Case 9920

MRI features of steroid induced medullary osteonecrosis
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Section: Musculoskeletal system
Area of Interest: Musculoskeletal system
Procedure: Diagnostic procedure
Imaging Technique: CT
Imaging Technique: MR
Special Focus: Ischaemia / Infarction Case Type: Clinical Cases
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Patient: 36 years, male

Clinical History:

36-year-old male patient, a known case of Hansen’s disease (Leprosy) on treatment, had suffered an acute episode of erythema nodosum leprosum reaction 1 year ago which was treated with high dose corticosteroids. He presented with pain and swelling in the right knee for 15 days.

Imaging Findings:

Patchy ill-defined serpigenous altered signal intensity lesions involving tibial and femoral epiphysis, metaphysis and diaphysis and patella. On T2-Weighted and STIR images, they have a central hypointense area with an outer hyperintense layer and a peripheral hypointense rim (double line sign). On T1-Weighted images, the lesions appear isointense with a peripheral hypointense rim. The above findings are suggestive of osteonecrosis (bone infarcts).

Minimal joint effusion is also seen.

Discussion:

Osteonecrosis of the bone is described as pathological and radiological changes in the bone secondary to vascular insufficiency due to various causes. When it occurs in the epiphyseal region (subarticular), it is called aseptic necrosis whereas it is called bone infarction in the metaphysis and diaphysis [1]. Many conditions and risk factors are associated with osteonecrosis. Prolonged usage of corticosteroids and alcohol consumption are the most common causes of atraumatic osteonecrosis. Other causes are haemoglobinopathies (sickle cell disease), vasculitides, metabolic / endocrine causes & idiopathic [1, 2].

The pathogenesis of steroid induced osteonecrosis consists of ischemic injury in the bone and marrow due to increased intraosseous vascular compromise. This is secondary to steroid induced increased bone marrow pressure and also due to fat microemboli. In the epiphysis, this leads to mechanical instability causing microfracture of subchondral trabeculae and subsequently articular collapse and secondary osteoarthritis [2, 3]. Similar pathogenesis also occurs in metaphyseal and diaphyseal osteonecrosis. Pathologically it is characterised by a central zone of avascular cells, middle zone of ischaemic area and reactive hyperaemia and a peripheral zone of normal bone with osteoblastic response referred to as creeping apposition [4].

Conventional radiographs are the least sensitive modality to detect early stages of the disease. A crescent-shaped
Subchondral lucency (crescent sign) may be seen in late stages of epiphyseal osteonecrosis and irregular sclerotic foci in medullary osteonecrosis [1, 3]. Bone scan shows lack of uptake in early stages but lacks specificity. MRI is the most sensitive and specific imaging tool for the detection and staging of the disease. The central necrotic zone appears hypointense on T1 and T2-Weighted sequences. On T2-Weighted sequences at the junction of viable and nonviable tissues, there is an inner high signal intensity area (vascularised granulation tissue) and an adjacent outer hypointense rim (sclerotic area) called as “double line sign”. This finding is diagnostic of osteonecrosis [4, 5].

Osteonecrosis must be distinguished from other pathological processes including neoplasms. Enchondromas are close differential diagnosis for medullary osteonecrosis. On MRI, enchondromas are well circumscribed, lobulated lesions which are hypointense on T1-Weighted images. On T2-Weighted images, enchondromas appear hyperintense with multiple central hypointense foci of calcifications [5].

Imaging morphology combined with a history of prolonged steroid intake in this case corresponds to the classical findings of osteonecrosis. Knowledge of imaging findings on MRI helps to make the correct diagnosis and avoid further unnecessary investigations/procedures.

**Differential Diagnosis List:** Steroid induced medullary osteonecrosis, Enchondroma, Chondrosarcoma

**Final Diagnosis:** Steroid induced medullary osteonecrosis

**References:**


Figure 1

**Description:** Sagittal reformatted CT image shows the lesser sensitivity of CT for demonstrating osteonecrosis compared to MRI. **Origin:** Dept of Radio Diagnosis, Fr Mullers Medical College Hospital, Mangalore, India
Description: Coronal T1-Weighted MRI image shows central area of infarction with peripheral hypointense rim at junction with normal bone. Origin: Dept of Radio Diagnosis, Fr Mullers Medical College Hospital, Mangalore, India
Description: Sagittal T1-Weighted MRI image shows central area of infarction with peripheral hypointense rim at junction with normal bone. Origin: Dept of Radio Diagnosis, Fr Mullers Medical College Hospital, Mangalore, India
**Description:** Coronal T2-Weighted image shows central hypointense necrotic zone, peripheral hyperintense zone and an outer hypointense line (double line sign). **Origin:** Dept of Radio Diagnosis, Fr Mullers Medical College Hospital, Mangalore, India
Description: Axial T2-Weighted MRI clearly demonstrates the double line sign. Origin: Dept of Radio Diagnosis, Fr Mullers Medical College Hospital, Mangalore, India
Description: Coronal STIR image shows the hyperintense peripheral layer corresponding to granulation tissue. Origin: Dept of Radio Diagnosis, Fr Mullers Medical College Hospital, Mangalore, India.
**Description:** Axial STIR image shows the hyperintense peripheral layer corresponding to granulation tissue. **Origin:** Dept of Radio Diagnosis, Fr Mullers Medical College Hospital, Mangalore, India.