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A Small Cell Osteosarcoma on the Calcaneus
—A Case Report—

Yong-Koo Park, M.D.,* Kyung-Nam Ryu, M.D.,**
Jin-Hwan Ahn, M.D.,*** Moon-Ho Yang, M.D.*

Departments of Pathology, Diagnostic Radiology** and Orthopedic Surgery****
College of Medicine, Kyung Hee University, Seoul, Korea

Small cell osteosarcoma is rare, representing 1-4% of all osteosarcomas. We experienced a case of small cell osteosarcoma in an 8-year-old girl on her calcaneus. Histologically, the tumor consists of small round cells that resemble those of Ewing's sarcoma, and variable foci of lacy osteoid formation between tumor cells. The rare location, histologic characteristics and differential diagnostic points are discussed.

Key Words : *Osteosarcoma, Small cell osteosarcoma, Calcaneus*

INTRODUCTION

Small cell osteosarcoma is a rare type of osteosarcoma characterized by sheets of small cells of about the same size and shape as those seen in Ewing's sarcoma (Sim et al., 1979). Small cell osteosarcoma can be mistaken for other small cell tumors, such as Ewing's sarcoma, malignant lymphoma, mesenchymal chondrosarcoma, and metastatic neuroblastoma. This is to report a case of small cell osteosarcoma occurring in the calcaneus in an 8-year-old girl and to discuss the rare location, histologic characteristics and differential diagnosis.

CASE REPORT

The subject was an 8-year-old girl who had had painful swelling in her right ankle for 3 months. She experienced more severe pain after exercise. No history of trauma or other systemic illnesses was elicited. Physical examination of her ankle showed swelling, local heat, and tenderness. The laboratory tests revealed an increased erythrocyte sedimentation rate, and c-reactive protein. Other laboratory tests were within normal limits.

Plain radiograph of the calcaneus (Fig. 1) showed an osteolytic bony destruction at the inferior portion. The inferior cortical margin was completely destroyed.

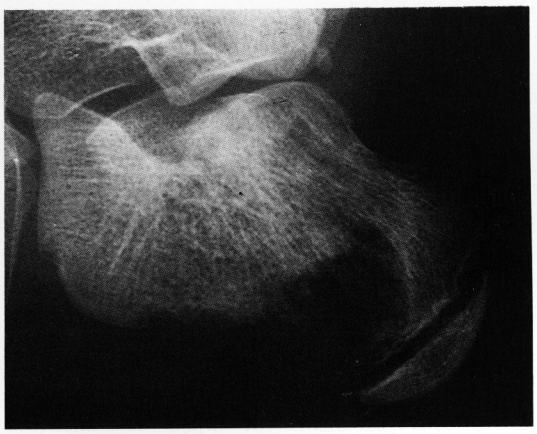

Fig. 1. Plain radiograph of the calcaneus shows an osteolytic bony destruction with irregular margin at the inferior portion. The remaining portion shows coarse bony trabeculation.

Address for correspondence : *Yong-Koo Park, M.D., Department of Pathology, College of Medicine, Kyung Hee University Hospital, Seoul, 130-702, Korea.*
Tel : (02)965-3211(Ext. 2268) Fax : (02)962-5278.

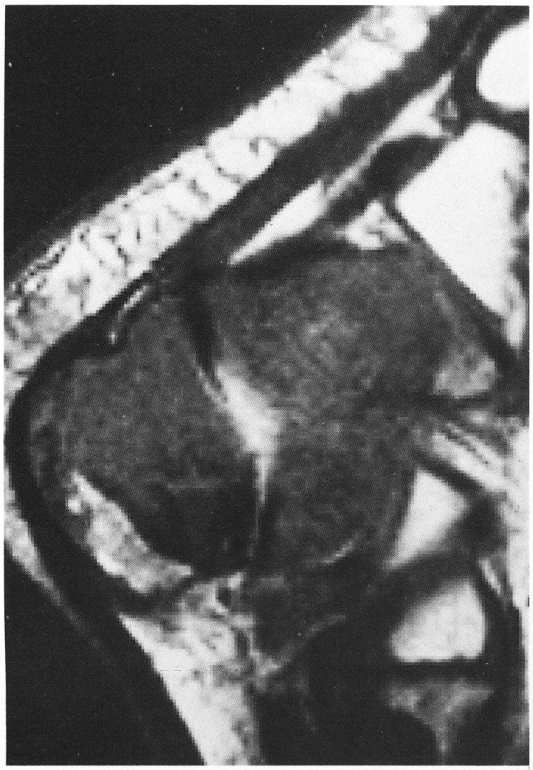

Fig. 2a. T1-weighted sagittal image of the calcaneus shows a diffusely low signal lesion with mild contour bulging of the inferior border.

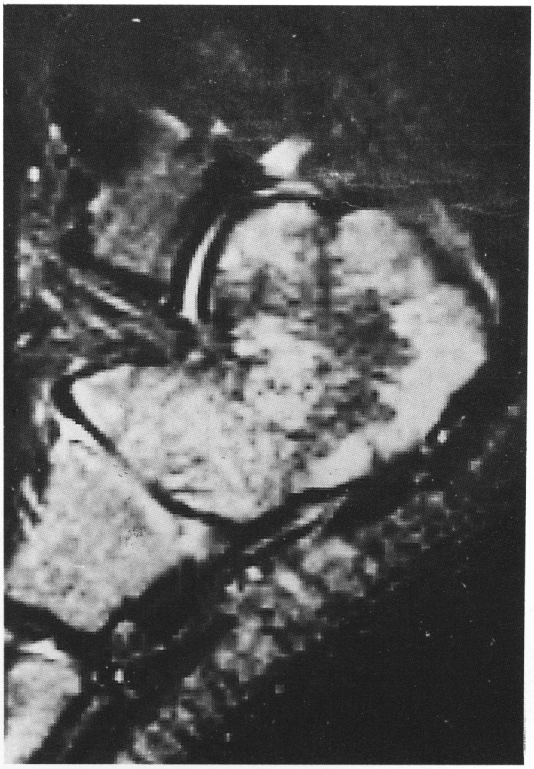

Fig. 2b. T2-weighted images shows heterogeneous high signal change of the lesion.

The margin of the lesion was very irregular, and the matrix was purely lytic. The remaining bony structure revealed mild thickening of bony trabeculae.

Tl-weighted sagittal image (Fig. 2a) showed a low signal lesion of the calcaneus. The inferior cortical margin was destroyed, and its contour was bulged out by soft tissue mass. The lesion changed to high signal intensity on T2-weighted image (Fig. 2b). The posterior portion of the lesion revealed brighter signal intensity than the anterior portion. T1-weighted enhanced image showed peripheral enhancement with central non-enhanced lesion, suggesting tumor necrosis.

On computed tomography the calcaneus was completely destroyed at the postero-inferior portion. The margin of the lesion was very irregular. The matrix of the lesion was purely lytic without ossification or calcification. A biopsy of the lesion was performed. Histologically, the cells were small and round and grew in solid nests (Fig. 3). The cytoplasmic borders were indistinct. The nuclei were generally round or oval and were small. The nuclear chromatin was finely dispersed and nucleoli were not prominent. The amount of osteoid was scanty; however, it was intimately associated with tumor cells (Fig. 4). The lesion contained a delicate thin-walled capillary network.

Electron microscopic examination showed small, round tumor cells, with irregular infoldings of the nuclear membrane. The nuclear chromatin was finely dispersed. The cells had a moderate amount of cytoplasm with abundant glycogen granules (Fig. 5).

DISCUSSION

Small cell osteosarcoma is an uncommon malignant bone neoplasm, accounting for only 1-4% of all osteosarcomas (Sim et al., 1979; Ayala et al., 1989; Bertoni et al., 1989). Approximately 75 cases have been reported (Sim et al., 1979; Martin et al., 1982;

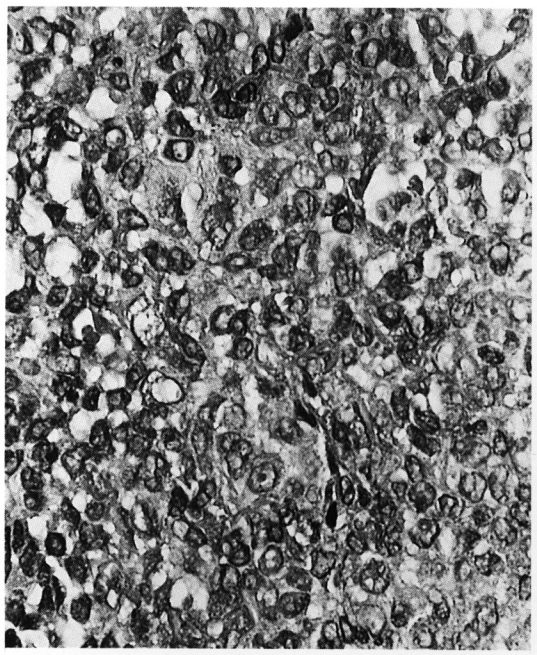

Fig. 3. Photomicrograph of the small cell osteosarcoma. Cells are round to oval and show slight variation in size(Hematoxylin-Eosin, ×400).

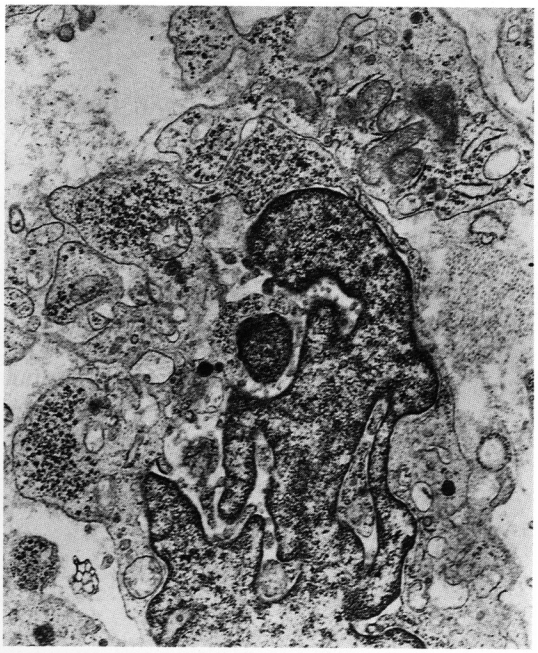

Fig. 5. Electron microscopic examination shows small round tumor cells with irregular infoldings of the nuclear membrane (EM ×10,000).

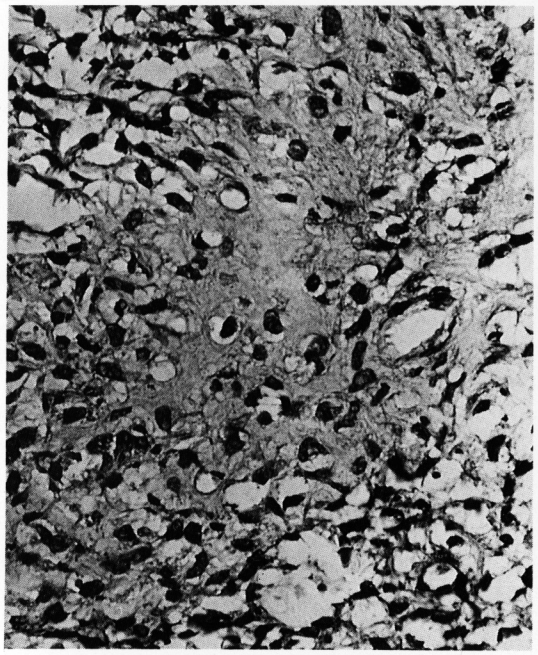

Fig. 4. Photomicrograph of another area showing small round tumor cells with osteoid production(Hematoxylin-Eosin, ×400).

Edeiken et al., 1987 ; Stea et al., 1988 ; Ayala et al., 1989 ; Bertoni et al., 1989). The anatomic distribution of small cell osteosarcoma is similar to that of conventional osteosarcoma. The metaphysis of long bones are primarily affected. The distal end of the femur is the most common site. However, 15% have been diaphyseal location (Sim et al., 1979 ; Edeiken et al., 1987 ; Ayala et al., 1989 ; Bertoni et al., 1989 ; Lopex-Barea et al., 1989). To our knowledge, this is the first case report of calcaneal involved small cell osteosarcoma. The age range of the patients with small cell osteosarcoma is similar to that of conventional osteosarcoma. Most of the cases affect patients younger than 20 years of age (Baro et al., 1989 ; Kyriakos et al., 1992).

Diagnosis of small cell osteosarcoma is based on combined pathologic and radiologic evidence. The study of radiographs is important when limited biopsies reveal only sheets of round cells, thus suggesting Ewing's sarcoma (Edeiken et al., 1987). Radiologically, destructive patterns are variable and cannot be absolutely distinguished from conventional osteosarcoma (Bertoni et al., 1989). Although Ayala et al. (1989) described a prominent combined mixed lytic and

blastic pattern, most have an osteoblastic component. The occurrence of a blastic component in the medullary cavity of a bone tumor is not necessarily diagnostic of osteosarcoma because Ewing's sarcoma and lymphoma may show such changes as a reactive osteoblastic process. Findings of CT and MRI in small cell osteosarcoma are non-specific. However, the majority shows a considerable soft tissue component.

Histologically, Ayala et al. (1989) divided small cell osteosarcoma into three types. The most common Ewing's sarcoma-like pattern consists of round to polygonal cells with densely hyperchromatic nuclei or coarsely clumped nuclear chromatin. Our case is a type of Ewing's sarcoma-like small cell osteosarcoma. The second or lymphoma-like pattern consists of cells with slightly larger, more vesicular nuclei and prominent nucleoli. The spindle cell pattern is characterized by the occurrence in the cells of short ovoid or spindle nuclei with inconspicuous or no nucleoli and a small amount of cytoplasm.

According to several electron microscopic studies (Roessner et al., 1985, Dickersin and Rosenberg, 1991 ; Kyriakos et al., 1992), there are small, round tumor cells whose nuclei are round to oval, with occasional infoldings of the nuclear membrane, many having occasional prominent nucleoli. The cells have a moderate amount of cytoplasm, most with abundant monoparticulate glycogen and numerous diffuse, haphazardly arranged intermediate filaments. Free ribosomes are the most consistently prominent organelles with variable proportions of mitochondria, rough endoplasmic reticulum, Golgi apparatus, and filaments. The ultrastructural spectrum of these cells overlaps the undifferentiated cells of Ewing's sarcoma and mesenchymal chondrosarcoma (Dickersin and Rosenberg, 1991).

Small cell osteosarcoma should be differentiated from other small cell malignant tumors occurring primarily in bone including Ewing's sarcoma, mesenchymal chondrosarcoma, lymphoma, and neuroectodermal tumor. The typical Ewing's sarcoma has a uniform population of small, round cells with so-called groung-glass nuclei and indistinct cell margins. The nuclei are much more uniform than those of small-cell osteosarcoma. The cells in Ewing's sarcoma often are arranged in clusters with intervening fibrous septa, but there is no stroma between individual tumor cells (Sim et al., 1979 ; Martin et al., 1982 ; Ayala et al., 1989 ; Bertoni et al., 1989 ; Fechner and Mills, 1993). Ayala et al. (1989) demonstrated glycogen in several of their cases, and others have reported glycogen in small cell osteosarcoma (Dickersin and Rosenberg, 1991 ; Kyriakos et al., 1922). Therefore a small cell tumor that contains glycogen does not rule out a diagnosis of small cell osteosarcoma. Mesenchymal chondrosarcoma may contain a small cell population indistinguishable from that of small cell osteosarcoma. However, mesenchymal chondrosarcoma has sharply demarcated nests of low-grade cartilage and not the high grade chondrosarcoma and osteoid seen in small cell osteosarcoma (Bertoni et al., 1989 ; Dickersin and Rosenberg, 1991). Malignant lymphoma of the bone rarely occurs in the first or second decade of life. No osteoid is seen and the size and shape of the cells is variable. Leukocytic common antigen is identified as an immunohistochemical marker for lymphoma (Sim et al., 1979 ; Ayala et al., 1989 ; Bertori et al., 1989 ; Kyriakos et al., 1992). Neuroectodermal tumor of the bone should show evidence of neuroendocrine differentiation in the form of positive staining for neuron specific enolase, Leu 7, synaptophysin, chromogranin, or other neural markers and may demonstrate Homer Wright-type rosettes (Bertoni et al., 1989 ; Kyriakos et al., 1992). In summary, a small cell osteosarcoma in a unique location-the calcaneus in an 8-year-old girl, has been presented. The clinical, radiological, and pathological aspects of small cell osteosarcoma are summarized. Differential diagnosis of small cell osteosarcoma is also stressed.

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