Susceptibility of *Eikenella corrodens* to Penicillin, Apalcillin, and Twelve New Cephalosporins

ELLIE J. C. GOLDSTEIN†* AND DIANE M. CITRON

R. M. Alden Research Laboratory, Los Angeles, California 90049

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The susceptibility of 29 strains of *Eikenella corrodens* to penicillin, apalcillin, and 12 new cephalosporins was determined by the agar dilution method. Most strains were resistant to cefsulodin, and some were resistant to apalcillin and cefpiramide. Although all strains were susceptible to the other cephalosporins tested, most of those drugs were as active as or less active than penicillin. Susceptibility testing of isolates should be performed whenever a cephalosporin is used to treat infections involving *E. corrodens*.

*Eikenella corrodens* has been implicated as a pathogen in a wide variety of clinical infections. Although it has been isolated as the sole pathogen in dental infections, pulmonary infections, brain abscesses, meningitis, osteomyelitis, and endocarditis (2-4, 7-9, 12, 13), it is usually isolated in mixed culture. *E. corrodens* is susceptible to penicillin and resistant to penicillinase-resistant penicillins, clindamycin, and the aminoglycosides (1, 10). The in vitro activity of the cephalosporins has been inconsistent (1, 5, 6). In addition to its poor activity against *E. corrodens*, cephalothin has led to clinical therapeutic failures (1, 4, 13). The susceptibility of fastidious and recondite pathogens to newer antimicrobial agents is often overlooked. Because *E. corrodens* is an important pathogen in mixed infections which are often treated with cephalosporins, we tested the comparative in vitro activity of penicillin, apalcillin, and 12 new cephalosporins against *E. corrodens*.

All 29 strains tested were clinical isolates and identified by standard criteria (1). The sources of the isolates were as follows: abscesses, nine; transbronchial aspirates, eight; bite wounds, seven; skin and soft tissue, four; and blood, one. Laboratory powders were kindly supplied by the following companies: apalcillin and cefpiramide, Wyeth Laboratories, Philadelphia, Pa.; cefetrapezone and ceforanide, Bristol Laboratories, Syraccuse, N.Y.; cefmenoxime and cefsulodin, Abbott Laboratories, North Chicago, Ill.; cefonicid, Smith Kline and French Laboratories, Philadelphia, Pa.; cefetetan, Stuart Pharmaceuticals, Wilmington, Del.; cefazidime and cefuroxime, Glaxo Inc., Research Triangle Park, N.C.; ceftriaxone, Hoffmann-LaRoche, Inc., Nutley, N.J.; and penicillin, Eli Lilly & Co., Indianapolis, Ind.

The *E. corrodens* strains were taken from frozen stock culture and grown on brucella agar supplemented with 5% sheep blood and vitamin K1 (10 μg/ml) in 5 to 10% CO2 for 48 h. After a transfer to ensure purity, the strains were transferred to tubes containing Mueller-Hinton broth (CalScott Laboratories, Carson, Calif.) supplemented with Fildes enrichment (Difco Laboratories, Detroit, Mich.) and incubated overnight in 5 to 10% CO2. The turbidity was adjusted to one-half of a McFarland standard no. 1. Mueller-Hinton agar plates supplemented with 5% sheep blood and antimicrobial agents at concentrations from 128 to 0.06 μg/ml were inoculated with a Steers replicator (Craft Machine Inc., Chester, Pa.). Antibiotic solutions were freshly prepared for each test by the manufacturer's instructions. Control plates without antibiotics were inoculated before and after each series of antibiotic-containing plates were inoculated. All plates were incubated in 5 to 10% CO2 for 48 h and then examined.

Control strains (Staphylococcus aureus ATCC 25923 and Escherichia coli ATCC 25922) were tested simultaneously on each plate.

The activities of 12 new cephalosporins, apalcillin, and penicillin against 29 strains of *E. corrodens* is shown in Table 1. All strains tested were uniformly susceptible to ceftriaxone (<2 μg/ml), cefotetan (<4 μg/ml), HR-810 (<4 μg/ml), cefmenoxime (<8 μg/ml), cefuroxime (<8 μg/ml), penicillin (<8 IU/ml), cefperazone (<16 μg/ml), ceforanide (<16 μg/ml), and ceftizoxime (<16 μg/ml). Susceptibility to the other agents was variable. Cefazidime showed relatively poor activity (MIC, 0.06 to 32 μg/ml); the activity of apalcillin and cefpiramide was also relatively poor, and some strains were resistant to these drugs. Whereas all strains were susceptible to cefonicid (<16 μg/ml), most strains required 16 μg/ml for inhibition. More than 64 μg of cefsulodin per ml was required to inhibit all but two of the strains of *E. corrodens* tested. Two strains, both isolated from transbronchial aspirates, that had higher than expected MICs (8 IU/ml) of penicillin were also resistant or relatively more resistant to all the other agents tested. These two strains, as well as six strains resistant to apalcillin, cefsulodin, or cefpiramide, were tested by cefinase disk (BBL Microbiology Systems, Cockeysville, Md.) for beta-lactamase production and were found to be negative.

The cephalosporins are frequently used as initial empirical therapy for a wide variety of infections in which *E. corrodens* may be present. Because *E. corrodens* is a fastidious, slow-growing organism and also may be overgrown in mixed culture, it may be missed on routine cultures. In addition, clinicians may fail to recognize its pathogenic potential and may not select appropriate antimicrobial therapy even when it has been isolated. Clinical evidence of therapeutic failure has been correlated with in vitro findings that the *E. corrodens* strain was resistant to the antibiotic used (1, 4, 13). Brooks et al. (1) noted that patients receiving cephalothin therapy developed infections with *E. corrodens*. It was recently reported that patients with hand infections from which *E. corrodens* was isolated who were not given effective therapy against *E. corrodens* (usually a cephalosporin or a penicillinase-resistant penicillin) had a higher incidence of complications and residual disability (4). However, use of an

* Corresponding author.
† Address reprint requests to Ellie J. C. Goldstein, 11980 San Vicente Boulevard no. 103, Los Angeles, CA 90049.
effective agent (penicillin, cefoxitin) was associated with clinical efficacy and no residual disability. Suwanagool et al. (13) noted clinical failures with both cephalothin and a combination of clindamycin and tobramycin. They concluded that "isolation of *E. corrodens* from an infection site should indicate specific treatment... especially in the compromised patient whose infections present a more aggressive course."

In general, although the new agents tested were active against *E. corrodens*, they were not significantly more active than penicillin, to which all strains were susceptible. Most strains were resistant to cefoxitin. These new agents were considerably less active than cefoxitin, cefotaxime, moxalactam, and imipenem, the drugs used in our previously published studies on the susceptibility of *E. corrodens* (5). In contrast to the results of Schoter and Strobel (11), our isolates were relatively less susceptible to cefotaxime and cefmenoxime and more susceptible to cefuroxime; both studies noted that almost all strains were resistant to cefoxitin.

The mechanism of the resistance of *E. corrodens* to many cephalosporins remains undetermined. Resistance does not appear to be due to beta-lactamase production as determined by the cefinase disk method. Because of the variable susceptibility of some strains of *E. corrodens* to the first-generation (5, 6) and many newer cephalosporins, the susceptibility pattern of *E. corrodens* should be considered in choosing empirical therapy when *E. corrodens* may be present. The clinical laboratory should perform susceptibility testing of isolates whenever a cephalosporin is to be used.

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**LITERATURE CITED**


