TABLE 183e-1 TREATMENT OF INFECTIONS CAUSED BY HACEK GROUP ORGANISMS

Organisms	Preferred Therapy	Alternative Agents	Comments
Haemophilus spp. *Aggregatibacter actinomycetemcomitans, A. aphrophilus, A. paraphrophilus*, other species *Cardiobacterium hominis* *Eikenella corrodens* *Kingella kingae*	Ceftriaxone (2 g/d)	Ampicillin/sulbactam (3 g of ampicillin q6h)	Ampicillin/sulbactam resistance has been described in *Haemophilus* and *Aggregatibacter* spp.
		Levofloxacin (500–750 mg/d)	Data on use of levofloxacin for endocarditis therapy are limited. Fluoroquinolones are not recommended for treatment of patients <18 years of age.
		Penicillin (16–18 million units q4h) or ampicillin (2 g q4h)	Penicillin or ampicillin can be used if the organism is susceptible. However, because of the slow growth of HACEK bacteria, antimicrobial testing may be difficult, and β-lactamase production may not be detected.

OTHER GRAM-NEGATIVE BACTERIA

Achromobacter xylosoxidans *Achromobacter* (previously *Alcaligenes*) *xylosoxidans* is probably part of the endogenous intestinal flora and has been isolated from a variety of water sources, including well water, IV fluids, and humidifiers. Immunocompromised hosts, including patients with cancer and postchemotherapy neutropenia, cirrhosis, chronic renal failure, and cystic fibrosis, are at increased risk. Nosocomial outbreaks and pseudo-outbreaks of *A. xylosoxidans* infection have been attributed to contaminated fluids, and clinical illness has been associated with isolates from many sites, including blood (often in the setting of intravascular devices). Community-acquired *A. xylosoxidans* bacteremia usually occurs in the setting of pneumonia. Metastatic skin lesions are present in one-fifth of cases. The reported mortality rate is as high as 67%—a figure similar to rates for other bacteremic gram-negative pneumonias.

TREATMENT *ACHROMOBACTER XYLOSOXIDANS* INFECTIONS

(Table 183e-2) Treatment is based on in vitro susceptibility testing of all clinically relevant isolates; multidrug resistance is common. Meropenem, tigecycline, and colistin are typically the most active agents.

***Aeromonas* Species** More than 85% of *Aeromonas* infections are caused by *A. hydrophila*, *A. caviae*, and *A. veronii* biovar *sobria*. *Aeromonas* proliferates in potable water, freshwater, and soil. It remains controversial whether *Aeromonas* is a cause of bacterial gastroenteritis; asymptomatic colonization of the intestinal tract with *Aeromonas* occurs frequently. However, rare cases of hemolytic-uremic syndrome following bloody diarrhea have been shown to be secondary to the presence of *Aeromonas*.

Aeromonas causes sepsis and bacteremia in infants with multiple medical problems and in immunocompromised hosts, particularly those with cancer or hepatobiliary disease. *A. caviae* is associated with health care–related bacteremia. *Aeromonas* infection and sepsis can occur in patients with trauma (including severe trauma with myonecrosis) and in burn patients exposed to *Aeromonas* by environmental (freshwater or soil) contamination of their wounds. Reported mortality rates range from 25% among immunocompromised adults with sepsis to >90% among patients with myonecrosis. *Aeromonas* can produce ecthyma gangrenosum (hemorrhagic vesicles surrounded by a rim of erythema with central necrosis and ulceration; see Fig. 25e-35) resembling the lesions seen in *Pseudomonas aeruginosa* infection. This organism causes nosocomial infections related to catheters, surgical incisions, or use of leeches. Other manifestations include necrotizing fasciitis, meningitis, peritonitis, pneumonia, and ocular infections.

TREATMENT *AEROMONAS* INFECTIONS

(Table 183e-2) *Aeromonas* species are generally susceptible to fluoroquinolones (e.g., ciprofloxacin at a dosage of 500 mg every 12 h PO or 400 mg every 12 h IV), third- and fourth-generation cephalosporins, carbapenems, and aminoglycosides, but resistance has been described to all those agents. Because *Aeromonas* can produce various β-lactamases, including carbapenemases, susceptibility testing must be used to guide therapy. Antibiotic prophylaxis (e.g., with ciprofloxacin) is indicated when medicinal leeches are used.

***Capnocytophaga* Species** This genus of fastidious, fusiform, gram-negative coccobacilli is facultatively anaerobic and requires an atmosphere enriched in carbon dioxide for optimal growth. *C. ochracea*, *C. gingivalis*, *C. haemolytica*, and *C. sputigena* have been associated with sepsis in immunocompromised hosts, particularly neutropenic patients with oral ulcerations. These species have been isolated from many other sites as well, usually as part of a polymicrobial infection. Most *Capnocytophaga* infections are contiguous with the oropharynx (e.g., periodontal disease, respiratory tract infections, cervical abscesses, and endophthalmitis).

TABLE 183e-2 TREATMENT OPTIONS FOR OTHER SELECTED GRAM-NEGATIVE BACTERIA

Organism	Treatment Options	Comments
Achromobacter xylosoxidans	Meropenem, tigecycline, colistin	Treatment should be based on in vitro susceptibility testing; multidrug resistance is common among these organisms.
Aeromonas spp.	Fluoroquinolones (e.g., ciprofloxacin), third- and fourth-generation cephalosporins, carbapenems, aminoglycosides	
Elizabethkingia/ Chryseobacterium spp.	Fluoroquinolones, trimethoprim-sulfamethoxazole, piperacillin/tazobactam	
Rhizobium radiobacter	Fluoroquinolones, third- and fourth-generation cephalosporins, carbapenems	
Shewanella spp.	Fluoroquinolones, third- and fourth-generation cephalosporins, β-lactam/β-lactamase inhibitors, carbapenems, aminoglycosides	
Capnocytophaga spp.	Ampicillin/sulbactam	Penicillin should be used if the isolate is known to be susceptible.
Pasteurella multocida	Ampicillin/sulbactam or ceftriaxone	Penicillin should be used if the isolate is known to be susceptible. *P. multocida* is also susceptible to tetracyclines and fluoroquinolones.