Unicameral Bone Cyst

By Le Trong Binh, MD [2]

Case History: A 20-year-old female admitted to the hospital complaining about a vague mild pain in her left knee joint area. She first noticed the pain several months ago without impact on her daily activities. Physical examination was unremarkable for knee joint effusion or swelling, deformity or activity limitation. She denied any history of injury to the knee. Laboratory test was normal for inflammation or rheumatoid.

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Figure 1. Frontal and lateral radiograph of the left knee demonstrate a geographic well-defined lytic lesion (white arrow) in the metadiaphysis of the distal femur with a sharp zone of transition. The long axis of the lesion parallels that of the long axis of the femur. There is no evidence of bone expansion, erosion or periosteal reaction. Overlying cortex remains intact. This finding is suggestive of a simple (unicameral) bone cyst, type IA according to Lodwick classification.

Figure 2. CT scan reveals a simple bone cyst in the distal metaphyseal region of the left femur. The cyst is centrally located in the medullary cavity of the femur with unremarkable expansion and thinning of the overlying bony cortex. No evidence of pathological fracture, fallen fragment or calcification.
Figure 3. On MRI, the lesion appears as relatively homogenous hypointense on T1W and hyperintense on T2W, T2 FLAIR and STIR which is consistent with simple bone cyst.

**Diagnosis:** Unicameral bone cyst

**Discussion:** Simple or unicameral bone cysts (UBC) are expansile, serous-fluid-containing defects that are not true neoplasms. This lesion was first described by Virchow R in 1876 and then was recognized by Bloodgood as a different entity from other cystic bone lesions in 1910. Jaffe and Lichtenstein provided a detailed discussion of simple bone cysts in 1942. Peak age ranges between
3-14 years in 80 percent of cases. The incidence is estimated at 3 percent of all bone lesions, with a male to female ratio of 2:1. The majority of these cysts occur in the proximal humerus (70 percent) and femur (25 percent). While exact figures are unknown, it is estimated that approximately 75 percent of children present with pathologic fracture. Cysts heal in less than 15 percent of children following fracture. Although unicameral bone cysts are believed to resolve with skeletal maturity, without treatment these children are at risk for pain, or recurrent fracture leading to activity restriction for many years. Many theories have been proposed to explain the pathogenesis of unicameral bone cysts. An early theory was that injury to the growth plate leads to abnormal endochondral bone formation. Another theory suggests that vascular obstruction causes cyst fluid to accumulate under pressure and expand at the expense of the normal bone. Other theories include blocked fluid drainage, increased lysosomal enzyme activity, prostaglandins, nitric oxide, oxygen free radicals, disorders of synovial origin and genetic causes. As these hypotheses concerning the pathogenesis of UBCs have evolved, various methods of treatment of unicameral bone cysts have been proposed, such as treatment with open curettage with bone-grafting, intralesional injection of steroids, autologous bone marrow, percutaneous injection of allogenic demineralized bone matrix, and percutaneous curettage and bone grafting with widely variable success rate.

Simple bone cysts usually present as well-defined, geographic lesions with narrow transition zones on radiograph. A thin sclerotic margin is a typical finding. Simple bone cysts are usually situated in the intramedullary metaphyseal region immediately adjacent to the physis. Occasionally, they may be diaphyseal. The long axis of the lesion parallels to that of the long axis of the tubular bone. Lesions may cause expansion of the bone with thinning of the overlying cortex. Some may have a multicellular appearance. In long bones, simple bone cysts are typically centrally located within the medullary cavity. A pathologic fracture through a simple bone cyst is a common occurrence. This may lead to the "fallen fragment" sign, which describes the migration of a fragment of bone to a dependent portion of the fluid-filled cyst. It occurs in only a minority of patients. This sign is an important differentiating feature between a simple bone cyst and other nonlytic bone lesions. When present, the fallen fragment sign is pathognomonic of a simple bone cyst. Radiography usually is sufficient to confirm the diagnosis of simple bone cysts.

CT scan is often unnecessary in the evaluation of simple bone cysts because of the high accuracy of diagnosis of radiography. CT is occasionally used in the evaluation of lesions observed in areas difficult to assess on plain radiography, such as the spine and pelvis. The role of CT is to determine the extent of the lesion as well as to detect subtle complications difficult to evaluate on plain radiography. The features of a simple bone cyst observed on plain radiography also can be appreciated on CT. Occasionally, air and air-fluid levels may be seen within simple bone cysts. Fluid-fluid levels also may be noted. Dynamic CT scan may help in differentiating a fluid-containing simple bone cyst, which is avascular, from other solid benign bone lesions that demonstrate varying degrees of vascularity. The presence of a fallen fragment sign on CT is diagnostic of a simple bone cyst. CT has high sensitivity and specificity for detecting simple bone cysts.

MRI can confirm the presence of fluid within a simple bone cyst. Uncomplicated simple bone cysts have low signal intensity on T1-weighted images and high signal intensity on T2-weighted images. Lesions that have a pathologic fracture have heterogeneous signal intensities on both T1- and T2-weighted images because of bleeding within the cyst. With gado enhancement, they demonstrate enhancement with focal, thick peripheral, heterogeneous or subcortical patterns. Septations within the lesions may be observed on MRI and may not be visualized on radiographs. MRI reveals the presence of thin reparative tissue lining the cyst wall. This tissue progressively thickens, and new bone formation is also observed. Residual cyst cavities may also be seen with no evidence of enhancing tissue, thus requiring further treatment. Uncomplicated lesions are diagnosed easily on MRI. Lesions complicated by pathologic fractures may reveal areas of heterogeneous signal and irregular enhancement patterns after the administration of IV contrast.

References
5. Harvey Teo E-L. Simple bone cyst imaging. Medscape