

## Case Report

# Bilateral stress fractures of the femoral neck in adults: a case report

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**Abstract:** The concurrent bilateral stress fractures of the femoral neck (SFFN) are extremely rare injuries in individuals without excessive bone activities. We present a case with compression type stress fracture in the right femoral neck, and displaced type stress fracture in the left femoral neck which might progress from an undiagnosed tension type fracture. Based on the findings of the literature review and our experience, we developed a strategy for early diagnosis and appropriate treatment of SFFN in adult patients. Early diagnosis along with immediate interventions might prevent serious complications. Plain radiographs could often confirm the diagnosis, but if not bone scan, MRI and occasionally CT scan could provide more information in detecting stress fractures. If the fracture is the compression type, we strongly recommend an additional CT scan for detection occult tension-type fracture. Treatment should be based on the classification of the fracture and the risk of exacerbation or serious complications.

**Keywords:** Adults, femoral neck, stress fracture, diagnosis, treatment

### Introduction

Stress fracture is a kind of overuse injury, which is primarily caused by repetitive and excessive mechanical load on bones, rather than a single traumatic event [1]. Stress fractures of the femoral neck (SFFN) are relatively uncommon, and were most reported in military recruits and athletes [1-3]. The concurrent bilateral SFFN are extremely rare with only few patients have been reported before [2, 4-7]. Moreover, the SFFN in nonathletic individuals without excessive bone activities are even rarer [6, 7]. We present a case with concurrent bilateral SFFN without any history of major or repetitive trauma. We also developed a strategy for early diagnosis and appropriate treatment of SFFN in adult patients.

### Case report

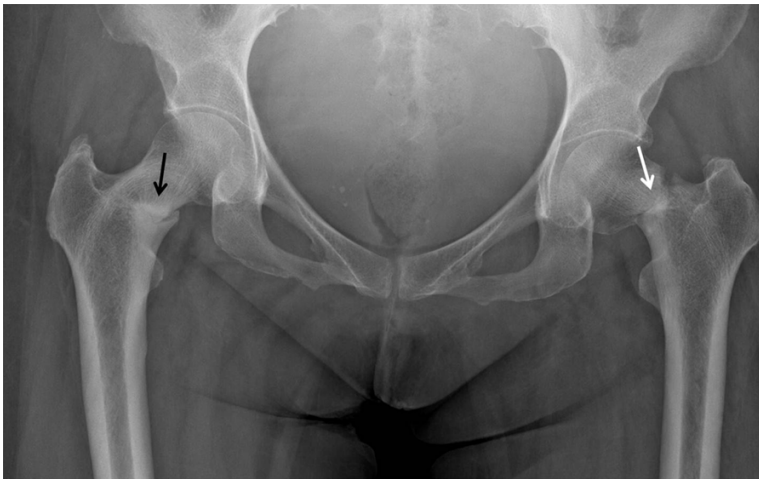
A 59-year-old woman presented 2 months history of bilateral hips pain, especially after long time walking or weight-bearing activities. There was no history of trauma, steroid use, menstrual abnormality, metabolic disorder, and any relevant illness. Her job involved walking for long

distances every day. Her height was 168 cm, weight 75 kg, and her body mass index (BMI) is 26.57 kg/m<sup>2</sup>. She consulted to a local clinic and an anteroposterior X-ray of the pelvis was taken (**Figure 1**). The radiograph showed obvious fracture lines with marginal sclerotic change on the inferomedial aspect of both femoral neck regions. No deformities of both hips were observed. She was advised to take rest, use walking aids for avoiding full weight-bearing, and take non-steroidal anti-inflammatory drugs for pain relief. However, the symptoms of her left hip did not improve. Two months later, she suddenly developed severe pain in the left hip while walking, and she was thereafter unable to bear weight. She was taken to the hospital. On admission, physical examination revealed that movement of the left hip was almost impossible due to the pain. On the right side, full range of motion with mild pain was noted. The neurovascular examination revealed normal status of both lower extremities. Radiographs also showed an incomplete fracture line on the inferomedial region of the right femoral neck, and a traverse fracture line on the left femoral neck, both with obvious sclerosis

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**Figure 1.** Anteroposterior radiograph of both hips showed incomplete fracture lines with marginal sclerosis on both the inferomedial regions of femoral necks (black arrows).



**Figure 2.** Anteroposterior radiograph of both hips show incomplete fracture line on the inferomedial region of the right femoral neck (black arrow), a transverse fracture line on the left femoral neck (white arrow), both with obvious sclerosis.

(**Figure 2**). Bone scintigraphy showed increased uptake in the left femoral neck and normal uptake in the right femoral neck (**Figure 3**). Bone mineral density (BMD) of the Hip (Left), measured by dual-energy x-ray absorptiometry (DEXA) scan was 0.892 g/cm, which indicated no sign of osteoporosis. Computed Tomography (CT) scan demonstrated a complete fracture with marginal sclerosis within the left femoral neck, and a no displaced fracture, as well as with sclerotic change, on the inferomedial aspect of the right femoral neck (**Figure 4**). Magnetic Resonance Imaging (MRI) showed incomplete, low-signal lines on the inferomedial aspect of the right femoral neck, and trans-

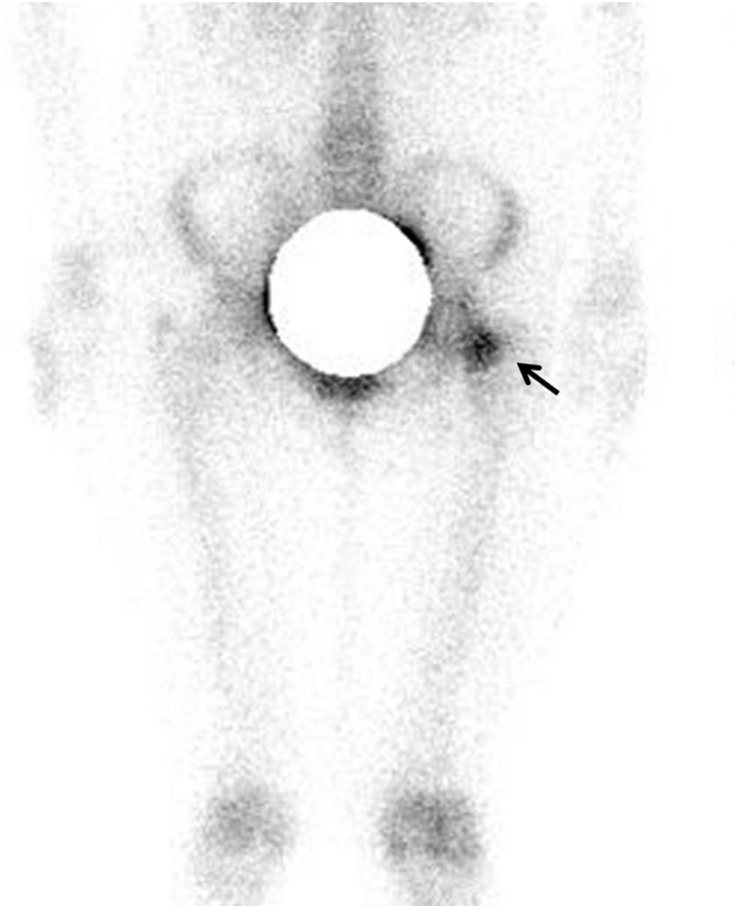
verse, low-signal lines on the left femoral neck on both T1 and T2-weighted images. Diffuse high signal surrounding the fracture site representing bone marrow edema and joint effusion, were only noted on the left side on T2-weighted images (**Figure 5**). The results of routine hematological tests, biochemical investigations, and tumor markers are all in normal range. No evidence of endocrine and bone metabolism abnormality was found. Based on the findings of the clinical and radiographic examination, the diagnosis was made as bilateral stress fractures of femoral neck (Left: displaced type; Right: compression type according to Fullerton and Snowdy classification [8]). We decided to treat the right side conservatively, and the left side operatively. The patient underwent total hip arthroplasty on the left side. The findings during the surgery confirmed our diagnosis. The fracture sites obtained from the osteotomy during arthroplasty showed typical sclerotic change (**Figure 6**), and the histological examination showed no evidence of pathological change. For treatment of right side femoral neck stress fracture, the patient was advised to

use crutches with non-weight bearing on the right leg for 8 weeks, and partial weight bearing was started after that. Full weight bearing without crutch was suggested 3 months postoperatively. At the one-year follow-up examination, the patient was symptom-free and could resume normal activities without limitation of the both hips. Radiographs showed no sign of fracture union or progress to displaced fracture of the right femoral neck (**Figure 7**).

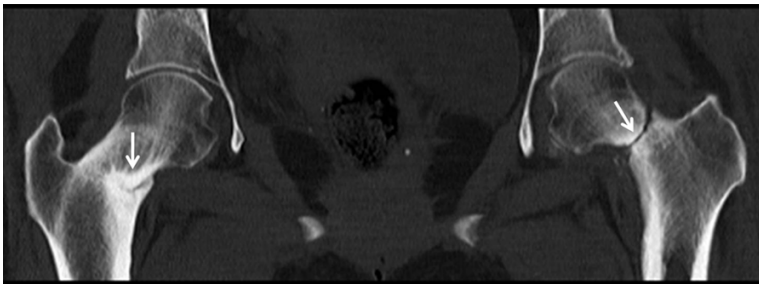
### Discussion

There are two types of stress fractures classified as fatigue fractures and insufficiency frac-

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**Figure 3.** Bone scintigraphy showed increased uptake in the left femoral neck (black arrows), and normal uptake in the right femoral neck.



**Figure 4.** CT showed a complete fracture on the left femoral neck, and a nondisplaced fracture on the inferomedial region of the right femoral neck, both with marginal sclerosis (white arrows).

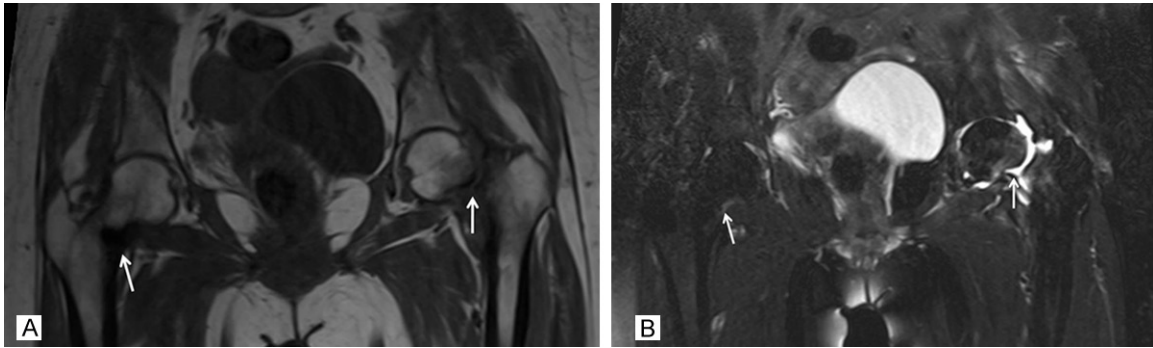
tures. Fractures induced by repetitive and excessive mechanical stress on normal bone are termed as fatigue fractures, while those induced by normal forces in bone with impaired quality are termed as insufficiency fractures [9, 10]. No evidence of preexisting bone metabolic diseases and other pathologies were found on

the current patient. Thus, we diagnosed a fatigue fracture of the bilateral femoral neck rather than an insufficiency fracture. We assumed that the patient was involved in some kind of repetitive load when walking, standing and squatting, which might cause abnormal stress, muscle fatigue, and eventually stress fracture on both sides of her hips.

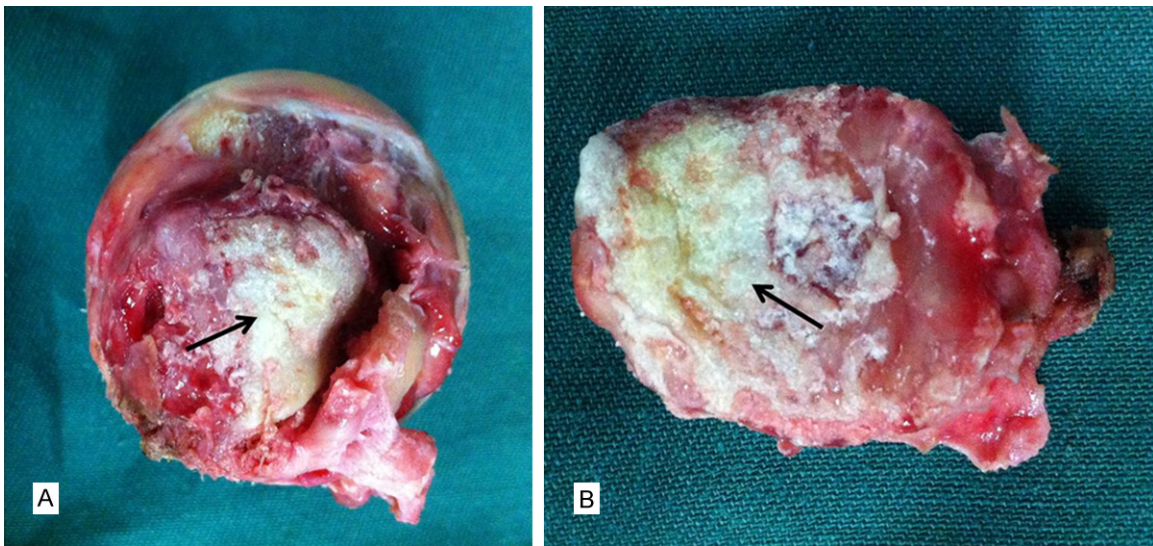
Delay in diagnosis and treatment of SFFN may result in serious complications and eventually cause disability of hip. Early and precise diagnosis of a femoral neck stress fracture is difficult because of lack of typical symptom, and absence of evident radiological change. We developed a strategy for early diagnosis and treatment for SFFN in adult patients as described in **Figure 8**, on the basis of review of previous articles [11-13]. The most frequent symptom is a deep pain in the hip, and the pain is often increased with activity and is relieved with rest [14]. Moreover, the patients usually deny specific trauma. Radiographs of both hips should always be taken, although the value of plain radiographs is limited in the early stage because of the inability to detect subtle changes in bone structure [4, 6, 11, 15]. If a fatigue fracture is suspected with a negative plain radiography, bone scan, MRI and occasionally CT scan are necessary for the early diagnosis [7, 9, 16]. Bone scan could provide high sensitivity in detecting stress fractures, and demonstrate increased uptake in high bone remodeling areas before radiographic changes occur. However, it is nonspecific due to similar uptake in cases of infection, osteonecrosis, and tumors as in stress fractures [4, 6,



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**Figure 5.** MRI showed incomplete, low-signal fracture line on the inferomedial aspect of the right femoral neck, and transverse, low-signal fracture line on the left femoral neck on both T1 (A) and T2-weighted (B) images. High signal surrounding the fracture site on T2-weighted images representing bone marrow edema and joint effusion were only noted on the left side (B).



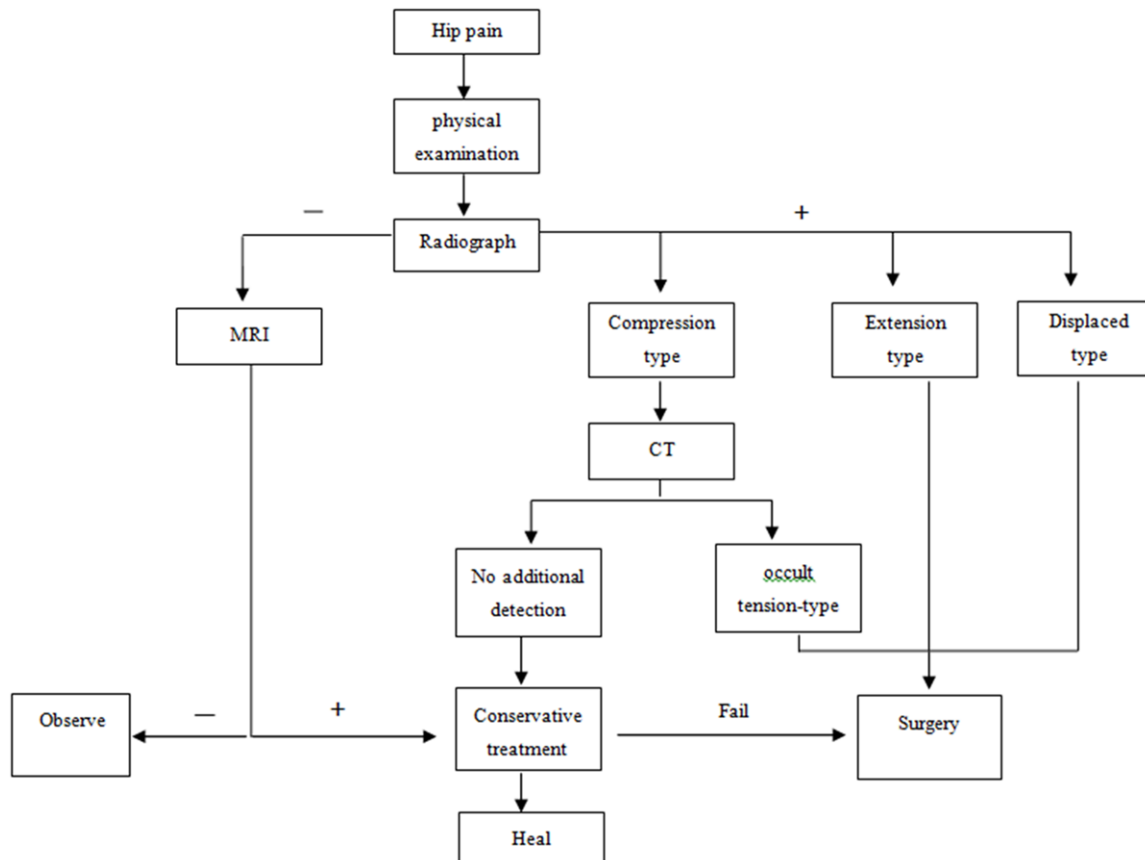
**Figure 6.** The fracture sites obtained from the osteotomy during arthroplasty (A: The side of femoral head; B: The side of femoral shaft) showed marginal sclerosis (black arrows).



**Figure 7.** Anteroposterior radiograph of both hips showed no sign of fracture union or progress to displaced fracture of the right femoral neck, and total hip arthroplasty of the left hip 12 months postoperatively.

17-19]. MRI can detect the early changes of bone stress injury and can be very helpful in differentiation of fatigue fracture from transient osteoporosis, soft-tissue injury, tumor and infection [4]. Typical signs on T2 sequences include a band of low signal representing the fracture itself, surrounded by diffuse high signal repre-

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**Figure 8.** Strategy for early diagnosis and treatment of the SFFN in adult patients.

senting marrow edema [11]. Computed tomography (CT) could demonstrate the presence, location, orientation, and extent of a fracture line. It could also be used to distinguish between a stress reaction and stress fracture, and reveal evidence of healing by showing periosteal reaction and resolution of a discrete lucency or sclerotic fracture line. CT scans can demonstrate occult fracture lines in locations where radiography could not [11, 15, 20-22]. In our opinion, once a tension-type fracture or a displaced-type fracture is evident, there is no need for further imaging tests. However, we do recommend CT is necessary for a compression-type fracture because ignorance of an occult tension-type fracture might cause serious results. This displaced fracture of the left femoral neck in our case likely resulted from an undiagnosed tension-side fracture. If so, we may speculate that a delay in diagnosis of the magnitude reported here may be disastrous.

Classifications of femoral neck stress fracture have been proposed and well summarized by

previous literatures [8, 23-25]. MRI-positive fractures without an overt fracture line on radiograph and the compression type fracture are generally considered mechanically stable, and could be treated conservatively [8, 15, 23, 25]. While tension type of stress fracture are thought to be mechanically unstable, and may progress to displaced fracture under persistent stress loading. Thus, surgical treatment is usually indicated [23]. Displaced fractures should be operated immediately [3]. The available surgical options include internal fixation and arthroplasty. We should take note that there are exceptions, such as conservative treatment might fail and surgery were needed in a low risk medial aspect SFFN [26], while a tension-type fracture could be successfully treated with conservative treatment [27]. We chose conservative treatment in our case of the right side with compression-type fracture. Total hip arthroplasty was performed in this elder patient of the left hip with displaced-type fracture, because the incidence of nonunion, malunion,

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avascular necrosis of the femoral head, severe osteoarthritis is particularly high in patients with displaced SFFN [3, 25, 28]. What's more, we do not think this displaced fracture could get bone union because of the large-area sclerotic change of the fracture site as shown in the pictures. The non-union of the inferior aspect of the right femoral neck after one year follow-up also proved our prediction indirectly.

### Conclusions

Early diagnosis along with immediate interventions might prevent serious complications. Plain radiographs could often confirm the diagnosis, but if not bone scan, MRI and occasionally CT scan could provide more information. If the fracture is the compression type on plain radiographs, we strongly recommend an additional CT scan for detection occult tension-type fracture. Treatment should be based on the classification of the fracture and the risk of exacerbation or serious complications.

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### Disclosure of conflict of interest

None.

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