Chondrosarcoma of the Foot

Amalia DeComas, MD, Douglas Lurie, MD, and Mark Meyer, MD

Abstract

Chondrosarcoma is a rare malignant cartilaginous tumor of the bone. It commonly occurs in the pelvis, proximal femur, and shoulder girdle.

We present a case of a woman in her mid-50s with chondrosarcoma of the foot—a rare lesion that accounts for 0.5% to 2.97% of all chondrosarcomas. Distinguishing a chondrosarcoma of the foot from an enchondroma can prove difficult because of the greater cellularity and atypia that is allowable for enchondromas of the foot compared with those of other sites. There must be a combined clinical, radiographic, and histologic diagnosis. Treatment for chondrosarcoma is generally wide surgical excision. Chemotherapy or traditional radiation is not effective for most of these lesions.

Chondrosarcoma is a rare malignant cartilaginous tumor of the bone. It commonly occurs in the pelvis, proximal femur, and shoulder girdle. Chondrosarcoma of the foot accounts for 0.5% to 2.97% of all chondrosarcomas.[1-3] Traditional treatment is wide excision; however, some have had success with cryosurgery.[4-6] The authors have obtained the patient's informed written consent for print and electronic publication of this case report.

Case Report

A 56-year-old woman with an unremarkable medical history presented with an 18-month history of left foot pain. The patient described the pain as localized to the lateral aspect of the midfoot and to the heel with the pain increasing with the first few steps of weight bearing. She denied any history of trauma, erythema, swelling, or sensory changes to the foot. Our review of the patient's systems was negative for any systemic complaints.

Dr. DeComas is former Resident, Department of Orthopaedic Surgery, Ochsner Health System, New Orleans, Louisiana. She has completed her fellowship at MD Anderson Cancer Center, Houston, Texas, and is currently practicing Musculoskeletal Oncology at the CORE Institute, Phoenix, Arizona.
Dr. Lurie is former Resident, Department of Orthopaedic Surgery, Ochsner Health System, New Orleans, Louisiana. He now practices at Orthopaedic Associates of New Orleans, New Orleans, Louisiana.
Dr. Meyer is Residency Director, Department of Orthopaedic Surgery, Ochsner Health System, New Orleans, Louisiana.

Address correspondence to: Mark Meyer, MD, Ochsner Health System, 1514 Jefferson Hwy, New Orleans, LA 70121 (tel, 504-842-3970; fax, 504-842-6784; e-mail, msmeyer@ochsner.org).

Am J Orthop. 2011;40(1):37-39.

On physical examination of the left foot, the patient had mild tenderness to palpation over the left fourth metatarsal as well as mild tenderness over the area of the plantar fascia insertion at the base of the heel. The patient had no warmth, erythema, swelling, or effusion.

Radiographs revealed a "moth-eaten" appearance of the fourth metatarsal with considerable cortical destruction, endosteal scalloping, and probable soft-tissue extension (Figures 1, 2). There also was a hint of calcification within the lesion on plain radio-

Figure 1. Anteroposterior standing radiograph of the foot, revealing cortical thinning and expansion of the fourth metatarsal.

Figure 2. Standing oblique radiograph of the foot, revealing cortical breakthrough and scalloping of the fourth metatarsal with some areas of calcification.

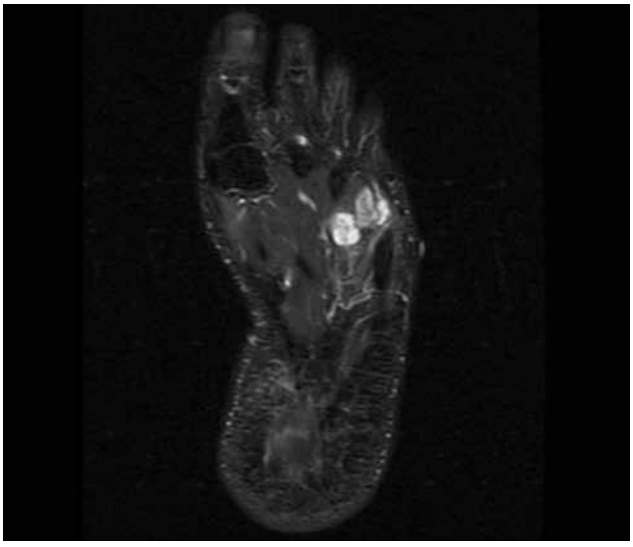

Figure 3. This axial short tau inversion recovery image reveals an area of increased signal intensity involving the fourth metatarsal with a lobulated appearance.

Figure 4. This thin-cut computed tomography scan reveals cortical thinning, cortical breakthrough, and matrix calcification involving the fourth metatarsal.

graphs. Bone scan showed intense uptake in the region of the fourth metatarsal. Magnetic resonance imaging (MRI) of the lesion showed cortical destruction, marrow replacement, and a soft-tissue mass with a cartilaginous matrix (Figure 3).

Computed tomography (CT) of the foot confirmed cortical destruction, soft-tissue mass, and presence of calcification within the lesion (Figure 4). Metastatic work-up, including a whole-body bone scan and chest CT, was negative.

An incisional biopsy was performed, confirming a cartilaginous neoplastic process that, when correlated with aggressive-appearing radiographic features, was consistent with a diagnosis of chondrosarcoma. The patient then underwent a fourth ray resection of her left foot. The specimens obtained were described grossly as 2 rubbery, firm nodules that were gelatinous in appearance, invading the surrounding cortical bone of the fourth metatarsal. Pathology confirmed the presence of low-grade chondrosarcoma of the fourth metatarsal with soft-tissue extension and negative surgical margins. No adjunct therapy was given.

The patient currently has been disease-free for 4½ years with no local or metastatic recurrence.

Discussion

In one review of 43 malignant neoplasms of the foot, by Murari and colleagues,[7] 22 neoplasms were chondrosarcomas, which led the authors to conclude that chondrosarcoma was the most common malignant neoplasm of the foot. The most commonly involved bone in this review was the metatarsal—as was the case with our patient, who had involvement of most of the fourth metatarsal shaft with some cortical breakthrough. Some studies have shown the most commonly involved bone to be the calcaneus.[3,8,9] It also has been shown that tumors occurring in the midfoot and hindfoot are more likely to be malignant than those found in the forefoot.[10]

The mean age at diagnosis for patients with chondrosarcoma of the foot has ranged from 46.5 to 52.3 years in previous studies.[3,4,11] Another interesting finding is the marked male predominance of chondrosarcoma of the feet (male to female ratio, approximately 2:1).[3,8,11] Pain is the most frequent presenting symptom. Commonly, patients also report an extended period of symptoms, ranging from 3 months to 72 years, with 70% of patients in one study having more than 4 years of symptoms and patients in another study averaging 19 years of symptoms.[11,12] Rarely does chondrosarcoma develop in patients with a previous enchondroma of the foot.[11,13,14] Distinguishing chondrosarcoma of the foot from enchondroma can prove difficult because of the greater cellularity and atypia that is allowable for enchondromas of the foot compared with other sites.[9,15] There must be a combined clinical, radiographic, and histologic diagnosis.[3,11] Cortical destruction and soft-tissue extension on radiographic and macroscopic sections are more reliable indicators of aggressiveness than histology. One study supports the idea that a diagnosis of chondrosarcoma is justified with radiologic evidence even if the histologic findings are not supportive of malignancy.[9]

The distinction is very important because of the rarity with which enchondroma becomes a malignant lesion. The common radiographic features of chondrosarcoma of the foot in one study included cortical destruction (90%), endosteal erosion (90%), matrix calcification (72%), bony expansion (72%), joint extension (27%), and pathologic fracture (9%).[3] Magnetic resonance imaging adds useful information because of high signal intensity on short tau inversion recovery and T_2-weighted images, cortical breakthrough, and

the ability to visualize the soft-tissue mass.[7] Gajewski and colleagues[10] showed that size helps to differentiate between an enchondroma and a chondrosarcoma (mean size of enchondroma, 2.7 cm^2; mean size of chondrosarcoma, 5.1 cm^2).

Recurrence and metastasis are not uncommon with chondrosarcoma of the foot. In one study, by Bovee and colleagues, 3 of 12 patients with chondrosarcoma of the foot developed recurrences, and all 3 patients ultimately died from metastasis (2 to the lung, 1 to the brain).[3] In another study, 6 of 11 patients with chondrosarcoma of the calcaneus developed recurrence.[9] Four of these 6 patients later developed metastasis, as did 2 others who had not developed a recurrence. In another study, by Nigrisoli and colleagues,[2] 5 of 10 patients had local recurrences, and 3 of the 5 patients died from metastasis.

Treatment for chondrosarcoma is surgical excison. Chemotherapy or traditional radiation is not effective for most chondrosarcomas. Multiple authors recommend aggressive treatment for chondrosarcoma of the foot.[3,9] Ray resection or amputation is recommended, while curettage or local excision is discouraged owing to the high rate of local recurrence, which likely would lead to metastasis. For example, in one study, 8 patients underwent curettage and all developed recurrence.[9] Rizzo and colleagues[16] showed a statistically significant association between positive margins and local recurrence, metastasis, and death. Wide excision is the treatment of choice and usually requires at least a 5-mm safety margin.[17,18] In the study by Bovee and colleagues,[3] 2 of the 3 recurrences occurred in patients who initially underwent limited local treatment. Cryosurgery, consisting of curettage with a triple freeze-thaw cycle of liquid nitrogen, followed by bone grafting, has been shown to be effective.[6] Due to the propensity for recurrence and metastasis, all patients with chondrosarcoma of the foot require long-term follow-up.

Conclusions

Chondrosarcomas are rare malignant tumors of the bone that are uncommonly found in the foot. Although uncommon, chondrosarcoma should be included in the differential diagnosis of destructive bony lesions in the foot.

Authors' Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article.

References

1. Dahlin DC, Henderson ED. Chondrosarcoma, a surgical and pathological problem; review of 212 cases. *J Bone Joint Surg Am*. 1956;38(5):1025-1038.
2. Nigrisoli M, Ferraro A, De Cristofaro R, Picci P. Chondrosarcoma of the hand and foot. *Chir Organi Mov*. 1990;75(4):315-323.
3. Bovee JV, van der Heul RO, Taminiau AH, Hogendoorn PC. Chondrosarcoma of the phalanx: a locally aggressive lesion with minimal metastatic potential: a report of 35 cases and a review of the literature. *Cancer*. 1999;86(9):1724-1732.
4. Ogose A, Unni KK, Swee RG, May GK, Rowland CM, Sim FH. Chondrosarcoma of small bones of the hands and feet. *Cancer*. 1997;80(1):50-59.
5. Masuda T, Otuka T, Yonezawa M, et al Chondrosarcoma of the distal phalanx of the second toe: a case report. *J Foot Ankle Surg*. 2004;43(2):110-112.
6. Chou LB, Malawer MM. Analysis of surgical treatment of 33 foot and ankle tumors. *Foot Ankle Int*. 1994;15(4):175-815.
7. Murari TM, Callaghan JJ, Berrey BH Jr, Sweet DE. Primary benign and malignant osseous neoplasms of the foot. *Foot Ankle*. 1989;10(2):68-80.
8. Patil S, de Silva MV, Crossan J, Reid R. Chondrosarcoma of the bones of the feet. *J Foot Ankle Surg*. 2003;42(5):290-295.
9. Landry MM, Sarma DP. In-situ chondrosarcoma of the foot arising in a solitary enchondroma. *J Foot Surg*. 1990;29(4):324-326.
10. Gajewski DA, Burnette JB, Murphey MD, Temple HT. Differentiating clinical and radiographic features of enchondroma and secondary chondrosarcoma in the foot. *Foot Ankle Int*. 2006;27(4):240-244.
11. Dohler R, Heinemann G, Busanny-Caspari W, Farrar MD. Chondrosarcoma of the first metatarsal--primary or secondary to enchondroma? *Arch Orthop Trauma Surg*. 1979;95(3):221-225.
12. Miki T, Yamamuro T, Oka M, Urushidani H, Itokazu M. Chondrosarcoma developed in the distal phalangeal bone of the third toe. A case report. *Clin Orthop*. 1978;(136):241-243.
13. Bakotic B, Huvos AG. Tumors of the bones of the feet: the clinicopathologic features of 150 cases. *J Foot Ankle Surg*. 2001;40(5):277-286.
14. Dahlin DC, Salvador AH. Chondrosarcomas of bones of the hands and feet--a study of 30 cases. *Cancer*. 1974;34(3):755-760.
15. Huvos A. *Bone Tumors: Diagnosis, Treatment and Prognosis.* 2nd ed. Philadelphia, PA: Saunders;1991.
16. Rizzo M, Ghert MA, Harrelson JM, Scully SP. Chondrosarcoma of bone. Analysis of 108 cases and evaluation for predictors of outcome. *Clin Orthop*. 2000;(391):224-233.
17. Hottya GA, Steinbach LS, Johnston JO, van Kuijk C, Genant HK. Chondrosarcoma of the foot: imaging, surgical and pathological correlation of three new cases. *Skeletal Radiol*. 1999;28(3):153-158.
18. Wagner A, Venbrocks RA, Fuhrmann RA. Chondrosarcoma of the calcaneus: amputation or resection with limb preservation: a case report. *Foot Ankle Int*. 2007;28(10):1090-1094.

This paper will be judged for the Resident Writer's Award.