TABLE 184-2 UTILITY OF SPECIAL LABORATORY TESTS FOR THE DIAGNOSIS OF LEGIONNAIRES' DISEASE

Test	Sensitivity, %	Specificity, %
Culture		
Sputum[a]	80	100
Transtracheal aspirate	90	100
Direct fluorescent antibody staining of sputum	50–70	96–99
Urinary antigen testing[b]	70	100
Antibody serology[c]	40–60	96–99

[a]Use of multiple selective media with dyes. [b]Reliable only for *L. pneumophila* serogroup 1. [c]IgG and IgM testing of both acute- and convalescent-phase sera. A single titer of ≥1:256 is considered presumptive, whereas a fourfold rise in titer between the acute and convalescent phases is considered definitive. Titers peak at 3 months.

IV route. A clinical response usually occurs within 3–5 days, after which oral therapy can be substituted. The total duration of therapy in the immunocompetent host is 10–14 days.

Alternative agents include tetracycline and its analogues doxycycline and minocycline. Tigecycline is active in vitro, but clinical experience with this drug is minimal. Anecdotal reports have described both successes and failures with trimethoprim-sulfamethoxazole, imipenem, and clindamycin.

For critically ill patients, the authors use combination regimens of azithromycin, a quinolone, and/or rifampin. This practice is empirical and is not supported by comparative studies. Rifampin is highly active in vitro and in cell models. Its interaction with other medications and its side effect of reversible hyperbilirubinemia can be minimized by limiting the duration of therapy to 3–5 days. A longer course of therapy (3 weeks) may be appropriate for immunosuppressed patients and those with advanced disease. For azithromycin, with its long half-life, a 5- to 10-day course is sufficient.

Pontiac fever requires only symptom-based treatment, not antimicrobial therapy.

PROGNOSIS

Mortality rates for Legionnaires' disease vary with the patient's underlying disease, the patient's immune status, the severity of pneumonia, and the timing of administration of appropriate antimicrobial therapy.

TABLE 184-3 ANTIBIOTIC THERAPY FOR *LEGIONELLA* INFECTION

Antimicrobial Agent	Dosage[a]
Macrolides	
Azithromycin	500 mg[b] PO or IV[c] q24h
Clarithromycin	500 mg PO or IV[c] q12h
Quinolones	
Levofloxacin	750 mg IV q24h
	500 mg[b] PO q24h
Ciprofloxacin	400 mg IV q8h
	750 mg PO q12h
Moxifloxacin	400 mg[b] PO q24h
Ketolide	
Telithromycin	800 mg PO q24h
Tetracyclines	
Doxycycline	100 mg[b] PO or IV q12h
Minocycline	100 mg[b] PO or IV q12h
Tetracycline	500 mg PO or IV q6h
Tigecycline	100-mg IV load, then 50 mg IV q12h
Others	
Trimethoprim-sulfamethoxazole	160/800 mg IV q8h
	160/800 mg PO q12h
Rifampin[d]	300–600 mg PO or IV q12h

[a]Dosages are derived from clinical experience. [b]The authors recommend doubling the first dose. [c]The IV formulation is not available in some countries. [d]Rifampin should be used only in combination with a macrolide or a quinolone.

Mortality rates are highest (80%) among immunosuppressed patients who do not receive appropriate antimicrobial therapy early in the course of illness. With timely antibiotic treatment, mortality rates from community-acquired Legionnaires' disease among immunocompetent patients range from 0 to 11%; without treatment, the figure may be as high as 31%. In a study of survivors of an outbreak of community-acquired Legionnaires' disease, sequelae of fatigue, neurologic symptoms, and weakness were found in 63–75% of patients 17 months after receipt of antibiotics.

PREVENTION

Routine environmental culture of hospital water supplies for *Legionella* is recommended as an approach to the prevention of hospital-acquired Legionnaires' disease. Guidelines mandating this proactive approach have been adopted throughout Europe and in several U.S. states. The presence of *Legionella* in the water supply mandates the use of specialized laboratory tests (especially culture on selective media and the urinary antigen test) for patients with hospital-acquired pneumonia. A 30% cutoff for the presence of *Legionella* in water from multiple hospital sites prompts an increased index of suspicion. When the 30% cutoff point is exceeded, diagnostic tests for *Legionella* need to be applied in all cases of hospital-acquired pneumonia, and measures directed at eliminating the organism from the water supply should be considered. Quantitative criteria at a given water site (colony-forming units [CFU]/mL) have proven unreliable and inconsistent in the prediction of disease.

Studies have shown that neither a high degree of outward cleanliness of the water system nor routine application of maintenance measures decreases the frequency or intensity of *Legionella* contamination. Thus, engineering guidelines and building codes, although routinely advocated as preventive measures, have little impact on the presence of *Legionella*.

Environmental cultures for *Legionella* from cold-water taps, hot-water taps, the hot-water recirculating line, and water-storage tanks will reveal the source of hospital-acquired infections. Disinfection of the hospital drinking-water system is an effective preventive measure for hospital-acquired cases of Legionnaires' diseases because this system is the reservoir for *Legionella*. In geographic areas where the climate is semitropical, cold-water lines may be colonized by *Legionella*.

Copper-silver ionization is a reliable method for eradication of *Legionella*. Unlike the efficacy of chlorine dioxide decontamination and chlorination, that of ionization is not affected by high water temperature. Ionization systems are easy to install, and the ions are odorless, with minimal adverse effects. The efficacy of copper-silver ionization has been documented in hospitals worldwide. A comprehensive review of 10 published studies concluded that copper-silver ionization is effective for *Legionella* control as long as ion levels are monitored. If cold-water colonization by *Legionella* is the source of an outbreak, chlorine dioxide and monochloramine offer advantages. Chlorine dioxide, often the least expensive option, penetrates biofilms better and is less corrosive than chlorine. The major disadvantage of chlorine dioxide is the need to maintain an effective residual throughout the drinking-water system, especially in the hot-water system. Eradication of *Legionella* by chlorine dioxide may require several months—a drawback in outbreak situations. Monochloramine is a promising approach in disinfection. Hyperchlorination is no longer recommended because of its expense, carcinogenicity, corrosive effects on piping, and unreliable efficacy.

Point-of-use disposable water filters (0.2 μm) may be an economical and effective option in high-risk areas (e.g., ICUs and transplantation units). These filters can be used in an outbreak situation for a limited period.

Ineffective yet expensive methods that are often promulgated include removal of stagnation ("dead legs") in the water-distribution system and replacement or disinfection/cleaning of distal outlets. Infection control personnel should oversee the selection of disinfection technology and should apply evidence-based criteria when making their choice. Managers of health care facilities should not be given the primary responsibility for selection and subsequent monitoring of measures to eliminate and control *Legionella*.