

CASE REPORT

Sonographic Hair-on-end Sign in Osteosarcoma

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ABSTRACT

This report is a case of osteosarcoma in a young female whose initial examination was sonography. This examination demonstrated a femoral tumor and included a unique finding corresponding to the radiographic hair-on-end sign of malignant new bone formation.

Key words: Hair-on-end, osteosarcoma, sonography, sunburst

INTRODUCTION

This report presents the case of a young female with knee pain whose ultrasound examination revealed a suspicious femoral cortical defect with associated soft tissue mass. In addition, a unique finding was seen, correlating with the hair-on-end radiographic sign occasionally seen in aggressive tumors.

CASE REPORT

A 12-year-old female was referred for ambulatory sonography of the knee because of several weeks of knee pain. Routine sonography of the knee was normal, but on questioning, the child's complaints were localized to the anterolateral distal thigh. Insonation of this area showed a

cortical defect with a saucerized appearance and an oval hypoechoic tissue filling the defect and protruding into the adjacent soft tissues [Figure 1a]. Extended field of view showed the defect in relation to the more distal epiphyseal plate [Figure 1b]. In the depths of the soft tissue within the cortical defect, parallel vertical echogenic structures 2.5 to 4.5 mm in height were identified, and color Doppler demonstrated blood vessels coursing between these structures [Figure 1c and d].

Subsequent X-ray of the knee confirmed the cortical defect in distal femoral diaphysis with inhomogeneity of the medullary cavity and periosteal reaction. A complete imaging workup was performed [Figure 2] and the child was referred to a pediatric oncology center where the

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diagnosis of telangiectatic osteosarcoma was established. A hair-on-end pattern was not identified in either the radiographs or the computed tomographic images of the knee [Figure 3].

DISCUSSION

Osseous abnormalities can be evaluated using multiple imaging modalities. The utility of sonography to evaluate osseous abnormalities has been well documented in trauma,^[1] as well as in benign^[2] and malignant bone lesions.^[3-6] Discontinuities in the normal smooth cortical contour of long bones are well seen on ultrasound. The soft tissue component accompanying the bony defect can be characterized on both gray-scale and Doppler

examinations.^[6] Ultrasound is also useful in providing guidance for percutaneous biopsy.^[4]

In the case reported here, ultrasound identified the large defect in the contour of the distal femur, as well as the accompanying oval soft tissue component. The aggressive nature of the lesion was suggested by the irregular and hypervascular tissue in the depth of the lesion. The parallel hyperechoic linear foci suggest the hair-on-end appearance occasionally seen on radiographs, in which periosteal new bone formation is represented by bone spicules perpendicularly oriented to the cortical contour. The hair-on-end pattern consists of parallel bone spicules originating from a broad-based lesion, whereas the similar sunburst pattern consists

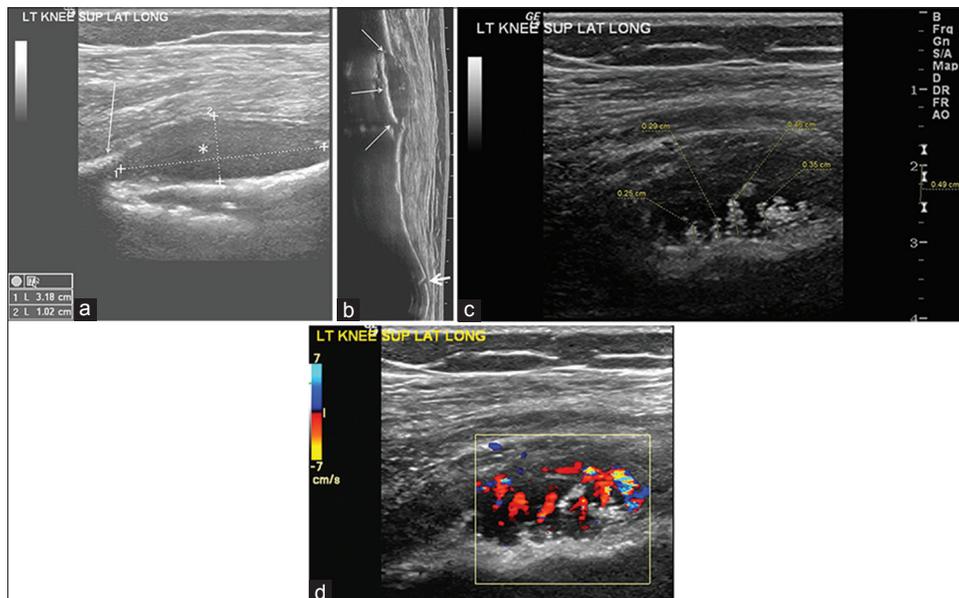


Figure 1: Femoral lesion in a 12-year-old girl who presented with leg pain. (a) Longitudinal gray-scale ultrasound image of the distal femur demonstrates a saucerized cortical defect (the length of the cortical defect is indicated by ultrasound cursor 1), peripheral periosteal reaction (arrow), and oval hypoechoic soft tissue mass (*). (b) Panoramic gray-scale ultrasound image shows the cortical defect (thin arrows) in relation to the femoral shaft and distal epiphyseal plate (thick arrow). (c) Gray-scale ultrasound image of the femoral soft tissue mass shows parallel linear hyperechoic structures in the depth of the lesion (dotted lines). (d) Color Doppler image shows blood vessels surrounding and partly obscuring the hyperechoic structures.

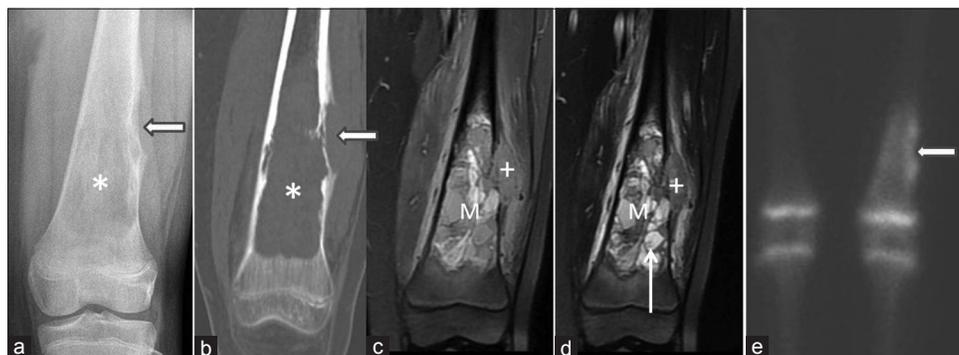


Figure 2: Femoral lesion in a 12-year-old girl who presented with leg pain. Comprehensive imaging of the femur, from left to right, includes (a) plain film and (b) coronal reformatted computed tomography image, both of which show a saucerized cortical lesion (arrow) and a central lytic lesion in the metadiaphysis of the femur (*); (c) coronal proton density fat-saturated magnetic resonance image and (d) coronal T1-weighted contrast enhanced magnetic resonance image which show a soft tissue mass within the cortical lesion (+) and the heterogeneous medullary tumor (M), with post-contrast enhancing nodules (arrow); (e) technetium 99m bone scan which shows tracer uptake at the margins of the cortical lesion (arrow).



Figure 3: (a-c) Femoral lesion in a 12-year-old girl who presented with leg pain. Enlarged images of radiograph and CT of the distal femur. (a) anteroposterior radiograph, (b) axial and (c) coronal CT images do not show a hair-on-end pattern. Codman triangles are indicated by arrows.

of radiating bone spicules originating from a narrower surface of bone destruction.^[7]

The color Doppler finding of vascularity surrounding the bony spicules is consistent with vascular reparative tissue.

CONCLUSION

Gray-scale ultrasound can be an effective tool in the discovery of destructive cortical bone lesions and their associated soft tissue masses. Doppler ultrasound is useful in characterizing the vascularity of these findings.

The combination of gray-scale and Doppler findings can demonstrate both the parallel spicules of the hair-on-end finding in new bone formation and the vascularized soft tissue between these spicules.

It is important to emphasize the necessity of examining the area of the patient's complaint if it is outside the area of the ultrasound request. In the case presented here, "knee" ultrasound was normal, but the patient's pain and sonographic abnormality were located in her femoral metadiaphysis.

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Conflicts of interest

There are no conflicts of interest.

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