

## CT Evidence for Subchondral Trabecular Injury of the Femoral Head in Transient Osteoporosis of the Hip: A Case Report

A 28-yr-old woman presented with both hip pain that started sequentially during the peripartum period. Diagnosis of transient osteoporosis of the hip (TOH) was made based on typical findings of plain radiographs and magnetic resonance images. The subchondral trabeculae of the femoral head were evaluated on serially taken coronal multiplanar reformation computerized tomogram images. At 4 weeks after pain onset, marked decrease in the sclerotic density with irregular discontinuation was observed in the primary compression trabeculae. At 12 weeks, a focal area of irregular thickening of trabeculae was observed. At 20 weeks, sclerotic density of trabeculae recovered markedly and the focal area of irregular trabecular thickening disappeared. At 1 yr, subchondral trabeculae recovered almost completely. The evidence of subchondral trabecular injury was observed in the femoral heads of TOH.

**Key Words :** *Transient Osteoporosis; Hip; Trabecular Injury*

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## INTRODUCTION

Transient osteoporosis of the hip (TOH) is an uncommon disease that has very characteristic clinical features (1). Disabling hip pain develops without antecedent trauma and disappears spontaneously in several months. Radiologically, osteopenia of the proximal femur is the only one abnormal finding and it also disappears in parallel with symptoms. The osteopenic area shows increased radionuclide uptake in bone scintigram and bone marrow edema pattern on MR images.

Although TOH affects middle-aged men more frequently, the first reported cases were in women during the last trimester of pregnancy. The etiology of TOH remains unknown, but it was recently proposed that subchondral fracture of the femoral head (SFFH) causes TOH (2-4).

Recently, the authors treated a woman with bilateral TOH that occurred sequentially during the peripartum period of her first delivery. Serial computerized tomograms (CTs) of the femoral heads showed evidences of trabecular injury. The patient was informed that data concerning this case would be submitted for publication.

## CASE REPORT

A 28-yr-old woman presented with pain in both hips. The patient, a previously healthy housewife, had delivered her first baby about 3 weeks previously. Pain had first developed in the left hip some 3 months previously, at gestation week 32, and in the right hip 3 weeks previously (immediately after delivery). She had to use crutches because of disabling hip pain on weight bearing. At the time of presentation (postpartum 3 weeks, 3 months after left hip pain onset), the left hip pain was improving, but the right hip pain was worsening. Plain radiographs taken at 1 week postpartum showed diffuse osteopenia in both proximal femora, which was more marked in the left side (Fig. 1). Magnetic resonance (MR) images taken at 2 weeks postpartum showed a diffuse bone marrow edema pattern in the femoral head, neck and intertrochanteric areas of both femurs. No definite MR crescent sign (5) was detected (Fig. 2). The patient was treated conservatively under a diagnosis of TOH. Symptoms improved gradually and disappeared completely at 7 weeks postpartum (4 months after left hip pain onset) in the left hip and at 11 weeks postpartum in the right hip. Bone densities of proximal femora recov-

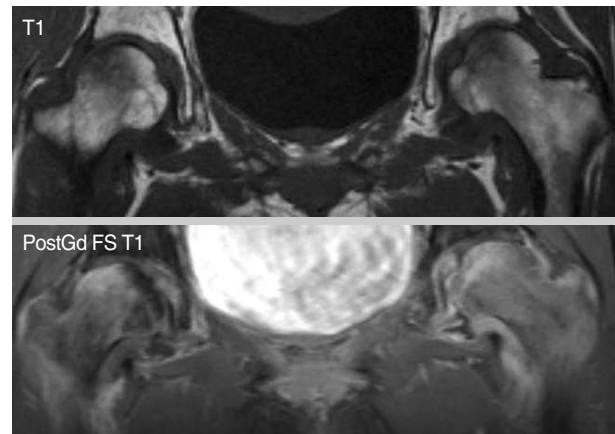
ered in parallel with symptomatic improvement (Fig. 3). Follow-up MR images taken at 7 weeks postpartum showed markedly reduced bone marrow edema in the left and increased bone marrow edema in the right. (Fig. 4).

Coronal multiplanar reformation (MPR) CT images were taken serially to evaluate the condition of trabecular bone of the femoral heads (Fig. 5). The first CT images taken at 4 weeks postpartum (4 weeks after right hip pain onset, and

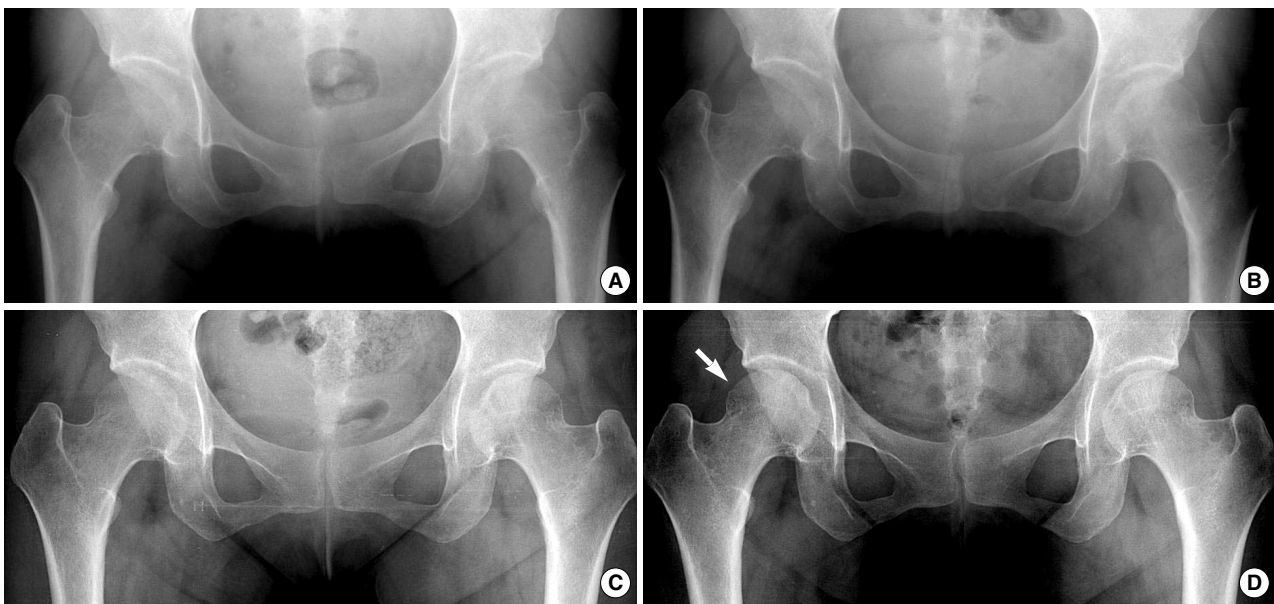


**Fig. 1.** A 28-yr-old woman with pain in both hips, which occurred at gestation 32 weeks in the left hip and immediately after delivery in the right. Anteroposterior radiograph obtained 1 week postpartum shows marked osteopenia in both proximal femurs.

12 weeks after left hip pain onset) showed marked decreases in the sclerotic densities of primary compression trabeculae with irregular discontinuation, more so in the right. In addition, a focal area showing irregular thickening of trabeculae was observed in the left femoral head, and in the right femoral head, breakages of subchondral bone with a linear dense scler-



**Fig. 2.** MR images taken at 2 weeks postpartum demonstrate the presence of a typical bone marrow edema pattern in both proximal femurs. T1-weighted coronal image (upper) shows decreased signal intensity area in the femoral head, neck, and intertrochanteric areas. With gadolinium enhancement (lower), the decreased intensity area was markedly enhanced.



**Fig. 3.** Serial radiographs taken during follow-up. (A) Anteroposterior radiograph obtained at 4 weeks postpartum shows marked osteopenia in both proximal femurs. The bone density in the left side had increased and that in the right side had decreased slightly as compared with radiographs taken at 1 week postpartum (Fig. 1). (B) Anteroposterior radiograph obtained at 7 weeks postpartum shows increased osteopenia in the right femoral head. However, bone density in the left femoral head had recovered markedly. At this time, the left hip pain had almost completely disappeared. (C) Anteroposterior radiograph obtained at 11 weeks postpartum shows markedly increased bone density in both femoral heads. At this time, the right hip pain had almost completely disappeared. (D) Anteroposterior radiograph obtained at 20 weeks postpartum shows complete bone density recovery in both femoral heads. Slight dimpling (arrow) is observed in the superolateral end of the right femoral head, and this was persistent on anteroposterior radiograph taken at one year postpartum.

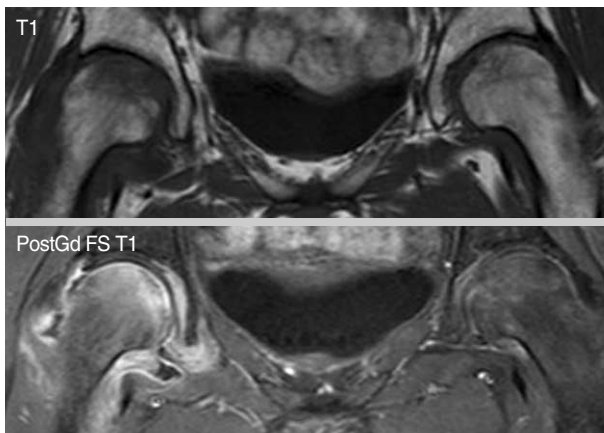


Fig. 4. On MR images taken at 7 weeks postpartum, the bone marrow edema in the left proximal femur had decreased markedly, whereas bone marrow edema persists in the right proximal femur. At this time, left hip pain had almost completely disappeared.

rotic line crossing vertical trabeculae (suggestive a fracture line) were observed. On the second CT images taken at 11 weeks postpartum (11 weeks after right hip pain onset, 19 weeks after left hip pain onset), sclerotic densities of primary compression trabeculae had recovered markedly in both femoral heads. A focal area showing irregular thickening of trabeculae was also observed in the right femoral head. Third CT images taken at 20 weeks postpartum (20 weeks after right hip pain onset, 28 weeks after left hip pain onset) demonstrated increased trabecular density in both femoral heads, and the focal area of irregular trabecular thickening disappeared in both heads. The fourth set of CT images taken at 1 yr postpartum showed almost complete recovery of primary compression trabeculae in both femoral heads.

## DISCUSSION

The etiology of TOH remains unknown, but several hypotheses have been proposed (1, 6). These include intermittent compression of the obturator nerve, a non-traumatic form of reflex sympathetic dystrophy, viral infection, transient ischemic insult to bone, hormonal imbalance and trauma. Recently, SFFH had been proposed as a possible etiology (2-4, 6, 7).

Noorda et al. (6) and Plenck et al. (8) have described the histological findings of biopsy specimens of the femoral head in TOH. Both observed irregular new bone formation in apposition to trabeculae. Noorda et al. (6) considered that microfracture might play a role in the early pathophysiology in TOH, whereas Plenck et al. (8) described new bone formation as microcallus-like, but considered that it was not associated with microfractures. In our case, irregular trabecular bone thickening was observed in both femoral heads in late stage of TOH, and this disappeared gradually. In view of our CT

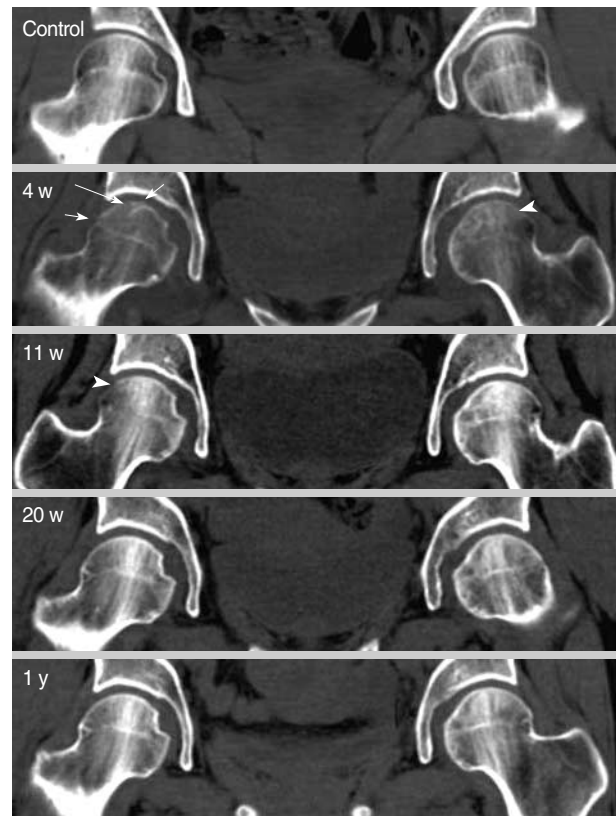


Fig. 5. Serial coronal 3D-CT images taken during follow-up are shown. Coronal CT image of a healthy young woman (control) shows well-oriented vertical primary compression trabeculae with normal bone density in both femoral heads. Image obtained at 4 weeks postpartum (4 w) shows reduced bone density in both proximal femurs, and a loss of thickness and continuation of vertical primary compression trabeculae. Area of irregular spotty increased bone density (arrowhead) is observed in the left femoral head immediately below the subchondral bone plate. Breakages of the subchondral bone plate (short arrows) and a sclerotic line (long arrow) obliquely crossing vertical primary compression trabeculae are observed in the right femoral head. Image taken at 11 weeks postpartum (11 w) shows a marked increase in trabecular density in both femoral heads. Area of irregular spotty bone density (arrowhead) is also observed in the right femoral head. Image taken at 20 weeks postpartum (20 w) shows almost normal appearing vertical trabeculae in both femoral heads. The irregular spotty bone density decreased. Image taken at one year postpartum (1 y) shows normalized vertical trabeculae in both femoral heads. The irregular spotty bone density has decreased further at this stage.

findings, which suggested subchondral fracture in the right femoral head, we consider that irregular trabecular thickening is due to callus formation around injured trabeculae which is gradually remodeled.

Todd et al. (9) observed lesions of irregular bone accretion around trabeculae of the femoral head in cadavers and patients suffering from femoral neck fractures, osteoarthritis, and rheumatoid arthritis. They concluded that these lesions were uniting fatigue fractures of isolated trabecula. This suggests

that some degree of fatigue type microfracture and repair occur continuously in normal healthy adults, but that when microfracture occurs massively, it might become symptomatic like TOH. A sudden increase in body weight during the third trimester of pregnancy could exacerbate any microfracture process.

The clinical course and image findings of TOH closely resemble those of SFFH (2-4, 6, 7). The only difference between them is the presence of the subchondral fracture line on MR images in SFFH. In cases with SFFH, the presence of a fracture line has been reported to be detectable only on some slices of MR images made with various techniques including T1-weighted, T2-weighted, and gadolinium enhanced (1, 10). It is expected that it is more difficult or impossible to detect subchondral fracture line when fractures are incomplete. In the present case, we were unable to detect any definite evidence of subchondral fracture of the femoral head on MR images. However, on MPR CT images, we observed a linear dense sclerotic line suggestive of a fracture line in the right femoral head, and a definite area of irregular trabecular thickening in both femoral heads, which suggested a subchondral trabecular injury and subsequent repair.

The presented case study confirmed the evidence of subchondral trabecular injury in TOH which might be the milder form of injury than SFFH. The authors recommend that CT be used to evaluate trabeculae of the femoral head of TOH cases diagnosed by MRI.

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