

Osteomyelitis in the Hospital Setting

Definition and Epidemiology

Osteomyelitis is an infection of bone, typically bacterial, causing inflammation, necrosis, and potential bone destruction. It is classified as acute (days to weeks) or chronic (months to years), and by route: hematogenous, contiguous, or direct inoculation.

- **Prevalence** Incidence is ~20-50 per 100,000; higher in diabetics (15-20% with foot ulcers), IV drug users, and post-orthopedic surgery patients. Chronic osteomyelitis accounts for 30-40% of cases.
- **Risk Factors** Diabetes mellitus (DM), peripheral vascular disease (PVD), trauma, prosthetic joints, IV drug use (IVDU).
- **Rare Demographics** Pediatric hematogenous osteomyelitis (e.g., *Kingella kingae*), sickle cell disease (*Salmonella*), immunocompromised (fungal osteomyelitis).

Pathophysiology

- **Mechanisms** Pathogens (e.g., *Staphylococcus aureus*) invade bone via bloodstream (hematogenous), adjacent infection (contiguous), or direct trauma (inoculation). Bacteria adhere to bone matrix, forming biofilms that resist antibiotics and immune clearance.
- **Effects** Infection causes osteoblast apoptosis, osteoclast activation, and bone resorption, leading to sequestrum (dead bone) and involucrum (new bone). Chronic inflammation forms sinus tracts or abscesses.
- **Molecular Pathways** *S. aureus* protein A binds bone sialoprotein, promoting adhesion. IL-1 β and TNF- α drive osteolysis. Biofilm exopolysaccharides (e.g., PNAG) shield bacteria from phagocytosis.
- **Key Pathway** Bacterial invasion → Biofilm formation → Inflammatory cytokine release → Bone necrosis and sequestration.

Causes

Category	Common Causes	Rare Causes	Notes
Hematogenous	<i>S. aureus</i> , <i>Streptococcus</i>	<i>Salmonella</i> (sickle cell), <i>Kingella</i> (pediatric)	Common in children, long bones

Category	Common Causes	Rare Causes	Notes
Contiguous	Diabetic foot ulcers, trauma	Actinomyces, Nocardia	PVD, DM increase risk
Direct Inoculation	Open fractures, surgery	Blastomyces, Coccidioides	Prosthetic joints prone to <i>S. epidermidis</i>
Immunocompromised	MRSA, Pseudomonas	Aspergillus, Candida	Fungal in HIV, transplant patients
Drug-Related	IVDU (Pseudomonas, MRSA)	IV catheter infections	Spinal osteomyelitis in IVDU
Systemic	None	TB (Pott's disease), Brucella	TB: Vertebral, endemic areas

Clinical Presentation

Symptoms

- Localized bone pain, worse with movement
- Fever, chills (acute, 50-70%)
- Swelling, erythema, warmth (contiguous spread)
- Rare Draining sinus (chronic), weight loss (TB)

Exam

- Tenderness over affected bone
- Reduced range of motion, soft tissue swelling
- Sinus tract or exposed bone (chronic)
- Rare Spinal deformity (Pott's disease), paraspinal abscess
- Red Flags
- Systemic sepsis (SBP <90 mmHg), non-healing ulcer with bone exposure, neurological deficits (spinal)

Labs and Studies

Labs

- ESR/CRP Elevated (>50 mm/h, >5 mg/L), non-specific
- CBC Leukocytosis (acute), anemia (chronic)
- Blood Cultures Positive in 30-50% of hematogenous cases
- Advanced Procalcitonin (>0.5 ng/mL, sepsis), IL-6 (research, chronic inflammation)

Imaging

- X-ray Cortical destruction, periosteal reaction (visible after 2-3 weeks)
- MRI Gold standard; marrow edema, abscess (sensitivity 95%)
- CT Bone destruction, sequestrum; alternative if MRI contraindicated
- Advanced PET-CT (18F-FDG, chronic osteomyelitis), bone scintigraphy (triple-phase)

Other

- Bone Biopsy Culture and histology; gold standard for pathogen ID
- Wound Cultures Swabs unreliable; deep tissue or bone preferred
- Advanced Synovial fluid analysis (septic arthritis overlap), 16S rRNA PCR (culture-negative)

Diagnosis

- Criteria Localized bone pain, fever, or systemic symptoms + imaging evidence (MRI/X-ray) of osteomyelitis + positive bone culture or histology.
- Differential Septic arthritis, cellulitis, Charcot arthropathy, bone tumor, gout.

Flowsheet

- Step 1 History/Exam Bone pain, fever, risk factors (DM, IVDU); assess sinus tracts
- Step 2 Labs ESR/CRP, blood cultures; rule out sepsis (lactate, procalcitonin)
- Step 3 Imaging MRI (marrow edema), X-ray if chronic (sequestrum)
- Step 4 Biopsy Bone culture/histology; ID pathogen and susceptibility
- Step 5 Differential Rule out tumor (biopsy), Charcot (weight-bearing X-ray)

Treatment

General Principles Eradicate infection, preserve bone integrity, and prevent recurrence through antibiotics and surgical intervention.

Supportive Care

- Pain Management Acetaminophen 1 g q6h, tramadol 50 mg q6h (avoid NSAIDs in chronic)
- Nutrition High-protein diet (1.5 g/kg/day), vitamin D (bone healing)
- Wound Care Debridement, negative pressure therapy for soft tissue defects

Specific Therapies

- Antibiotics Empiric vancomycin 15 mg/kg IV q12h + ceftriaxone 2 g IV q24h; tailor to culture (e.g., MRSA: vancomycin, MSSA: nafcillin 2 g IV q4h)
- Duration Acute 4-6 weeks IV; chronic 6-12 weeks (IV + PO), rifampin 600 mg PO daily for biofilm
- Surgical Debridement Remove sequestrum, abscess; hardware removal if infected
- Advanced Hyperbaric oxygen (2.5 ATA, 90 min daily, 20-40 sessions), antibiotic-impregnated cement
- Rare Causes Fungal (amphotericin B 0.7 mg/kg IV), TB (RIPE therapy, 6-9 months)

Monitoring

- Weekly ESR/CRP, CMP (renal/hepatic function)
- MRI q4-6 weeks if persistent symptoms
- Cultures post-debridement to confirm clearance

Complications

Acute

- Sepsis Bacteremia, multi-organ failure (10-20% mortality)
- Pathologic Fracture Bone weakening from osteolysis
- Abscess Epidural, paraspinal, or soft tissue

Long-Term

- Chronic Osteomyelitis Recurrence in 20-30% without surgery
- Amputation 5-10% in diabetic foot osteomyelitis
- Rare Amyloidosis (chronic inflammation), squamous cell carcinoma (sinus tract)

Clinical Scenarios

Case 1 Diabetic Foot Osteomyelitis

- Presentation 55 y/o M with type 2 DM, non-healing foot ulcer, and fever. Vitals BP 130/80, HR 95, SpO2 98%, RR 16. Exam Exposed bone, purulent drainage.

- Labs/Studies ESR 80 mm/h, CRP 10 mg/L, WBC 14K. MRI Metatarsal osteomyelitis. Bone culture *S. aureus* (MSSA).
- Interpretation Contiguous osteomyelitis, diabetic foot.
- Management Nafcillin 2 g IV q4h x 6 weeks, surgical debridement. Wound vac, offloading boot. Monitor ESR weekly. Discharge day 10 with PICC line, healed by week 8.

Case 2 Vertebral Osteomyelitis (Rare)

- Presentation 60 y/o F with IVDU, back pain, and leg weakness. Vitals BP 110/70, HR 100, SpO2 96%, RR 18. Exam Paraspinal tenderness, reduced leg strength.
- Labs/Studies MRI L3-L4 osteomyelitis, epidural abscess. Blood culture MRSA. CRP 15 mg/L.
- Interpretation Hematogenous vertebral osteomyelitis, IVDU-related.
- Management Vancomycin 15 mg/kg IV q12h, rifampin 600 mg PO daily, neurosurgery for abscess drainage. PT for rehab. MRI q4 weeks. Recovery by 3 months.

Case 3 Pediatric Osteomyelitis

- Presentation 8 y/o M with fever, limp, and knee pain. Vitals BP 100/60, HR 110, SpO2 98%, RR 20. Exam Warm, swollen femur, pain on movement.
- Labs/Studies WBC 16K, ESR 60 mm/h, bone culture *Kingella kingae*. MRI Femoral osteomyelitis.
- Interpretation Acute hematogenous osteomyelitis, pediatric.
- Management Ceftriaxone 50 mg/kg IV q24h x 4 weeks, no surgery needed. Monitor CRP weekly. Full recovery by week 6.

Expert Tips

- Obtain bone biopsy before antibiotics unless sepsis; cultures guide therapy
- Use rifampin for biofilm in prosthetic joint infections; start after 2 weeks to avoid resistance
- Suspect *Salmonella* in sickle cell patients; *Kingella* in children <5 years
- Monitor for epidural abscess in vertebral osteomyelitis; urgent MRI if neuro deficits
- Consider hyperbaric oxygen in chronic, non-healing cases; improves tissue oxygenation
- Pitfall Relying on X-ray alone; MRI detects early marrow changes
- Advanced PET-CT for chronic osteomyelitis; 16S rRNA PCR for culture-negative cases

Key Pearls

- MRI is diagnostic gold standard; bone biopsy confirms pathogen
- *S. aureus* is most common; tailor antibiotics to culture, use 4-6 weeks IV
- Surgical debridement is critical for chronic osteomyelitis or hardware infection
- Diabetic foot osteomyelitis often requires amputation if PVD severe
- Rare causes (TB, fungi) need prolonged therapy, specialized workup

References

UpToDate “**Osteomyelitis: Diagnosis and Management**” (2025)

CID “**Management of Osteomyelitis in Adults**” (2024)

NEJM “**Osteomyelitis: A Review**” (Berbari, 2023)

Lancet Infect Dis “**Pediatric Osteomyelitis: Advances in Diagnosis**” (2024)

J Bone Joint Surg “**Hyperbaric Oxygen in Osteomyelitis**” (2023)

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