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Early Diagnosis and Management of Osteomyelitis

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Abstract

Osteomyelitis is an infection of bone and bone marrow with acute and chronic presentations (1) Early diagnosis and appropriate management are essential to prevent chronic disease and disability. Imaging plays a central role, with MRI being the most sensitive modality for early detection. CT, nuclear medicine, and FDG PET-CT provide complementary information in chronic and complex cases(2). Management requires a multidisciplinary approach combining antimicrobial therapy and surgical intervention.

Keywords: Osteomyelitis; MRI; PET/CT; Bone infection; Chronic osteomyelitis; Diabetic foot

Introduction

Osteomyelitis remains a challenging musculoskeletal infection despite advances in imaging and antimicrobial therapy. It occurs via hematogenous spread, contiguous spread from adjacent soft tissues, or direct inoculation following trauma or surgery(1). Delay in diagnosis may result in chronic infection, pathological fractures, and significant morbidity (2).

Classification of Osteomyelitis

Classification is based on duration, route of infection, and host factors. Acute disease is commonly hematogenous, whereas chronic osteomyelitis is characterized by necrotic bone, sequestrum, involucrum, and sinus tracts.

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Table 1: Classification of Osteomyelitis(3)

Type	Pathogenesis	Examples
Acute	Hematogenous infection	Children, vertebral osteomyelitis
Chronic	Persistent infection with necrotic bone	Post-traumatic, diabetic foot

Pathophysiology and Microbiology

Staphylococcus aureus remains the most common pathogen, including MRSA. Chronic infections are often polymicrobial, particularly in diabetic foot osteomyelitis. Biofilm formation contributes to persistence and recurrence.

Imaging in Osteomyelitis(2)

Plain Radiography

Initial modality with low sensitivity in early disease; changes appear after 10–14 days.

Foot radiograph (AP view)

Computed Tomography (CT)

Excellent for cortical destruction, sequestrum, and surgical planning; enables CT-guided biopsy.

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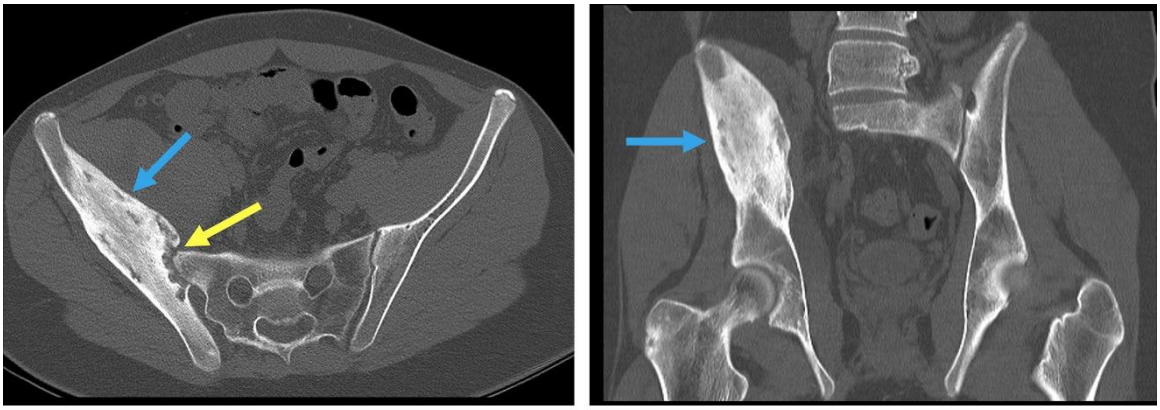

(a) (b)

CT Pelvis (Non-contrast study) : There is right iliac bone expansion & sclerosis with erosion of right sacro-iliac joint.

Chronic osteomyelitis depicts a sequestrum, a distinct sclerotic bone fragment, within the posterior proximal tibial metadiaphysis. The sequestrum is surrounded by an involucrum characterized by cortical thickening.

Magnetic Resonance Imaging (MRI)

Modality of choice due to high sensitivity and specificity; delineates marrow edema, abscesses, and sinus tracts.

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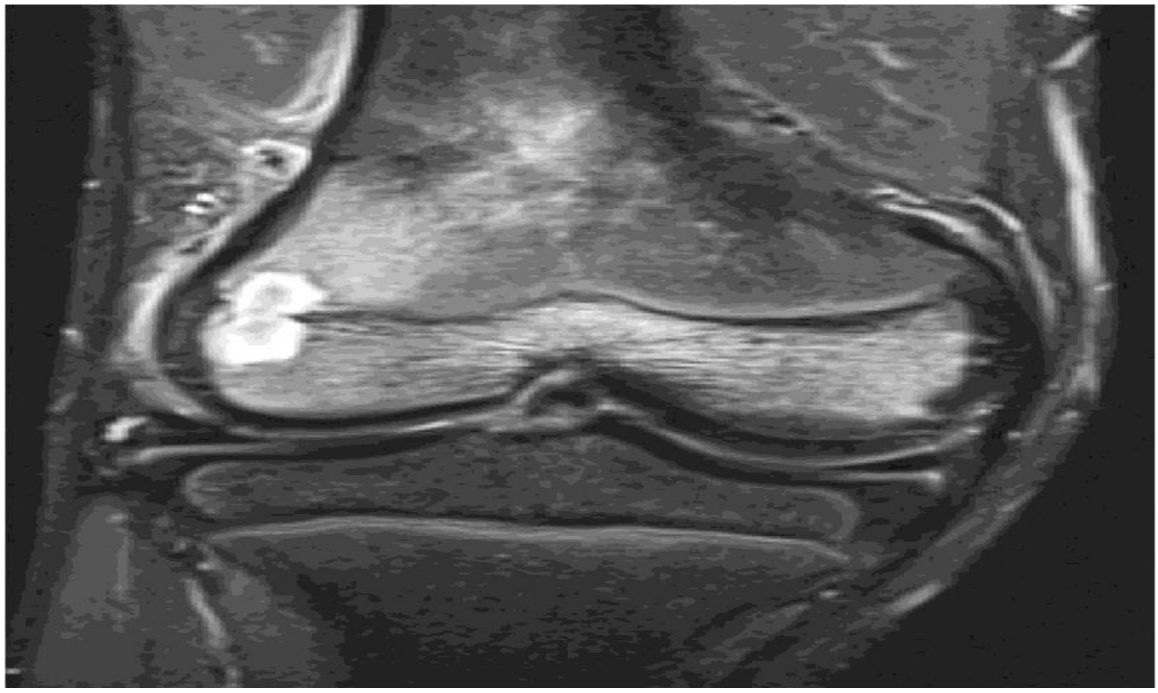
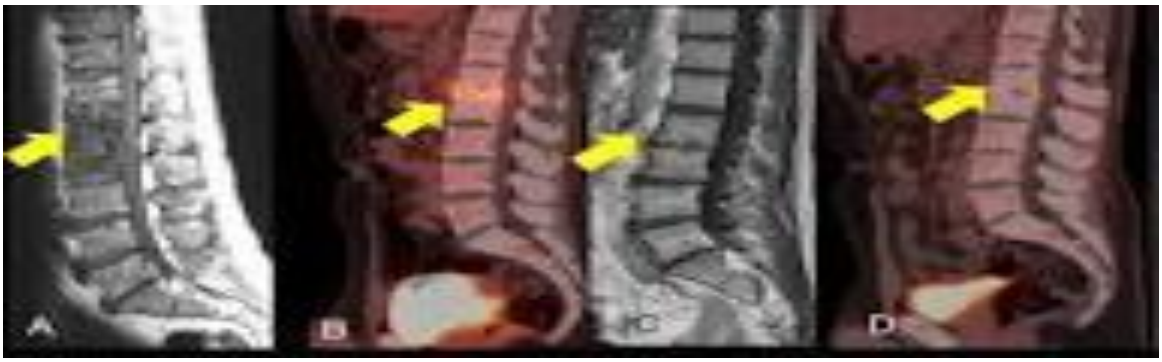


Osteomyelitis in an 11-year-old boy. Coronal MRI demonstrates transphyseal spread of a T2-hyperintense distal femoral epiphyseal lesion and substantial marrow edema, involving the epiphysis greater than metaphysis. Biopsy demonstrated evidence of chronic osteomyelitis

Nuclear Medicine and PET Imaging

Useful in chronic, post-operative, and implant-related infections; FDG PET-CT has high diagnostic accuracy.



MRI and PET/CT imaging in a 38 years old patient with back pain, fever and S. Epidermidis infection of the lumbar spine confirmed by positive microbiology culture of the vertebral biopsy. (A): baseline lumbar MRI, sagittal image showed oedema in the intervertebral disc between L1

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and L2, confirmed by fused PET/CT scans (B). After three mounts of therapy, both scans (C, D) showed spondylodiscitis in resolution.

Imaging Algorithm for Suspected Osteomyelitis(3)

Suspected osteomyelitis → Plain radiograph → MRI → CT / Nuclear imaging / FDG PET-CT if MRI contraindicated or inconclusive.

Management of Osteomyelitis(4)

Antimicrobial Therapy

Culture-guided antibiotics are recommended. Acute disease typically requires IV therapy followed by oral agents; chronic disease needs prolonged therapy post-debridement.

Surgical Management(5)

Indicated in chronic disease, sequestrum, abscess, implant infection, or failure of medical therapy.

Table 2: Management Strategies

Clinical Scenario	Management	Imaging Role
Acute osteomyelitis	Antibiotics ± drainage	MRI
Chronic osteomyelitis	Surgery + prolonged antibiotics	CT/MRI
Diabetic foot	Multidisciplinary care	MRI / Nuclear imaging

- **Complications(6)**
- sinus tract formation with occasional superimposed squamous cell carcinoma (Marjolin ulcer)
- secondary sarcoma (e.g. osteosarcoma): rare
- pathological fracture
- secondary amyloidosis

Conclusion

MRI is central to diagnosis, while CT and nuclear imaging provide valuable adjuncts. Multidisciplinary care is essential for optimal outcomes.

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