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# In Vitro Susceptibility of 96 *Capnocytophaga* Strains, Including a β-Lactamase Producer, to New β-Lactam Antibiotics and Six Quinolones

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**The in vitro activities of new beta-lactam antibiotics and new quinolones were studied against 96 *Capnocytophaga* strains, including a beta-lactamase-producing strain which was resistant to ampicillin, amoxicillin, carbenicillin, cephalothin, and cefamandole. All strains were susceptible to the combination of amoxicillin and clavulanic acid, ureidopenicillins, cefoxitin, broad-spectrum cephalosporins, and imipenem. Cephalothin and cefamandole did not show good activity against most strains. All *Capnocytophaga* spp. were uniformly susceptible to the five new quinolones tested.**

*Capnocytophaga* sp., a gram-negative fusiform and capnophilic rod, is part of the normal oral flora of humans (10). In nonimmunocompromised hosts, this bacterium has been isolated from periodontal pockets in patients with periodontosis and from other diseased sites (7, 8). In immunocompromised and neutropenic patients, *Capnocytophaga* sp. has been more often isolated from blood (2, 8). Because this bacterium causes various infections, and since a beta-lactamase-producing strain has been isolated from blood in a neutropenic patient, it seemed interesting to study the in vitro activity of new beta-lactam antibiotics and new fluoroquinolones on 96 strains of *Capnocytophaga* spp. Of the 96, 87 strains were clinical isolates, 47 of which were obtained from compromised hosts. Nine strains were kindly provided by E. Falsen, Department of Clinical Bacteriology, University of Göteborg, Göteborg, Sweden: three reference strains (EF9714, Leadbetter strain $4^T$ [type strain], ATCC 33612; EF9715, Leadbetter strain $27^T$, ATCC 33624; and EF9716, ATCC $28872^T$) and six clinical isolates. All were identified on the basis of colonial, morphological, and biochemical characteristics (4, 5, 10) and stored at −70°C. They were routinely grown on chocolate agar supplemented with PolyVitex (Biomérieux Laboratories, France) at 37°C in a humid $CO_2$ atmosphere.

The antimicrobial agents utilized in this study were supplied by their respective manufacturers. MICs were determined by an agar dilution method as previously described (9), except that we used Wilkins-Chalgren agar to give final concentrations ranging from 0.06 to 128 μg/ml for all antibiotics except for carbenicillin, mezlocillin, and piperacillin (0.06 to 512 μg/ml). When the combination of amoxicillin and clavulanic acid was tested, the concentration of clavulanic acid was 4 μg/ml in all plates. Drug-free plates were included as a bacterial growth control.

Bacterial inocula were prepared from 48-h cultures on chocolate agar and diluted in sterile saline solution, and the turbidity was adjusted to a 0.5 McFarland $BaSO_4$ standard. Plates were then inoculated by the MIC 2000 inoculator, which delivers approximately $10^4$ to $10^5$ CFU per spot. The MIC was defined as the lowest antibiotic concentration at which no growth was visible after 48 h of anaerobic incubation. Strains of *Escherichia coli* ATCC 25922 and *Staphylococcus aureus* ATCC 25923 were included with each set of plates.

To test the in vitro susceptibility of this fastidious capnophilic rod, we used Wilkins-Chalgren agar (Difco Laboratories), a medium which allows a very good growth of *Capnocytophaga* sp. without additional factors (12). Our results (Table 1) are similar to those cited in the literature (1, 3, 6, 9, 11). No difference was observed between strains isolated from immunocompromised and nonimmunocompromised hosts. Except for the beta-lactamase-producing strain, all *Capnocytophaga* spp. were in vitro susceptible to penicillins, imipenem, cefoxitin, and broad-spectrum cephalosporins except cefoperazone. MICs of broad-spectrum ceph-

TABLE 1. Antimicrobial susceptibility of 96 *Capnocytophaga* strains to beta-lactam antibiotics and quinolones

| Antimicrobial agent | MIC (μg/ml)[a] | | |
|---|---|---|---|
| | 50% | 90% | Range |
| Ampicillin | 0.25 | 0.5 | ≤0.06–>128 |
| Amoxicillin | 0.25 | 0.5 | ≤0.06–>128 |
| Amoxicillin + clavulanic acid | 0.06 | 0.25 | ≤0.06–2 |
| Carbenicillin | 0.25 | 1 | ≤0.06–128 |
| Mezlocillin | 0.25 | 1 | ≤0.06–8 |
| Piperacillin | 0.25 | 2 | ≤0.06–8 |
| Imipenem | 0.12 | 0.5 | ≤0.06–0.5 |
| Cephalothin | 16 | 32 | 0.5–128 |
| Cefamandole | 4 | 8 | 0.5–64 |
| Cefoxitin | 0.5 | 2 | ≤0.06–4 |
| Cefoperazone | 1 | 4 | ≤0.06–32 |
| Cefotaxime | 0.06 | 1 | ≤0.06–2 |
| Ceftriaxone | 0.12 | 1 | ≤0.06–2 |
| Ceftazidime | 0.25 | 1 | ≤0.06–4 |
| Moxalactam | 0.25 | 1 | ≤0.06–4 |
| Nalidixic acid | 8 | 16 | 1–16 |
| Norfloxacin | 0.5 | 1 | 0.12–4 |
| Rosoxacin | 0.25 | 0.5 | ≤0.06–0.5 |
| Pefloxacin | 0.25 | 0.5 | ≤0.06–1 |
| Ofloxacin | 0.12 | 0.25 | ≤0.06–0.5 |
| Ciproflaxacin | 0.06 | 0.12 | ≤0.06–0.5 |

[a] 50% and 90%, MICs for 50 and 90% of strains tested, respectively.

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alosporins and moxalactam against the more resistant strains of Rummens et al. (9) were notably higher than against our strains (including the beta-lactamase-producing one), which can be considered as susceptible strains when compared with critical concentrations. We obtained the same range of activity with the combination of amoxicillin and clavulanic acid as these authors (9) did, however; this result suggests that clavulanic acid inhibits the beta-lactamase activity detected in one of our strains and three of those of Rummens et al. *Capnocytophaga* sp. has been isolated from patients receiving treatment including first- or second-generation cephalosporins associated with aminoglycosides; the use of new beta-lactamines for empiric therapy in neutropenic patients could prevent systemic infections caused by this organism.

As noted in other reports (3, 9), we found a very good in vitro activity of the new quinolones; those oral antibiotics could be used to treat oral, cerebral, respiratory, bony, and genital infections where this opportunistic bacterium has been isolated.

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## LITERATURE CITED

1. **Forlenza, S. W., M. G. Newman, A. L. Horikoshi, and U. Blachman.** 1981. Antimicrobial susceptibility of *Capnocytophaga*. Antimicrob. Agents Chemother. **19**:144–146.
2. **Forlenza, S. W., M. G. Newman, A. I. Lipsey, S. E. Siegel, and U. Blachman.** 1980. *Capnocytophaga* sepsis: a newly recognised clinical entity in granulocytopenic patients. Lancet **i**:567–568.
3. **Hawkey, P. M., S. D. Smith, J. Haynes, H. Malnick, and S. W. Forlenza.** 1987. In vitro susceptibility of *Capnocytophaga* species to antimicrobial agents. Antimicrob. Agents Chemother. **31**:331–332.
4. **Kristiansen, J. E., A. Bremmelgaard, H. E. Busk, O. Heltberg, W. Fredriksen, and T. Justesen.** 1984. Rapid identification of *Capnocytophaga* isolated from septicemic patients. Eur. J. Clin. Microbiol. **3**:236–240.
5. **Laughon, B. E., S. A. Syed, and W. J. Loesche.** 1982. API ZYM system for identification of *Bacteroides* spp., *Capnocytophaga* spp., and spirochetes of oral origin. J. Clin. Microbiol. **15**:97–102.
6. **Mashimo, P. A., Y. Yamamoto, M. Nakamura, and J. Slots.** 1983. Selective recovery of oral *Capnocytophaga* spp. with sheep blood agar containing bacitracin and polymyxin B. J. Clin. Microbiol. **17**:187–191.
7. **Moore, W. E. C., E. P. Cato, and L. V. Holdeman.** 1981. Anaerobes associated with periodontal disease, p. 121–128. *In* Specia Symposium Paris, 1980: Les anaérobies. Microbiologie-Pathologie, Masson, Paris.
8. **Parenti, D. M., and D. R. Snydman.** 1985. *Capnocytophaga* species: infections in nonimmunocompromised and immunocompromised hosts. J. Infect. Dis. **151**:140–147.
9. **Rummens, J. L., B. Gordts, and H. W. Van Landuyt.** 1986. In vitro susceptibility of *Capnocytophaga* species to 29 antimicrobial agents. Antimicrob. Agents Chemother. **30**:739–742.
10. **Socransky, S. S., S. C. Holt, E. R. Leadbetter, A. C. R. Tanner, E. Savitt, and B. F. Hammond.** 1979. *Capnocytophaga*: new genus of gram-negative gliding bacteria. III. Physiological characterization. Arch. Microbiol. **122**:29–33.
11. **Sutter, V. L., D. Pyeatt, and Y. Y. Kwok.** 1981. In vitro susceptibility of *Capnocytophaga* strains to 18 antimicrobial agents. Antimicrob. Agents Chemother. **20**:270–271.
12. **Walter, C. B., T. A. Niebloom, and S. S. Socransky.** 1979. Agar medium for use in susceptibility testing of bacteria from human periodontal pockets. Antimicrob. Agents Chemother. **16**:452–457.