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Osteonecrosis of the femoral head with subchondral collapse

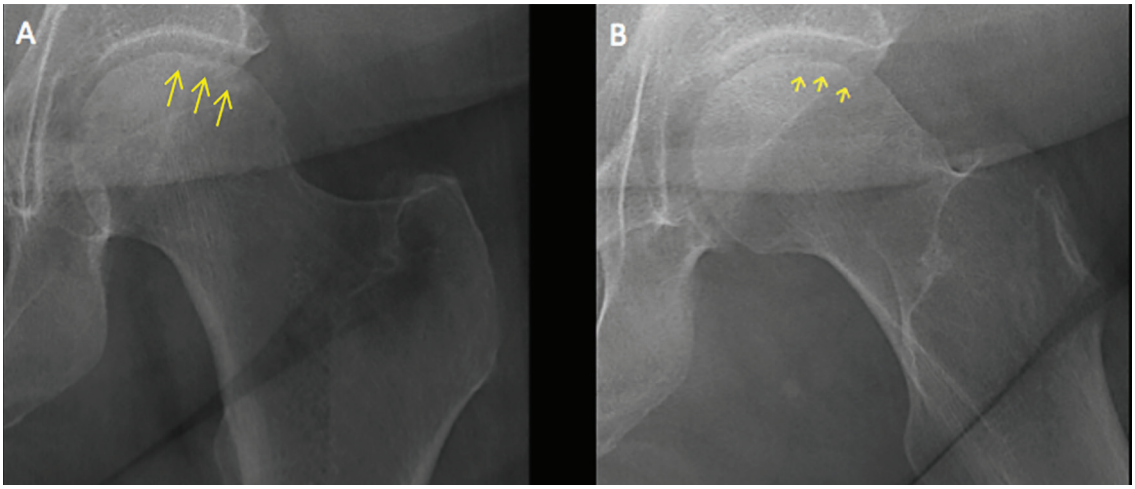

Figure 1. On plain radiography, a subchondral radiolucent line (arrows) was seen on internal rotation of the hip (A), and more clearly on external rotation (B) (arrows).

The 'crescent sign' on radiography indicates an advanced stage of femoral head osteonecrosis

A 45-year-old woman with a history of multiple organ transplants presented with a 1-month history of anterior left hip pain with insidious onset. Although she was able to perform activities of daily living, she reported increasing difficulty with weight-bearing activities.

Physical examination of the left hip elicited pain on passive movement, particularly on internal rotation. Plain radiography of the left hip (**Figure 1**) revealed a subchondral radiolucent line in the femoral head, representing subchondral collapse. This radiographic sign, referred to as the "crescent sign," is seen in advanced stages of osteonecrosis of the femoral head. Recognition of this subtle radiographic sign is important because it represents considerable subchondral necrosis and collapse, and indicates that further collapse is likely.[1]

doi:10.3949/ccjm.86a.19004

RISK FACTORS

Osteonecrosis of the hip is caused by prolonged interruption of blood flow to the femoral head.[2] While idiopathic osteonecrosis is not uncommon, the condition is often associated with alcohol abuse or, as in our patient, long-term corticosteroid use after organ transplant.[3] Corticosteroid use is also the most frequently reported risk factor for multifocal osteonecrosis.

Less common risk factors include systemic lupus erythematosus, antiphospholipid antibodies, coagulopathies, sickle cell disease, Gaucher disease, trauma, and external-beam therapy.

Young age is also associated with osteonecrosis, as nearly 75% of patients are between age 30 and 60.[4]

APPROACH TO DIAGNOSIS

Our patient had a typical clinical presentation of this disease: she was relatively young, was

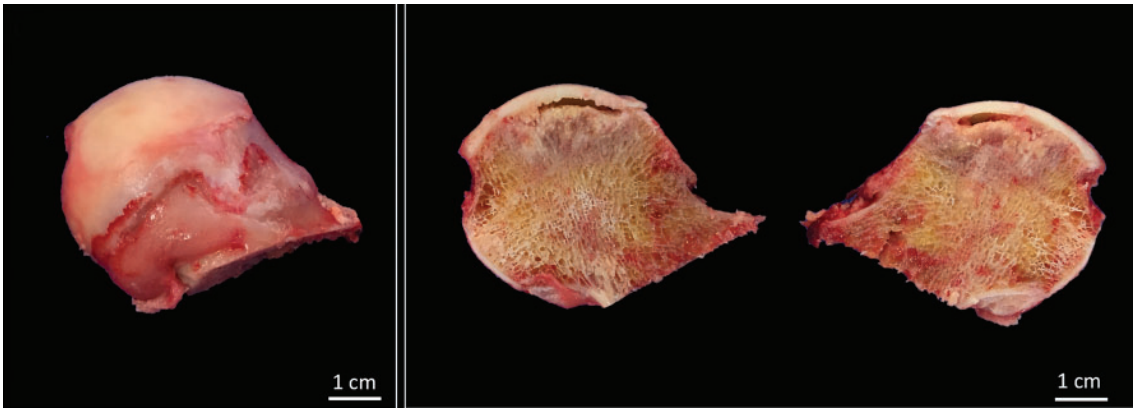

Figure 2. Inspection of the femoral head confirmed palpable chondral softening and necrosis.

on long-term corticosteroids, and had acute anterior groin pain followed by progressive functional impairment.

The diagnostic evaluation consists of a detailed history, with attention to specific risk factors, and a thorough clinical examination followed by imaging, usually with plain radiography. However, plain radiographs are often unremarkable when the condition is in the early stages. In such cases, magnetic resonance imaging is recommended if clinical suspicion for osteonecrosis is high. It is far more sensitive (> 99%) and specific (> 99%) than plain radiography, and it detects early changes in the femoral head such as focal lesions and bone marrow edema.[5]

TREATMENT OPTIONS

Treatment of osteonecrosis is surgical and depends on the stage of disease.[6]

Joint preservation may be an option for small to medium-sized lesions before subchondral collapse has occurred; options include core decompression, bone grafting, and femoral osteotomy to preserve the native femoral head. These procedures have a higher success rate in young patients.

Subchondral collapse usually warrants hip replacement.

OUR PATIENT'S TREATMENT

Our patient underwent total arthroplasty of the left hip. Macroscopic inspection and palpation of the femoral head demonstrated chondral softening. Anatomic specimens (**Figure 2**) showed the distinct correlation between radiographic images and subchondral collapse secondary to the underlying necrotic bone in the femoral head.

REFERENCES

1. **Pappas JN**. The musculoskeletal crescent sign. Radiology 2000; 217(1):213–214. doi:10.1148/radiology.217.1.r00oc22213
2. **Shah KN, Racine J, Jones LC, Aaron RK**. Pathophysiology and risk factors for osteonecrosis. Curr Rev Musculoskelet Med 2015; 8(3):201–209. doi:10.1007/s12178-015-9277-8
3. **Moya-Angeler J, Gianakos AL, Villa JC, Ni A, Lane JM**. Current concepts on osteonecrosis of the femoral head. World J Orthop 2015; 6(8):590–601. doi:10.5312/wjo.v6.i8.590
4. **Assouline-Dayan Y, Chang C, Greenspan A, Shoenfeld Y, Gershwin ME**. Pathogenesis and natural history of osteonecrosis. Semin Arthritis Rheum 2002; 32(2):94–124. pmid:12430099
5. **Pierce TP, Jauregui JJ, Cherian JJ, Elmallah RK, Mont MA**. Imaging evaluation of patients with osteonecrosis of the femoral head. Curr Rev Musculoskelet Med 2015; 8(3):221–227. doi:10.1007/s12178-015-9279-6
6. **Chughtai M, Piuzzi NS, Khlopas A, Jones LC, Goodman SB, Mont MA**. An evidence-based guide to the treatment of osteonecrosis of the femoral head. Bone Joint J 2017; 99-B(10):1267–1279. doi:10.1302/0301-620X.99B10.BJJ-2017-0233.R2

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