A 39-year-old man presented with pain on ambulation 4 days after falling onto his left ankle. Neurovascular examination was normal, and no ligamentous instability was found. No significant swelling or deformity was evident. Pain was noted with subtalar motion and medial to lateral compression of the calcaneus. *Your diagnosis?*
DIAGNOSIS: Intraosseous lipoma of the calcaneus (Figure). Based on the amount of cortical involvement, the patient underwent curettage and iliac crest bone grafting through a lateral calcaneal approach. On gross examination following extraction of the tumor, a large 2.5×3.5 cm fibrofatty mass with random calcific stippling throughout the lesion was noted.

Histologically, an intraosseous lipoma of the calcaneus was confirmed by pathology. Using a new set of instruments to avoid cross-contamination and seeding, iliac crest bone graft was harvested to fill the capacious rent in the calcaneus. The wound was closed, and the patient was kept nonweight-bearing postoperatively.

Lipoma is a rare benign primary tumor of bone histologically comprised of mature adipose tissue. Lipomas involving bone are divided into two types: intraosseous (intramedullary) and parosteal. Parosteal lipomas are not true bone tumors and are considered to be a soft-tissue tumor. Intraosseous lipomas are extremely rare and account for approximately 0.1% of all primary bone tumors, excluding myeloma. In 1880, Cornill and Ranvier first reported this tumor, followed by Wehrsig in 1910. Since these original descriptions, the largest case series reported in the literature involves 61 patients. The most common location of intraosseous lipoma is the distal femur followed closely (approximately 15% of cases) by the calcaneus.

The first report of calcaneal involvement was by Child in 1955 and has been followed by several case reports. There is now known sex predilection. The most common sites are the metaphyses of long bones, especially the proximal femur and fibula. Involvement of the calcaneus also is a common occurrence. Other reported sites of occurrence include the tibia, maxilla, sacrum, phalanges, and the bones about the shoulder and elbow.

ETIOLOGY

The etiology of intraosseous lipoma is unknown. Historically, speculation has centered on a traumatic origin with subsequent fatty degeneration of the fracture callus. Others have suggested a role of prior bone infarct with fatty metaplasia. Today, most authors believe intraosseous lipoma represents a primary tumor of the medullary adipose tissue.

CLINICAL PRESENTATION

The clinical presentation of intraosseous lipoma is variable and depends on the location and aggressiveness of the lesion. Approximately two-thirds of patients are symptomatic, typically experiencing localized pain with variable amounts of soft-tissue swelling. The most common symptom of calcaneal involvement is heel pain with exertion. When asymptomatic, most lesions are found on incidental radiographs.

RADIOGRAPHIC FINDINGS

Conventional radiography alone can be diagnostic in approximately 50% of cases. Radiographically, intraosseous lipoma is characterized by a well-defined lytic lesion without an abundance of local reactivity. In long bones, the lesion may appear expansile with no periosteal reaction. In short tubular bones, the lesion has a geographic pattern with a sclerotic ring. Within the calcaneus, the lesion has a lytic appearance often accompanied by a central nidus of calcification. Most lesions occur in the triangle between the major trabecular groups in approximately the same location as simple cysts.

Computed tomography diagnosis
has been advocated by some as a means of avoiding a diagnostic lesional biopsy.\textsuperscript{13} Computed tomography characteristics of intraosseous lipoma include osteolysis, distinct definition of margins, and CT values typical of fat.\textsuperscript{5} The value of CT diagnosis seems to be in excluding malignant processes.

**HISTOPATHOLOGY**

Histologically, lipoma of bone consists of mature adipocytes that do not differ from common lipomas of soft tissue.\textsuperscript{1} Fat necrosis with dystrophic calcification frequently is seen and corresponds to the central nidus of calcification seen radiographically.\textsuperscript{1}

**DIFFERENTIAL DIAGNOSIS**

Differential diagnosis should include other benign lesions involving the calcaneus. Simple bone cysts, pseudocysts, aneurysmal bone cysts, chondroblastomas, chondromyxoid fibromas, and less commonly, eosinophilic granulomas and fibrous dysplasia can be distinguished from intraosseous lipoma. Plain radiographic and CT features of intraosseous lipoma can assist in the differential diagnosis.

**TREATMENT**

Outcomes or follow-up data regarding treatment of intraosseous lipoma are unavailable due to the rarity of these tumors. The most widely used treatment, however, is curettage through a wide bone window, with filling of the defect with autogenous bone graft or polymethylmethacrylate. Others have simply advocated serial observation with reservation of surgery for symptomatic lesions or impending fractures.\textsuperscript{4,6}

**PROGNOSIS**

Metastasis or sarcomatous transformation of intraosseous lipoma have not been reported in the literature. The natural history of this tumor resembles that of its soft-tissue counterpart. The tumor will continue slow intraosseous growth and eventually become symptomatic.

**CONCLUSION**

Although rare, intraosseous lipoma of the calcaneus is a benign lesion that can present as heel pain, ankle pain, or both, or may be asymptomatic and discovered on incidental radiographs. Depending on the degree of osseous involvement and whether weight-bearing limbs are involved, operative intervention including curettage and bone grafting or cementation may be necessary.

**REFERENCES**

1. Dorfman HD, Czerniak B. Bone Tumors.

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