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Case Report

Avascular necrosis of lateral femoral condyle in a middle-aged woman from central India ☆

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ABSTRACT

Bone infarcts, also called avascular necrosis of the knee or osteonecrosis, are defined as the anoxic death of the bone parts caused by interrupted blood supply and can occur in any bone of the body. It is most associated with trauma, sickle cell disease, steroid intake, alcohol abuse, gout, and liver cirrhosis. The most affected lower limb sites are the head of the femur, medial femoral condyle and talus. We present a case of a 38-year-old female with a history of working long standing hours a day, found to have avascular necrosis of the lateral femoral condyle of the distal femur on magnetic resonance imaging of the knee, which is a rare condition.

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Introduction

A reduction in the blood supply to the bone results in bone loss, which causes infarction of the bone and is known as avascular necrosis (AVN). The most common location for the AVN to develop are the head of the femur, medial femoral condyle and talus. The course of AVN progresses through various stages pathophysiologically. Initially, the AVN can be painless, but with the progression of the disease, the pain increases. With further progression of the disease, the joint and the affected bone collapses, which impairs the normal functioning of the joint and causes severe pain. The pain increases

with weight bearing. Radiography is the first line of investigation, with magnetic resonance imaging (MRI) being the imaging modality of choice. The management can be medical or surgical depending on the stage of the disease and symptoms of the patient [1,2].

Case presentation

A 38-year-old female residing in a third-tier city in central India came to the orthopedic outpatient department (OPD) with complaints of progressive pain in the lateral aspect of the right knee joint for the past 4 weeks. The pain has progressed to such an extent that it was limiting her daily activities. She

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Table 1 – Lab parameters of the patient with avascular necrosis of the lateral femoral condyle.

Investigation	Patient	Reference values
Hemoglobin	13.4	12.1–15.2g/dl
MCHC	35.6	32–36g/dl
MCV	87.6	80–100fl
MCH	28.3	27–33pg
Total RBC count	5.2	4.3–6.2 cells/mcl
Total WBC count	9600	4000–11000 cells/microliter
Total platelet count	330000	150000–400000 g/dl
HCT	42	36%–44%
Granulocytes	9.3	1.5–8.5 × 10 ⁹ /L
RDW	16.7	12.2%–16.1%
APTT	28	21–35 seconds
Prothrombin time	12.1	10–13 seconds
INR	1.0	<1.2
Urea	13	5–20 mg/dl
Creatinine	0.9	0.6–1.1 mg/dl

works in a beauty parlor and has a profession which involves working with long standing hours of a minimum of 12 hours daily. She is a mother of 2 children, which were through vaginal delivery. There is no history of trauma, alcohol, or drug intake. She is not a known case of the COVID-19 virus and has never taken any steroids. She is not a known case of any systemic disease and has not visited the hospital before for any complaints. The family history is not significant, and she did not undergo any surgical procedures. On examination, she had tenderness in the lateral aspect of the knee joint with some swelling around the joint. The pain was exacerbated as she stood up from a sitting position and on weight-bearing on the affected side. The lab parameters showed an increase in the WBC count, granulocytes and red cell distribution width (RDW), as shown in Table 1.

The X-ray showed osteopenia on the distal end of the femur. On the imaging of the knee joint using magnetic resonance imaging, a geographical area of altered signal intensity was visualized in the lateral femoral condyle of the femur having an irregular peripheral rim of hypo intensity on T1 weighted imaging, double line sign and rim sign with bone marrow oedema and minimal joint effusion on T2 weighted imaging and proton density fat-suppressed imaging sequences suggesting avascular necrosis of the lateral femoral condyle as shown in Fig. 1. The articular cartilage appeared normal.

She was advised to avoid standing for long hours daily, to start doing exercise, and to undergo physiotherapy sessions. Ibuprofen, a type of nonsteroidal anti-inflammatory drug, was prescribed to her to help reduce pain and swelling. She was advised to follow up after 15 days or if any complaints develop.

Discussion

Avascular necrosis (AVN), also known as osteonecrosis or bone infarction, is a term that describes bone tissue loss caused by the reduced or absent blood supply to the affected bone. Avascular necrosis of the distal femur is mostly found in middle-

aged and elderly individuals with a predilection towards females aged more than 60 years. The lateral femoral condyle is rarely involved, while the medial femoral condyle is 1 of the most common sites for avascular necrosis [3,4]. The cause of AVN affecting the knee joint is multifactorial. It might be caused by drug abuse, alcohol abuse, steroid overuse, trauma, hypercoagulable state, vascular causes, excessive weight lifting, systemic causes, and sickle cell disease [5,6].

The pathophysiology of the AVN starts with the reduction of blood supply to the bone, which can be temporary or permanent depending on the cause. This leads to the development of interstitial bone marrow oedema and hematopoietic marrow necrosis, which are characterized as the earliest changes in AVN. After 2–3 hours of anoxia, osteocyte necrosis starts and is histologically evident after 24–72 hours [7]. At the periphery of the zone of necrosis, a reparative process takes place, which includes vascularized granulation tissue growth supported by osteoblastic/osteoclastic activity leading to ineffective bone remodeling at the viable and necrotic bone interface with an outer sclerotic rim formation. This process is known as creeping substitution and appears as a double-line sign on magnetic resonance imaging (MRI). This causes simultaneous bone production and resorption, leading to the formation of a weak woven bone. At the center, in the necrotic zone, ischemia leads to the loss of nutrient and oxygen supply, which causes a loss of osteoblastic/osteoclastic support; hence, no bone remodeling takes place, affecting the structural integrity and bone compliance, eventually causing an articular collapse [8].

The patient often presents with the chief complaints of slowly progressive pain and a limited range of motion. The diagnosis requires a careful history, physical examination and imaging correlation. On X-ray, early changes do not appear; however, later changes may be visible in the form of rim calcification, patchy sclerosis, the collapse of the articular surface and a crescent sign. This may further progress to cortical collapse and secondary degenerative changes [9].

MRI is the most sensitive and specific imaging sequence for identifying avascular necrosis and is able to detect the earliest visible changes. The earliest change suggesting AVN is the reactive interface line, which is represented as a focal serpentine line of low signal intensity and a fatty center. The double line sign on MRI is diagnostic and is seen on T2 weighted imaging as a serpentine outer dark line of sclerosis and an inner bright line of the granulation tissue. Other additional imaging features such as oedema, rim sign and secondary degenerative changes are best identified using MRI [10].

Bone scan can be done using Technetium-99 methylene diphosphonate (MDP), which has a sensitivity of around 85% in detecting AVN. The early stages of the disease appear to be cold areas, mostly due to vascular interruption. The late stages appear as a cold spot with a surrounding high signal uptake ring and is called a doughnut sign [11].

The differential diagnosis includes osteochondritis dissecans, which is due to aseptic osteochondral fragment separation and is frequently linked with intra-articular loose bodies [12,13]; subchondral insufficiency fracture of the knee (SIFK), which occurs in the absence of trauma and is a type of stress fracture caused by micro traumatic stress on the weakened trabeculae of the tibial plateau or the femoral condyles [14].

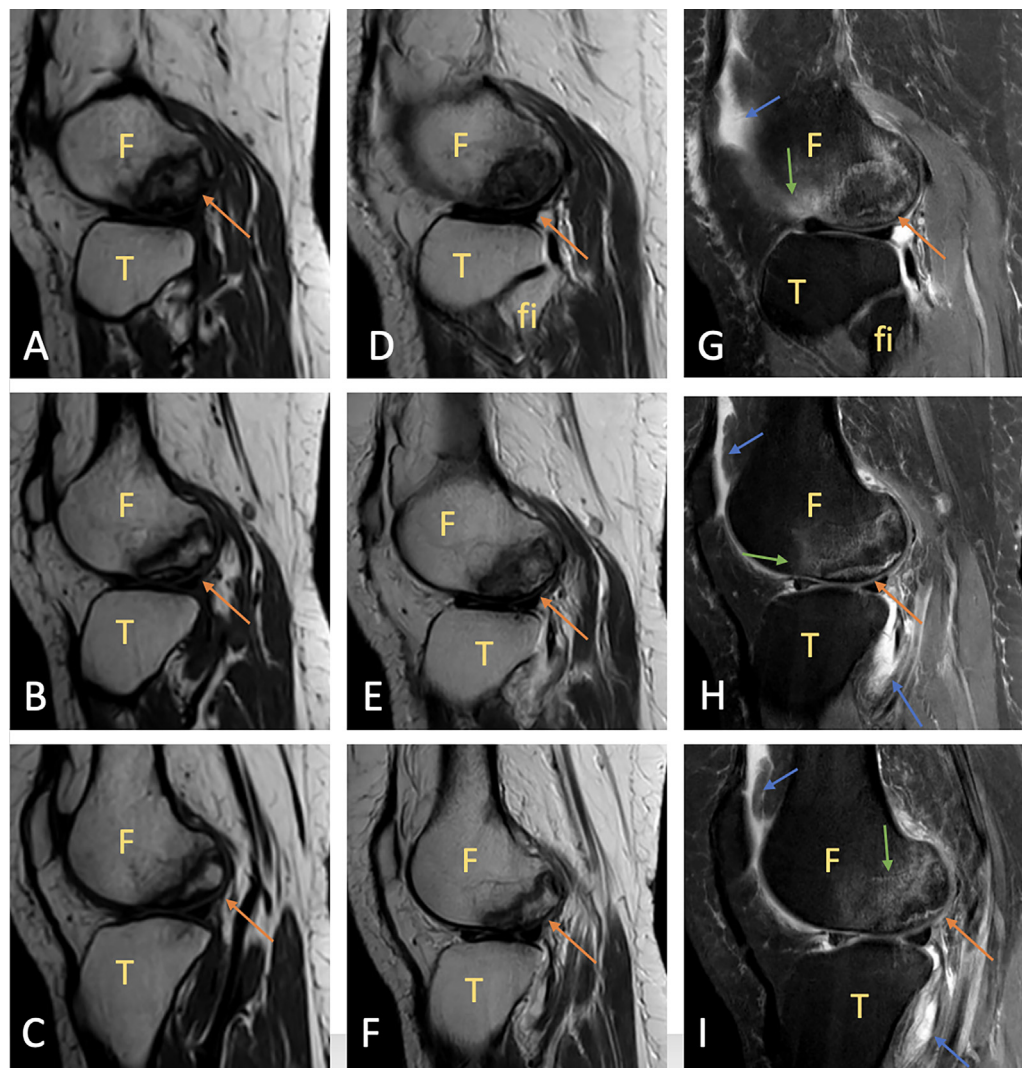


Fig. 1 – Sequential Magnetic Resonance Imaging of the knee joint sagittal sections T1 weighted imaging (A, B, C), T2 weighted imaging (D, E, F), and proton density fat-suppressed imaging (G, H, I) sequences showing an altered signal intensity area in the lateral femoral condyle giving an appearance of a geographical region showing rim sign and double line sign with surrounding bone marrow OEDEMA (green arrows), minimal joint effusion (blue arrows) and normal appearance of the articular cartilage suggesting avascular necrosis of lateral femoral condyle (orange arrows). F, femur; fi, fibula; T, tibia.

The management can be medical or surgical. Medical management can be provided to the patient in the form of physiotherapy, exercises, reduced weight bearing, strengthening of quadriceps muscles, and nonsteroidal anti-inflammatory drugs. The surgical management includes core decompression in cases of an extra-articular lesion; diagnostic arthroscopy to remove unstable small fragments from the joint; osteochondral allograft in cases of symptomatic patients with large lesions and did not get cured with medical management; total knee replacement in case of large involved area, multicompartamental osteonecrosis or collapse [15].

The complications include bone cysts, cartilage decaying, bony spurs, or inflammation of the joint. A rare complication includes bone-infarct-associated sarcoma. Sarcoma is found to typically affect 6th-decade men, with undifferentiated pleomorphic adenoma (previously called malignant fibrous histiocytoma) being the most common subtype [16].

Avascular necrosis is a painful condition and can lead to severe pain, limiting daily activities. It is, therefore, of utmost importance to diagnose and treat the pathology early. For diagnosing it earlier, imaging plays a crucial role, with X-rays being the first imaging modality and MRI being the imaging investigation of choice. Our case presented a rare site of avascular necrosis, which is the lateral femoral condyle. The treatment can be either medical or surgical depending upon the stage of the disease, and thus, diagnosing it early is important.

Patient consent

An informed verbal and written consent was obtained from the patient.

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