AVASCULAR NECROSIS OF THE FEMORAL HEAD AFTER COVID-19: A CASE REPORT

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Abstract
Avascular necrosis of the femoral head can traumatic or non-traumatic in origin. Embolism (hemoglobinopathies, dysbaric osteonecrosis), corticosteroid treatment, alcohol usage, pelvic irradiation, and genetic susceptibility are among the causes of this clinical entity. Pathogenesis is influenced by thrombophilia, hypofibrinolysis, and hypoangiogenesis. Coronavirus disease 2019 (COVID-19) infection stands as a cause of non-traumatic osteonecrosis of the femoral head. The condition can be related to the use of corticosteroids throughout the disease course of COVID-19. Yet, there could be other disease-related factors that may contribute to the development of osteonecrosis of the femoral head. The current article aimed to present a case with COVID-19 associated avascular necrosis of the femoral head.

Keywords: aseptic necrosis of bone; avascular necrosis of femur head; COVID-19; COVID-19 virus infection; osteonecrosis.


Introduction
Non-traumatic avascular necrosis of the femoral head occurs mostly in adults under 50 years of age. Approximately 10% of total hip arthroplasties are performed due to non-traumatic avascular necrosis of the femoral head [1]. The etiology of this clinical entity, defined by Chandler as «Coronary Disease of the Hip» [2], includes embolism (hemoglobinopathies, dysbaric osteonecrosis), corticosteroid therapy, alcohol use, pelvic radiotherapy, and genetic predisposition. Thrombophilia, hypofibrinolysis and hypoangiogenesis play role in the pathogenesis [1].

In this case report, a patient with avascular necrosis of the femoral head after Coronavirus disease 2019 (COVID-19) infection will be presented.

Case report
An 85-year-old man was admitted to our clinic with left hip pain for about four months. It was learned that the left hip pain increased with walking and weight lifting, and decreased relatively with rest. The pain did not radiate to the leg, and there was no history of numbness. The patient did not describe a history of trauma, fever, sweating, or weight loss. On medical history, he had hypertension, had been operated for papillary
urothelial neoplasm in 2012, and hospitalized for 13 days in January 2022 due to COVID-19 infection. The patient had been given 6000 IU low-molecular-weight heparin during hospitalization, intravenous pulse steroid (250 mg methylprednisolone) for three days, 40 mg intravenous methylprednisolone for ten days. The treatment regimen had continued with 32 mg oral methylprednisolone treatment after discharge, gradually decreased, and discontinued. His current medications on admission were valsartan/hydrochlorothiazide 160mg/12.5mg and carvedilol 12.5 mg daily.

On musculoskeletal examination, the patient mobilized with a single balance cane on the right side. Muscle strength was 5/5 in the bilateral lower extremities, and there was no sensory deficit. Straight leg raise and femoral stretching tests were negative bilaterally, while FABER and FADIR tests were positive in the left hip.

The laboratory examination was as follows: 25(OH)D3: 19.4 ng/ml, erythrocyte sedimentation rate: 18 mm/hr, white blood cell count: 5.7 $10^3$/l, hemoglobin: 13.7 g/dl, platelets: 239. $10^3$/l, urea: 18.9 mg/dl, creatinine 0.84 mg/dl, serum albumin: 38.27 g/l, magnesium: 1.97 mg/dl, inorganic phosphorus: 3.47 mg/dl, calcium: 9.17 mg/dl, parathormone: 44.5 pg/ml, alkaline phosphatase: 83 U/l, aspartate aminotransferase: 17 U/l, alanine aminotransferase: 17 U/l.

On anteroposterior radiograph of the left hip, the patient had degenerative changes and a crescent sign in the left hip (Figure 1). Contrast-enhanced magnetic resonance imaging of the left hip revealed diffuse bone marrow edema in the left femoral head-neck and intertrochanteric areas, and a focus of advanced avascular necrosis (with a diameter of approximately 2 cm) in the left femoral head (Figure 2).

**Figure 1.** Anteroposterior radiograph of the left hip revealing degenerative changes and a crescentic sign in the left hip.
With these findings, the patient was diagnosed with avascular necrosis of the left femoral head. The patient was advised to rest and avoid loading on the left hip joint. Vitamin D replacement therapy (cholecalciferol) was given. The patient then, was started on a combined therapy of alendronate 70 mg + cholecalciferol 2800 IU once a week. The patient was referred to the orthopedics clinic for surgical evaluation for advanced osteonecrosis.

Written informed consent was obtained from the patient for the publication of his clinical and radiological data.

Discussion

Non-traumatic avascular necrosis of the femoral head may occur in adults due to various causes. The leading causes include corticosteroid use, alcohol, and hemoglobinopathies. In the literature, there are several case reports of avascular necrosis of the femoral head after COVID-19 [3, 4]. In a study by Assad et al., the mean interval between COVID-19 infection and admission to the clinic was 6.53 months. Of the total sample (n=17), 11 patients (64.7%) had a history of steroid injections during the COVID-19 infection course [4].

In such cases, avascular necrosis of the femoral head may partly be related to the corticosteroid treatment used for COVID-19. On the other hand, various factors involved in the clinical course and pathogenesis of COVID-19 may also predispose to the development of avascular necrosis in bones.

Avascular necrosis of the femoral head can be observed across different age groups including the elderly. In older adults, traumatic causes may include prior hip dislocation or femoral fracture. Yet, non-traumatic factors can also lead to osteonecrosis in the femoral head. Okewunmi et al. run a comparative analysis between patients undergoing total hip arthroplasty who had and did not have osteonecrosis. Osteonecrosis appeared as a more frequent indication for older patients [5]. The results might be partly related to the fact that older patients were more likely to suffer from severe courses of COVID-19 and therefore treated with corticosteroids more often [5].

Proper management of patients with avascular necrosis of the femoral head is essential. The patients can be managed by conservative methods and/or surgical methods. Patient education regarding the avoidance of loading on the hip joint is necessary. The patients can be advised to use assistive devices such as walker and cane(s) during mobilization. In terms of pharmacological therapy, bisphosphonates can be used for the early stages of post-COVID osteonecrosis of the femoral head [6]. Assad et al., in their 17-patient-report used conservative treatment in nine cases (53%) and surgical treatment (core decompression was performed in five cases, total hip replacement in three) for the rest [4]. Agarwala et al. retrospectively evaluated the response of cases diagnosed with osteonecrosis of the femoral head following COVID-19 infection. Patients were given 5mg intravenous zoledronic acid at the start of treatment. The patients, then received 35 mg oral alendronate twice weekly for at least
6 months. The mean follow-up was 10 months. Of the 88 hips, 95.5% showed good clinical response to bisphosphonate treatment, 4.5% of the hips required surgical intervention [6]. A systematic review by Hassan and Khalifa evaluated how the diagnoses and management of post-COVID-19 femoral head avascular necrosis among various reports. The results showed that 80.8% of the hips were treated non-surgically, while 19.2% were managed surgically [core decompression, primary total hip replacement, staged total hip replacement or first stage total hip replacement (debridement and application of antibiotic-loaded cement spacer)] [7].

Early detection of post-COVID osteonecrosis of the femoral head is of great value. The condition can be diagnosed by magnetic resonance imaging at early stages [8]. In this regard, the physicians should be aware of COVID-19 related osteonecrosis of the femoral head. Careful physical and radiological examination should be carried out in post-COVID cases presenting with hip pain.

AUTHORS’ CONTRIBUTIONS
All authors contributed to the conception and design of the manuscript. Drafting the article: ICB, CO. Revising it critically for important intellectual content: ICB, CO, AS. All authors approve the submitted version of the manuscript and take full responsibility for the integrity and accuracy of all aspects of the manuscript.

CONFLICT OF INTEREST
The authors have completed the ICMJE Disclosure Form. The authors declare that there are no potential conflicts of interest.

REFERENCES