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Occult fracture of the femoral neck associated with extensive osteonecrosis of the femoral head: A case report

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ABSTRACT

INTRODUCTION: Although the subchondral portion of the femoral head is a common site for collapse in osteonecrosis of the femoral head (ONFH), femoral-neck fracture rarely occurs during the course of ONFH. We report a case of occult insufficiency fracture of the femoral neck without conditions predisposing to insufficiency fractures, occurring in association with ONFH.

PRESENTATION OF CASE: We report a case of occult fracture of the femoral neck due to extensive ONFH in a 60-year-old man. No abnormal findings suggestive of ONFH were identified on radiographs, and the fracture occurred spontaneously without any trauma or unusual increase in activity. The patient's medical history, age, and good bone quality suggested ONFH as a possible underlying cause. Contrast-enhanced magnetic resonance imaging was useful in determining whether the fracture was caused by ONFH or was instead a simple insufficiency fracture caused by steroid use.

DISCUSSION: The patient was treated with bipolar hemiarthroplasty, but if we had not suspected ONFH as a predisposing condition, the undisplaced fracture might have been treated by osteosynthesis, and this would have led to nonunion or collapse of the femoral head. To avoid providing improper treatment, clinicians should consider ONFH as a predisposing factor in pathologic fractures of the femoral neck.

CONCLUSION: ONFH should be included in the differential diagnosis of insufficiency fracture of the femoral neck.

1. Introduction

Idiopathic osteonecrosis of the femoral head (ONFH) occurs frequently in young and middle-aged patients. The disease frequently leads to progressive collapse of the femoral head, followed by degenerative arthritis of the hip [1–5]. Corticosteroid therapy and alcohol abuse have been identified as risk factors for the development of ONFH [6]. Although collapse usually occurs in the subchondral portion of the femoral head, another fracture site is the junction between necrotic bone and reparative bone [7–9], located in the subcapital area when osteonecrosis involves the whole femoral head. However, insufficiency fracture can occur without an associated history of a recent or unusual increase in activity. The conditions predisposing to insufficiency fractures include osteoporosis, rheumatoid arthritis, osteogenesis imperfecta, Paget disease, hyperparathyroidism, osteomalacia, fibrous dysplasia, and osteopetrosis. In this report, we describe a case of occult insufficiency fracture of the femoral neck without conditions predisposing to insufficiency fractures, occurring in association with ONFH. No abnormal findings indicative of ONFH were identified in the femoral heads on plain radiographs. The entire femoral head was found to be necrotic, and the fracture occurred at the junction of the necrotic and reparative bone in the femoral neck.

2. Case report

A 60-year-old carpenter who had taken oral steroids daily (prednisolone; daily maximum, 50 mg; daily average, 18 mg) for about 10 months to treat dermatomyositis arrived at our hospital because he experienced sudden pain in his right hip. The patient's height was 170 cm, his weight was 59 kg, and his body mass index was 20.4 kg/m^2. He had no history of trauma or alcohol abuse, but he experienced sudden pain in his right hip joint when he was in a half-sitting posture holding a heavy log (weighing approximately 10 kg) 2 weeks before he visited at our department.

Findings on routine laboratory tests were normal. Physical examination revealed a slight limitation of hip-joint motion: flexion, 90°; abduction, 30°; adduction, 10°; internal rotation, 0°; and external rotation, 40°. His Harris hip score was 75 of a possible 100 points. The bone mineral density for his lumbar spine, measured by dual X-ray absorptiometry, was 0.786 g/cm^2 (*T* score, −1.9). The density was 1.697 g/cm^2 for his right femoral head and 0.667 g/cm^2

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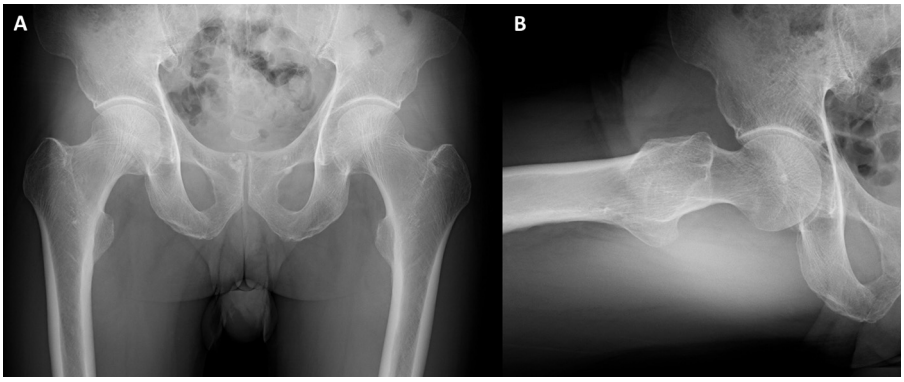

Fig. 1. Radiographs obtained 2 weeks after the onset of right hip pain. There were no significant findings on either the **(A)** anteroposterior view or the **(B)** frog lateral view.

for his right femoral neck, and was 1.693 g/cm^2 for left his femoral head and 0.460 g/cm^2 for his left femoral neck.

A plain radiograph of the right hip joint showed no signs in particular (Fig. 1), but there was a thick, very-low-signal-intensity band at the medial part of the femoral neck on T_1-weighted and T_2-weighted magnetic resonance images. Also, a linear low-signal-intensity band extended and descended to the intertrochanteric area on T_1-weighted images. Simultaneously, a deep wedge-shaped low-intensity band in the left femoral head, as is seen in primary osteonecrosis, was apparent on T_1-weighted images (Fig. 2). The radiologist diagnosed occult fracture of the right femoral neck and osteonecrosis of the left femoral head on the basis of findings on plain radiographs and magnetic resonance images. When bone scintigraphy was performed to confirm the occult fracture, it showed increased uptake in the medial subcapital area. Simultaneously, it seemed to show a decreased uptake in the right femoral head, similar to the left femoral head. Because the femoral head showed a cold uptake, bone scintigraphy raised the question of bilateral ONFH (Fig. 3). Tomosynthesis and computed tomography were also performed on the right hip joint, and images from both processes showed a sclerotic linear lesion in the medial subcapital area (Fig. 4). Finally, we performed gadolinium-enhanced magnetic resonance imaging (MRI) to determine whether the occult fracture occurred because of an insufficiency fracture or instead because of a pathologic fracture in association with ONFH. The results appeared to indicate that ONFH caused the occult fracture (Fig. 2). On the basis of findings on all images, our diagnosis was occult fracture associated with extensive ONFH.

The fracture was treated with bipolar hemiarthroplasty, and the resected femoral head was observed both grossly and microscopically. The femoral heads were fixed in 10% formalin solution, decalcified in 5% nitric acid solution, processed, and embedded in

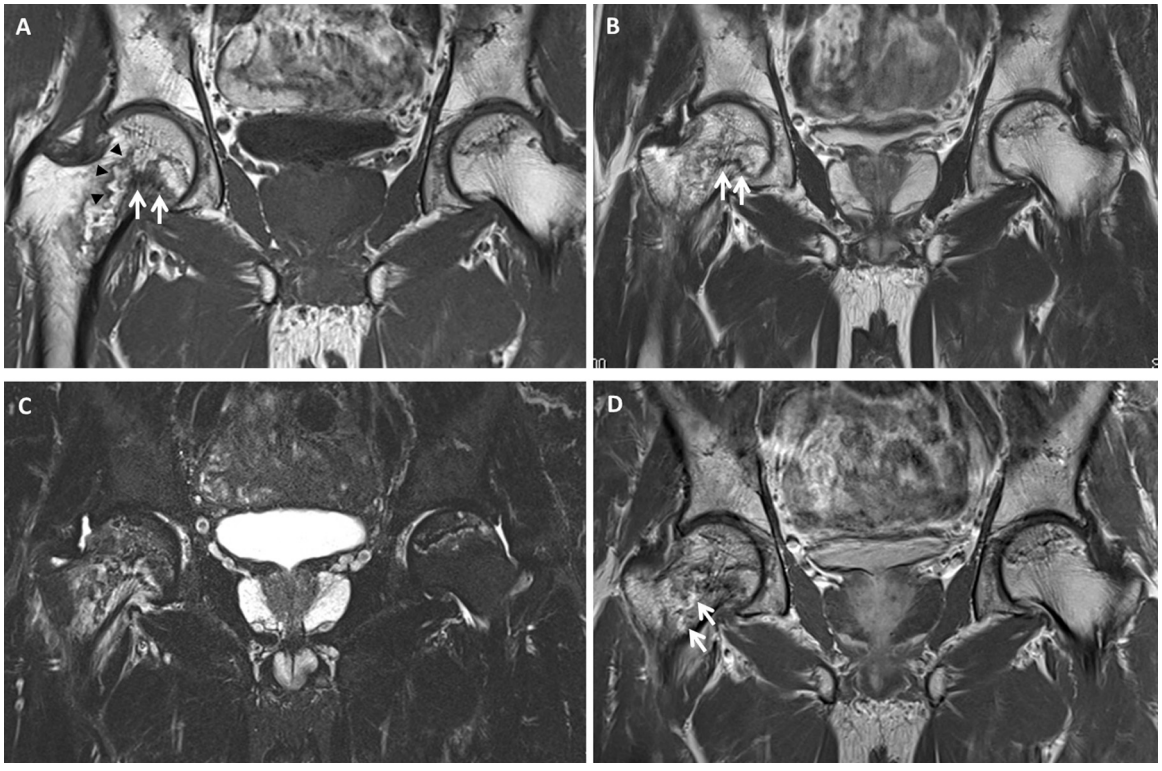

Fig. 2. Coronal T_1-weighted **(A)** and T_2-weighted **(B)** magnetic resonance images show a thick low-signal-intensity band at the medial part of the femoral neck (*white arrows*). Furthermore, the irregular, serpentine, low-signal-intensity lesion extended and descended to the intertrochanteric area on T_1-weighted images (*black arrowheads*). A coronal short τ inversion recovery sequence **(C)** shows an edema pattern in the bone marrow of the right femoral neck. A coronal gadolinium-enhanced T_1-weighted magnetic resonance image **(D)** shows no contrast enhancement in the proximal segment from the distal low-intensity band. The proximal low-intensity band is not contrast-enhanced, but the distal low-intensity band is partially contrast-enhanced (*white arrows*).