

BILATERAL AVASCULAR NECROSIS OF FEMORAL HEAD FOLLOWING COVID-19 INFECTION: CASE SERIES

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Abstract: Introduction: Despite having a substantial impact on survivors' mobility and leading to morbidity, musculoskeletal involvement was the post-COVID-19 infection sequelae area that received the least attention in the literature. Reviewing the COVID-19 histories of patients who visited a tertiary health center, the research is aimed at finding an association between COVID-19 infection and avascular femoral head necrosis, a condition brought on by insufficient blood flow. Avascular necrosis of the femoral head is a condition characterized by a restricted range of motion, pain, and disturbance of gait. It is brought on by insufficient blood flow. **Case reports:** We discussed several examples in which COVID-19 caused individuals to develop bilateral femoral head necrosis. When COVID-19 infection is the only factor present, and corticosteroids are used to treat it, avascular necrosis of the femoral head may become more prevalent. Detecting avascular necrosis of the femoral head in its early stages, hip MRI might reduce the patient's disability and need for continuous treatment. **Conclusion:** Early identification and treatment of AVN patients reduce the need for surgery and the chance of disabilities.

Keywords: Avascular necrosis (AVN), sedimentation rate of erythrocytes (ESR), C-reactive proteins (CRP), White blood cells (WBC), Steroid-induced AVN femoral head (SANFH).

INTRODUCTION

COVID-19 patients suffer a range of symptoms, including fever, sore throats, acute respiratory distress syndrome, thrombotic events, and acute myocardial infarction. These symptoms are only a few of the significant problems that result from the virus's systemic hyper-inflammation (1). According to the case report series by Agarwala et al, a lack of blood flow to the

bone tissue causes avascular femoral head necrosis, which is characterized by bone marrow necrosis and osteocyte loss (2, 3). For COVID-19 treating patients with hip pain, diagnostic information, and imaging recommendations are not yet available. Here, we present 3 cases of symptomatic femoral head necrosis that developed following COVID-19 treatment.

Case report No 1

On April 13, 2021, a 28-year-old female patient was diagnosed with COVID-19, for which she was admitted to an intensive care Karnataka Institute of Medical Science, India. She received 80 mg per day of intravenous methylprednisolone for a week while in the hospital. She had right hip joint ache four months after COVID-19. A local doctor treated her with analgesics for three months. She subsequently developed both hip and joint pain. AVN with oedema was seen in Magnetic Resonance Imaging (MRI) (Figure 1, 2, 3). She had a hybrid total hip replacement.



Figure 1. X-ray of pelvis and both hips AP view

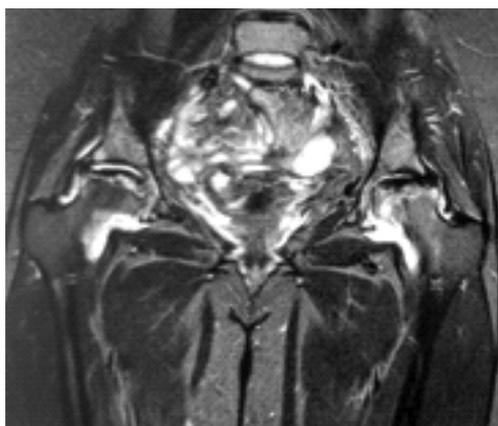


Figure 2. Coronal view of Magnetic resonance imaging of bilateral femoral heads



Figure 3. Post-operative x-ray of the pelvis and both hips - AP view

Case report No 2

On June 24, 2021, a male patient, 32 years old, was diagnosed with COVID-19 and was thereafter admitted to the hospital. He received intravenous (IV)



Figure 4. X-ray of pelvis and both hips - AP view



Figure 5. Post operative-ray of the pelvis and both hips - AP view

methylprednisolone 80 mg/day for a week while in the hospital. He started experiencing right hip joint pain six months later. A nearby physician treated him with analgesics for eight months. He later developed both hip joint pain and stiffness as a result. Magnetic Resonance Imaging (MRI) revealed both femoral heads to have AVN. He underwent an uncemented total hip arthroplasty (Figure 4 and 5).

Case report No 3

On July 16, 2021, a male patient, 28 years old, was diagnosed with COVID-19 and was thereafter admitted to the Karnataka Institute of Medical Science and Hospital, India. He received intravenous (IV) methylprednisolone 80 mg/day for a week while in the hospital. He started experiencing right hip joint pain 14 months later. He later developed both hip and joint pain as a result. Magnetic Resonance Imaging (MRI) revealed both femoral heads to have AVN. He underwent core decompression with bone marrow aspirate infiltration (Figure 6 and 7).



Figure 6. X-ray of PBH - AP view



Figure 7. Intra-operative bone marrow infiltration

Physical examinations of all three patients showed that hip joint flexion or rotation worsened the preexisting discomfort. There was a limited range of motion because of discomfort in both hips, particularly the right hip. With the exception of the hip, no other joints were painful to move, and the range of motion was within normal ranges. Muscle strength was normal in the patient, and reflexes in the deep tendons were normal. Neither of the three patients had any particular risk factors, such as alcohol use, smoking, sickle cell anemia, trauma, or systemic lupus erythematosus, that may have led to AVN of the femoral head. Nevertheless, a SARS-CoV-2 PCR test allowed for the patient's COVID-19 diagnosis.

All three patients who came to our outpatient clinic complaining of severe hip pain were first evaluated with conventional radiographs and subsequently with an MRI. An MRI was used to diagnose AVN, and a senior musculoskeletal radiologist for interpretation. T-1-weighted MRI pictures showing a single density “bandlike” lesion with a low signal intensity rim around necrosis. The diagnosis of AVN was made using T-2 weighted MRI images showing a “double line sign” made up of an inside high signal intensity rim and an outward low signal intensity rim. Using Ficat and Arlet grading, the AVN was staged in radiographs. “Mitchell classification” was used to stage the AVN based on the MRI signal inside the lesion's epicenter. The necrotic angle severity was calculated using the mid-coronal and mid-sagittal images from the MRI, and it was then categorized using the modified “Kerboul angle” stages -1 (200°), stage 2 (200° - 249°), stage 3 (250° - 299°), and stage 4 ($> 300^\circ$) (4). Examples of laboratory parameters include erythrocyte sedimentation rate, C-reactive protein, and total white blood cell count.

To exclude concomitant septic arthritis, hip aspiration was performed on patients who presented with

increased inflammatory markers. Total hip arthroplasty was performed on both of our patients.

DISCUSSION

Ages 40 and under were the most often affected age group in this case series investigation, affecting all three individuals. The majority of COVID-19 infection patients are asymptomatic, but some have mild to severe symptoms that can affect several organ systems and lower quality of life. A hypercoagulable condition is brought on by COVID-19, which raises the possibility of thrombosis. Pro-inflammatory cytokines such as Interleukin (IL-1, IL-6, IL-17) and tumor necrosis factor-alpha, are increased according to immunological investigations (5). Vascular wall fragmentation, endothelial cell pyknosis, and karyorrhexis are the distinctive pathological characteristics. Small and medium-sized blood arteries are typically affected by neutrophilic infiltrates, which are the typical histological findings of vasculitis (6). Glucocorticoids impair the blood vessels' ability to respond to vasoactive chemicals, which results in vascular constriction that affects the femoral head and causes further femoral head ischemia. “Micro RNA (miR)-596” is discovered to be up-regulated in instances of steroid-induced avascular necrosis femoral head (SANFH), which hinders the healing of osteonecrotic bone by preventing bone stromal cell proliferation and osteogenic differentiation (7). However, in the case report series of Agarwala et al., they reported that avascular femoral head necrosis developed in three patients who received corticosteroids in the treatment of COVID-19. The average time between the COVID-19 diagnosis to the start of AVN symptoms was 58 days (2). Li et al. looked into 1406 COVID-19 patients. One patient who had 1960 mg of methylprednisolone was found to have bilateral femoral head necrosis. According to observations in the literature, the average time it takes for AVN to manifest following corticosteroid medication is between 6 and 12 months (8). When 23 patients with AVN following COVID-19 were studied by Daltro et al., they discovered that 66% had moderate to severe COVID-19 infections and had received corticosteroid treatment. The remaining 33% had a mild COVID-19 past without using corticosteroids. Overall, they reported that in these 23 individuals, the median interval between COVID-19 infection and the start of AVN was 132.8 days (between 64 and 180) (9).

CONCLUSION

Since COVID-19 infection alone and corticosteroid medication administered in its treatment may increase the incidence of AVN, clinicians should be cau-

tious about the early detection and treatment of AVN in post-COVID patients presenting with hip and thigh discomfort.

Learning objective

► Steroids are “life-saving in the treatment of COVID-19”.

► Individuals with COVID-19 infection are more likely to develop avascular femoral head necrosis at minimal steroid dosages, and early presentation.

► Magnetic resonance imaging of the hips can be used to confirm a diagnosis if someone complains of hip and thigh discomfort.

► Advanced stage avascular femoral head necrosis can be effectively treated in individuals receiving total hip arthroplasty.

Declaration:

Human subjects: All participants in this study provided informed consent or waived it. The ethics committee of the KARNATAKA INSTITUTE OF MEDICAL SCIENCES approved 728/2021-22. The

institutional ethics committee gave its approval to the project.

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Author contributions.

Dr. S F Kammar: Organising, collecting evidence, performing statistical analysis, drafting an article, reducing, and editing. DR. CHANDRASHEKAR MUDGAL: Statistical analysis, article authoring, and data gathering. Planning, data gathering, statistical analysis, and article writing are each performed by Dr. Mahuchandra R. DR. AKASH KUMAR. Planning, data gathering, statistical analysis, writing, reducing, and editing an article.

Sažetak

BILATERALNA AVASKULARNA NEKROZA GLAVE BUTNE KOSTI NAKON INFEKCIJE COVID-19: PRIKAZ SLUČAJA

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Uvod: Uprkos tome što ima značajan uticaj na mobilnost preživelih i dovodi do morbiditeta, zahvaćenost mišićno-skeletnog sistema bila je oblast posledica infekcije posle KOVID-19 kojoj se u literaturi posvetilo najmanje pažnje.

Pregledom istorija KOVID-19 pacijenata koji su posetili tercijarni zdravstveni centar, istraživanje je imalo za cilj pronalaženje veze između infekcije KOVID-19 i avaskularne nekroze glave butne kosti, stanja izazvanog nedovoljnim protokom krvi.

Prikaz slučaja: Analizirali smo nekoliko primera u kojima je KOVID-19 prouzrokovao da pojedinci

razviju bilateralnu nekrozu glave butne kosti. Kada je infekcija KOVID-19 jedini prisutni faktor, a za lečenje se koriste kortikosteroidi, avaskularna nekroza glave butne kosti može postati češća. Otkrivanjem avaskularne nekroze glave butne kosti u ranim fazama, MRI kuka može smanjiti invaliditet pacijenta i potrebu za kontinuiranim lečenjem. **Zaključak:** Rana identifikacija i lečenje pacijenata sa AVN smanjuje potrebu za operacijom i mogućnost invaliditeta.

KLjučne reči: Avaskularna nekroza, brzina sedimentacije eritrocita, C-reaktivni proteini, Bela krvna zrnca, Steroidom indukovana AVN femoralna glava.

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