

# Intraosseous Lipoma of the Calcaneus: A Clinicopathologic Study of Three Cases

*Intraosseous lipoma is a neoplasm which has classically been regarded in the literature as a rare bone tumor. The tumor has several distinguishing characteristics on plain film radiograph, magnetic resonance imaging, and computerized tomography scan. Due to appearances that are similar to simple bone cysts, infarctions, and other lesions, intraosseous lipomas are often misdiagnosed, possibly accounting for their purported rarity. Diagnosis based on plain film radiographs, magnetic resonance imaging, and computerized tomography scans, and appropriate treatments are discussed. Three case studies of calcaneal intraosseous lipomas are followed through the treatment course from initial presentation to postoperative follow-up. Radiographic studies and surgical procedures are discussed, as well as surgical pathology results that demonstrate the potential misdiagnosis of this tumor. (The Journal of Foot & Ankle Surgery 36(4):306-310, 1997)*

Key words: intraosseous, lipoma, calcaneus

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**I**ntraosseous lipoma is one of the rarest benign primary tumors occurring in bone (1-20). Cornill and Ranvier first described this tumor in 1880, and Childs published the first case of intraosseous lipoma involving the calcaneus in 1955 (1, 2). There is some disparity in the literature as to the number of reported and confirmed cases, but most investigators attest this to the rarity of the tumor. Dahlin estimates the incidence of intraosseous lipomas at less than one per thousand bone neoplasms seen at the Mayo Clinic (3), and the incidence of intraosseous lipomas involving the calcaneus is even less (15% of all intraosseous lesions) (4).

The calcaneus has many anatomical features that make it potentially more prone to develop tumors. Internally, it has an abundant vascular supply and a large cancellous component, which may sequester tumors for long periods of time before they become symptomatic. Externally, it has an extensive surface area and numerous points of attachment for intrinsic and extrinsic

muscles, tendons, and ligaments that make it susceptible to a vast array of tumors and tumor-like conditions. Its role in ambulation also causes it to have a high propensity for trauma (5, 6). However, the etiology of the intraosseous lipoma is still unknown. The most common hypothesis is that it represents a true benign neoplasm of marrow adipose tissue, whereas others postulate a healed bony infarct, secondary to trauma, to be the cause (3, 7). Freiberg et al. suggested a metabolic cause for multiple intraosseous lipomas associated with hyperlipoproteinemia (8).

## General Diagnosis and Treatment Guidelines

The most frequent presenting symptoms are localized pain and soft tissue swelling (9). However, the lesion is often discovered as an incidental finding on a radiograph and may be completely asymptomatic (10, 11). A review of the literature as stated by Ramos et al. concluded that approximately one-third of patients with intraosseous lipomas were asymptomatic (12).

The tumor may present varying radiographic features, dependent upon its stages of evolution, that may cause confusion in diagnosis (13). Therefore, lipomas may be confused with other benign tumors, simple cysts, and cases of bone infarction. Many investigators agree that the reported rarity of intraosseous lipomas is possibly secondary to incorrectly categorizing these lesions as infarcts or unicameral and aneurysmal bone cysts (1, 11, 12, 14, 15). Radiographically, the lesion is often seen as an osteolytic area with a well defined or sclerotic border.

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Furthermore, when the intraosseous lipoma consists of live fat cells, it is seen as a radiolucency on plain film radiograph due to resorption of bone, and it may be expansile. When fat necrosis is present, the lesion may show areas of increased density due to fat calcification or reactive bone formation. Occasionally, a central nidus of calcification is found, helping to differentiate the intraosseous lipoma from a unicameral bone cyst which has no central focus of calcification (16). Fatty tumors of the calcaneus invariably occur in the region of the neutral triangle or pseudocyst (11). Ramos et al. found that intraosseous lipomas have this characteristic pattern, enabling accurate diagnosis using conventional radiographs in 50% of the cases involving calcaneal lesions (12). Another lesion that is present in the calcaneus that may be similar to the lipoma is the chondroblastoma. Unlike the intraosseous lipoma that tends to be trapezoidal in shape, the chondroblastoma appears as a spherical lesion with occasional characteristic small, punctate, and multiple calcifications (7). In the cases of intraosseous neoplasms that do not have a central nidus, computerized tomography (CT) or magnetic resonance imaging (MRI) should be used to aid in the diagnosis.

A CT scan can definitively diagnose the presence of an intraosseous lipoma by measuring the attenuation of the lesion. Tissue density is measured using Hounsfield units (HU) and is calculated from the measured x-ray relationship of air (-1000 HU) and water (0 HU). Furthermore, dense bone is measured to be between +1000 and +2000 HU and soft tissue between +40 and +60 HU. Fatty tissue has a typical density of approximately -100 HU based on this scale. However, the extent of calcification within the lesion may alter the significance of the lipoma attenuation rate. A negative tissue attenuation value aids in differentiating intraosseous lipomas from unicameral or aneurysmal bone cysts, which have positive values (1, 2, 12, 14, 16-18).

Although CT seems to be the most popular noninvasive tool for diagnosing intraosseous lipomas, MRI is also effective. MRI shows a well demarcated lesion with a short T1 relaxation value that reflects a high signal intensity consistent with normal adipose tissue. Regions where the signal is absent correspond to the central nidus or other ossifications. Areas of necrosis or cyst formation have signal characteristics of fluid, demonstrating low signal intensity on T1-weighted images, and high signal intensity on T2-weighted images (4, 6, 14, 17, 19). Moreover, the expansion of the bony contour may be appreciated on axial images (6).

Lauf states that if a lesion is asymptomatic and is not in an area subject to stress, trauma, or load, then radical treatment of this benign lesion may not be indicated (15). However, if the lesion occurs in an area where

there is stress, trauma, or weightbearing, a pathologic fracture can have serious consequences. Therefore, prompt treatment is indicated. Symptomatic patients should undergo curettage and biopsy along with bone grafting. If, upon histological examination, premalignant or malignant changes of tissue are noted, then a more radical excision should be performed. The potential for malignant degeneration of fatty tumors of bone has not yet been shown in cases of intraosseous lipomas involving the calcaneus.

### Case 1

A 62-year-old white male presented to the Hines Veterans Administration Medical Center (VAMC) Podiatry Clinic on March 21, 1990 for an eight-month follow-up of a left fibular sesamoid fracture. The sesamoid pain had largely resolved, but the patient had a new complaint of left heel pain. The patient related mild but noticeable tenderness in the left heel of approximately 1 year's duration with the first steps in the morning and after extended standing or ambulation. There was no history of trauma or previous injury. His physical exam was negative for any pain with palpation in or around the left heel. No radiographs were taken, and the diagnosis at this visit, based on subjective and objective findings, was plantar fasciitis.

Eight months later the patient presented for follow-up and related no improvement or change in heel pain. His physical exam revealed some tenderness with subltalar range of motion. Radiographs were taken and a well circumscribed radiolucent lesion was seen at the anterior aspect of the calcaneus near the inferior aspect of the subtalar joint (Fig. 1). A CT scan of the left foot was taken and a well circumscribed, expansile lesion was noted below the middle facet of the subtalar joint in the left calcaneus. The cyst extended anteriorly to a level near the subchondral bone adjacent to the calcaneal-cuboid joint. The joints themselves did not appear to be involved (Fig. 2). The patient was admitted on Decem-



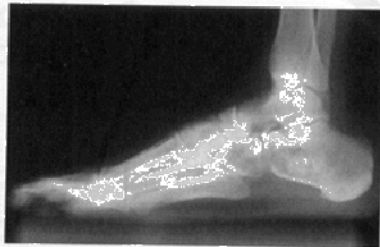
**FIGURE 1** A well circumscribed, radiolucent lesion at the anterior aspect of the calcaneus, consistent with intraosseous lipoma, Case 1.



**FIGURE 2** CT scan of left foot showing a well circumscribed, expansile lesion below the middle facet of the subtalar joint. Note the joints themselves do not appear to be involved, Case 1.

ber 27, 1990, and was brought to the operating room the next day for curettage and packing with freeze-dried bone graft, after being given an ankle block. Two tissue samples were taken for biopsy, as well as fungal, AFB, and aerobic and anaerobic culture and susceptibilities. The intraoperative bacterial and fungal cultures were all negative, and pathology diagnosed the two tissue specimens to be fragments of bone and adipose tissue consistent with intraosseous lipoma. The patient was placed in a below-the-knee, nonweightbearing cast and discharged on December 31, 1990 for outpatient followup.

The patient spent 4 weeks in nonweightbearing casts and 2 weeks in partial weightbearing casts. Follow-up radiographs showed remodeling and healing of the graft site with a gradual return of trabecular pattern (Fig. 3). At the March 25 appointment, the patient was ambulating pain free in normal shoe gear with continued signs of healing radiographically. The patient continues to participate in normal activities as of August 2, 1995, and there has been no clinical or radiographic signs of recurrence or complication.



**FIGURE 3** Radiographs at 6-weeks postop reveal remodeling and healing at the graft site, Case 1.

### Case 2

A 31-year-old white female presented to the Loyola University Medical Center's Podiatry Clinic complaining of severe pain in the right heel of one year's duration. Her physical exam revealed considerable tenderness to palpation along the lateral border with lesser tenderness at the medial calcaneal tuberosity consistent with plantar fasciitis. Radiographs revealed a rather large calcaneal cyst approximately 4 cm. in diameter (Fig. 4). CT suggested this lesion to be on the lateral side of the heel in the same area where tenderness on palpation was noted. Bone scans were negative, suggesting a benign lesion. The impression was that there was a bone cyst in the right foot with possible nonossifying fibroma, unicameral bone cyst, or intraosseous lipoma. The patient was admitted on October 13, 1991, and was brought to the inpatient operating room the next day for curettage and debridement of the calcaneal cyst with packing, utilizing an autogenous iliac crest bone graft under general anesthesia. The lesion contained tan-red and tan-gray soft tissue, and pathology diagnosed them to be fragments of thin, lamellar, bony spicules surrounded by fibrous tissue and granulation tissue, as well as adipose tissue consistent with intraosseous lipoma. The procedure went well, and there were no postoperative com-



**FIGURE 4** A large radiolucent calcaneal lesion consistent with intraosseous lipoma, Case 2.

plications. The patient was placed in a below-the-knee, nonweightbearing cast and discharged on October 18 for outpatient follow-up. Radiographs taken 2-months postoperative revealed signs of bone incorporation. The patient related no complications. At 3-months postoperative, the patient returned to full community ambulation, however, the patient related occasional numbness along the lateral column of the foot. Radiographs demonstrated continued remodeling and healing of the graft site (Fig. 5). At the 2-year follow-up, the patient related no complications.

### Case 3

A 41-year-old white male presented to the Hines VAMC Podiatry Clinic with a left foot that had been painful for many years. The patient sustained closed head injuries in the early 1970s and was a wheelchair ambulator. His physical exam revealed considerable pain on palpation along the lateral aspect of the left heel. A bony protuberance on the lateral side was also noted. The patient related an increase in pain and an increase in the size of the protuberance occurring over several months. Radiographs and an MRI revealed a large

calcaneal cyst on the lateral side of calcaneus where the pain and protuberance were noted. An MRI revealed a lesion consistent with a lipoma that was intraosseous in the calcaneus. The patient was admitted on April 20, 1992 and brought to the operating room the next day for curettage and debridement of the intraosseous lipoma with autogenous iliac crest bone graft packing under general anesthesia. This was performed without complication. Radiographically, the bone graft had fully incorporated 3-months postoperative and the heel pain had resolved. However, the patient developed intractable neuritis/nerve entrapment of the lateral dorsal cutaneous nerve that failed to respond to accommodation and local corticosteroid injections. Ultimately, the patient required two additional surgeries to address the neuritis/nerve entrapment. The patient showed longterm incorporation of the bone graft with no complications regarding the intraosseous lipoma at the 2-year follow-up (Fig. 6).

### Discussion

Three surgeries involving intraosseous lipomas of the calcaneus were presented. Each patient underwent similar procedures including curettage and debridement of the lesion. However, in one case (Case 1), the surgeon used a freeze-dried bone graft in order to replace the cancellous bone, whereas in the other two cases (Case 2 and Case 3), the surgeon used an autogenous bone graft from the patients' iliac crests. The strong potential for pathologic fracture of the calcaneus as well as subjective complaints in the patients made surgical intervention imperative. Currently, none of the patients has shown any complications to the procedure nor any recurrences of the lipoma.

At the time of the first surgery (Case 1), the diagnosis based on plain film radiograph was aneurysmal bone cyst



FIGURE 5 Radiographs at 3-months postoperative demonstrate incorporation of the graft, Case 2.

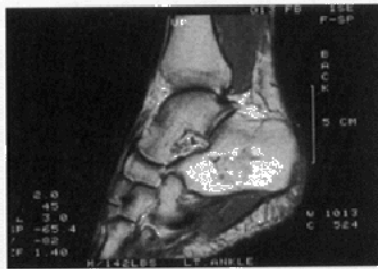


FIGURE 6 MRI at 2-years postoperative reveals complete incorporation of graft, Case 3.

or unicameral bone cyst. The diagnosis of intraosseous lipoma was not made until the pathology results were available. In retrospect, that would have done little to change our treatment plan, therefore the differential diagnosis is largely an academic issue. Moreover, this reinforces the point that intraosseous lipomas may often be misdiagnosed and, therefore, are not as rare as once believed. This point has also demonstrated that patients presenting with heel pain, whether acute or chronic, should have radiographs and careful follow-ups to rule out any osseous abnormality before diagnosing "typical plantar fasciitis." Although bone cysts and calcaneal fractures are not usually the cause of heel pain, the risk of pathologic fracture warrants this precaution, especially due to the stress of weightbearing and gait. Furthermore, there have not been any published reports of intraosseous lipoma reoccurring after this type of procedure.

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