Similarity in Sequential Bilateral Transient Osteoporosis of the Hip

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Similarity in Sequential Bilateral Transient Osteoporosis of the Hip

A Report of 3 Cases

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Abstract

Case: Three middle-aged men with habitual drinking developed unilateral hip pain and were referred for osteonecrosis of the femoral head (ONFH). Radiographs showed osteopenia, and magnetic resonance imaging (MRI) showed diffuse bone marrow edema (BME). After several months, the patients' symptoms resolved and radiographic images normalized. More than 6 months later, the contralateral side showed the same clinical course.

Conclusion: Transient osteoporosis of the hip (TOH) resembles ONFH but heals spontaneously. We report 3 rare cases of sequential TOH, similar in that they occurred in middle-aged male habitual drinkers at risk for ONFH, characterized by diffuse BME on MRI and radiographic resolution.

Transient osteoporosis of the hip (TOH) is characterized by acute-onset hip pain and bone marrow edema (BME). TOH is self-healing and benign[1-3]. The natural history of TOH is a temporary osteoporotic condition of the proximal femur, such as that observed during osteopenia, malnutrition, or pregnancy. Laboratory tests are usually considered unhelpful for the diagnosis of TOH[1,2]. In 1959, TOH was first reported in 3 pregnant women[4]. Acute hip pain was reported, and radiographs showed focal demineralization of one or both femoral heads and femoral necks, with resolution and normalization of imaging after delivery. TOH seems to be more frequent in middle-aged men and in women in the last trimester of pregnancy[1-3,5]. A recent review reported that the average age of affected individuals is 39.5 years. Approximately 58% of those affected are male[1].

With the exception of rare cases of femoral neck fracture secondary to TOH during pregnancy[6,7], the natural course of TOH does not require surgical intervention[1-5]. However, TOH is difficult to distinguish from early-stage osteonecrosis of the femoral head (ONFH) and subchondral insufficiency fracture (SIF), which are usually progressive[1-3,8-11]. One of the key reasons why it is important to distinguish between TOH and ONFH is because joint-preserving surgeries are most effective early in the natural course of ONFH before there is evidence of subchondral collapse. In untreated ONFH, 70% to 80% of patients develop progressive collapse of the femoral head and are treated with total hip arthroplasty (THA)[12-14]. Magnetic resonance imaging (MRI) became more popular as a diagnostic tool[15-18], BME named from MRI findings that of diffuse lesion had been recognized in also TOH[15-21]. In 1988, Wilson et al. reported that the knee and hip joints of patients undergoing normal or reduced dual-energy x-ray absorptiometry (DEXA) show a local decrease in bone marrow signal intensity on T1-weighted MRI and an increase in signal intensity on T2-weighted MRI[22]. In recent years, BME has received attention as a subchondral lesion in knee osteoarthritis (OA)[23,24].

Because BME is observed in ONFH[25], SIF, TOH[26-28], OA[23,24], and complex regional pain syndrome[29], many researchers have focused on the issue of differential diagnosis[19-21] and clinical courses between TOH, ONFH, and SIF[8-11].

TOH is considered a unilateral disease[1-3]. Recently, the authors have reported rare cases of pregnant women with simultaneous bilateral TOH[7,30]. However, there have been no reports on multiple cases of sequential bilateral TOH. Here, we present 3 cases of sequential bilateral TOH and report a literature review.

Disclosure: The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (http://links.lww.com/JBJSCC/B545).

Keywords: osteonecrosis of the femoral head, transient osteoporosis of the hip, subchondral insufficiency fracture, bone marrow edema, magnetic resonance image

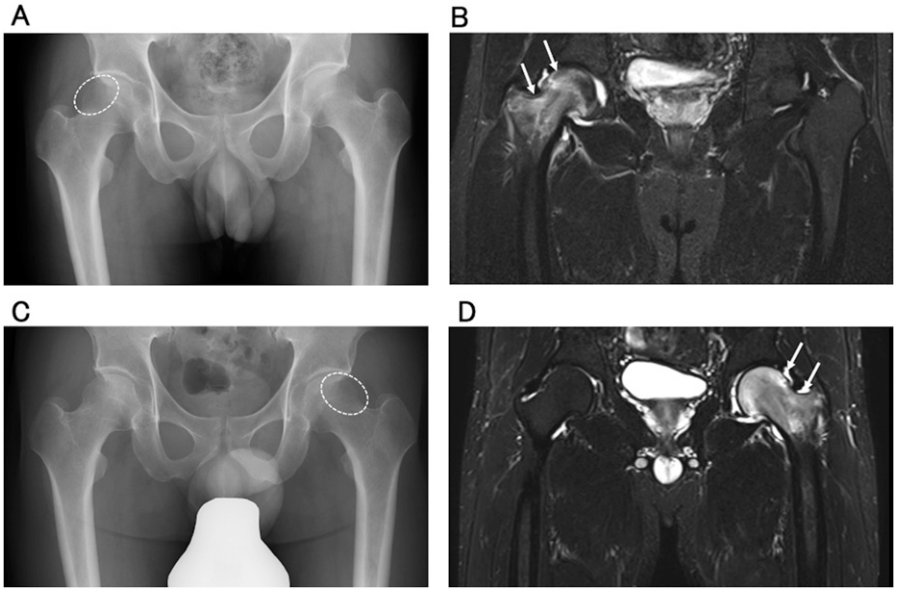

Fig. 1

Radiographic images in case 1. **Fig. 1-A** Anteroposterior pelvic radiograph at first onset. Focal osteopenia is observed (white dashed circle). **Fig. 1-B** Diffuse bone marrow edema (white arrows) extending from the right femoral head to the femoral neck. **Figs. 1-C** Anteroposterior pelvic radiograph at second onset. Focal osteopenia is observed (white dashed circle). **Fig. 1-D** Coronal short tau inversion recovery magnetic resonance imaging at second onset. Diffuse bone marrow edema (white arrows) extending from the left femoral head to the femoral neck.

Patients were informed that anonymized data from electronic medical records would be published, and they provided verbal consent.

Case Report

Case 1. The first patient was a 43-year-old man who experienced right hip pain. The initial symptoms had a sudden onset and pain increased when waking. The patient was referred to a local hospital. Radiography, computed tomography (CT), and MRI were performed, and a low-signal region in the femoral head was observed on T1-weighted images. The patient was suspected of ONFH because of his habitual drinking history. He was referred to our hospital 1 month after onset for further evaluation. Radiographs (Fig. 1-A) and CT scans performed at the previous clinic showed osteopenia of the lateral femoral head. On initial MRI, BME was more spread out than localized osteopenia on radiographs. BME expanded from the femoral head to the femoral neck showed a low signal on T1-weighted images, a high signal on T2-weighted images, and a high signal on short tau inversion recovery (STIR) images (Fig. 1-B). We diagnosed unilateral TOH, and the patient was followed up conservatively without restriction. Four months from onset, symptoms disappeared, and follow-up MRI and radiography showed resolution of BME and osteopenia.

After 3.2 years, the patient was referred to our hospital again for acute hip pain on the contralateral (left) side. Osteopenia (Fig. 1-C) and BME (Fig. 1-D) were revealed on radiograph and MRI, respectively, and the clinical course resolved 3 months later, with radiological normalization of osteopenia (Fig. 2-A) and reduction in the size of BME (Fig. 2-B). The patient canceled further MRI because of resolution. The follow-up period at our hospital was 7.0 years. Follow-up plain pelvic radiography of the pelvis showed normalization of osteopenia.

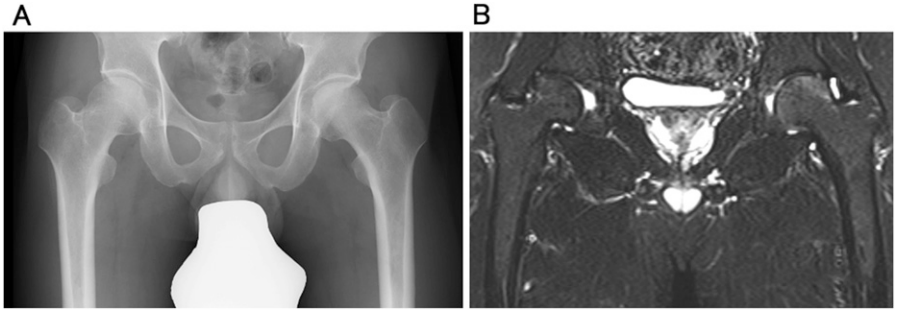

Fig. 2

Normalized radiographic images during resolution of case 1. **Fig. 2-A** Anteroposterior pelvic radiograph. **Figs. 2-B** Coronal short tau inversion recovery magnetic resonance imaging. Reduction in the size of diffuse bone marrow edema in the left femur.

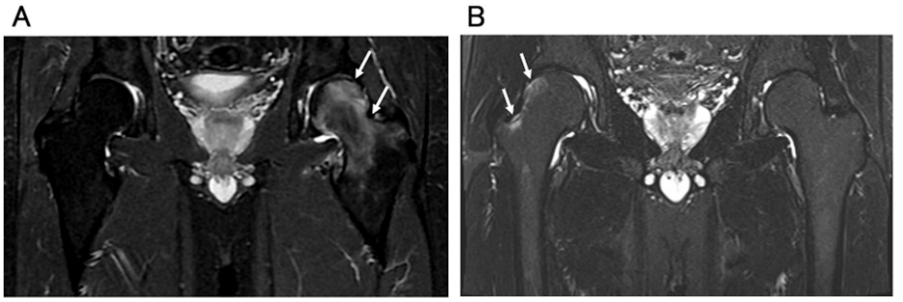

Fig. 3

Coronal short tau inversion recovery magnetic resonance imaging in case 2. **Fig. 3-A** At first onset, diffuse bone marrow edema (white arrows) extending from the left proximal femur. **Fig. 3-B** At second onset, bone marrow edema (white arrows) extending from the right femoral head to the femoral neck.

However, we could not confirm the complete absence of BME by follow-up MRI because of recovery in plain radiographs and complete absence of any symptoms.

Case 2. The second patient was a 58-year-old man who was referred to our hospital for acute-onset right groin pain. One year previously, the patient was diagnosed with left-sided ONFH associated with alcohol intake at another hospital. In the radiographic images taken by the previous doctor, radiography showed localized osteopenia and MRI showed diffuse BME of the left proximal femur (Fig. 3-A). The interval between sequential TOH was 1.1 years. MRI showed that previous BME was absent, but there was BME of the proximal right femur (Fig. 3-B). We diagnosed sequential bilateral TOH, and the patient was followed up as an outpatient without walking restrictions. After 4.5 months, symptoms resolved, and radiograph and MRI were near-normal. The patient canceled further MRI because of resolution. The follow-up period at our hospital was 4.2 years. Pelvic radiographs were performed and confirmed normalization of osteopenia, but further confirmatory MRI was not performed because of the same reasons as case 1.

Case 3. The third patient was a 54-year-old man who was referred to our hospital for further treatment of unilateral ONFH associated with alcohol intake. After jogging, the patient experienced severe pain in his right groin. Initial radiography performed at a previous clinic showed localized osteopenia of the lateral femoral head, and MRI showed diffuse BME extending from the femoral head to the femoral neck (Fig. 4-A). The patient was advised to stop sports activities and to use crutches, and 3 months later, his right hip was asymptomatic. After 6 months, left groin pain appeared. Radiographs showed osteopenia with a slight flattening of the femoral head on the left side, and MRI showed extensive diffuse BME (Fig. 4-B). Four months later, the patient's symptoms disappeared, and radiograph and MRI showed no further progression. The follow-up period at our hospital was 3.8 years. Pelvic radiographs showed normalization of osteopenia. However, for the same reasons as cases 1 and 2, further confirmatory MRI was not performed.

Discussion

We have presented 3 cases of sequential bilateral TOH occurring at least after 6 months. Bilateral TOH was treated conservatively, and resolution was achieved after 3 to 4 months. There were several similarities in the 3 cases reported. All patients were middle-aged men and habitual drinkers who were referred for suspected ONFH. In all cases, radiography revealed osteopenia, MRI indicated BME, resolution was achieved within a few months, and a similar clinical course was observed on the contralateral side more than 6 months later (Table I). Follow-up plain pelvic radiography of the pelvis showed normalization of osteopenia. However, we need to mention that there was 1 limitation that we could not confirm the complete absence of BME because the patients did

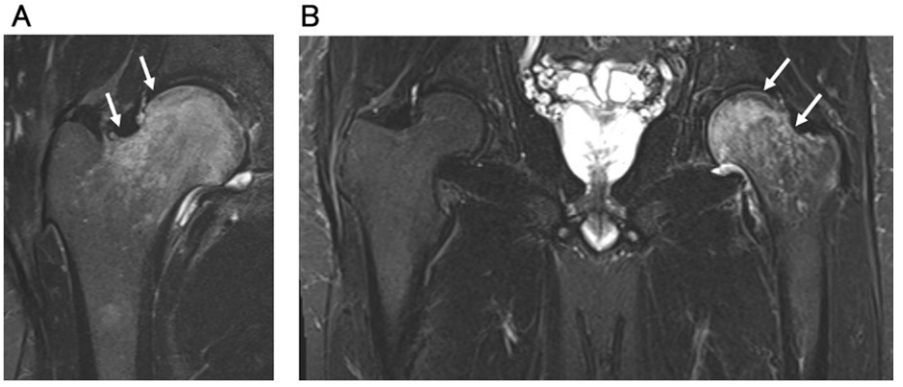

Fig. 4

Coronal short tau inversion recovery magnetic resonance imaging in case 3. **Fig. 4-A** At first onset, diffuse bone marrow edema (white arrows) extending from the right proximal femur. **Fig. 4-B** At second onset, diffuse bone marrow edema (white arrows) extending from the left proximal femur.

TABLE I Demographics and Clinical Course*

	Case 1	Case 2	Case 3
Age (yrs)	43	58	54
Sex	Male	Male	Male
Height (cm)	160	171	175
Weight (kg)	63	78	80
BMI (kg/m^2)	24.6	26.6	26.1
Habitual alcohol intake/type and consumption of drinks	Yes/beer 1.5-2 L/d	Yes/beer 0.5 L/d	Yes/beer 0.5 L/d
Initial diagnosis by previous clinicians	ONFH	ONFH	ONFH
Onset	Acute hip pain	Acute hip pain	Acute hip pain
Radiographic features	Localized osteopenia	Localized osteopenia	Localized osteopenia
MRI features	Diffuse BME	Diffuse BME	Diffuse BME
First side of TOH	Right	Left	Right
Second side of TOH	Left	Right	Left
Interval from remission to onset on the opposite side of TOH (yrs)	3.2	1.1	0.5
Resolution	Yes	Yes	Yes
Time for resolution on first side of TOH (mo)	4.0	3.0	3.3
Time for resolution on second side of TOH (mo)	3.0	4.5	4.0

*BME = bone marrow edema, BMI = body mass index, MRI = magnetic resonance image, ONFH = osteonecrosis of the femoral head, and TOH = transient osteoporosis of the hip.

not want confirmatory follow-up MRI, because of recovery in plain radiographs and complete absence of any symptoms.

TOH should be differentiated from early-stage ONFH and SIF. Joint-preserving surgeries are most effective for the patients with early-stage ONFH without subchondral collapse. At initial diagnosis, more than half of ONFH is already collapsed at the time of diagnosis, and simultaneous bilateral ONFH is also observed in more than half of cases[31]. Reports of TOH in pregnant women include simultaneous bilateral cases[4,5,7], but TOH in middle-aged men usually occurs unilaterally at a time. All previous reports of rare sequential bilateral TOH were single cases[32-35] (Table II), and the present report may be meaningful in that we observed commonality between the 3 cases.

TOH, early-stage ONFH, and SIF are difficult to differentiate because of the multifaceted overlap between the 3 diseases (Fig. 5). First, all are localized to the femoral head. TOH and SIF are primarily localized to lateral part of the femoral head, whereas ONFH has variations that include both medial and lateral localization. Second, the age of susceptibility overlaps between TOH and ONFH. Patients with SIF tend to be older, but the 2 major groups that suffer from TOH, pregnant women and middle-aged men[1-3,5], are no different between TOH and ONFH. Third, the background factors of these 3 conditions are similar. Steroid-associated ONFH and alcohol-associated ONFH, osteopenia in heavy drinkers, and osteoporosis in the elderly can cause bone to become fragile, which can lead to femoral head collapse. Case 3 showed a slight flattening of the femoral head, but neither the imaging characteristics nor symptoms progressed. As seen in Figure 1-B (case 1), CT scans may be appropriate because it may be more sensitive to identifying early subchondral collapse or osteopenia[36,37]. Fourth, MRI is the main diagnostic tool in these 3 diseases[15-18,38], making it difficult to interpret BME[8-11,19-21]. Early-onset ONFH is characterized by a

TABLE II Previous Reports of Sequential Bilateral Transient Osteoporosis of the Hip (TOH)

First Author/Year	Cases (No.)	Age (yrs)	Sex	Interval of Sequential Bilateral TOH (yrs)	Habitual Alcohol Intake
Ikemura[32]/2008	1	49	Female	2.8, 5.3*	No
Bolland[33]/2008	1	32	Male	0.5	No
Vogler[34]/2014	1	31	Male	0.6	No
Iannò[35]/2017	1	44	Male	12.5	No
Present study/2020	3	43, 58, 54	Male	3.2, 1.1, 0.5	Yes, Yes, Yes

*A bilateral case involving recurrence in 1 side of the hip.

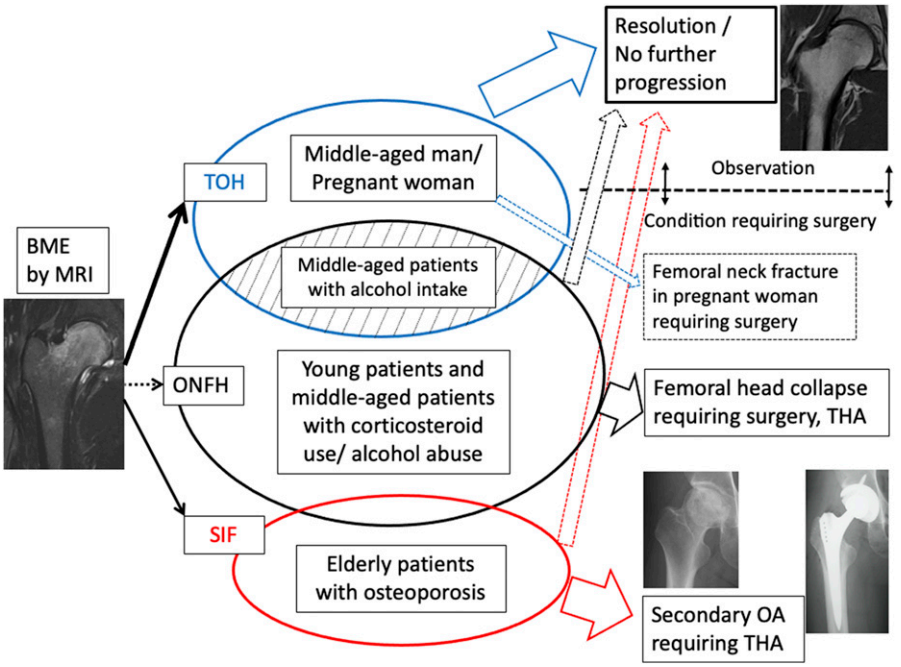

Fig. 5

Schematic diagram, showing the overlap between TOH, ONFH, and SIF. The 3 diseases are suspected to show bone marrow edema on magnetic resonance imaging. A differential diagnosis can be confirmed by performing a multilateral investigation, including a careful radiographic evaluation, and understanding the age of disease and background factors. Solid arrows are more frequent than dotted arrows. BME = bone marrow edema, MRI = magnetic resonance imaging, OA = osteoarthritis, ONFH = osteonecrosis of the femoral head, SIF = subchondral insufficiency fracture, THA = total hip arthroplasty, and TOH = transient osteoporosis of the hip.

concave low-signal band pattern on T1-weighted images, whereas SIF shows a convex low-signal band similar to the crescent line. In TOH, the expanding diffuse BME is characterized by a low signal on T1-weighted images and a high signal on T2-weighted and STIR images[19-21]. MRI evaluation of 155 BME hips reported that 40% of cases spread to the femoral neck and 49% to the femoral shaft[21]. We did not perform DEXA, but it may be useful for the diagnosis of osteopenia[22].

Standardized management of TOH has not been established[1-3]. A few studies have reported that bisphosphonates may speed up recovery[1,39,40], but these were case–control studies. Surgically, core decompression was performed in the 1990s[41].

TABLE III Differences in Imaging Findings in the Proximal Femur between 3 Diseases: TOH, Early-Stage ONFH, and SIF*†

	Image Findings					
			Level of Typical Signal Intensity by MRI Condition			
Diagnosis	Radiographs	MRI	T1	T2	STIR	CT
TOH	Osteopenia of the lateral femoral head	Diffuse BME extending from the femoral head to the femoral neck	Low	High	High	Osteopenia, suspected microfracture
ONFH (stage 1)	Normal	Band pattern with a clear boundary	Low	Low	High	Normal
SIF	Osteoporosis, suspected subchondral fracture	Diffuse BME, band lining crescent line	Low	High	High	Subchondral fracture, flattening

*Early-stage ONFH is characterized by a concave low-signal band pattern on T1-weighted images, whereas SIF with subchondral fracture and TOH suspected microfracture shows the expanding diffuse BME from the femoral head to the femoral neck. The diffuse BME is characterized by a low signal on T1-weighted images and a high signal on T2-weighted and STIR images. †BME = bone marrow edema, CT = computed tomography, MRI = magnetic resonance imaging, ONFH = osteonecrosis of the femoral head, SIF = subchondral insufficiency fracture, STIR = short tau inversion recovery, T1 = T1-weighted images, T2 = T2-weighted images, and TOH = transient osteoporosis of the hip.

At this stage, TOH is primarily defined as "transient" on observation. ONFH and SIF are usually progressive and may require THA; therefore, differentiating TOH from early-stage ONFH is essential. However, the radiological diagnosis of TOH should be exclusionary (Table III) because it is more detrimental to the patient to have ONFH misdiagnosed as TOH. Our experience with 3 rare cases of sequential TOH has given us an opportunity to identify how best to differentiate TOH from ONFH and SIF. ■

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