

Multifocal Osteonecrosis in Spinal Cord Injury

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Dear Editors,

Necrosis of the bone marrow and trabecular portion as a result of limited blood flow is known as osteonecrosis (ON) [1]. Several causes have been proposed for the development of ON, including vascular occlusions, ischemia, intravascular coagulation in interosseous tissue, increased intracortical pressure, mechanical stress, precursor cell death, and suppression of angiogenesis. There are multiple risk factors and medical condition associated with ON, including infections, hematological and coagulation problems, connective tissue illnesses, kidney diseases, excessive alcohol and tobacco use, and the use of corticosteroids and cytotoxic drugs [2].

Multifocal osteonecrosis, defined as the presence of osteonecrosis in three or more bone sites, is a rare entity representing less than 3% of osteonecrosis patients [3].

Due to its potent anti-inflammatory properties, methyl prednisolone (MP), one of the most extensively used corticosteroids, has been used for a long time in the acute phase of spinal cord injury and brain edema due to its strong anti-inflammatory properties [4]. Although studies have reported cases of multifocal osteonecrosis (MFON) brought on by corticosteroid medication, this link has never been examined in a patient with a spinal cord injury.

This letter aims to highlight MFON that occurred in a patient who underwent acute spinal cord injury and high-dose steroid therapy.

Patient Information

A 24-year-old man who underwent general surgery in another facility owing to hepatic and intestinal damage as a result of a gunshot wound was monitored in the anesthetic intensive care unit of our hospital for 11 days. He had no prior history of smoking, alcohol usage, or any other diseases. After being followed up in the intensive care unit for 2 weeks, the patient was started to be followed up in the neurosurgery service with undisplaced fractures posterior to T11-12 vertebral bodies and paraplegia clinic and patient was not operated. He received steroid treatment, which was started during his intensive care stay and continued while he was



hospitalized in the neurosurgery ward, four intravenous doses of 40 mg of steroids totaling 2880 mg over the course of 18 days. Enoxaparin was started on the 4th day of her hospitalization in the intensive care unit. The patient was transferred to our clinic in August with a diagnosis of T11(ASIA-A) paraplegia in order to receive rehabilitation.

The patient with flaccid paralysis had edema in both knees, an elevated body temperature, and a passive restriction of 40 degrees in flexion. ALP levels in the serum were measured in lab testing to be 224 IU/L (30-120), Calcium levels was 10.1 mg/dL (8.8-10.6), and Phosphor levels was 5.0 mg/d (2.5-4.5) respectively. The CRP was above the normal range at 2.7 (0-0.5) and the erythrocyte sedimentation rate was 81 mm/hr.

These observations led to the tentative diagnosis of heterotopic ossification (HO). definitive diagnosis of HO has been made after the patient's bilateral knee MRI and comparative knee radiography. (Figure 1 and 2) Around the medially-positioned knee joints on both sides, HO was seen. Knee MRI revealed large regions of osteonecrosis in addition to heterotrophic ossification in the bilateral distal femur and proximal tibia.

The patient received indomethacin 100mg/day and alendronate 75 mg/week as initial therapy for HO. The bilateral knee joints, gentle range-of-motion exercises were initiated. One month after beginning the indomethacin treatment, the patient's swelling in both knees lessened, the limitation was shown to retreat by 20 degrees, and walking practice on a parallel bar with a long walking aid and waist belt was initiated.

In the third month of rehabilitation, swelling in the right ankle was observed, and bilateral ankle MRI was performed for the differential diagnosis of osteomyelitis due to decubitus ulcer in the heel area and an increase in acute phase reactants) and HO. MRI of the ankle revealed areas of necrosis in the bilateral distal tibia, bilateral talus, talar dome and 2nd and 3rd metatarsal heads, and diffuse edema in the muscles and fascia of the surrounding soft tissues.(Figure 3) Although ON is most commonly seen in the femoral head and hip joint, ON was not found in the hip MRI of our patient.

During the follow-up of our patient, chest pain and shortness of breath developed, and the patient was diagnosed with pulmonary embolism with the tests. Acute deep vein thrombosis in the popliteal vein was detected in the lower extremity venous Doppler

ultrasound performed for the etiology of pulmonary embolism. We wanted to see a thrombophilia panel from our patient because of pulmonary embolism that developed at an early age in the panel was found heterozygous mutations in the MTHFR-C677T, MTHFR-A1298C, PA1-1/4G, Factor XIII-V34L, and GPIIIa-L33P (HPA-1) genes. As a result, the prophylactic dose of enoxaparin was increased.

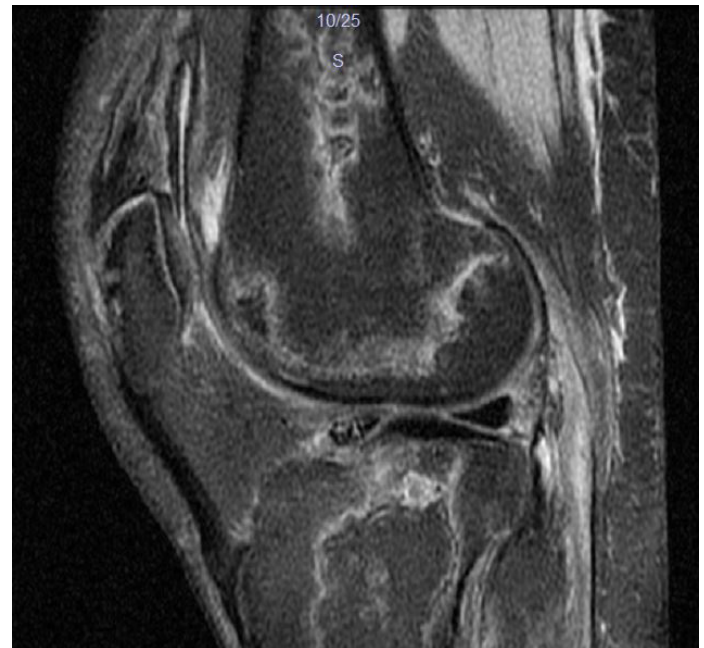


Figure 1. T2 STIR sequences for magnetic resonance imaging diffuse osteonecrosis areas in the proximal tibia and distal femur



Figure 2. Heterotrophic ossification on knee radiography, more prominent medially around the bilateral knee joint

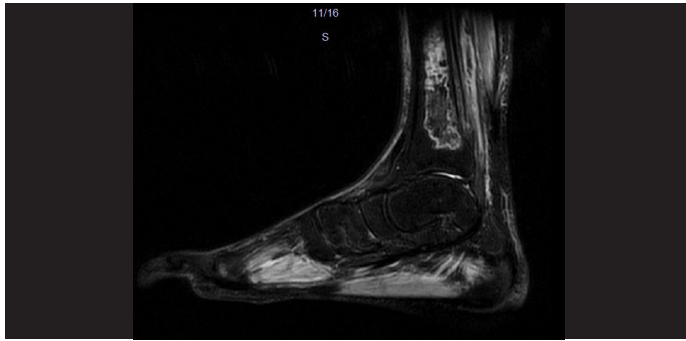


Figure 3. T2 STIR sequences for magnetic resonance imaging areas of osteonecrosis in the distal tibia, talus, talar dome, and metatarsal head

DISCUSSION

Studies have shown that ON can develop locally or multifocally in response to high-dose steroid therapy [5]. Osebold et al. [5] investigation, the effects of spinal cord damage on bilateral humeral head ON were assessed. The importance of various prothrombotic variables that raise the risk of steroid-induced ON was highlighted in this investigation. In this study, the threshold for corticosteroid dose was defined as 2000 mg prednisolone. Our case received 2880 mg of methylprednisolone. Except for steroid usage, which was present in the case study but lowered the threshold for ON in our case, there was no history of spinal canal surgery or alcohol use.

Another study reported that thromboplastic substances produced by injured neural tissue, increased tissue thromboplastin release, and fat embolism that may occur after spinal cord injury may all raise the incidence of ON [6]. In our case, it was discovered that the pre- and postoperative serum lipid levels, platelet count, APTT, PTZ, and fibrin degradation products were all within normal ranges. Our patient did not exhibit any of the risk factors for ON, such as alcoholism, hemoglobinopathies, pancreatitis, radiation, chemotherapy, or storage disorders.

Contrarily, heterozygous mutations in the genes for MTHFR-C677T, MTHFR-A1298C, PA1-1/4G, Factor XIII-V34L, and GPIIIa-L33P (HPA-1) were found in the thrombophilia panel run on our patient. These mutations could raise a patient's relative risk of thrombosis, cardiovascular disease, and cerebrovascular disorders.

It is believed that the use of corticosteroids in individuals with hypercoagulation abnormalities, such as thrombophilia,

accelerates the development of ON because these patients are highly sensitive to thrombosis [7]. This study by Shah et al. [7] is supported by mutations found in the thrombophilia panel of our case and MFON that appeared following corticosteroid therapy. MFON developing in patients with spinal cord injury has not been adequately studied in the literature Kuijk et al. [8] gave radiotherapy to patients in order to treat HO that develops after a cord injury, these patients developed ON at the treatment site. At the same time, Kuijk et al. [8] except for the case series that developed ON as a complication after HO treatment, no case was reported on the coexistence of HO and MFON. Our case is the first in this respect.

ON, especially in patients with spinal cord injury in our case as well as shortly after the end of corticosteroid treatment. However, it may also develop in the long term after treatment. On the other hand, especially spinal cord patients may have loss of pain sensation and sensory loss in patients with injuries. They may not report any complaints in tissues that develop ON. Due to the potential of MFON to cause additional disability, especially in young patients, it is of great importance to properly organize weight-bearing exercises in the rehabilitation programme of SCI patients.

Patients' histories of steroid usage should be investigated, hospital records should be reviewed, and in cases of uncertainty, patients should undergo clinical and radiological evaluations.

Yours sincerely,

Keywords: Multifocal osteonecrosis, Spinal cord injury

REFERENCES

- [1] Matthews AH, Davis DD, Fish MJ, Stitson D (2024) Avascular Necrosis. StatPearls. StatPearls Publishing Copyright © 2024, StatPearls Publishing LLC., Treasure Island (FL)
- [2] Goodman SB (2020) Osteonecrosis: Overview of New Paradigms in the Etiology and Treatment. Instr Course Lect 69:103-110
- [3] Gallart Ubeda V, Elia Martinez JM, Puerta de Diego R, Elia Martinez I, Valero Inigo JC (2020) [Multiple osteonecrosis. Update and case report]. Rehabilitacion (Madr) 54:63-67.

- <https://doi.org/10.1016/j.rh.2019.07.006>
- [4] Fehlings MG, Tetreault LA, Wilson JR, Kwon BK, Burns AS, Martin AR, Hawryluk G, Harrop JS (2017) A Clinical Practice Guideline for the Management of Acute Spinal Cord Injury: Introduction, Rationale, and Scope. *Global Spine J* 7:84S-94S. <https://doi.org/10.1177/2192568217703387>
- [5] Osebold WR, Kody MH (1994) Bilateral humeral head osteonecrosis following spinal cord injury: a case report illustrating the importance of adhering to the recommendations of the Second National Acute Spinal Cord Injury Study. *Iowa Orthop J* 14:120-124
- [6] Rafael BG, Lackner H, Engler GL. Disseminated Intravascular Coagulation during Surgery for Scoliosis. *Clin. Orthop.* 162:41-46, 1982.
- [7] Shah KN, Racine J, Jones LC, Aaron RK (2015) Pathophysiology and risk factors for osteonecrosis. *Curr Rev Musculoskelet Med* 8:201-209. <https://doi.org/10.1007/s12178-015-9277-8>
- [8] van Kuijk AA, van Kuppevelt HJ, van der Schaaf DB (2000) Osteonecrosis after treatment for heterotopic ossification in spinal cord injury with the combination of surgery, irradiation, and an NSAID. *Spinal Cord* 38:319-324. <https://doi.org/10.1038/sj.sc.3100987>

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