"Do Not Touch": An Uncommon Benign Fatty Bone Tumour

A 27-year-old male with no medical illness presented to the orthopaedic clinic with left knee pain since 1 week. There was no history of trauma. There was no tenderness or swelling on physical examination and the range of motion of the left knee was normal. Frontal and lateral radiographs of the left knee (Fig. 1) were obtained, which showed an eccentric and well defined radiolucent lesion with a thin sclerotic rim located in the proximal metadiaphysis of the left tibia. The lesion had a narrow zone of transition. There was no cortical destruction, periosteal reaction or any soft tissue swelling. The left knee joint was normal. The radiographic findings were in keeping with a non-aggressive bone lesion of the tibia.

What is the most likely diagnosis?

A. Fibrous dysplasia
B. Non-ossifying fibroma
C. Simple bone cyst
D. Chondroid tumour
E. Intraosseous lipoma

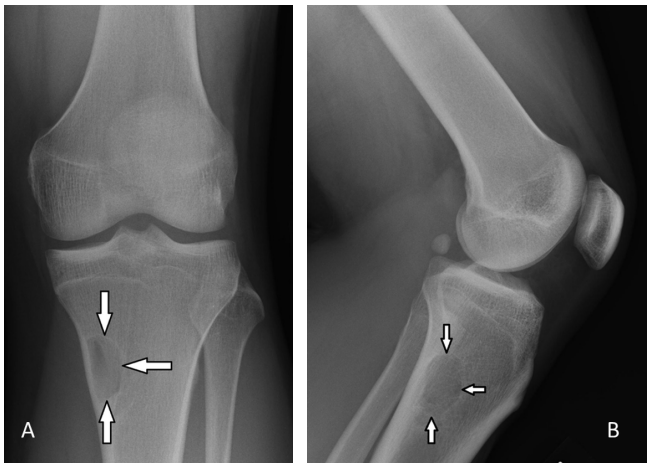

Fig. 1. A) Frontal and B) lateral radiographs of the left knee show an eccentric radiolucent lesion with a thin sclerotic rim (arrows) located in the proximal metadiaphysis of the left tibia.

Findings and Diagnosis

Radiographically, the common differential diagnosis of non-aggressive lucent lesion affecting the tibia in patients less than 40 years of age includes fibrous dysplasia, non-ossifying fibroma, simple bone cyst, aneurysmal bone cyst, and chondroid tumours like chondromyxoid fibroma and enchondroma.

Subsequently, magnetic resonance imaging (MRI) of the left knee was performed on the patient. The MRI showed that the lesion was hyperintense, with signal intensity similar to that of the subcutaneous fat on coronal T1-weighted MRI image (Fig. 2A). It had a thin hypointense rim that corresponded to the sclerotic margin seen on radiographs. On the coronal T2-weighted fat-suppressed MRI image, the lesion appeared largely hypointense, consistent with the suppression of fat signal (Fig. 2B). The lesion also showed an irregular internal low signal intensity area on the T1-weighted image which appeared hyperintense on T2-weighted fat-suppressed image. The diagnosis was intraosseous lipoma. The patient has been asymptomatic since then. Hence, no follow-up investigation was done.

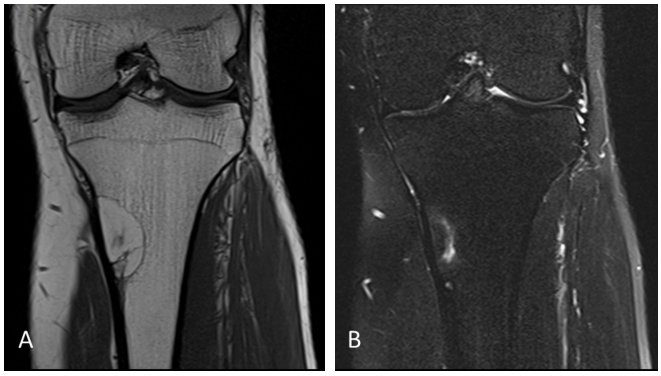

Fig. 2. A) Coronal T1-weighted MR image shows a well defined hyperintense lesion, with signal intensity similar to that of subcutaneous fat, in the medial proximal tibia. It has a thin hypointense rim corresponding to the sclerotic margin and an irregular internal low-signal-intensity area corresponding to fat necrosis. B) Corresponding coronal T2-weighted MR image with fat suppression shows a largely hypointense lesion consistent with suppression of fat signal. The central hyperintense area within the lesion is consistent with fat necrosis.

Answer: E

Discussion

Intraosseous lipoma was first described in 1880.[1] It is a rare primary bone tumour accounting for only 0.1% cases of all primary bone tumours.[1-4] With the increasing use of computed tomography (CT) and MRI, intraosseous lipomas are now diagnosed more often than before.[1,2] It can affect both sexes of any age group; however, it is most commonly discovered in the fourth and fifth decades of life.[2,3]

It is generally intraosseous but can be cortical or parosteal.[3] It may affect any skeletal bones due to normal marrow fat content.[2] In the appendicular skeleton, the common sites are the intertrochanteric and subrochanteric regions of femur, calcaneum, ilium, proximal tibia, and fibula.[5] In the axial skeleton, the craniofacial bones, pelvis, spine and ribs are more commonly involved, in decreasing order of frequency.[2,5] It usually affects the metadiaphysis of long bones.[3]

Clinically, pain might be the presenting symptom in 70% of patients.[5] Others are asymptomatic and discovered incidentally.[5] The exact cause of the pain is unclear but it may be due to expansile bone remodelling.[2,3] Some patients may present with swelling or pathological fractures.[1,2]

Milgram proposed a 3-stage classification system for intraosseous lipomas based on their histological appearances (Table 1).[2] The appearances on radiographs, CT and MRI often correspond to the histological stage of the lesion. The stage I lesions are radiolucent, with or without bony expansion, and represent viable, non-necrotic fat with resorption of bony trabeculae. On CT, the lesion shows fat attenuation ranging from -60 to -100 HU.[3] On MRI, the lesion has signal intensity similar to that of subcutaneous fat on all sequences including the fat-suppressed sequence.[1,3,4] Stage I lesions may show a peripheral rim of sclerosis on radiographs and CT images which appear as rim of low signal intensity on T1- and T2-weighted MRI images.[2-4] In stages II and III, intraosseous lipomas appear as an expansile lucent lesion with peripheral sclerotic rim and central area of increased density on conventional radiographs and CT. This finding is due to fat necrosis followed by dystrophic calcification. Stage III lesions are more radiodense with thicker peripheral zone of reactive sclerosis than stage I or II lesions, due to extensive areas of fat necrosis and calcification, and greater cystic changes.[2,3] On MRI images, areas of fat necrosis reveal variable signal on T1-weighted images and increased signal on T2-weighted images.[1,4] The areas of calcification have low signal intensity on both T1- and T2-weighted images.[1,4] Cysts are seen as well defined areas of intermediate signal intensity on T1-weighted images and high signal on T2-weighted images.[5] Stage III lesions are most confusing and difficult to diagnose due to fat necrosis, calcification, cystic changes and reactive ossification closely mimicking bone infarcts and chondroid lesions. Other lesions which may closely mimic lipomas on radiographs are fibrous dysplasia, simple cysts, non-ossifying fibroma, chondromyxoid fibroma and aneurysmal bone cysts. Hence, identification of fat signal on CT and MRI is crucial and helps confirm the diagnosis of intraosseous lipoma.[4]

Table 1. Milgram's Histological Classification for Intraosseous Lipoma

Stage	Histopathological Classification
I	Non-necrotic viable fat with resorption of bony trabeculae.
II	Partial necrosis of the fat together with viable lipocytes.
III	Extensive fat necrosis with variable grade of dystrophic calcification and cyst formation.

Management in an asymptomatic patient involves conservative treatment with regular follow-up scanning. Pain and swelling suggest a complication such as pathological fracture or malignant transformation, which can be treated with surgical curettage and bone grafting.[1,2] MRI may be useful in the follow-up of treated lesions. Malignant transformation or recurrence after surgery is very rare.[1] Milgram reported 4 cases of presumed malignant transformation in which lipoma developed into malignant fibrous histiocytoma or liposarcoma. If a stage I lipoma shows rapid bone destruction associated with pain, malignant transformation of lipoma should be suspected. [6]

Conclusion

Although lipomas are an uncommon bone neoplasm, they may not be as rare as the literature suggests. Hence, it is important to recognise the characteristic radiographic, CT or MRI appearances of intraosseous lipomas in guiding appropriate management and preventing unnecessary biopsy and surgery.

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