Arthroplasty Today 16 (2022) 83–89

Contents lists available at ScienceDirect

Arthroplasty Today

journal homepage: http://www.arthroplastytoday.org/

Case Report

A Case of Fragility Fracture of the Pelvis Initially Diagnosed as Osteoarthritis of the Hip

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ARTICLE INFO

Article history:
Received 5 March 2022
Received in revised form
27 April 2022
Accepted 28 April 2022
Available online xxx

Keywords:
Fragility fracture of the pelvis
Hip osteoarthritis
Total hip arthroplasty
Computed tomography

ABSTRACT

We present the case of a 58-year-old woman who presented with anterior groin pain, initially diagnosed with hip osteoarthritis (OA), scheduled for total hip arthroplasty, and subsequently diagnosed with an occult fragility fracture of the pelvis (FFP) by preoperative computed tomography (CT) examination. We diagnosed the patient with pre-existing hip OA and a bilateral sacrum and left pubic tubercle fracture that exacerbated the groin pain. We operated on the FFP followed by simultaneous bilateral total hip arthroplasty. Given the high prevalence of hip OA and the increasing incidence of FFP, comorbidity of these 2 entities should be ruled out. Even if hip OA is apparent, plain radiographs are insufficient to rule out FFP, necessitating a thorough clinical examination, followed by a CT examination if an FFP is suspected.

Introduction

Fragility fractures of the pelvis (FFPs) are becoming an increasingly important injury due to their rising prevalence and significant morbidity and mortality rates. They are pelvic fractures that occur in elderly patients as a result of low-energy impact or even as an insufficiency fracture in patients with severe osteoporosis [1]. The primary risk factor for FFPs is osteoporosis [2], and FFPs comprise 7% of osteoporotic fractures in patients over 50 years of age in the US [3]. Other risk factors include hypertension, diabetes, vitamin D deficiency, hypocalcemia, nicotine abuse, history of long-term immobilization, rheumatoid arthritis, long-term corticosteroid use, pelvic irradiation, bone harvesting at the posterior aspect of the ilium, previous internal fixation of the proximal femur, hip arthroplasty, lower lumbar arthritis, and scoliosis [2,4,5]. The incidence of these fractures is increasing due to increasing life expectancies in advanced and emerging countries. One recent Finnish study estimated that the number of FFPs in patients older than 80 years will be 2.4 times more in 2030 than in 2013 [6]. FFPs cause significant morbidity, including prolonged hospitalization, immobility, and loss of independence [2], and their mortality rate is similar to that of hip fracture patients [7]. FFPs may become increasingly unstable over time [8], and fracture progression is seen in 14.2%-22.8% of patients [9,10]. Surgical treatment is recommended for patients with fractures of higher degrees of instability and for those unable to mobilize after a certain period [1].

The diagnosis of FFPs can be difficult at times, especially with plain radiographs [2,5]. In this report, we present a case of FFP that was initially diagnosed as bilateral osteoarthritis (OA) of the hip by plain radiography and scheduled for bilateral total hip arthroplasty (THA). Preoperative computed tomography (CT) revealed an occult FFP, which was diagnosed as the cause of pain exacerbation. Patients with pre-existing hip OA may experience FFP, and plain radiographs are insufficient to rule it out. Thus, even if hip OA is apparent on plain radiographs, FFPs should be ruled out with a thorough physical examination. Physical examination findings such as a negative hip flexion abduction external rotation test or a negative diagnostic intra-articular injection suggest an etiology other than the hip joint, while tenderness with palpation of the pelvic ring raises suspicion of FFP. If an FFP is suspected, a CT examination is necessary to confirm the diagnosis and guide treatment.

Case history

A 58-year-old woman with a history of idiopathic scoliosis and progressive left anterior groin pain was referred to our hospital. She

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https://doi.org/10.1016/j.artd.2022.04.016
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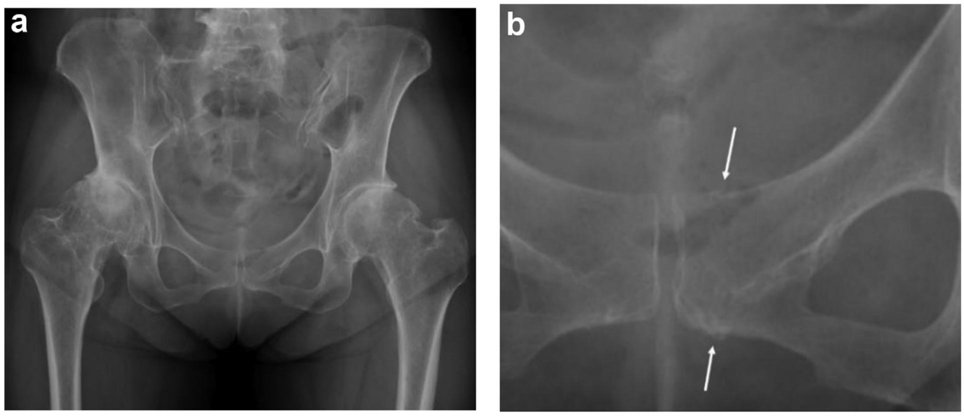

Figure 1. (a) Anteroposterior pelvic radiograph taken at a previous institution 5 weeks prior to the patient's visit showing bilateral osteoarthritis of the hip, with gross loss of joint space with sclerosis and cysts, and large osteophytes. (b) Magnified view of the left pubis showing a minimally displaced fracture through the pubic tubercle (arrows).

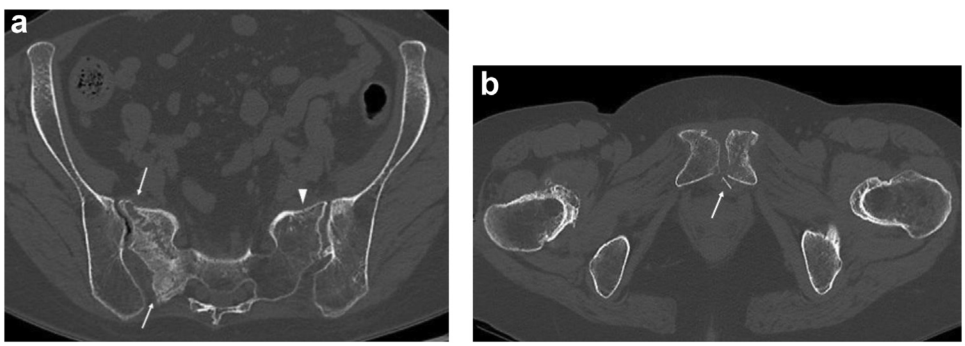

Figure 2. Axial CT images taken at a previous institution 2 weeks prior to the patient's visit showing a fragility fracture of the pelvis (FFP). (a) A right nondisplaced complete sacral fracture (arrows), left nondisplaced incomplete sacral fracture (arrowhead), and (b) left pubic fracture (arrow) are depicted.

had a 2-year history of bilateral anterior groin pain and experienced an exacerbation of left anterior groin pain 2 months prior, without a history of trauma. She had visited an outside institution 5 weeks prior and was diagnosed with bilateral OA of the hips on plain radiography (Fig. 1a) and was indicated for simultaneous bilateral THA. Retrospectively, a minimally displaced fracture through the left pubic tubercle can be observed on the radiograph (Fig. 1b). A CT for preoperative planning revealed an occult bilateral nondisplaced sacrum fracture (right: Denis classification zone II, left: zone I) and left pubic fracture (Nakatani classification type I) (Fig. 2), which was confirmed by magnetic resonance imaging (MRI) (Fig. 3). She was diagnosed with FFP and referred to our hospital. Upon presentation, she experienced severe left anterior groin pain with weight-bearing and pain upon palpation of her pubic symphysis. She was ambulatory indoors with the assistance of 2 canes and outdoors with a wheelchair. The Harris Hip Score was 29 for her right hip and 20 for her left hip, and the modified Majeed Score was 25 (total 80). Progressive left pubis osteolysis was apparent; however, the sacral fracture was difficult to identify on standard anteroposterior, inlet, and outlet pelvic radiographs (Fig. 4). CT showed fracture

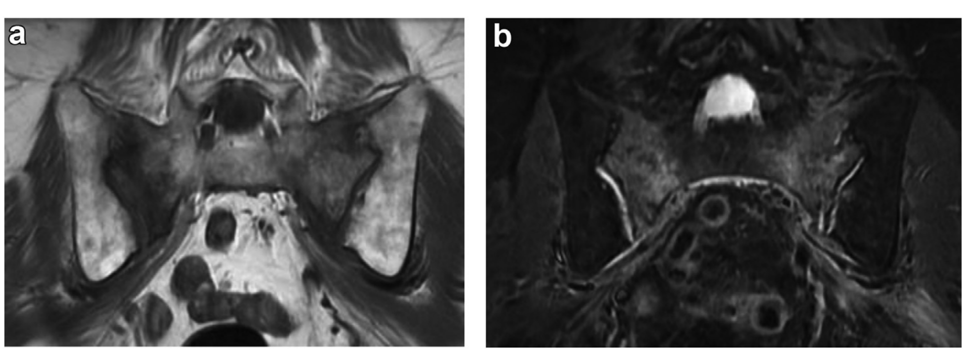

Figure 3. Coronal (a) T1-weighted and (b) T2-weighted short tau inversion recovery (STIR) MRI taken at a previous institution 1 week prior to the patient's visit showing a bilateral sacrum fracture.

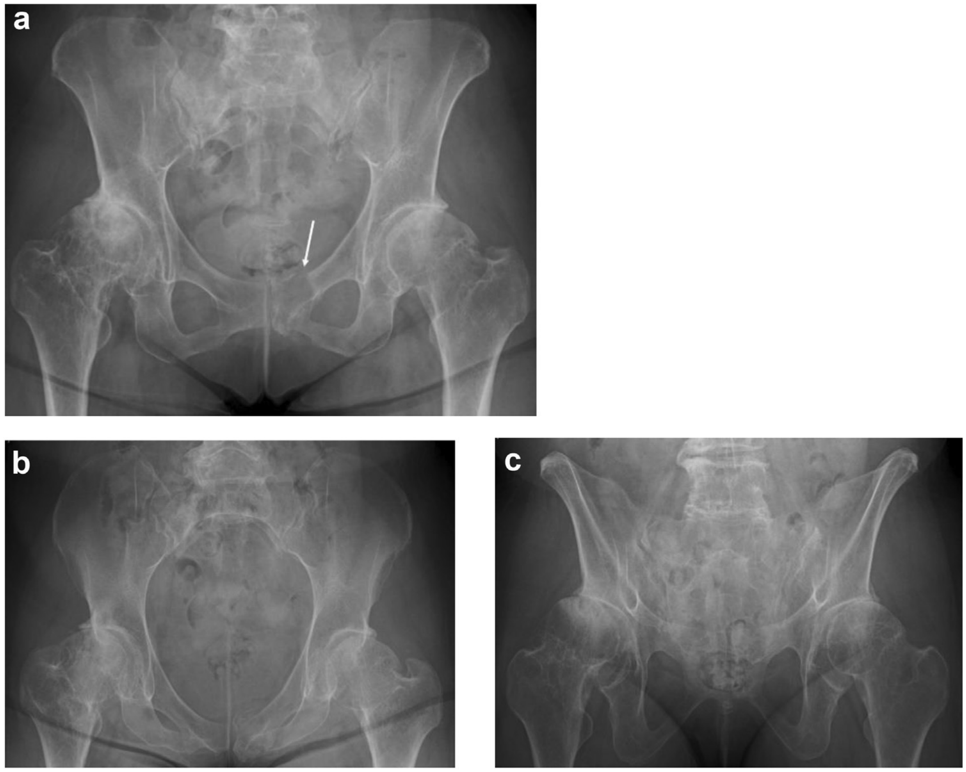

Figure 4. (a) Anteroposterior, (b) inlet, and (c) outlet pelvic radiograph taken at the patient's initial visit showing osteolysis of the left pubis (arrow). The sacrum fracture is difficult to identify.

progression to FFP classification type IIIC, with the right sacrum fracture becoming displaced and the left sacrum fracture progressing to a complete fracture (Fig. 5). Scoliosis with a Cobb angle of 28 degrees at Th7-L3 with secondary spondylosis, including spontaneous fusion of the L5 and S1 vertebrae, was evident on whole-spine radiographs (Fig. 6).

FFP, rather than bilateral hip OA, was determined to be the cause of the left anterior groin pain exacerbation, based on physical examination and apparent fracture progression on imaging tests. Due to the relatively young age of onset and lack of history of trauma, further examination was performed to rule out pathological fractures. Serological tumor markers, upper gastrointestinal endoscopy, enhanced CT, and MRI findings were all negative for neoplasms. Calcium, vitamin D, intact parathyroid hormone, tartrate-resistant acid phosphate 5b, and total procollagen type 1 N-terminal propeptide levels were within normal limits; however, the bone mineral density (BMD) was decreased, with a T-score of -2.32 for the lumbar spine and -2.23 for the femoral neck.

Considering the patient's immobilizing pain, surgical stabilization was indicated for FFP to control the pain and restore mobility. Treatment options such as surgical and nonsurgical treatment, both with osteoporosis treatment, were discussed, and the patient elected for surgery. The anterior pelvic ring was reduced using a Pfannenstiel approach, and the resulting void was grafted with tricalcium phosphate and stabilized with a reconstruction plate (Fig. 7). The use of a superior pubic ramus screw or infra-acetabular screw was avoided considering the possibility of interference during future THA. The posterior pelvic ring was stabilized with transiliac-trans-sacral and ilio-sacral screws (Fig. 8). Immediate weight-bearing was commenced postoperatively, and the patient's

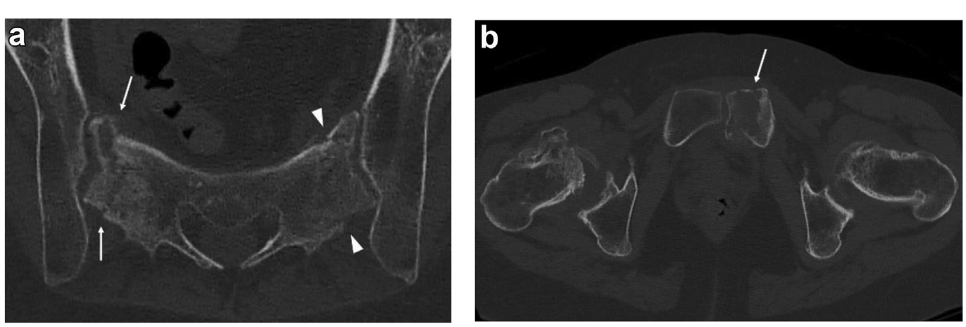

Figure 5. CT images taken at the patient's initial visit showing an FFP with fracture progression to FFP classification type IIIC. (a) Axial image of S1 depicting a right displaced complete sacral fracture (arrows) and left nondisplaced complete sacral fracture (arrowheads). (b) Axial image of the left pubis depicting a fracture with osteolysis (arrow).

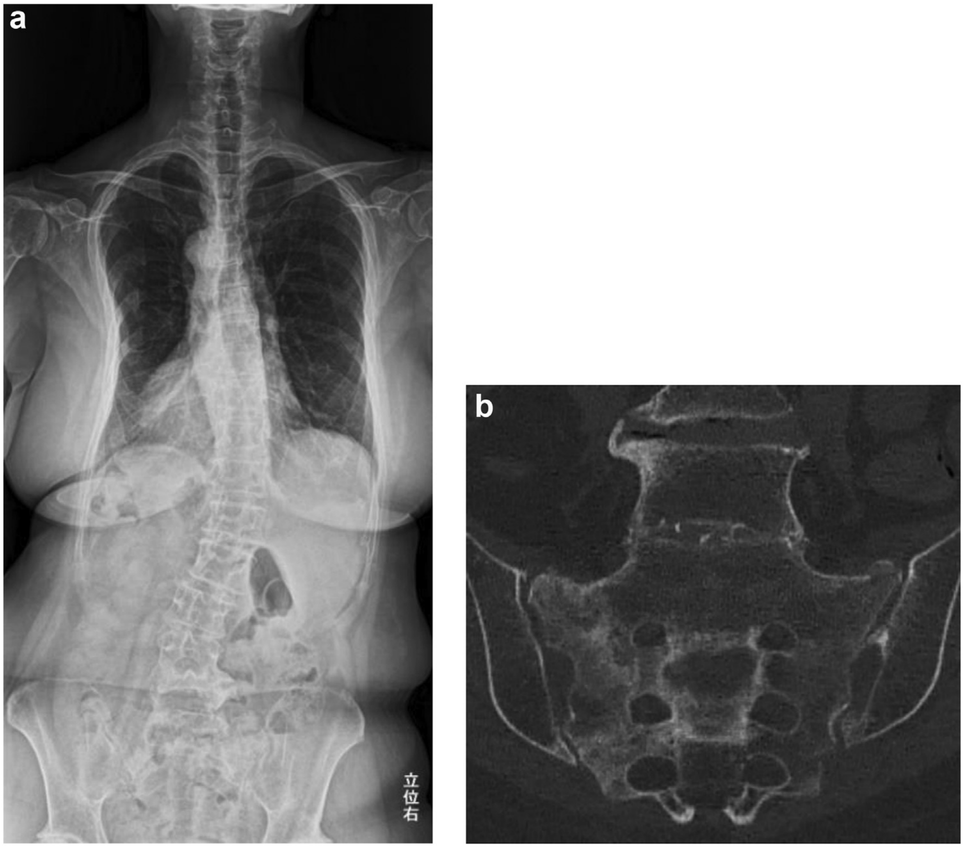

Figure 6. (a) Whole-spine anteroposterior radiograph and (b) coronal CT image of the sacrum showing scoliosis with a Cobb angle of 28 degrees at Th7-L3, with secondary spondylosis and spontaneous fusion of the L5 and S1 vertebrae.

pain was relieved. One month after surgery, the Harris Hip Score improved to 58 bilaterally, and the modified Majeed Score was 66. Pathological examination of the surgically excised tissue from the left pubis osteolysis showed bone necrosis with granulation tissue formation and no evidence of malignancy. Although pain with weight-bearing was relieved, the patient still experienced limp and bilateral anterior groin pain, which existed before the pain exacerbation. These symptoms were attributed to bilateral hip OA, and the patient elected for prompt surgery. Simultaneous bilateral THA was performed using an anterior minimally invasive surgical approach 5 weeks after the initial surgery (Fig. 9).

Fourteen months after the initial surgery, the patient was pain-free and fully ambulatory. The Harris Hip Score was 97 bilaterally, and the modified Majeed Score was 78. Bone union of the sacrum and left pubis was confirmed by plain radiography and CT (Fig. 10).

Discussion

To the best of our knowledge, concomitant FFP and hip OA has not been reported in the literature; however, comorbidity is possible due to the high prevalence of both conditions. The

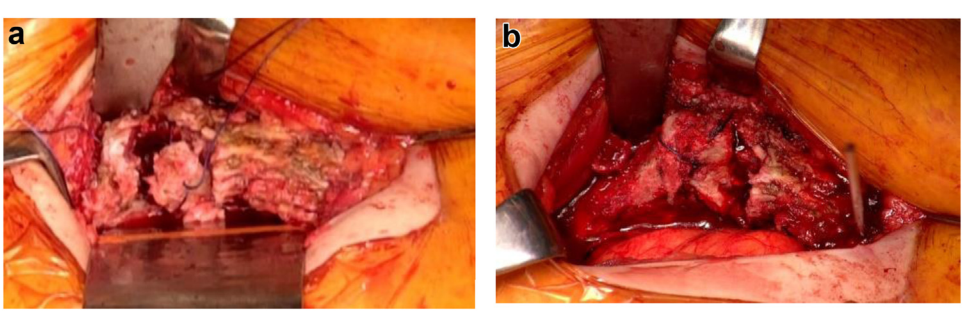

Figure 7. Intraoperative photograph of the left pubis (a) after debridement of granulation tissue, reduction, and temporary fixation with a Kirschner wire and (b) after grafting of the void with tricalcium phosphate and suturing of the remaining cortical bone.

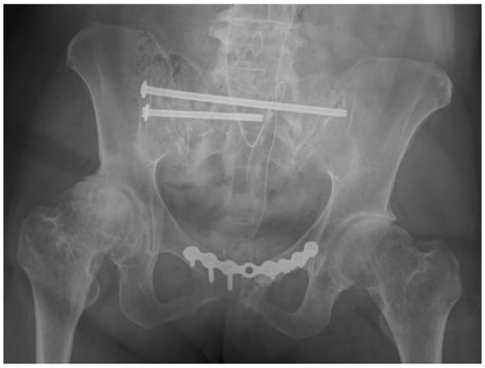

Figure 8. Postoperative anteroposterior pelvic radiograph after stabilization of the FFP. The anterior pelvic ring was stabilized with a reconstruction plate, and the posterior pelvic ring was stabilized with transiliac-trans-sacral and ilio-sacral screws. The use of a superior pubic ramus screw or infra-acetabular screw was avoided, considering the possibility of interference during future THA.

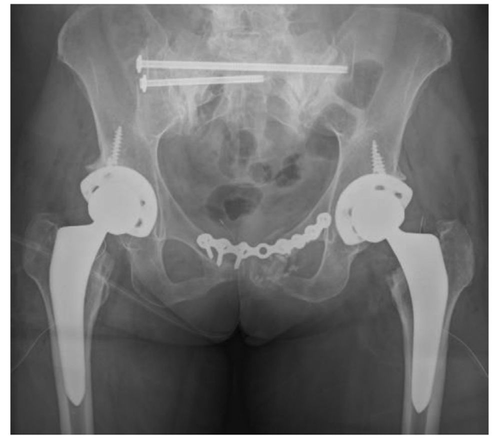

Figure 9. Postoperative anteroposterior pelvic radiograph after simultaneous bilateral THA, at 5 weeks after the initial surgery.

prevalence of symptomatic hip OA is 6.2% in people aged >60 years [11], and a recent systematic review found that the rate of radiographic evidence of OA on plain radiographs is 34% among patients presenting to primary care physicians with hip or groin pain [12]. The incidence rate of FFP in people aged over 60 years is 22.4/10,000 persons per year [13] and is steadily increasing due to longer life expectancies in advanced and emerging countries [5,6]. Patients with symptomatic or radiographic hip OA may suffer an FFP; thus, ruling out FFP is essential, even in patients with apparent signs of hip OA on plain radiographs.

FFP and hip OA are both differential diagnoses of hip pain [12]; however, differentiating between the two may be difficult because of similar patient demographics and symptoms. The incidence of FFP is higher in women, and the mean age of those affected is 80.3 (±8.7) years [13]. Likewise, hip OA is twice as common in women as in men and is more common in people over the age of 60 years [12]. Symptoms of FFP are nonspecific and include severe pain in the hip, groin, or lower lumbar region, and low back pain and sciatica [14]. Patients with hip OA experience pain in the anterolateral hip, often expressed as the C sign, and/or in the posterior hip and buttocks [12,15]. Clinical examinations for FFP include palpation of the anterior and posterior pelvic ring and manual pressure on both iliac crests to test pelvic ring stability [14]. Clinical examinations for hip OA include the flexion abduction external rotation test; posterior hip pain caused by squatting; pain with internal rotation, abduction, or adduction; decreased internal rotation or adduction; and abductor weakness, although positive findings are not specific solely to hip OA [12,15,16]. Diagnostic intra-articular injections may also be useful in differentiating between pain originating from the hip joint and pain from other origins [17].

Although plain radiography is the simplest, least expensive, and most commonly used method for diagnosing hip OA [12,18], plain radiography alone may be insufficient to rule out FFPs. Fractures of the pubic rami are often minimally displaced or simply appear as atypical bony changes [19], as was the case initially in this patient. Fractures of the sacrum are less visible due to overlying bowel gas, bladder content, and osteoporosis [20], and only 20%-38% of sacral insufficiency fractures are identified on plain radiographs [21]. Thus, a CT scan of the pelvis is recommended to evaluate the posterior pelvic ring when a pubic fracture is visible on plain radiograph [20] or when clinical examination is atypical for hip OA or raises suspicion of FFP. Although MRI is not part of the classic diagnostic workup of FFPs, it is more sensitive than CT in diagnosing sacral fractures in elderly patients and may be considered as the next step in the diagnostic workup after negative CT results [5,22].

We believe that FFP occurred in this atypical young patient due to a combination of low BMD and stiffness of the lumbar spine and hip, which caused biomechanical stress to her pelvis. BMD may falsely increase in areas with osteophytes [23], and a recent study of FFP patients showed that BMD of the lumbar spine by dual-energy radiograph absorptiometry does not correlate with regional sacral bone density [24]. Thus, because of the presence of osteophytes in both the lumbar spine and hip, the BMD of this patient's sacrum may have been even lower than that on dual-energy radiograph absorptiometry. Spondylosis and scoliosis are risk factors for FFP, with lumbar spine stiffness resulting in force transmission to the upper sacral segment [2]. Hip OA has also been reported to be a risk factor for pelvic stress fractures [25]. Since both the patient's lumbar spine and hip were stiff due to osteoarthritic changes, forces from activities of daily life and trivial trauma may have been concentrated to her pelvis, causing a fracture. Previous hip surgery has been reported as a risk factor for FFP [2], and we propose that hip OA may also be a risk factor for FFP and should be further evaluated.

In this case, from the clinical examination and progression of FFP on imaging tests, we diagnosed the patient with pre-existing hip OA and left anterior groin pain exacerbation due to the onset of FFP. Concomitant FFP and hip OA must be considered even in atypical cases, such as younger patients without a history of trauma. Even if hip OA is apparent on plain radiographs, it is essential for physicians to rule out FFP by a thorough clinical examination, followed by a CT examination if an FFP is suspected.

Summary

We present the case of a patient presenting with anterior groin pain initially diagnosed with hip OA by plain radiography, scheduled for THA, and subsequently diagnosed with occult FFP by CT examination. Patients with pre-existing hip OA may experience FFP, and plain radiographs are insufficient to rule out FFP. Even if hip OA is apparent on plain radiographs, we advise physicians to rule out

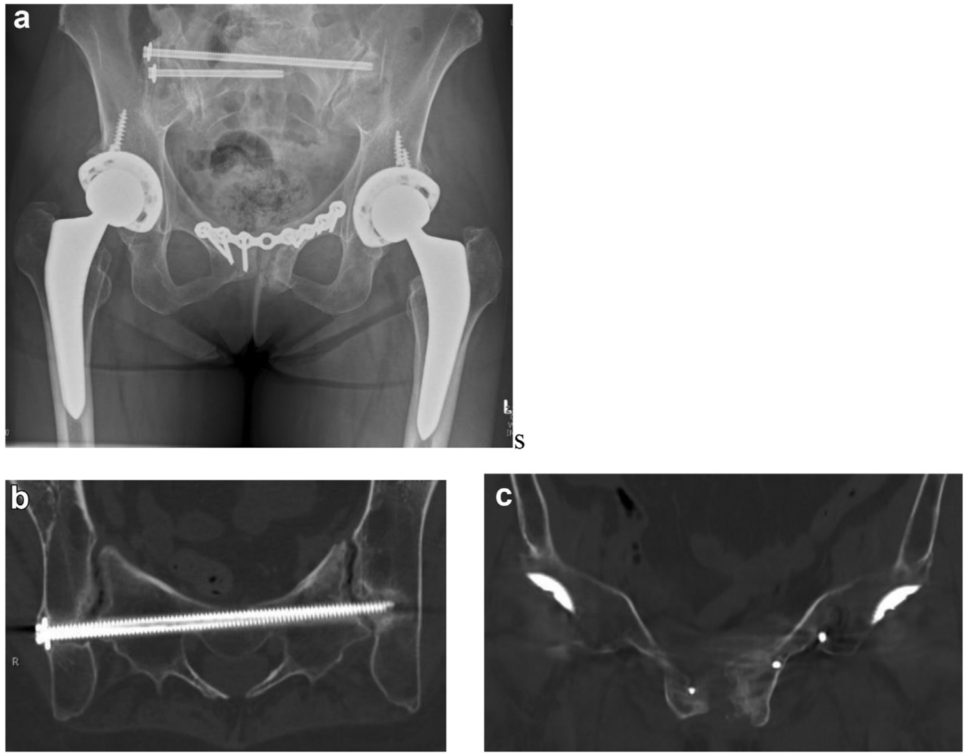

Figure 10. (a) Anteroposterior pelvic radiograph, (b) axial CT images of S1, and (c) coronal CT images of the pubis, showing complete bone healing at 14 months after the initial surgery.

FFP by clinical and/or CT examination, especially in patients with immobilizing pain or an episode of pain exacerbation.

Conflicts of interest

The authors declare that there are no conflicts of interest.

For full disclosure statements refer to https://doi.org/10.1016/j.artd.2022.04.016.

Informed patient consent

The author(s) confirm that informed consent has been obtained from the involved patient(s) or if appropriate from the parent, guardian, power of attorney of the involved patient(s); and, they have given approval for this information to be published in this case report (series).

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