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Arthroscopic correction for concomitant cam impingement in a patient with idiopathic osteonecrosis of the femoral head: A case report

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ABSTRACT

A 53-year-old man presented with pain in the right hip. Radiological examination showed idiopathic osteonecrosis of the femoral head (ONFH) combined with a cam lesion. Findings on physical examination were consistent for femoroacetabular impingement. At surgery, we performed isolated arthroscopic correction for the cam lesion but did not use other treatment options such as hip arthroplasty or osteotomies for the ONFH. At the latest follow-up evaluation 3 years after surgery, findings indicted a satisfactory outcome, with a Harris hip score of 93.2 (compared with 76.4 before surgery), no joint-space narrowing, and no collapse of the femoral head. It is important to accurately diagnose the status of idiopathic ONFH and to consider another possible pathogenesis when a patient with idiopathic ONFH has hip pain even without femoral-head collapse.

1. Introduction

Idiopathic osteonecrosis of the femoral head (ONFH) usually affects young and middle-aged patients, and most of the radiographically larger lesions progress to collapse, resulting in the rapid destruction of the hip joint [1–5]. Corticosteroid therapy and alcohol abuse have been identified as risk factors for the development of the disease [6]. Collapse of the femoral head usually occurs in the subchondral portion [7–9], and the collapse is often the first symptom of the disease [10]. ONFH accounts for 10% of total hip arthroplasties performed every year in the United States and Western Europe [11]. Although good clinical results can be obtained by treating ONFH with total hip arthroplasty or bipolar hemiarthroplasty [12,13], consideration of joint-preservation surgery for idiopathic ONFH is important because it allows avoidance or delay of hip-replacement procedures, because the disease often occurs early in adolescence. In fact, several joint-preservation surgeries have performed in young patients, with good clinical results [14–20]. Mont et al. suggested in a systematic literature review that consideration for joint-preserving surgical treatment even in asymptomatic patients with a medium to large and/or laterally located lesion may be beneficial [21]. Meanwhile, with the recent recognition of femoroacetabular impingement (FAI), progress in hip arthroscopy, and development of arthroscopic management of FAI, numerous studies dealing with this subject have been reported [22–26]. Until now, surgical intervention with arthroscopic treatment for concomitant cam impingement in patients with idiopathic ONFH had not been reported. Therefore, we describe here a case of idiopathic ONFH in which the patient was able to avoid hip-replacement surgery by undergoing arthroscopic correction for concomitant cam impingement.

2. Case report

A 53-year-old man with alcoholism who was employed by a sake factory visited our hospital because of pain in his right hip. In January 2007, he underwent hemiarthroplasty of his left hip joint at another hospital because of bilateral alcoholic ONFH, according to the criteria described by Steinberg et al. [27] (left: stage 3A; right: stage 2C) and the criteria described by Sugano et al. [2] (left: type C1, stage 3A; right: type B, stage 2) (Fig. 1). The patient's height was 170 cm, and his weight was 58 kg. His body mass index was 20.1 kg/m^2. He reported a gradual increase in right hip joint pain, with no obvious precipitating event, in September 2009. He went to the hospital where he undergone surgery for his left hip, but he was referred to our hospital because he refused to undergo the same surgery for his right hip.

Findings for routine laboratory examinations were normal. Physical examination revealed a slight limitation of hip joint motion: flexion, 110°; abduction, 40°; adduction, 20°; internal rotation, 0°; and external rotation, 50°. Findings for the anterior impingement sign were positive on the right side, but he had not

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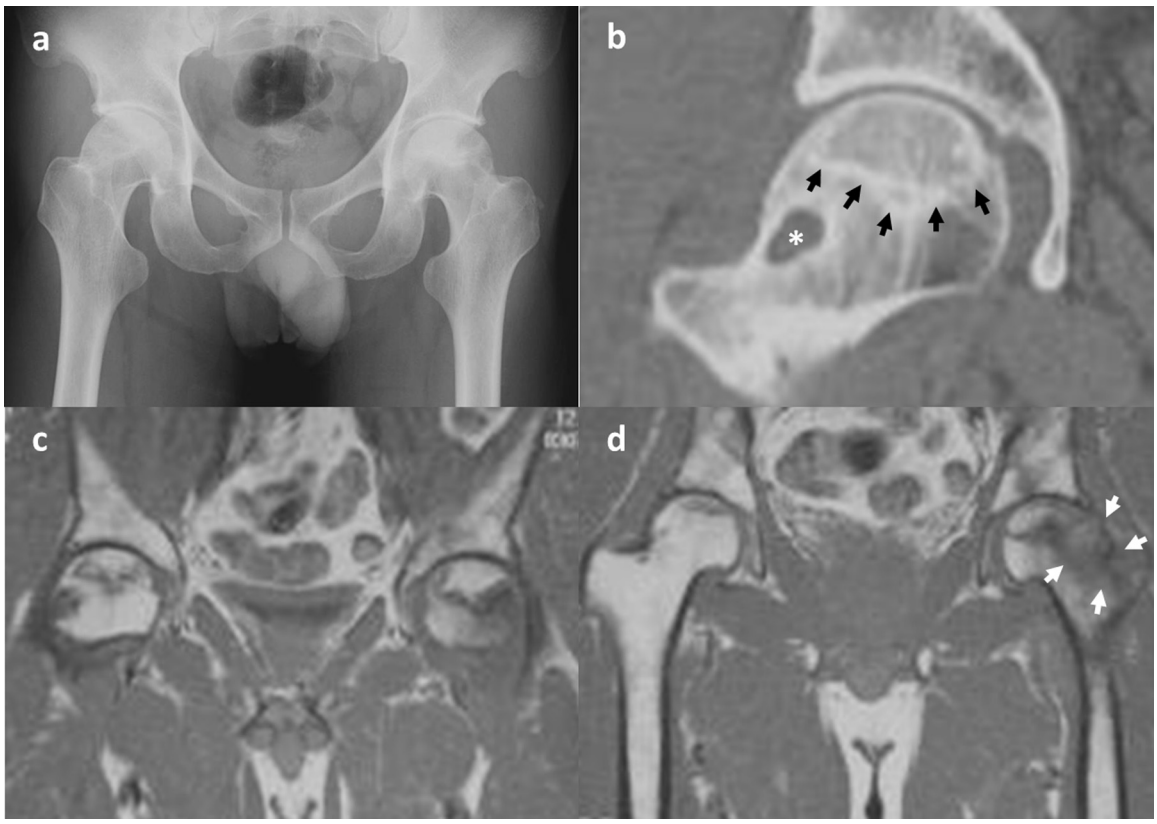

Fig. 1. (a) Anteroposterior radiograph obtained 4 years before arthroscopic surgery. A sclerotic band is apparent in both femoral heads. (b) Multiplanar reconstruction via computed tomography at the same time show a herniation pit at the junction of the femoral head and neck (asterisk), in addition to the obvious sclerotic band in the femoral head (black arrow). (c and d) T1-weighted magnetic resonance images show a bone marrow edema pattern that indicates collapse of the femoral head in the head and neck of the left femur (white arrow).

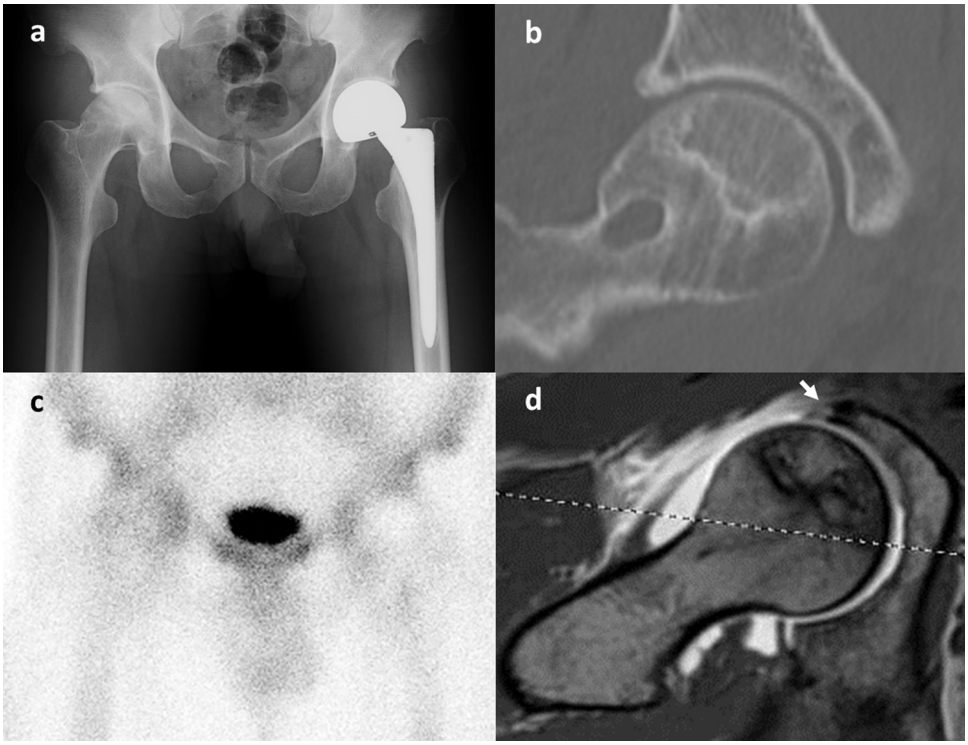

Fig. 2. (a) Anteroposterior radiograph obtained just before the arthroscopic surgery. Sclerotic band and herniation pit was more obvious than 4 years ago. (b) Multiplanar reconstruction of computed tomographic image showing no obvious collapse of the femoral head. (c) Bone scintigraphy demonstrated cold in hot pattern as seen in primary osteonecrosis and no increased uptake due to collapse. (d) Arthro-MRI showing intensity change of anterolateral part of the labrum which indicates labral tear (white arrow).

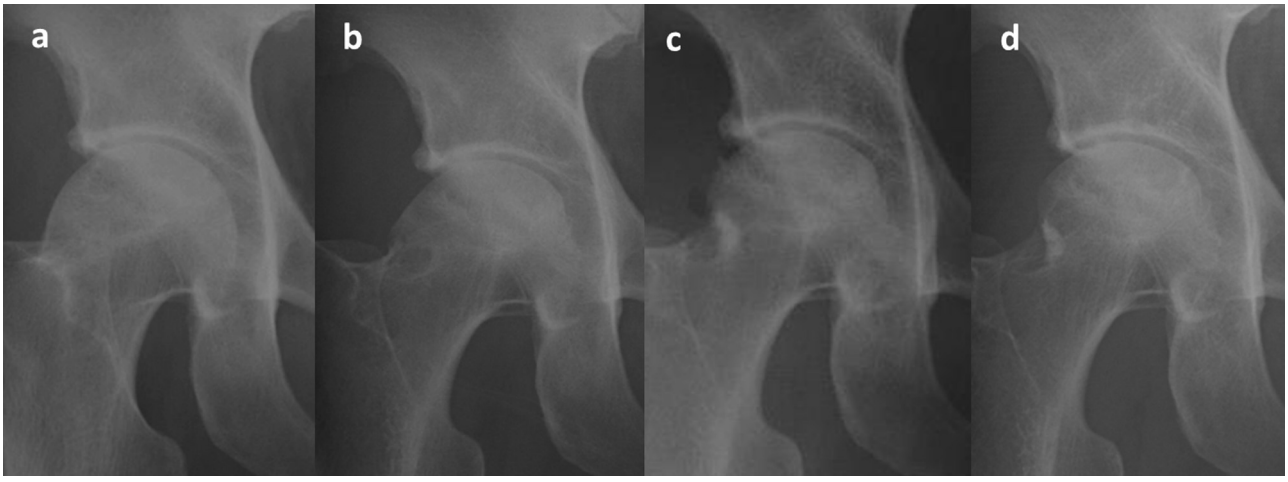

Fig. 3. Anteroposterior radiographs taken (a) 4 years before the arthroscopic surgery, (b) just before surgery, (c) immediately after surgery, and (d) 3 years after surgery. No obvious progression of joint-space narrowing has been seen in the 7 years.

experienced pain except during flexion and internal rotation of his hip. His bone mineral density, measured by dual X-ray absorptiometry, was 1.110 g/cm^2 for his right femoral neck. A plain radiograph showed slight joint-space narrowing, a sclerotic band in the femoral head, cam deformity, and a large herniation pit in the femoral head–neck junction (Fig. 2). The center-edge angle of Wiberg [28] was 31°, and the acetabular roof angle [29] was 1°. On the cross-table view, the alpha angle [30] was 64°. T_1-weighted magnetic resonance imaging of the right hip joint showed a deep wedge-shaped, low-intensity band in the right femoral head, as seen in primary osteonecrosis. However, no bone marrow edema pattern was seen. Computed tomography also showed a deep wedge-shaped sclerotic band in the femoral head, but no obvious collapse was seen. On the basis of those image findings, the radiologist diagnosed primary osteonecrosis of the right femoral head. In addition, we performed magnetic resonance imaging arthrography to see if there was a labral tear or delamination of the acetabular cartilage due to cam impingement. We found that the anterolateral portion of the labrum was torn (Fig. 3). Taking all image findings into consideration, we diagnosed the cause of the pain as a labral tear arising from cam impingement, rather than alcoholic ONFH. The labral tear was treated with arthroscopic labral debridement and osteochondroplasty of the femoral head–neck junction. At surgery, hip arthroscopy was performed through anterolateral and mid-anterior portals.

The surgical setup for hip arthroscopy was according to the technique reported by Philippon et al. [22]. Arthroscopic examination revealed a full-thickness labral tear (classification of Lage et al. [31]; radial fibrillated type) and acetabular cartilage defect at the anterosuperior region (classification of Konan et al. [32]; zone 3, grade 4A). Because of the small size of the cartilage defect, we did not perform microfracture [33]. A labral tear was identified at the anterosuperior edge of the acetabulum, and we performed the minimum debridement necessary. Although there was softening of the cartilage in the necrotic area, the femoral head did not collapse as we had expected before surgery. For confirmation, we perforated the necrotic area to see if it bled, but it did not do so. In the peripheral compartment, we removed the osteochondral surface and synovium, using a motorized burr and shaver, at and around the head–neck junction to avoid cam impingement. The herniation pit was so large (approximately 11 × 13 × 10 mm) that we removed the contents and filled the cavity with 3 mL of hydroxyapatite bone substitute (Cerafit, NTK, Aichi, Japan) to prevent postoperative fracture of the femoral neck; we used the method of Jamali et al. [34] (intraoperative video). Histological analysis showed that the bone cyst found in the herniation pit consisted of collagen fiber, adipose tissue, blood vessels, and a few chronic inflammatory cells.

Passive motion of the operated hip was initiated on the first day after surgery. Weight-bearing was allowed 3 days after surgery. The patient's Harris hip score [35] had improved from 76.4 before surgery to 93.2 by the time of the 3-year postoperative follow-up evaluation. In addition, a plain radiograph obtained at the latest follow-up evaluation demonstrated no obvious progression of joint-space narrowing and no collapse of the femoral head. To date, there has been no postoperative femoral neck fracture.

Our study was approved by our institution's review board, and the appropriate written evidence of informed consent was obtained from the patient.

3. Discussion

Our most important finding was the clinical efficacy of arthroscopic correction for concomitant cam impingement in idiopathic ONFH without collapse of the femoral head. Generally, hip replacement is required for symptomatic ONFH if collapse of the femoral head advances. Kang et al. and Nam et al. respectively demonstrated that symptoms developed in 55.9% and 59% of asymptomatic ONFH. In addition, both groups reported that the prevalence of symptom development was significantly higher for large lateral lesions [36,37]. Min et al. suggested that the extent of large necrotic lesions (involving >30% of the femoral head) [10] and the location of type C2 [2] necrotic lesions predict collapse. Furthermore, they also indicated that the mean interval between diagnosis of asymptomatic ONFH and collapse was 4.1 years. In our patient, the femoral head on the left side collapsed because of the large size and lateral position (>30% of the head; type C2) of the lesion. Meanwhile, although Nishii et al. reported that the collapse rates of type B according to the criteria described by Sugano et al. [38] was 50% we assumed that the right femoral head had not collapsed because of the lesion there was of medium size and had a relatively medial position (15–30% of the head; type B). Besides, more than 4 years had already passed since the original diagnosis at the patient's first visit to our hospital. The passage of that amount of time without any change indicates that the possibility future collapse of the right femoral head is low. In planning surgery, we had several treatment options, such as total hip replacement, bipolar hemiarthroplasty, osteotomies, and hip

arthroscopy. We determined that the cause of his right hip joint pain was cam impingement instead of idiopathic ONFH, because of evidence of the presence of a large cam lesion and a herniation pit, in addition to a lack of collapse of the femoral head. Moreover, the joint space had already been maintained for more than 4 years by the time of his first visit to our hospital. Thus, we considered arthroscopic cam correction the best option. Hip arthroscopy is a minimally invasive technique for diagnosis as well as therapeutic management of FAI [22–26]. If we had performed an osteotomy, such as a femoral varus osteotomy, the patient's symptoms might have been aggravated because the varus position of the femoral neck makes impingement of the cam lesion easier. In some poor outcome patients who underwent osteotomies for idiopathic ONFH might be included the ones who were ignored or misdiagnosed concomitant FAI. Bipolar hemiarthroplasty also might lead to early failure due to central migration of the bipolar head, because he already had a grade IV cartilage defect (classification system of Outerbridge and Dunlop [39]) at the time of surgery. Recently, it has been reported that the timing of surgery and the patient's age are important factors in avoiding the occurrence of chondral defects in patients with symptomatic cam-type FAI [40]. In this case, it might have been possible to avoid the occurrence of a chondral defect if the patient's disease had been diagnosed precisely and earlier.

With regard to artificial bone grafts for herniation pits, Wijdicks et al. demonstrated, in an in vitro biomechanical study, that there are significant decreases in ultimate load and energy to failure in femoral cortical notching of a depth >4 mm with cam resection [41]. In our patient, the depth of the herniation pit was approximately 10 mm, so there was concern about postoperative fracture of the femoral neck. Therefore, we decided to use artificial bone graft to decrease the risk of the fracture. At 3 years after surgery, the graft seemed to be well incorporated into the bone.

4. Conclusion

In a patient with idiopathic ONFH, concomitant cam impingement was treated arthroscopically. Our findings show that it is important to diagnose precisely the status of idiopathic ONFH. Our patient's recovery was uneventful, and his Harris hip score improved from 76.4 before surgery to 93.2 by the latest follow-up evaluation, and he had no joint-space narrowing or collapse of the femoral head. It is important to consider another pathogenesis when a patient with idiopathic ONFH has hip pain even without femoral-head collapse. Ignored or misdiagnosed concomitant femoroacetabular impingement in a patient with idiopathic osteonecrosis of the femoral head might lead to poor outcomes of surgical treatments such as bipolar hemiarthroplasty or osteotomies.

Conflict of interest

No conflicts of interest.

Funding

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Ethical approval

We report about a single case that did not require ethical approval. The manuscript is not a clinical study.

Consent

We obtained written and signed consent to publish a case report from the patient.

Author contributions

All authors were involved in drafting the article or revising it critically for important intellectual content, and all authors approved the final version for publication. Dr. Fukui had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study conception and design. Fukui.

Acquisition of data: Fukui.

Analysis and interpretation of data: Fukui, Kaneuji, Matsumoto.

Guarantor

Fukui.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.ijscr.2015.12.021.

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