to the irinotecan and vincristine therapy with decreasing symptoms and stabilization of radiographic findings. Limb salvage surgery was performed with insertion of a left femoral prosthesis in order to treat his primary site, relieve pain, and decrease the chance of pathological fracture. At that time, the



**Fig. 4** Histopathologic section from the ossified soft-tissue focus along the initial biopsy tract demonstrates atypical cells forming an osteoid diagnostic of osteosarcoma

ossified soft-tissue mass in the biopsy tract was resected en bloc and was confirmed to be metastatic osteosarcoma (Fig.4). After surgery, he remained stable for several months on irinotecan and vincristine.

Six months after the surgery, the patient developed multiple foci of rib, vertebral, and skull metastases. The tumor masses on the right iliac crest and left scapula increased in size. He continued on palliative therapy, but no additional imaging was performed.

## Discussion

Although osteosarcoma is the most common malignancy of bone in children and adolescents, multifocal osteosarcomas have been reported in only 1–10% of newly diagnosed cases. There are controversies about the entity of multifocal osteosarcomas. Previous investigators have considered this entity to be multiple foci neoplasia, but more recently it has been suggested that all cases of multifocal osteosarcoma represent rapidly progressive metastatic disease that is usually present as one dominant lesion and multiple smaller lesions [2]. The most widely accepted classification of multifocal osteosarcoma is that of Amstutz [3].

Our patient had multiple sclerotic osseous lesions of various sizes with the dominant lesion in the proximal

left femur. Although only one lesion was biopsied, we believed that all lesions represented the same disease, as determined by their identical radiographic findings.

The p53 mutation can be associated with an aggressive behavior in osteosarcoma. Park et al. [4] found in 2001 that the presence of p53 oncogene in osteosarcoma was associated with a shorter survival, increased tumor activity, and drug resistance. Our patient did not have a germ-line mutation in the p53 oncogene. However, we did not test the tumor directly. Others have found somatic p53 mutations to be common in multifocal osteosarcoma [5].

Even though open biopsy is the best way to obtain adequate tissue for pathological diagnosis, many investigators report that fine-needle aspiration is a cost-effective method of providing the diagnosis of osteosarcoma prior to definitive treatment [6–8]. The specific incidence of connective tissue tumor seeding at the biopsy site is not known [9]. In a variety of tumors, the incidence of needle tract seeding by tumor is between 0.003 and 0.009%. Half of the reported cases were in pancreatic tumors, but such seeding has also occurred in hepatocellular carcinoma, papillary thyroid carcinoma, renal cell carcinoma, and peritoneal carcinoid tumor [10–14]. Only one reported case, by Davies et al. [1], is related to osteogenic sarcoma. The incidence of the biopsy tract seeding from incisional biopsy might be higher, but the seeding tumors are routinely resected during surgery and can be effectively treated with neoadjuvant chemotherapy. In our case, the seeding likely occurred at the first biopsy because it is unlikely that the seeding would have developed in so few days after the second incisional biopsy. We detected seeding of tumor in the radiographic images because of the characteristic new tumor bone formation. The case we present is not the usual seeding in the tract of a needle biopsy, because this lesion was considered in an outside hospital to be a benign lesion, and significant time elapsed between the biopsy and the subsequent, correct diagnosis and surgery.

This case highlights the importance of looking for osteogenic deposits in the biopsy tract and supports the idea that surgery should aim to remove the biopsy tract en bloc to prevent local recurrence.

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