TABLE 158-2 ANTIBIOTIC THERAPY FOR OSTEOMYELITIS ASSOCIATED WITH ORTHOPEDIC DEVICES

Microorganism	Antimicrobial Agent[a] (Dose, Route)
Staphylococcus spp.	*Recommendation for initial treatment phase (2 weeks with implant)*
Methicillin-susceptible	Rifampin (450 mg PO/IV q12h[b])
	plus
	Nafcillin *or* oxacillin[c] (2 g IV q6h)
Methicillin-resistant	Rifampin (450 mg PO/IV q12h[b])
	plus
	Vancomycin (15 mg/kg IV q12h) *or* daptomycin (6–8 mg/kg IV q24h)
Staphylococcus spp.	*Recommendation after completion of initial treatment phase*
	Rifampin (450 mg PO q12h[b])
	plus
	Levofloxacin (750 mg PO q24h or 500 mg PO q12h *or* ciprofloxacin (750 mg PO q12h) *or* fusidic acid (500 mg PO q8h) *or* TMP-SMX[d] (1 double-strength tablet PO q8h) *or* minocycline (100 mg PO q12h) *or* linezolid (600 mg PO q12h) *or* clindamycin (1200–1350 mg/d PO in 3 or 4 divided doses)
Streptococcus spp.[e]	Penicillin G[c] (18–24 million units/d IV in 6 divided doses) *or* ceftriaxone (2 g IV q24h) for 4 weeks
	followed by
	Amoxicillin (750–1000 mg PO q6–8h) *or* clindamycin (1200–1350 mg/d PO in 3 or 4 divided doses)
Enterococcus spp.[f]	
Penicillin-susceptible	Penicillin G[c] (24 million units/d IV in 6 divided doses) *or* ampicillin or amoxicillin[g] (2 g IV q4–6h)
Penicillin-resistant	Vancomycin (15 mg/kg IV q12h) *or* daptomycin (6–8 mg/kg IV q24h) *or* linezolid (600 mg IV/PO q12h)
Enterobacteriaceae	A β-lactam selected in light of in vitro susceptibility profile for 2 weeks[h]
	followed by
	Ciprofloxacin (750 mg PO q12h)
Enterobacter spp.[i] and nonfermenters[j] (e.g., *Pseudomonas aeruginosa*)	Cefepime or ceftazidime (2 g IV q8h) *or* meropenem (1 g IV q8h[k]) for 2–4 weeks
	followed by
	Ciprofloxacin (750 mg PO q12h)
Propionibacterium spp.	Penicillin G[c] (18–24 million units/d IV in 6 divided doses) *or* clindamycin (600–900 mg IV q8h) for 2–4 weeks
	followed by
	Amoxicillin (750–1000 mg PO q6–8h) *or* clindamycin (1200–1350 mg/d PO in 3 or 4 divided doses)
Gram-negative anaerobes (e.g., *Bacteroides* spp.)	Metronidazole (500 mg IV/PO q8h)
Mixed bacteria (without methicillin-resistant staphylococci)	Ampicillin-sulbactam (3 g IV q6h) *or* amoxicillin-clavulanate[l] (2.2 g IV q6h) *or* piperacillin-tazobactam (4.5 g IV q8h) *or* imipenem (500 mg IV q6h) *or* meropenem (1 g IV q8h[k]) for 2–4 weeks
	followed by
	Individualized oral regimens chosen in light of antimicrobial susceptibility

[a]Antimicrobial agents should be chosen in light of the isolate's in vitro susceptibility, the patient's drug allergies and intolerances, potential drug interactions, and contraindications to specific drugs. All dosages recommended are for adults with normal renal and hepatic function. See text for total durations of antibiotic treatment. [b]Other dosages and intervals of administration with equivalent success rates have been reported. [c]When the patient has delayed-type penicillin hypersensitivity, cefazolin (2 g IV q8h) can be administered. When the patient has immediate-type penicillin hypersensitivity, the penicillin should be replaced by vancomycin (1 g IV q12h). [d]Trimethoprim-sulfamethoxazole. A double-strength tablet contains 160 mg of trimethoprim and 800 mg of sulfamethoxazole. [e]Determination of the minimal inhibitory concentration (MIC) of penicillin is advisable. [f]Combination therapy with an aminoglycoside is optional since its superiority to monotherapy for prosthetic joint infection is unproved. When using combination therapy, monitor signs of aminoglycoside ototoxicity and nephrotoxicity; the latter is potentiated by other nephrotoxic agents (e.g., vancomycin). [g]For patients with hypersensitivity to penicillin, see treatment options for penicillin-resistant enterococci. [h]Ciprofloxacin (PO or IV) can be administered to patients with hypersensitivity to β-lactams. [i]Ceftriaxone and ceftazidime should not be administered for treatment targeting *Enterobacter* species, even strains that test susceptible in the laboratory, but can be used against nonfermenters. Strains producing extended-spectrum β-lactamases should not be treated with any cephalosporin, including cefepime. *Enterobacter* infections can also be treated with ertapenem (1 g IV q24h); however, ertapenem is not effective against *Pseudomonas* spp. and other nonfermenters. [j]Addition of an aminoglycoside is optional. Use of two active drugs can be considered in light of the patient's clinical condition. [k]The recommended dosage is in line with the guidelines of the Infectious Diseases Society of America. In Europe, 2 g IV q8h is suggested for *P. aeruginosa* infections. [l]Not available as an IV formulation in the United States.

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are required for complete elimination of the infection. If implants cannot be removed, oral suppressive long-term treatment should follow the initial course of IV antibiotics. The optimal duration of suppressive therapy is unknown. However, if antibiotic therapy is discontinued after, for example, 1 year, close clinical and laboratory (CRP) follow-up is needed.

COMPLICATIONS

Complications include persistent pain, persistently increased CRP levels, and new-onset or persistent neurologic impairment. In cases of persistent pain with or without signs of inflammation, paravertebral, epidural, or psoas abscesses (Fig. 158-1) must be sought. Epidural abscesses occur in 15–20% of cases. This complication is more common in the cervical column (30%) than in the lumbar spine (12%). Persistent pain despite normalization of CRP values indicates mechanical complications such as severe osteonecrosis or spinal instability. These patients require a consult with an experienced orthopedic surgeon.

OSTEOMYELITIS IN LONG BONES

PATHOGENESIS

Osteomyelitis in long bones is a consequence of hematogenous seeding, exogenous contamination during trauma (open fracture), or perioperative contamination during orthopedic repairs. Its presentation is either acute (with a duration of days to a few weeks) or chronic. Hematogenous infection in long bones typically occurs in children. Ineffectively treated hematogenous osteomyelitis during childhood can progress to chronic disease. In adults, the leading pathogenic source is exogenous infection, mainly associated with internal fixation