Case report

RADIOLOGICAL DIAGNOSTICS OF RARE BENIGN BONE TUMOR INTRAOSSEOUS LIPOMA (Intraosseous lipoma)

Nemanja Rančić¹, Jelena Golubović¹, Jasna Pešić¹, Ratko Stamatović¹, Miroslav Mišović¹,
Biserka Vukomanović-Đurđević², Jasenka Vasić-Vilić¹

¹Institute of Radiology, Military Medical Academy, Belgrade

²Institute of Pathology, Military Medical Academy, Belgrade

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Abstract

Introduction/Aim: Lipomas are frequent benign tumors; however, they are rarely localized in bone tissue. Osseous lipomas are categorized according to their location into parosteal, intraosseous, and intracortical. The incidence of intraosseous lipomas is 0.1% of all bone tumors. The most frequent location is in the long tubular bones and calcaneus. This case report aims to present the radiological diagnostics of intraosseous lipoma. **Case report:** 43-year-old patient with Achilles tendon rupture was admitted to the orthopedic clinic. Radiography of left ankle joint detected a radiolucent, well-circumscribed lesion in the anterior aspect of the calcaneus with a sclerotic board. Magnetic resonance imaging (MRI) revealed bone lesion dimension anteroposterior, craniocaudal, and laterolateral 38 x 22 x 37 mm, composed of peripheral adipose tissue and central calcified nidus, which indicate intraosseous lipoma. Based on histopathological findings, necrotic and viable bone tissue with components of mature and necrotic fatty tissue confirmed the diagnose of intraosseous lipoma. **Conclusion:** Standard radiographs of bone structures, as the first diagnostic procedure, can make suspects of intraosseous lipoma. MRI and multidimensional computerized tomography can further verify and with more details completely characterize, while histopathological verification is the final step in the diagnose of intraosseous lipoma.

Key words: lipoma, intraosseous tumor, calcaneus, radiography, MRI

Introduction

Intraosseous lipomas (IOL) are benign bone tumors that are composed of mature adipose tissue with no evidence of cellular atypia. It is one of the rarest primary benign bone tumors, but the most common lipogenic tumor in bone ¹. Bone marrow consists of red bone marrow, known as myeloid tissue, and yellow bone marrow, or adipose tissue, from which the development of intraosseous lipoma should be expected ². The IOL is asymptomatic lesion located in the long bones and calcaneus, and often discovered incidentally ³. The major concern is an extensive differential diagnosis as numerous benign and malignant bone lesions have a similar radiographic appearance as IOL ¹. A histopathological examination usually confirms accidental radiological findings of the intraosseous lipoma. Here we present the case and radiological diagnostics of intraosseous lipoma.

Case report

A 43-year-old patient with Achilles tendon rupture was admitted in the orthopedic clinic. He complained of sudden and moderate pain at the back of the left ankle, which appeared during recreational sports. The physical examination showed mild to moderate swelling near the heel. Radiography of left ankle joint in standard anteroposterior (AP) and laterolateral (LL) projections (Vizaris Vision C, Belgrade, Serbia). The plain radiographs showed radiolucent, well-circumscribed 2-2.5 cm, sharply demarcated lesion, on the anterior aspect of the calcaneus, with a sclerotic board and calcified nidus 5-10 mm (Figure 1.). There was no periosteal and no cortical reaction of the bone involved. Radiographic characteristics, typical location, and appearance of the well defined lytic lesion with a central dystrophic calcification known as cockade sign were considered as IOL. The diag-

Figure 1. Radiography, lateral view: radiolucent, well-circumscribed, osteolytic lesion of the anterior aspect of the calcaneus with the sclerotic board and central nidus of calcification.

nostic approach included magnetic resonance imaging (MRI) in T1-weighted image (T1WI), T2-weighted image (T2WI), and Short tau inversion recovery (STIR) sequence (GE Signa 3.0T system, GE, Chicago, USA).

MRI showed well-demarcated lesion 38 x 22 x 37 mm (AP, craniocaudal (CC) and LL) characterized with high signal intensity at the edge in the T1WI and T2WI sequences and the central part low signal intensity. In the STIR sequences, the edge intensity of the signal decreases, the central intensity of the signal remains low, which indicates that the lesion is made of the fat component peripheral and central calcification so it corresponds to intraosseous lipoma. Small necrotic areas had signal characteristics of fluid, slow signal intensity on T1WI, and high signal intensity on T2WI. ova recenica kao da nije završena, nije jasna Based on paramagnetic characteristics, we concluded that bone lesion, composed of peripheral

adipose tissue and central calcified nidus is intraosseous lipoma (Figure 2). Orthopedic excision included tumor removal with the edge of resection without tumor tissue. Macroscopically fatty tissue was observed within the obtained bone fragment on the intersection mature fatty tissue was observed. Histopathological examination showed small areas of necrotic bone fragments, mature adipose tissue, and fibrous tissue. In a minor part of the tumor, mature adipose tissue without elements of hematopoiesis surrounded bone spicules of viable bone tissue (Figure 3).

Discussion

Intraosseous lipomas are benign tumors with unknown etiology and good prognosis¹. With an incidence of 0.1% to 2.5% of all primary bone tumors, intraosseous lipomas are some of the rarest bone tumors⁴. Two thirds (63%) of the intraosseous lipoma occurred in males, 30 to 60 years old, predominantly younger than 40 years, as was the case with our patient^{3,4}.

The same as in our case, the most common location of intraosseous lipomas is the region of Ward's triangle within the calcaneus⁵. However, the intraosseous lipoma is often asymptomatic and frequently misdiagnosed due to its heterogeneous radiologic and histopathologic appearance. The symptoms are usually non-specific and occur in the period between months to years. Usual symptoms are dull aching pain, swelling, and tenderness of the lateral ankle or region of the foot, similar to plantar fasciitis. Healing bone infarct, benign neoplasm, and post-traumatic secondary bone reaction can coexist with the intraosseous lipoma^{3,5}. The first report of an intraosseous lipoma was reported by Brault, in 1868 and Milgram reported four cases of its malignant transformation⁶.

The typical radiographic appearance of intraosseous lipoma is well defined lytic lesion with or without central calcification and sclerotic margins. The radiographical appearance of intraosseous lipoma is usually uncharacteristic so that it can be similar to many benign bone lesions such as simple or aneurysmal bone cysts, chondroblastoma, liposclerosing myxofibrous tumor (LSMFT), bone infarction, avascular osteonecrosis or some other benign bone tumors^{1,4}. Occasionally, we can find

Figure 2. MRI: bone lesion dimension (CC/AP/LL) 38 x 22 x 37 mm composed of peripheral adipose tissue and central calcified nidus, which indicate intraosseous lipoma.

a central nidus of calcification, which could be a useful sign to differentiate the intraosseous lipoma from a unicameral bone cyst, usually find in children, which has no central focus of calcification ².

Bone infarction as a consequence of medullary osteonecrosis and avascular osteonecrosis, as a result, a subchondral osteonecrotic process are results of ischemia. They can lead to osteodestruction, pain, and loss of function, similarly as an intraosseous lipoma. Bone infarctions have numerous causes and have fairly distinctive imaging features on

conventional radiography, multidetector computed tomography (MDCT), and MRI ⁷. The double line sign on MRI is a typical finding and consequence of demarcation between the normal and ischemic zone developed from viable granulation separating dead tissue in avascular osteonecrosis.

LSMFT consists of lipomatous, fibroxanthomatous, myxomatous, and myxofibromatous components, have sclerotic margin and may resemble at IOL, but does not usually show macroscopic fat on MDCT or MRI. Chondroblastomas present as well

Figure 3. Histopathological examination confirmed diagnosis of intraosseous lipoma by showing areas of necrotic bone fragments, mature adipose tissue, calcification and fibrous tissue without elements of hematopoiesis.

defined lucent lesions, with solid periosteal reaction and internal calcification. MRI mostly showed associated surrounding bone marrow and soft tissue edema, which isn't pathognomonic for IOL.

Large intraosseous lipomas can be associated with a thin cortex, cortical penetration, or periosteal reaction, which is clinically associated with

pain and swelling ⁵. The plain radiographs performed in our patient showed radiolucent, well-circumscribed 2-2.5 cm, sharply demarcated lesion, with a sclerotic board on the anterior aspect of the calcaneus with a sclerotic nidus 5-10 mm in large, in the center.

Multiple detector computed tomography (MDCT) is a noninvasive tool for diagnosing intraosseous lipomas, which reveals intraosseous well-circumscribed fat density lesion with sclerotic margins. Calcified nidus, as other calcifications in MDCT are visible as hyperdense areas, while in MRI are visible as low signal intensity. In our case, we have decided to perform MRI as more sensitive than MDCT and more specific diagnostic procedures for bone tumors pathology.

The MRI commonly shows a well-demarcated lesion with high signal intensity on T1WI and shortening of a signal on T2WI the same as subcutaneous fat tissue. Short T1 and T2 relaxation values reflect high signal intensity consistent with normal adipose tissue. STIR image represents complete fat suppression with low signal intensity, so that confirms the diagnosis of fat existence. Areas of cyst formation have signal characteristics of the fluid, demonstrating low signal intensity on T1WI, and high signal intensity on T2WI ².

In our case, MRI showed well-demarcated lesion with high signal intensity at the edge in the T1WI and T2WI sequences, but low signal intensity at the central part of the lesion. In the STIR sequences, the edge intensity of the signal decreases, the central intensity of the signal remains low, which corresponds with fat component and peripheral and central calcification of intraosseous lipoma.

According to MDCT or MRI characteristics, Milgram divided intraosseous lipoma into three stages, based on different degrees of involution and necrosis. Stage I is roughly delineated, viable lipoma with homogeneous fat content. Stage II represents predominantly fatty lesions with central necrosis, calcifications, or ossifications, while stage III represents heterogeneous, fat-containing lesions, cystic formations, wall sclerosis, necroses, and extensive calcifications or ossifications ⁸. Based on this staging, our patient belongs to stage II. Although MDCT and MRI can be very helpful in establishing the diagnosis, the histopathological analysis is the final method of this type of tumor confirmation ^{1, 9}. The bone MDCT or MRI precedes biopsy.

Intraosseous lipomas have characteristic features based on their evolutionary changes, which used Milgram to divide them into three histopathological stages. The stage I- lesions characteristics are viable fat cells; there is no cellular atyp-

ia, mitoses, or capsular tissue. The stage II-lesions are composed of fat cells with areas of necrosis and calcification, and the stage III-lesions presents with necrosis, calcification, cyst, and reactive new bone formation. Histopathological examination of our patient's lesion shows a picture stage II of Milgram ⁴. Histopathologic confirmation is determined by the actual procurement of a tissue specimen, and it is advised to be done promptly as it is done in our patient.

Asymptomatic intraosseous lipoma of the calcaneus can undergo spontaneous involution; therefore, their treatment is conservative. The surgical removal is suggested in case of severe pain and as prevention of a pathologic fracture, especially when the lesion is in weight-bearing bone ^{3, 5, 10, 11}. The surgical curettage with or without grafting is a method of choice. Bone graft, from the autologous iliac crest, is used to "backfill" the evacuated cyst defect ^{1, 5}. About 90% of patients are recovered completely after 6-12 months of usual treatment process ^{3, 12}. The patient needs to avoid sports and activities involving direct impact over the heel for 12 weeks post-operatively.

Conclusion

Standard radiographs of bone structures with the clinical examination are the first diagnostic procedures which directing on a further course of diagnostics and treatment. Only standard radiographs made in standard projections can detect intraosseous lipoma. The MRI and MDCT scans can further verify and, with more details, present susceptible lesions. Histopathological verification is the final step, confirm the diagnose of the observed lesion.

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