CASE REPORT
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Avascular necrosis of the femoral head following an occult femoral neck stress fracture

Avaskularna nekroza glave femura nakon okultnog stres preloma vrata femura

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Abstract

Introduction. Osteonecrosis (ON) of the femoral head (FH) – (ONFH) is an intractable disease that causes progressive femoral head collapse, severe pain, and gait disturbance. We report a case of avascular necrosis of the femoral head following an occult femoral neck (FN) stress fracture. **Case report.** A 55-year-old woman presented to our department with a chief complaint of low back pain that radiated into the left anterolateral thigh over the period of two months. Her left anterolateral thigh became progressively more painful over the past two weeks. No abnormal findings indicative of ONFH or an occult fracture of the FN were detected by X-ray or computed tomography, but an occult insufficiency fracture of the left FN was identified on magnetic resonance imaging (MRI). The diagnosis of FN stress fracture was delayed, resulting in femoral head necrosis. The fracture was treated with total hip arthroplasty, and the resected FH was subjected to histopathology (HP). Based on the HP findings, the final diagnosis of this case was ONFH with an occult fracture of the left FN. Clinical symptoms were relieved postoperatively. **Conclusion.** An early MRI examination is recommended in patients presenting with a suspected stress fracture of the FN to avoid FH necrosis due to a delayed diagnosis.

Key words:
arthroplasty, replacement, hip fracture; fracture, stress; femur head necrosis; magnetic resonance imaging; surgical procedures, operative; osteonecrosis.

Apstrakt

Uvod. Osteonekroza (ON) glave femura (GF) – (ONGF) je bolest koju je teško kontrolisati, a izaziva progresivni kolaps GF, praćen jakim bolom i otežanim hodom. Prikazana je bolesnica sa avaskularnom nekrozom GF, nastalom usled okultne stres frakture vrata femura (VF). **Prikaz bolesnika.** Žena stara 55 godina javila se na Odeljenje, žaleći se na bol u leđima koji se širio u levu butinu u prethodna dva meseca. Bol u levoj butini se progresivno pojačavao tokom prethodne dve sedmice. Na radiografskim snimcima, kao i snimanjem kompjuterizivanom tomografijom, nije utvrđen patološki nalaz indikativan za ONGF ili okultnu frakturu VF, ali je snimanjem magnetnom rezonancom (MR) utvrđena okultna insuficijentna fraktura levog VF. Dijagnoza stres frakture VF nije postavljena, što je rezultiralo nekrozom GF. Bolesnici je urađena totalna artroplastika kuka, a uzorak GF je upućen na histopatološku (HP) analizu. Na osnovu HP nalaza, postavljena je konačna dijagnoza ONGF sa okultnom frakturom levog VF. Simptomi bolesnice su se povukli posle operacije, što je rezultiralo njenim kliničkim oporavkom. **Zaključak.** Kod bolesnika koji se prezentuju stanjem koje je sumnjivo na stres frakturu VF, preporučuje se rano snimanje MR, da bi se, usled odložene dijagnoze, izbegla nekroza GF.

Ključne reči:
artroplastika kuka; kuk, prelom; prelomi usled zamora; femur, nekroza glave; magnetska rezonanca, snimanje; hirurgija, operativne procedure; osteonekroza.

Introduction

Osteonecrosis (ON) of the femoral head (FH) – ONFH is an intractable disease that causes progressive FH collapse, severe pain, and gait disturbance [1–3]. The most common risk factors for ONFH are previous trauma, long-term corticosteroid use, and alcohol abuse; however, idiopathic ONFH, in which the patient has no known risk factors, is not an infrequent finding [4, 5]. The collapse of a necrotic FH often occurs in subchondral bone, but an occult insufficiency fracture

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of the femoral neck (FN) is relatively rare in cases of ONFH. As the pathogenesis of ONFH is unclear, it is necessary to investigate its clinical manifestations to improve diagnosis, treatment, and prognosis. In this report, we describe a case of avascular necrosis of the FH following an occult FN stress fracture. The fracture was spontaneous, and there was no trauma or unusual activity. No signs of an occult FN fracture or ONFH were found by X-ray or computed tomography (CT). The entire FH was necrotic following the occult FN stress fracture. Written informed consent was obtained from the patient to publish this case report and any accompanying images.

Case report

A 55-year-old woman (height, 160 cm; weight, 55 kg; body mass index 21.4 kg/m^2) presented to our Department with a chief complaint of low back pain that had radiated into the left anterolateral thigh over the past two months.

The patient had experienced progressive pain in the left anterolateral thigh for about two weeks. The pain was relieved when she lay down on a bed but was exacerbated by standing or walking. She had no history of trauma, alcohol abuse, corticosteroid use, or smoking.

The physical findings were thoracolumbar spine range of motion of approximately 80° flexion, 10° extension, and 15° lateral flexion bilaterally. The lumbar paraspinal musculature was tender to the touch at all levels, and there was a negative Lasegue sign and no lower extremity numbness. Deep left groin area tenderness and a positive Patrick sign were observed on the hip examination.

Routine laboratory tests were normal. Lumbar spine magnetic resonance imaging (MRI) demonstrated intervertebral disc degeneration at the L4/5 levels. The bone mineral density (BMD) of the left hip measured by dual X-ray absorptiometry was 0.772 g/cm^2 (T score, -1.9). The BMD of the lumbar spine was 0.900 g/cm^2 (T score, -2.5). No abnormal findings were detected on a plain radiograph of the left hip (Figure 1). No bone necrosis or fracture signs were found on a CT scan (Figure 2), but T1-weighted MRI revealed a large, low-intensity area in the left FH and FN. An occult insufficiency fracture of the left FN was found (Figure 3A) on the T2-weighted image, and there was a large area of bone marrow edema (BME) in the left FH and FN (Figure 3B).



Fig. 1 – No significant findings were observed in the anteroposterior view.



Fig. 2 – Coronal computed tomography (CT) images of the left hip did not reveal bone necrosis or fracture signs.

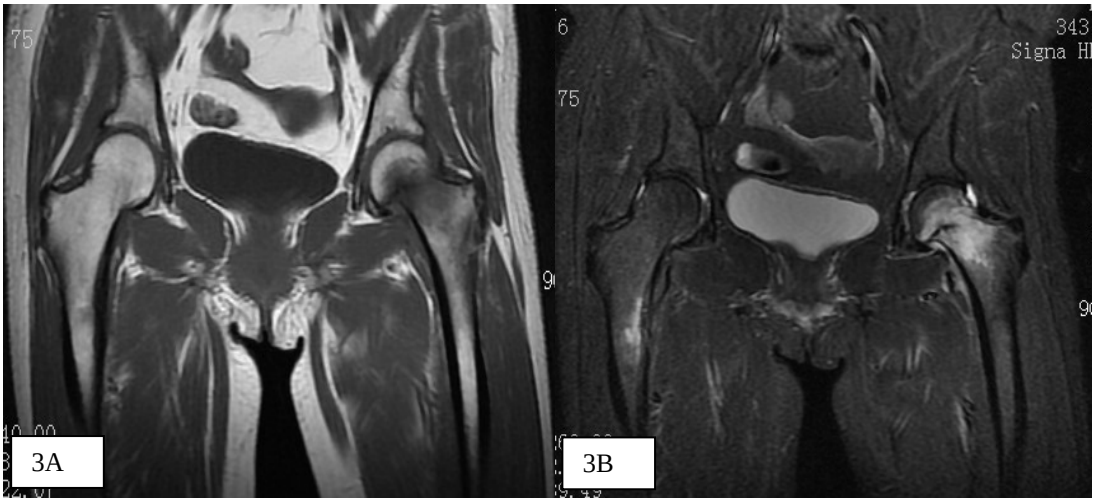


Fig. 3 – A) T1-weighted magnetic resonance image (MRI) showing a large low-intensity area in the left femoral head (FH) and femoral neck (FN) and an occult insufficiency fracture of the left FN; B) T2-weighted MRI showing a large area of bone marrow edema in the left FH and FN and an occult insufficiency fracture of the left FN.

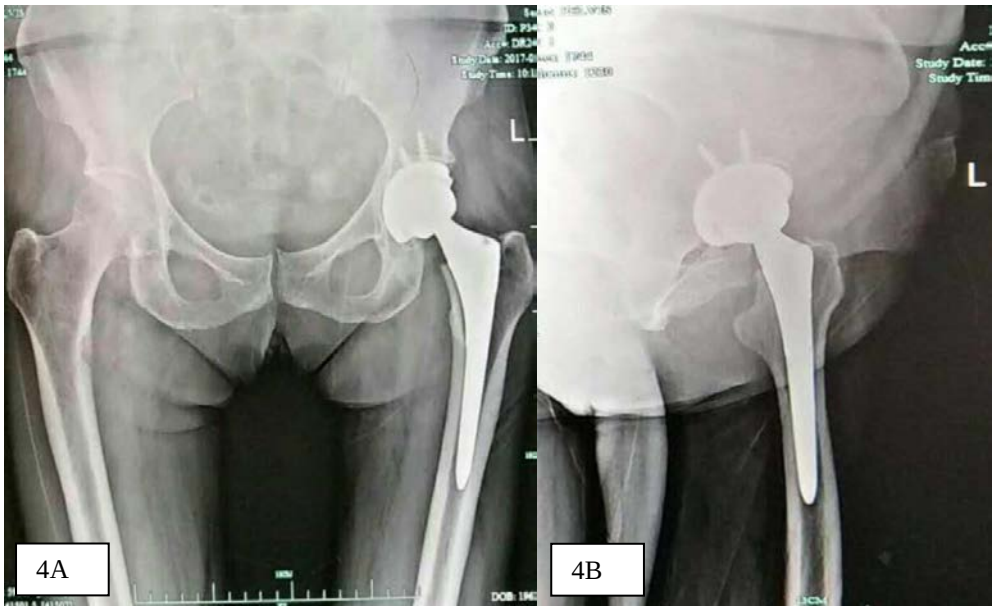


Fig. 4 – Anteroposterior (4A) and lateral (4B) X-ray of the left total hip arthroplasty.

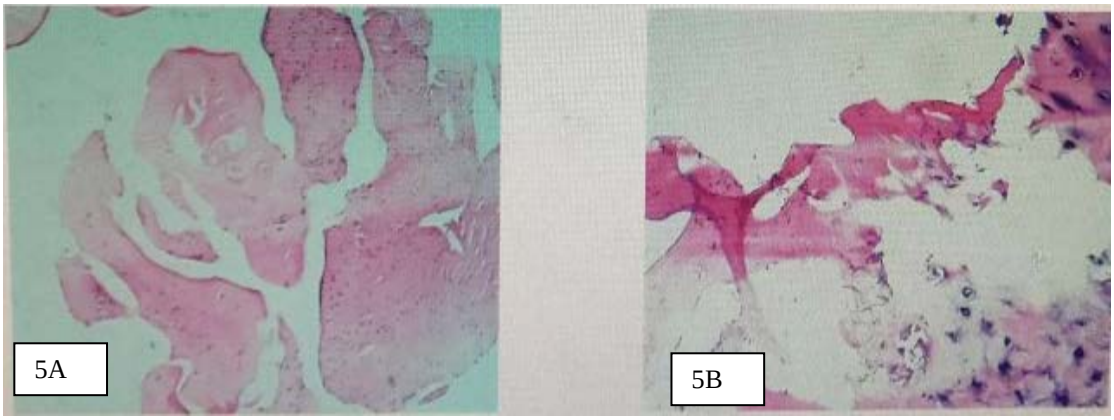


Fig. 5 – Histological examination reveals dead osteocytes in the trabeculae of the femoral head (5A), which is consistent with the pathological diagnosis of osteonecrosis (5B). (hematoxylin and eosin, ×100).

The diagnosis was an occult fracture of the left FN based on the MRI findings. The occult fracture may have been caused by osteoporosis. The diagnosis of FN stress fracture was delayed, resulting in FH necrosis. The fracture was treated using total hip arthroplasty (Figure 4), and the resected FH was observed histopathologically. The histological examination revealed a typical pattern of dead osteocytes in the trabeculae of FH, consistent with a pathologic diagnosis of osteonecrosis (Figure 5). Based on these histopathological findings, the final diagnosis, in this case, was ONFH with an occult fracture of the left FN. The clinical symptoms were relieved postoperatively.

Discussion

ONFH often leads to FH collapse and disabling secondary osteoarthritis of the hip joint, which destroys the hip. In the United States, 20,000–30,000 patients are diagnosed with osteonecrosis every year [6]. The most important risk factors for ONFH in the United States are alcohol misuse (20–40%), corticosteroid therapy (35–40%), and idiopathic diseases (20–40%) [7]. Idiopathic (primary or spontaneous) ONFH is the fourth leading cause of ONFH and has no overt risk factors. The most common clinical manifestation of ONFH is progressive hip pain. The clinical presentation can vary and may involve spine or knee symptoms, with normal hip physical examination findings or onset of pain in the pelvis, buttocks, groin, and lower limbs [8]. Our patient had no history of trauma, alcohol abuse, corticosteroid use, or smoking, so it was not intuitive to suspect occult FN stress fracture or ONFH based on the medical history and clinical manifestations. In particular, no signs of occult FN fracture or ONFH were found by X-ray or CT, which delayed the diagnosis of a stress fracture of the FN and thus promoted the progression to FH necrosis.

ONFH often occurs in the weight-bearing area of the FH, i.e., in the subchondral bone, and rarely involves the FN. An occult insufficiency fracture of the FN is relatively rare in

cases of ONFH. In our patient, T1-weighted MRI demonstrated a large low-intensity area in the left FH and FN, and an occult insufficiency fracture of the left FN was found on the T2-weighted image, in association with a large area of BME in the left FH and FN. However, BME should be distinguished from osteonecrosis because it is a secondary phenomenon resulting from FH collapse that resolves spontaneously [9–11]. No typical clinical pattern was found in our patient, and the quality of the bone was insufficiently poor for a spontaneous fracture of the FN to occur. Subchondral insufficiency fracture of the FN may occur in elderly patients with osteoporosis; spontaneous necrosis of the FH may occur first, followed by a stress fracture of the FN. In this case, the resected FH was observed histopathologically and showed a zonal pattern comprised of an area of bone infarction, reparative granulation tissue, and viable tissue. Based on these findings, the final diagnosis, in this case, was ONFH with an occult fracture of the left FN. Subcapital fractures in cases of ONFH rarely have good outcomes. Consequently, these patients should be treated with hip arthroplasty. We treated our case with total hip arthroplasty. Fukui et al. [12] reported a case of occult fracture of the FN due to extensive ONFH in a 60-year-old man with hip pain. Yoon et al. [13] reported an unusual case of ONFH that was misdiagnosed as a stress fracture. However, in our patient, the delayed diagnosis of FN stress fracture resulted in FH necrosis.

Conclusion

Although the clinical relevance of an occult fracture of the FN in cases of ONFH remains unclear, an early MRI examination is recommended in a patient with a suspected stress fracture of the FN to avoid FH necrosis due to a delayed diagnosis.

Availability of data and materials

All data generated or analyzed during this study are included in this article.

Conflict of interest

No potential conflicts of interest relevant to this article are reported.

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