Osteomyelitis in adults

The management of osteomyelitis can be complex and require a multi-disciplinary approach. The presence of necrotic bone, vascular insufficiency, foreign body/hardware, trauma and location of affected bone (vertebral, sacral, extremities) require distinct therapeutic strategies. Osteomyelitis can develop as a result of contiguous spread, from hematogenous seeding of bone from a distant focus, or from direct inoculation of micro-organisms through trauma or surgery. The clinical course can be acute, chronic, or exacerbation of a chronic process. This guideline addresses the empiric antibiotic management of osteomyelitis; a separate guideline is available for diabetic foot infections, and for joint infections (septic arthritis).

MICROBIOLOGY

***Staphylococcus aureus* (MSSA or MRSA)**
Coagulase-negative staphylococci (CoNS) in the presence of hardware
Less commonly:

- *Streptococci*, *Enterococci*
- Gram-negative bacteria: *Enterobacteriaceae* including *Salmonella* in sickle cell or other special hosts; *Pseudomonas* species
- Anaerobes
- Fungi, Mycobacteria

ORGANISMS ISOLATED IN SELECT PATIENT POPULATIONS

Open fractures	*S. aureus*, gram-negative bacilli if Gustilo type III
Diabetic foot and/or PVD	Polymicrobial
Intravenous drug use	S. aureus (including MRSA), gram-negative bacilli including *P. aeruginosa*, *Candida*
Vertebral osteomyelitis	*S. aureus*, CoNS, streptococci Less common: *Brucella*, *Salmonella*, mycobacteria, fungi

DIAGNOSTIC CONSIDERATIONS

- Blood cultures + bone/tissue cultures (through needle aspiration or bone biopsy) should be done **before starting antibiotics** unless hemodynamic instability
- Swabs of superficial wounds or sinus tracts do not reliably predict bone culture results, and should not replace bone biopsy/aspirate
- If clinical + radiographic findings are suggestive of osteomyelitis and growth of a likely pathogen in blood (e.g. *S. aureus*), bone biopsy may be omitted
- The gold standard for diagnosis of osteomyelitis is MRI but if symptoms > 2 weeks, X-ray or CT may be sufficient to show typical findings; bone and gallium scan is both less sensitive and **much** less specific than MRI and **should not be performed in most circumstances**.
- New imaging modalities like PET scan may prove reliable but at present there is insufficient evidence to broadly recommend.

EMPIRIC PHARMACOLOGIC TREATMENT[1]

SCENARIO	INITIAL ANTIBIOTIC CHOICE
Acute, secondary to contiguous spread (long bone, or post-fixation surgery)	
Clinically stable	**No empiric therapy; base treatment on culture results**
Acutely ill	**Cefazolin** 2 g IV q8h *If severe β-lactam allergy or known MRSA colonized:* Vancomycin[3] 15 mg/kg IV q12h
Hemodynamically unstable	**Piperacillin-tazobactam** 4.5 g IV q8h (blood cultures before starting antibiotics) *If severe penicillin allergy:* ceftriaxone 2 g IV q12h PLUS ciprofloxacin 400 mg IV q12h (or 500 mg PO q12h) *If risk factors for MRSA[2], add:* Vancomycin[3] 15 mg/kg IV q12h
Acute, secondary to hematogenous spread (vertebreal, sternal, clavicular osteomyelitis)	
Hemodynamically stable	**No empiric therapy; base treatment on culture results**
Unstable	**Piperacillin-tazobactam** 4.5 g IV q8h *If severe penicillin allergy:* ceftriaxone 2 g IV q12h PLUS ciprofloxacin 400 mg IV q12h (or 500 mg PO q12h) *If risk factors for MRSA[2], add:* Vancomycin[3] 15mg/kg IV q12h
Chronic osteomyelitis	**No empiric therapy; base treatment on culture results; surgical debridement critical**

[1]Dosing of antibiotics assume normal renal function; adjustments are required if presence of renal dysfunction
[2]Risk factors for MRSA: **Previous MRSA infection/colonization,** homelessness, injection drug use
[3]See Vancomycin Therapeutic Drug Monitoring guideline; consult pharmacy for dosing adjustments

- Duration: ± 6 weeks (depending on surgical debridement, removal of orthopedic hardware); step down to oral antibiotics can be considered in certain cases
- If suspicion of vertebral osteomyelitis, consult ID/ortho spine
- If diabetic foot – see guideline

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