Chondrosarcoma of the Foot
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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.\textsuperscript{1-3} Traditional treatment is wide excision; however, some have had success with cryosurgery.\textsuperscript{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.

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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.
graphs. Bone scan showed intense uptake in the region
of the fourth metatarsal. Magnetic resonance imaging
(MRI) of the lesion showed cortical destruction, mar-
row replacement, and a soft-tissue mass with a cartilagi-
nous 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 appear-
ance, 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, 22 neoplasms were chondrosar-
comas, which led the authors to conclude that chondrosar-
comas 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. 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.

The mean age at diagnosis for patients with chon-
drosarcoma of the foot has ranged from 46.5 to 52.3
years in previous studies. Another interesting find-
ing is the marked male predominance of chondrosar-
coma of the feet (male to female ratio, approximately
2:1). 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. Rarely does chondrosarcoma
develop in patients with a previous enchondroma of
the foot. 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.
There must be a combined clinical, radiographic, and
histologic diagnosis. Cortical destruction and soft-
tissue extension on radiographic and macroscopic sec-
tions 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.

The common radiographic features of chon-
drosarcoma of the foot in one study included cortical
destruction (90%), endosteal erosion (90%), matrix
calcification (72%), bony expansion (72%), joint exten-
sion (27%), and pathologic fracture (9%). Magnetic
resonance imaging adds useful information because of
high signal intensity on short tau inversion recovery
and T₂-weighted images, cortical breakthrough, and

![Figure 3](image-url). This axial short tau inversion recovery image reveals an area of increased signal intensity involving the fourth metatarsal with a lobulated appearance.

![Figure 4](image-url). This thin-cut computed tomography scan reveals cortical thinning, cortical breakthrough, and matrix calcification involving the fourth metatarsal.
the ability to visualize the soft-tissue mass. Gajewski and colleagues showed that size helps to differentiate between an enchondroma and a chondrosarcoma (mean size of enchondroma, 2.7 cm²; mean size of chondrosarcoma, 5.1 cm²).

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). In another study, 6 of 11 patients with chondrosarcoma of the calcaneus developed recurrence. 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, 5 of 10 patients had local recurrences, and 3 of the 5 patients died from metastasis.

Treatment for chondrosarcoma is surgical excision. Chemotherapy or traditional radiation is not effective for most chondrosarcomas. Multiple authors recommend aggressive treatment for chondrosarcoma of the foot. 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. Rizzo and colleagues 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. In the study by Bovee and colleagues, 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. 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**