Comparative In Vitro Activity of Newer Cephalosporins Against Anaerobic Bacteria

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The in vitro susceptibilities of 408 recent clinical isolates of anaerobic bacteria against cefaclor, cephalexin, cephalothin, cefazolin, cefamandole, and cefoxitin were compared by an agar dilution technique. Against gram-positive bacteria, especially peptococci, peptostreptococci, and propionibacteria, cephalexin and cefaclor were significantly less active than cephalothin (P < 0.05). Cephalexin was also less active than cephalothin against clostridia and lactobacillus (P < 0.05). Against gram-negative bacteria, major differences were observed primarily with *Bacteroides fragilis*, against which cephalexin, cefazolin and cefoxitin were all significantly more active than cephalothin (P < 0.001). At concentrations of 16 μ g per ml, however, all cephalosporins showed high in vitro activity, except against *Lactobacillus* species and *B. fragilis*. Cephalothin, cefazolin and cefamandole were considerably more active against the former, whereas cefoxitin was distinctly more active against the latter.

A host of new cephalosporin and cephamycin antibiotics have been introduced recently, some differing considerably both in antibacterial spectra and pharmacological properties. Their comparative in vitro activity against anaerobic bacteria, however, has not been extensively studied. In this study, we examined the in vitro susceptibility of 408 recent clinical isolates of anaerobic bacteria by an agar dilution technique against six cephalosporins, including cefaclor, cephalexin, cephalothin, cefazolin, cefamandole, and cefoxitin.

MATERIALS AND METHODS

The isolates examined in this study, obtained from inpatients of Harbor General Hospital during 1974 through 1977, are listed in Table 1. Identification to species level was determined in prereduced anaerobically sterilized differential media by the method of Holdeman and Moore (6). Clinical isolates were stored in 20% skim milk and frozen at -75° C until ready for susceptibility testing.

Susceptibility testing was performed by an agardilution technique previously described by us (3). A reference strain with known minimal inhibitory concentrations (MICs) was included in each test to demonstrate reproducibility, and the MIC recorded was the least antibiotic concentration that yielded no visible growth after 48 h of incubation.

RESULTS

The geometric mean MIC and cumulative percent of various anaerobic bacteria inhibited by each cephalosporin antibiotic are summarized in Tables 2 and 3.

Against gram-positive anaerobic bacteria, cephalexin and cefaclor were significantly less active than cephalothin (P < 0.05), especially against *Peptococcus*, *Peptostreptococcus*, and *Propionibacterium* species. Cephalexin was uniquely less active than cephalothin against *Clostridium* (P < 0.001) and *Lactobacillus* species (P < 0.05). At concentrations of 16 μ g per ml, however, all cephalosporins inhibited grampositive anaerobic bacteria except the *Lactobacillus* species *cillus* species relatively well.

Against gram-negative anaerobic bacteria, major differences in in vitro activity of the cephalosporins were observed primarily with *Bacteroides fragilis*. Cephalexin, cefazolin, and cefoxitin were all significantly more active than cephalothin (P < 0.001). Cefoxitin was the most active, followed by cefazolin and cephalexin. Cefamandole, cefaclor and cephalothin were least active. All cephalosporins showed good in vitro activity against gram-negative anaerobes other than *B. fragilis*, although their geometric mean MICs against *Bacteroides* were generally two-

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to fivefold higher than against *Fusobacterium* or *Veillonella* species.

DISCUSSION

Data presented here show that in the study reported herein, except for *B. fragilis* and *Lactobacillus* species, only minor differences existed in the in vitro activity of the cephalosporins tested against anaerobic bacteria. Most were readily inhibited by 16 μ g of each antibiotic per ml.

Against Lactobacillus species, the geometric mean MICs of cefaclor and cephalexin were fivefold higher than that of cephalothin, and only 45% of strains were inhibited by 16 μ g of either of these two antibiotics per ml. Cefoxitin was similarly inactive. Although cephalothin exhibited good inhibitory activity in vitro against Lactobacillus species, we have found that the bactericidal activity of both cephalothin and penicillin G are often widely disparate, with the minimal bactericidal concentration ≥ 100 -fold more than the corresponding MIC (2). This suboptimal bactericidal activity in vitro is reflected in the frequency of therapeutic failures of these antibiotics in eradicating lactobacillemia associated with endocarditis (2).

The most striking differences in in vitro activity between the cephalosporins were observed with *B. fragilis.* Cefoxitin was by far the most active; 70% of strains were inhibited by 16 μ g of the antibiotic per ml. This is similar to the results reported by Sutter and Finegold (7) and Ernst et al. (5). Cefoxitin is a cephamycin derivative known to be resistant to certain beta-lactamases as well as cephalosporinase of *B. fragilis* (1, 4, 8). In contrast, cefamandole, another cephalosporin resistant to hydrolysis by betalactamases of facultative bacteria (5), is relatively inactive against *B. fragilis*, as are cefaclor and cephalothin.

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 TABLE 2. Comparative in vitro activity of cephalosporins against gram-positive anaerobic bacteria

$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Organism tested against var-	Geometric mean MIC ± SD_	Cumulative $\%$ strains inhibited by ($\mu g/ml$):				
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	ious agents (no. of isolates)	(μg/ml)"	≤0.25	1	4	16	64
$\begin{array}{c} \mbox{Cephalothin} & 0.45 \pm 0.29 & 52 & 94 & 96 & 100 \\ \mbox{Cefaclor} & 0.94 \pm 0.55^{\circ} & 50 & 68 & 86 & 96 & 100 \\ \mbox{Cefazolin} & 0.37 \pm 0.26 & 64 & 96 & 98 & 100 \\ \mbox{Cefazolin} & 0.37 \pm 0.26 & 64 & 96 & 98 & 100 \\ \mbox{Cefazilin} & 0.58 \pm 0.42 & 56 & 78 & 92 & 100 \\ \mbox{Cefazilin} & 0.58 \pm 0.42 & 56 & 78 & 94 & 100 \\ \mbox{Cephalothin} & 0.48 \pm 0.50' & 42 & 69 & 85 & 100 \\ \mbox{Cefazilin} & 0.48 \pm 0.50' & 42 & 69 & 85 & 100 \\ \mbox{Cefazilin} & 0.48 \pm 0.50' & 42 & 69 & 85 & 100 \\ \mbox{Cefazilin} & 0.48 \pm 0.50' & 33 & 52 & 79 & 92 & 100 \\ \mbox{Cefazilin} & 0.48 \pm 0.46 & 50 & 73 & 85 & 100 \\ \mbox{Cefazilin} & 0.48 \pm 0.46 & 50 & 73 & 85 & 100 \\ \mbox{Cefazilin} & 0.48 \pm 0.46 & 50 & 73 & 85 & 100 \\ \mbox{Cefazilin} & 0.48 \pm 0.46 & 50 & 73 & 85 & 100 \\ \mbox{Cefazilin} & 0.48 \pm 0.46 & 50 & 73 & 85 & 100 \\ \mbox{Cefazilin} & 0.48 \pm 0.46 & 50 & 73 & 85 & 100 \\ \mbox{Cefazilin} & 0.48 \pm 0.46 & 73 & 81 & 100 \\ \mbox{Cefazilin} & 0.94 \pm 0.51 & 33 & 74 & 81 & 100 \\ \mbox{Cefazilin} & 0.94 \pm 0.51 & 33 & 74 & 81 & 100 \\ \mbox{Cefazilin} & 0.94 \pm 0.51 & 33 & 74 & 85 & 100 \\ \mbox{Cefazilin} & 1.58 \pm 0.94 & 76 & 78 & 89 & 100 \\ \mbox{Cefazilin} & 1.58 \pm 0.94 & 76 & 78 & 89 & 100 \\ \mbox{Cefazilin} & 1.58 \pm 0.94 & 76 & 78 & 89 & 100 \\ \mbox{Cefazilin} & 1.70 \pm 1.10 & 44 & 55 & 67 & 89 & 100 \\ \mbox{Cefazilin} & 1.70 \pm 1.10 & 44 & 55 & 67 & 89 & 100 \\ \mbox{Cefazilin} & 1.70 \pm 1.10 & 44 & 55 & 67 & 89 & 100 \\ \mbox{Cefazilin} & 0.82 \pm 0.48 & 33 & 45 & 55 & 81 & 100 \\ \mbox{Cefazilin} & 0.82 \pm 0.48 & 67 & 391 & 100 \\ \mbox{Cefazilin} & 0.82 \pm 0.48 & 67 & 391 & 91 & 100 \\ \mbox{Cefazilin} & 0.82 \pm 0.48 & 67 & 73 & 81 & 100 \\ \mbox{Cefazilin} & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ \mbox{Cefazilin} & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ \mbox{Cefazilin} & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ \mbox{Cefazilin} & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ \mbox{Cefazilin} & 0.82 \pm 0.69 & 57 & 57 & 89 & 191 & 100 \\ \mbox{Cefazilin} & 0.82 \pm 0.69 & 77 & 46 & 45 & 71 & 100 \\ \mbox{Cefazilin} & 0.82 \pm 0.54 & 45 & 73 & 82 & 100$	Peptococcus (50)	· · · · · · · · · · · · · · · · · · ·					
$\begin{array}{c} {\rm Cephalexin} & 0.80 \pm 0.55^\circ & 50 & 68 & 86 & 96 & 100 \\ {\rm Cefazolin} & 0.37 \pm 0.26 & 64 & 96 & 98 & 100 \\ {\rm Cefazolin} & 0.54 \pm 0.28 & 42 & 94 & 98 & 100 \\ {\rm Cefoxinin} & 0.58 \pm 0.42 & 56 & 78 & 92 & 100 \\ {\rm Pertostreptococcus} (48) & & & & & & & & & & & & & & & & & & &$	Cephalothin	0.45 ± 0.29	52	94	96	100	
$\begin{array}{cccc} Certacolin & 0.37 \pm 0.50^{\circ} & 32 & 68 & 86 & 96 & 100 \\ Cefazinin & 0.37 \pm 0.26 & 64 & 96 & 98 & 100 \\ Cefazinin & 0.58 \pm 0.42 & 56 & 78 & 92 & 100 \\ Peptostreptococcus (48) & & & & & & & & & & & & & & & & & & &$	Cephalexin	0.80 ± 0.55^{b}	50	68	86	96	100
$\begin{array}{cccc} Cefazalin & 0.37 \pm 0.26 & 64 & 96 & 98 & 100 \\ Cefazinandole & 0.54 \pm 0.28 & 42 & 94 & 98 & 100 \\ Cefoxitin & 0.58 \pm 0.42 & 56 & 78 & 92 & 100 \\ Pattostreptococcus (48) & & & & & & & & & & & & & & & & & & &$	Cefaclor	$0.94 \pm 0.50^{\circ}$	32	68	86	96	100
$\begin{array}{c} \mbox{Cefamandole} & 0.54 \pm 0.28 & 42 & 94 & 98 & 100 \\ \mbox{Cefavitin} & 0.58 \pm 0.42 & 56 & 78 & 92 & 100 \\ \mbox{Peptostreptococcus} (48) & & & & & & & & & & & & & & & & & & &$	Cefazolin	0.37 ± 0.26	64	96	98	100	
$\begin{array}{c c} \hline Cefoxitin \\ Peptostreptocccus (48) \\ \hline Cephalexin \\ Cephalexin \\ Cefaclor \\ C$	Cefamandole	0.54 ± 0.28	42	94	98	100	
Pertostreptococcus (48)0.00Cephalothin0.48 \pm 0.36608794100Cephalothin0.48 \pm 0.30'426985100Cefaclor1.36 \pm 0.59'33527992100Cefazolin0.45 \pm 0.34608996100Cefazolin0.45 \pm 0.34608596100Cefoxitin0.68 \pm 0.46507385100Cephalothin1.16 \pm 0.4218638596100Cephalothin1.16 \pm 0.4218638596100Cephalothin0.94 \pm 0.51337481100Cefazolin0.94 \pm 0.51337481100Cefazolin1.35 \pm 0.9855567899100Cefazolin2.0 \pm 0.7022487481100Cefazolin1.35 \pm 0.9855567899100Cefazor2.0 \pm 0.8333445589100Cefazor2.0 \pm 0.8333445589100Cefazor2.0 \pm 0.8333445589100Cefazor2.0 \pm 0.8333445589100Cefazor0.93 \pm 0.8464739191100Cefazor0.93 \pm 0.854573829191Cephalothin0.82 \pm 0.69 <t< td=""><td>Cefoxitin</td><td>0.58 ± 0.42</td><td>56</td><td>78</td><td>92</td><td>100</td><td></td></t<>	Cefoxitin	0.58 ± 0.42	56	78	92	100	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Peptostreptococcus (48)						
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Cephalothin	0.48 ± 0.36	60	87	94	100	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Cephalexin	$0.84 \pm 0.50^{\circ}$	42	69	85	100	
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Cefaclor	1.36 ± 0.59^{d}	33	52	79	92	100
$\begin{array}{c cccccc} \hline Cefamandole & 0.42 \pm 0.34 & 69 & 85 & 96 & 100 \\ \hline Cefoxitin & 0.68 \pm 0.46 & 50 & 73 & 85 & 100 \\ \hline Cephalothin & 1.16 \pm 0.42 & 18 & 63 & 85 & 96 & 100 \\ \hline Cephalexin & 5.16 \pm 0.67' & 4 & 26 & 55 & 81 & 92 \\ \hline Cephalothin & 0.94 \pm 0.51 & 33 & 74 & 81 & 100 \\ \hline Cefazolin & 0.94 \pm 0.51 & 33 & 74 & 81 & 100 \\ \hline Cefazolin & 0.94 \pm 0.51 & 33 & 74 & 81 & 100 \\ \hline Cefazolin & 0.94 \pm 0.51 & 33 & 74 & 81 & 100 \\ \hline Cefazolin & 0.94 \pm 0.51 & 33 & 74 & 81 & 100 \\ \hline Cefazolin & 0.94 \pm 0.51 & 33 & 74 & 81 & 100 \\ \hline Cefazolin & 1.58 \pm 0.54 & 7 & 67 & 81 & 85 & 100 \\ \hline Cefoxitin & 1.35 \pm 0.98 & 55 & 55 & 67 & 89 & 100 \\ \hline Cefazolin & 1.70 \pm 1.10 & 44 & 55 & 89 & 100 \\ \hline Cefazolin & 1.70 \pm 1.10 & 44 & 55 & 89 & 100 \\ \hline Cefazolin & 1.70 \pm 1.10 & 44 & 55 & 67 & 89 & 100 \\ \hline Cefazolin & 1.70 \pm 1.10 & 44 & 55 & 55 & 78 & 100 \\ \hline Cefazolin & 0.72 \pm 0.68 & 64 & 73 & 91 & 91 & 100 \\ \hline Cefazolin & 0.72 \pm 0.68 & 64 & 73 & 91 & 91 & 100 \\ \hline Cefazolin & 0.82 \pm 0.48 & 36 & 73 & 82 & 91 & 91 \\ \hline Cefazolin & 0.82 \pm 0.54 & 57 & 382 & 100 \\ \hline Labotectrum (11) & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ \hline Cefazolin & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ \hline Cefazolin & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ \hline Cefazolin & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ \hline Cefazolin & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ \hline Cefazolin & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ \hline Cefazolin & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ \hline Cefazolin & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ \hline Cefazolin & 1.86 \pm 0.80 & 27 & 36 & 82 & 100 \\ \hline Cefazolin & 1.86 \pm 0.80 & 27 & 36 & 82 & 100 \\ \hline Cefazolin & 0.80 \pm 0.14 & 27 & 27 & 54 & 91 & 91 \\ \hline Cephalexin & 2.09 \pm 0.14 & 27 & 27 & 54 & 91 & 91 \\ \hline Cephalexin & 2.09 \pm 0.55 & 45 & 64 & 82 & 100 \\ \hline Cefazolin & 0.03 \pm 0.55 & 45 & 64 & 82 & 100 \\ \hline Cefazolin & 0.03 \pm 0.21 & 83 & 95 & 100 \\ \hline Cefazolin & 0.03 \pm 0.21 & 83 & 95 & 100 \\ \hline Cefazolin & 0.03 \pm 0.21 & 83 & 95 & 100 \\ \hline Cefazolin & 0.34 \pm 0.21 & 65 & 95 & 100 \\ \hline Cefazolin & 0.31 \pm 0.18 & 69 & 100 \\ \hline Cefazolin & 0.31 \pm 0.18 & 69 & 100 \\ \hline Cefazolin & 0.31 \pm 0.18 & 69 & 100 \\ \hline Cefazolin$	Cefazolin	0.45 ± 0.34	60	89	96	100	100
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Cefamandole	0.42 ± 0.34	69	85	96	100	
$\begin{array}{c c} Clostricium (27) & cephalothin & 1.16 \pm 0.42 & 18 & 63 & 85 & 96 & 100 \\ Cephalexin & 5.16 \pm 0.67'' & 4 & 26 & 55 & 81 & 92 \\ Cefaclor & 2.0 \pm 0.70 & 22 & 48 & 74 & 81 & 100 \\ Cefazolin & 0.94 \pm 0.51 & 33 & 74 & 81 & 100 \\ Cefazolin & 1.58 \pm 0.54 & 7 & 67 & 81 & 85 & 100 \\ Cefoxitin & 1.58 \pm 0.54 & 7 & 67 & 81 & 85 & 100 \\ Cefoxitin & 1.55 \pm 0.21 & 44 & 44 & 67 & 78 & 89 \\ Cephalothin & 2.15 \pm 1.21 & 44 & 44 & 67 & 78 & 89 \\ Cephalexin & 1.35 \pm 0.98 & 55 & 56 & 78 & 89 & 100 \\ Cefazolin & 1.70 \pm 1.10 & 44 & 55 & 67 & 89 & 100 \\ Cefazolin & 1.70 \pm 1.10 & 44 & 55 & 67 & 89 & 100 \\ Cefazolin & 1.70 \pm 1.10 & 44 & 55 & 55 & 78 & 89 & 100 \\ Cefazolin & 1.70 \pm 1.10 & 44 & 55 & 55 & 78 & 89 & 100 \\ Cefazolin & 1.70 \pm 1.068 & 64 & 73 & 91 & 91 & 100 \\ Cephalexin & 0.82 \pm 0.48 & 36 & 73 & 91 & 91 & 100 \\ Cephalothin & 0.72 \pm 0.68 & 64 & 73 & 91 & 91 & 100 \\ Cephalothin & 0.72 \pm 0.68 & 64 & 73 & 91 & 91 & 100 \\ Cefazolin & 0.82 \pm 0.43 & 64 & 73 & 91 & 91 & 100 \\ Cefazolin & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ Lactobacillus (11) & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ Lactobacillus (11) & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ Lactobacillus (11) & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ Cefazolin & 1.86 \pm 0.50 & 27 & 36 & 82 & 100 \\ Cefazolin & 1.86 \pm 0.50 & 27 & 36 & 82 & 100 \\ Cefazolin & 1.86 \pm 0.50 & 27 & 36 & 82 & 100 \\ Cefazolin & 1.86 \pm 0.50 & 27 & 36 & 82 & 100 \\ Cefazolin & 1.86 \pm 0.50 & 27 & 36 & 45 & 91 & 91 \\ Cephalothin & 2.05 \pm 0.14 & 27 & 27 & 54 & 91 & 91 \\ Cephalexin & 2.41 \pm 0.64 & 18 & 45 & 67 & 91 & 100 \\ Cefoxitin & 1.86 \pm 0.50 & 27 & 36 & 45 & 91 & 100 \\ Cefazolin & 0.30 \pm 0.21 & 83 & 95 & 100 \\ Cefazolin & 0.30 \pm 0.21 & 83 & 95 & 100 \\ Cefazolin & 0.34 \pm 0.20 & 62 & 99 & 100 \\ Cefazolin & 0.34 \pm 0.21 & 65 & 95 & 100 \\ \end{array}$	Cefoxitin	0.68 ± 0.46	50	73	85	100	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	Clostridium (27)	0.00 2 0.10	00		00	100	
Cephalexin 1.16 ± 0.67" 4 26 55 81 92 Cefaclor 2.0 ± 0.70 22 48 74 81 100 Cefazolin 0.94 ± 0.51 33 74 81 100 Cefazolin 0.90 ± 0.40 30 63 92 96 100 Cefoxitin 1.58 ± 0.54 7 67 81 85 100 Cephalothin 2.15 ± 1.21 44 467 78 89 100 Cefazolin 1.35 ± 0.98 55 55 67 89 100 Cefazolin 1.70 ± 1.10 44 55 89 100 Cefazolin 1.70 ± 1.10 44 55 78 89 Cefazolin 0.82 ± 0.68 64 73 91 91 100 Cefazolin 0.82 ± 0.68 64 73 91 91 100 Cefazolin 0.82 ± 0.69 54 73 82 91 91 100 Cefazolin 0.82 ± 0.69 54 73 82 1	Cenhalothin	1.16 ± 0.42	18	63	85	96	100
Cefaclor 20 ± 0.70 22 48 74 81 100 Cefazolin 0.94 ± 0.51 33 74 81 100 Cefamandole 0.90 ± 0.40 30 63 92 96 100 Cefoxitin 1.58 ± 0.54 7 67 81 85 100 Cephalexin 1.35 ± 0.98 55 55 67 89 100 Cefazolin 1.70 ± 1.10 44 55 67 89 100 Cefazolin 1.70 ± 1.10 44 55 67 89 89 Cefoxitin 1.84 ± 0.92 33 55 57 88 100 Cephalexin 0.82 ± 0.48 366 73 91 91 000 Cefazolin 0.72 ± 0.68 644 73 91 91 000 Cefazolin 0.82 ± 0.69 54 73 82 91 91 Cefazolin 0.82 ± 0.64 45 73 82 100 <td>Cenhalevin</td> <td>5.16 ± 0.67^{d}</td> <td>4</td> <td>26</td> <td>55</td> <td>81</td> <td>492</td>	Cenhalevin	5.16 ± 0.67^{d}	4	26	55	81	492
$\begin{array}{cccc} Cefazolin & 0.34 \pm 0.51 & 33 & 74 & 81 & 100 \\ Cefazolin & 0.90 \pm 0.40 & 30 & 63 & 92 & 96 & 100 \\ Cefoxitin & 1.58 \pm 0.54 & 7 & 67 & 81 & 85 & 100 \\ \hline Actinomyces (9) & & & & & & & \\ Cephalexin & 1.35 \pm 0.98 & 55 & 55 & 67 & 89 & 100 \\ Cefazolin & 1.70 \pm 1.10 & 44 & 55 & 67 & 89 & 100 \\ Cefazolin & 1.70 \pm 1.10 & 44 & 55 & 67 & 89 & 100 \\ Cefazolin & 1.70 \pm 1.10 & 44 & 55 & 67 & 89 & 100 \\ Cefazolin & 1.64 \pm 0.92 & 33 & 55 & 55 & 78 & 89 & 100 \\ Cefazolin & 0.72 \pm 0.68 & 64 & 73 & 91 & 91 & 100 \\ Cephalethin & 0.72 \pm 0.68 & 64 & 73 & 91 & 91 & 100 \\ Cefazolin & 0.82 \pm 0.48 & 36 & 73 & 91 & 91 & 100 \\ Cefazolin & 0.82 \pm 0.48 & 36 & 73 & 91 & 91 & 100 \\ Cefazolin & 0.82 \pm 0.48 & 36 & 73 & 91 & 91 & 100 \\ Cefazolin & 0.82 \pm 0.54 & 45 & 73 & 82 & 91 & 91 \\ Cephalethin & 0.72 \pm 0.68 & 64 & 73 & 91 & 91 & 100 \\ Cefaclor & 0.93 \pm 0.85 & 45 & 73 & 82 & 91 & 91 \\ Cephalethin & 0.82 \pm 0.48 & 36 & 73 & 91 & 91 & 100 \\ Cefazolin & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ Cefazolin & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ Cefazolin & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ Cefazolin & 0.82 \pm 0.54 & 45 & 73 & 82 & 100 \\ Cefazilus (11) & & & & & \\ Cephalethin & 3.50 \pm 0.80 & 18 & 27 & 54 & 91 & 91 \\ Cephalethin & 20.53 \pm 0.95' & 9 & 18 & 18 & 45 & 73 \\ Cefazolin & 1.66 \pm 0.50 & 27 & 36 & 82 & 100 \\ Cefazolin & 1.66 \pm 0.50 & 27 & 36 & 82 & 100 \\ Cefazolin & 1.66 \pm 0.50 & 27 & 36 & 45 & 91 & 100 \\ Cefazolin & 2.00 \pm 0.14 & 27 & 27 & 45 & 64 \\ Bifdobacterium (11) & & & & & \\ Cephalexin & 2.41 \pm 0.64 & 18 & 45 & 67 & 91 & 100 \\ Cefazolin & 2.00 \pm 0.79 & 18 & 54 & 64 & 91 & 100 \\ Cefazolin & 2.00 \pm 0.79 & 18 & 54 & 64 & 91 & 100 \\ Cefazolin & 2.00 \pm 0.79 & 18 & 54 & 64 & 91 & 100 \\ Cefazolin & 2.00 \pm 0.79 & 18 & 54 & 64 & 91 & 100 \\ Cefazolin & 2.00 \pm 0.79 & 18 & 54 & 64 & 91 & 100 \\ Cefazolin & 2.00 \pm 0.75 & 45 & 54 & 73 & 100 \\ Propionibacterium (85) & & & \\ Cephalexin & 0.30 \pm 0.21 & 83 & 95 & 100 \\ Cefazolin & 0.34 \pm 0.21 & 65 & 95 & 100 \\ \end{array}$	Cefaclor	20 ± 0.07	22	48	74	81	100
Cefamandole 0.90 ± 0.40 30 63 92 96 100 Cefoxitin 1.88 ± 0.54 7 67 81 85 100 Actinomyces (9) 2.15 ± 1.21 44 44 67 78 89 Cephalexin 1.35 ± 0.98 55 55 67 89 100 Cefacolon 2.0 ± 0.83 33 44 55 89 100 Cefazolin 1.70 ± 1.10 44 55 67 89 89 Cefoxitin 1.84 ± 0.92 33 55 57 89 100 Cephalexin 0.82 ± 0.68 64 73 91 91 100 Cephalothin 0.82 ± 0.69 54 73 82 91 91 Cefazolin 0.82 ± 0.69 54 73 91 91 100 Cefaclor 0.33 ± 0.85 45 73 82 100 162 18 27 54 91 91 <td< td=""><td>Cefazolin</td><td>0.94 ± 0.51</td><td>22</td><td>74</td><td>81</td><td>100</td><td>100</td></td<>	Cefazolin	0.94 ± 0.51	22	74	81	100	100
$\begin{array}{c} \text{Cefoxitin} & 1.58 \pm 0.54 & 7 & 67 & 81 & 85 & 100 \\ \text{Actinomyces (9)} & & & & & & & & & & & & & & & & & & &$	Cefamandole	0.04 ± 0.01	30	63	92	96	100
Actionary ces (9)1.601.601.601.60Cephalethin2.15 ± 0.214444677889Cephalexin1.35 ± 0.9855556789100Cefaclor2.0 ± 0.8333445589100Cefazolin1.70 ± 1.104455678989Cefaxin1.84 ± 0.923355557889Cefoxitin0.72 ± 0.6864739191Cephalexin0.72 ± 0.68647391100Cefaclor0.93 ± 0.854573829191Cefazolin0.82 ± 0.48367391100Cefaclor0.93 ± 0.854573829191Cefazolin0.82 ± 0.54457382100Lactobacillus (11)0.82 ± 0.54457382100Cefaclor17.02 ± 1.621827549191Cefaclor17.02 ± 1.621827549191Cefaclor17.02 ± 1.621827546464Cefazolin1.86 ± 0.50273682100Cefazolin1.66 ± 0.6527364591100Cefazolin1.60 ± 1.451818276464Bifidobacterium2.09 ± 0.1427275491100Cefaxitin2.09 ± 0.7918 <td< td=""><td>Cefovitin</td><td>1.58 ± 0.54</td><td>7</td><td>67</td><td>81</td><td>85</td><td>100</td></td<>	Cefovitin	1.58 ± 0.54	7	67	81	85	100
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	Actinomycae (9)	1.00 ± 0.04	•	07	01	00	100
Cephalexin 1.35 ± 0.98 55 55 67 89 100 Cefaclor 2.0 ± 0.83 33 44 55 89 100 Cefazolin 1.70 ± 1.10 44 55 67 89 89 Cefamandole 1.16 ± 0.80 55 55 78 89 100 Cetoxitin 1.84 ± 0.92 33 55 55 78 100 Cephalothin 0.72 ± 0.68 64 73 91 91 100 Cephalothin 0.82 ± 0.48 36 73 91 100 100 Cefaclor 0.93 ± 0.85 45 73 82 91 91 Cefatolin 0.82 ± 0.69 54 73 91 100 100 Cefaxolin 0.82 ± 0.54 45 73 82 100 100 Cefaxitin 0.82 ± 0.54 45 73 82 100 100 Cefaxolin 1.86 ± 0.50 27 36 82 100 100 Cefaxitin 1.90 ± 0.14 27	Cenhalothin	915 ± 191	44	44	67	78	80
$\begin{array}{c} \text{Cefactor} & 2.0 \pm 0.83 & 33 & 44 & 55 & 89 & 100 \\ \text{Cefazolin} & 1.70 \pm 1.10 & 44 & 55 & 67 & 89 & 89 \\ \text{Cefazolin} & 1.84 \pm 0.92 & 33 & 55 & 55 & 78 & 89 & 100 \\ \text{Cefoxitin} & 1.84 \pm 0.92 & 33 & 55 & 55 & 78 & 100 \\ \hline \\ \text{Eubacterium (11)} & & & & & & & & & & & & & & & & & & &$	Cenhalevin	1.35 ± 0.98	55	55	67	80	100
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Cefeclor	20 ± 0.83	33	44	55	80	100
$\begin{array}{c} \mbox{Cefazonin} & 1.16 \pm 1.10 & 44 & 35 & 57 & 88 & 100 \\ \mbox{Cefoxitin} & 1.84 \pm 0.92 & 33 & 55 & 55 & 78 & 100 \\ \mbox{Eubacterium} (11) & & & & & & & & & & & & & & & & & & $	Cefacilin	1.70 ± 0.00	44	55	67	03 90	100
Cefoxitin 1.10 ± 0.60 33 55 55 78 100 Eubacterium (11) 0.72 ± 0.68 64 73 91 91 100 Cephalexin 0.82 ± 0.48 36 73 91 91 100 Cefaclor 0.93 ± 0.45 45 73 91 91 100 Cefazolin 0.82 ± 0.69 54 73 91 91 100 Cefacolor 0.56 ± 0.43 64 73 91 100 Cefaxin 0.82 ± 0.54 45 73 82 100 Lactobacillus (11) 0.82 ± 0.54 45 73 82 100 Cephalexin 20.53 ± 0.95 ^c 9 18 18 45 73 Cephalexin 20.53 ± 0.95 ^c 9 18 18 45 73 Cefacior 17.02 ± 1.62 18 27 27 45 64 Cefacin 1.86 0.50 27 36 82 100 Cefacolin 2.66 ± 0.65 27 36 45 91 <td>Cefamandolo</td> <td>1.10 ± 1.10 1.16 ± 0.80</td> <td>44 55</td> <td>55</td> <td>79</td> <td>60</td> <td>100</td>	Cefamandolo	1.10 ± 1.10 1.16 ± 0.80	44 55	55	79	60	100
1.64 \pm 0.323335353578100Cephaletrin0.72 \pm 0.6864739191100Cephaletrin0.82 \pm 0.4836739191100Cefaclor0.93 \pm 0.854573829191Cefaclor0.93 \pm 0.854573829191Cefaclor0.93 \pm 0.854573829191Cefaclor0.93 \pm 0.854573829191Cefaclor0.56 \pm 0.43647391100Cefoxitin0.82 \pm 0.54457382100Cefoxitin0.82 \pm 0.54457382100Cefoxitin0.82 \pm 0.54457382100Cefaclor17.02 \pm 1.621827549191Cefaclor17.02 \pm 1.621827274564Cefaclor1.86 \pm 0.50273682100Cefacion1.86 \pm 0.65273682100Cefoxitin16.00 \pm 1.451818276464Bifidobacterium (11)Cefaclor2.90 \pm 0.1427275491100Cefaclor2.90 \pm 0.952745	Cefevitin	1.10 ± 0.80 1.84 ± 0.92	22	55	70 55	09 79	100
Data of the function 0.72 \pm 0.68 64 73 91 91 100 Cephalexin 0.82 \pm 0.48 36 73 91 100 Cefaclor 0.93 \pm 0.85 45 73 82 91 91 Cefaclor 0.93 \pm 0.85 45 73 82 91 91 Cefaclor 0.82 \pm 0.69 54 73 91 91 00 Cefaclor 0.56 \pm 0.43 64 73 91 100 Cefaclor 0.56 \pm 0.43 64 73 91 91 Cephalothin 0.82 \pm 0.54 45 73 82 100 Lactobacillus (11) 0 0 0 0 0 0 Cephalexin 20.53 \pm 0.95' 9 18 18 45 73 Cefaclor 17.02 \pm 1.62 18 27 27 45 64 Cefazolin 1.86 \pm 0.50 27 36 82 100 0 Cefaxolin 1.600 \pm 1.45 18 18 27 64	Fubacterium (11)	1.04 ± 0.52	00	00	55	10	100
Cephalexin 0.72 ± 0.36 0.74 ± 0.36 0.73 ± 0.16 73 ± 0.16	Cenhalothin	0.72 ± 0.68	64	73	01	01	100
Cephalerin 0.32 ± 0.40 30 15 31 100 Cefaclor 0.93 ± 0.85 45 73 91 91 Cefazolin 0.82 ± 0.69 54 73 91 91 Cefaxilin 0.82 ± 0.54 45 73 82 100 Cefoxitin 0.82 ± 0.54 45 73 82 100 Lactobacillus (11)Cephalothin 3.50 ± 0.80 18 27 54 91 91 Cephalothin $20.53 \pm 0.95^{\circ}$ 9 18 18 45 73 Cefaclor 17.02 ± 1.62 18 27 27 45 64 Cefazolin 1.86 ± 0.50 27 36 82 100 Cefarandole 2.56 ± 0.65 27 36 45 91 100 Cefaclor 1.45 18 18 27 64 64 Bifidobacterium (11) 2.90 ± 0.14 27 27 54 91 100 Cefaclor 2.90 ± 0.95 27 45 54 73 73 Cefaclor 2.90 ± 0.95 27 45 54 73 73 Cefaclor 2.90 ± 0.79 18 54 64 91 100 Cefaclor 2.90 ± 0.55 45 64 81 100 Cefaclor 2.78 ± 0.35^{d} 3 22 73 94 100 Cefaclor 2.78 ± 0.35^{d} 3 22 73 94 100 Cefaclor	Cenhalevin	0.12 ± 0.00	36	73	01	100	100
Cefatoli 0.30 \pm 0.69 40 75 62 51 51 Cefazolin 0.82 \pm 0.69 54 73 91 91 100 Cefazolin 0.82 \pm 0.54 45 73 92 100 Lactobacillus (11) 0.82 \pm 0.54 45 73 82 100 Lactobacillus (11) 20.53 \pm 0.95° 9 18 18 45 73 Cephalexin 20.53 \pm 0.95° 9 18 18 45 73 Cefazolin 1.62 18 27 27 45 64 Cefazolin 1.86 \pm 0.50 27 36 82 100 Cefazolin 1.86 \pm 0.50 27 36 45 91 100 Cefatorin 1.86 \pm 0.65 27 36 45 91 100 Cefatorin 1.80 \pm 0.46 18 18 27 54 91 100 Cefatorin 2.90 \pm 0.14 27 27 54 91 100 Cefaclor 2.90 \pm 0.79 18 54 </td <td>Cefaclor</td> <td>0.02 ± 0.40</td> <td>45</td> <td>73</td> <td>82</td> <td>01</td> <td>01</td>	Cefaclor	0.02 ± 0.40	45	73	82	01	01
Cefazolin 0.52 ± 0.43 64 73 91 100 Cefoxitin 0.82 ± 0.54 45 73 82 100 Lactobacillus (11) 0.82 ± 0.54 45 73 82 100 Cephalothin 3.50 ± 0.80 18 27 54 91 91 Cephalexin $20.53 \pm 0.95^{\circ}$ 9 18 18 45 73 Cefazolin 1.62 18 27 27 45 64 Cefazolin 1.86 ± 0.50 27 36 82 100 Cefazolin 1.86 ± 0.50 27 36 45 91 100 Cefaxitin 16.00 ± 1.45 18 18 27 54 91 100 Cefazolin 2.90 ± 0.14 27 27 54 91 100 Cefazolin 2.41 ± 0.64 18 45 67 91 100 Cefazolin 2.0 ± 0.79 18 54 64 91 1000 <td>Cefazolin</td> <td>0.33 ± 0.69</td> <td>54</td> <td>73</td> <td>01</td> <td>01</td> <td>100</td>	Cefazolin	0.33 ± 0.69	54	73	01	01	100
Cefanial of the second sec	Cefamandole	0.52 ± 0.03	64	73	01	100	100
CetoXiii 100 Lactobacillus (11) 3.50 ± 0.80 18 27 54 91 91 Cephalothin $20.53 \pm 0.95^{\circ}$ 9 18 18 45 73 Cefaclor 17.02 ± 1.62 18 27 27 45 64 Cefaclor 17.02 ± 1.62 18 27 27 45 64 Cefaclor 17.02 ± 1.62 18 27 27 45 64 Cefacolin 1.86 ± 0.50 27 36 82 100 Cefaundole 2.56 ± 0.65 27 36 45 91 100 Cefoxitin 16.00 ± 1.45 18 18 27 64 64 Bifidobacterium (11) 2.90 ± 0.14 27 27 54 91 100 Cefaclor 2.90 ± 0.95 27 45 54 73 73 Cefaclor 2.90 ± 0.95 27 45 54 73 100 Cefaclor 0.87 ± 0.55 45 64 82 100 00 00<	Ceforitin	0.82 ± 0.43	45	73	91 90	100	
Darkoulting (11) 3.50 ± 0.80 18 27 54 91 91 Cephalexin $20.53 \pm 0.95^{\circ}$ 9 18 18 45 73 Cefaclor 17.02 ± 1.62 18 27 27 45 64 Cefazolin 1.86 ± 0.50 27 36 82 100 Cefaxin 186 ± 0.50 27 36 82 100 Cefaxin 16.00 ± 1.45 18 18 27 64 Bifidobacterium (11) 2.90 ± 0.14 27 27 54 91 Cephalexin 2.41 ± 0.64 18 45 67 91 100 Cefaclor 2.90 ± 0.95 27 45 54 73 73 Cefazolin 2.0 ± 0.79 18 54 64 91 100 Cefaxolin 2.0 ± 0.79 18 54 64 91 100 Cefaxolin 0.37 ± 0.55 45 64 82 100 Cefoxitin 4.0 ± 0.76 9 45 54 73 100 Propionibacterium (85) $Cephalexin$ $0.91 \pm 0.22d^2$ 8 81 99 100 Cefaclor $2.78 \pm 0.35d^2$ 3 22 73 94 100 Cefacloin 0.34 ± 0.20 62 99 100 Cefacloin 0.34 ± 0.21 65 95 100	Lactobacillus (11)	0.02 ± 0.04	-10	10	02	100	
Cephalexin 3.05 ± 0.365 10 13 21 34 91 91 Cephalexin $20.53 \pm 0.95^{\circ}$ 9 18 18 45 73 Cefaclor 17.02 ± 1.62 18 27 27 45 64 Cefazolin 1.86 ± 0.50 27 36 82 100 Cefaxin 1.86 ± 0.50 27 36 82 100 Cefaxin 1.86 ± 0.50 27 36 45 91 100 Cefoxitin 16.00 ± 1.45 18 18 27 64 64 Bifidobacterium (11) 2.90 ± 0.14 27 27 54 91 100 Cephalexin 2.41 ± 0.64 18 45 67 91 100 Cefaclor 2.90 ± 0.95 27 45 54 73 73 Cefazolin 2.0 ± 0.79 18 54 64 91 100 Cefaxolin 0.87 ± 0.55 45 64 82 100 Cefoxitin 4.0 ± 0.76 9 45 54 73 100 Propionibacterium (85) 73 2.273 94 100 Cefaclor 2.78 ± 0.35^d 3 22 73 94 100 Cefaclor 2.78 ± 0.35^d 3 22 73 94 100 Cefazolin 0.34 ± 0.20 62 99 100 62 Cefaxolin 0.34 ± 0.21 65 95 100	Cenhelothin	350 ± 0.80	19	97	54	01	01
Ceptatexin20.05 \pm 0.355161643173Cefaclor17.02 \pm 1.621827274564Cefazolin1.86 \pm 0.50273682100Cefaxin1.86 \pm 0.6527364591100Cefoxitin16.00 \pm 1.451818276464Bifidobacterium (11)2.90 \pm 0.1427275491100Cephalothin2.90 \pm 0.1427275491100Cephalothin2.90 \pm 0.7918546491100Cefaclor2.90 \pm 0.7918546491100Cefazolin2.0 \pm 0.7918546491100Cefaxin0.87 \pm 0.55456482100Cefoxitin4.0 \pm 0.769455473100Propionibacterium (85)730.91 \pm 0.22d88199100Cefaclor2.78 \pm 0.35d3227394100Cefazolin0.34 \pm 0.206299100Cefazolin0.34 \pm 0.216595100	Cephalevin	$20.53 \pm 0.05^{\circ}$	0	18	10	45	72
$\begin{array}{cccc} certation & 1.86 \pm 0.52 & 1.6 & 27 & 36 & 82 & 100 \\ \hline Cefazolin & 1.86 \pm 0.65 & 27 & 36 & 45 & 91 & 100 \\ \hline Cefaxin & 16.00 \pm 1.45 & 18 & 18 & 27 & 64 & 64 \\ \hline Bifidobacterium (11) & 2.90 \pm 0.14 & 27 & 27 & 54 & 91 & 100 \\ \hline Cephalexin & 2.41 \pm 0.64 & 18 & 45 & 67 & 91 & 100 \\ \hline Cefaclor & 2.90 \pm 0.95 & 27 & 45 & 54 & 73 & 73 \\ \hline Cefazolin & 2.0 \pm 0.79 & 18 & 54 & 64 & 91 & 100 \\ \hline Cefaxin & 2.0 \pm 0.79 & 18 & 54 & 64 & 91 & 100 \\ \hline Cefaxin & 2.0 \pm 0.76 & 9 & 45 & 54 & 73 & 73 \\ \hline Cefazolin & 0.30 \pm 0.21 & 83 & 95 & 100 \\ \hline Cephalexin & 0.91 \pm 0.22d & 8 & 81 & 99 & 100 \\ \hline Cefazolin & 0.34 \pm 0.20 & 62 & 99 & 100 \\ \hline Cefaxin & 0.34 \pm 0.21 & 65 & 95 & 100 \\ \hline \end{array}$	Cefaclor	17.02 ± 1.62	18	10 97	10	40	64
Cefazonn 1.80 \pm 0.80 27 36 82 100 Cefaxandole 2.56 \pm 0.65 27 36 45 91 100 Cefoxitin 16.00 \pm 1.45 18 18 27 64 64 Bifidobacterium (11) 2.90 \pm 0.14 27 27 54 91 100 Cephalexin 2.41 \pm 0.64 18 45 67 91 100 Cefaclor 2.90 \pm 0.95 27 45 54 73 73 Cefazolin 2.0 \pm 0.79 18 54 64 91 100 Cefazolin 2.0 \pm 0.79 18 54 64 91 100 Cefoxitin 4.0 \pm 0.76 9 45 54 73 100 Cefazolin 0.30 \pm 0.21 83 95 100 00 Cefaclor 2.78 \pm 0.35 ^d 3 22 73 94 100 Cefazolin 0.34 \pm 0.20 62 99 100 Cefazolin 0.34 \pm 0.20 62 99 100 Cefazolin	Cofazolin	196 ± 0.50	10	27	27	100	04
Cefanial obje 2.30 \pm 0.05 27 36 45 91 100 Cefoxitin 16.00 \pm 1.45 18 18 27 64 64 Bifidobacterium (11) Cephalothin 2.90 \pm 0.14 27 27 54 91 100 Cephalexin 2.41 \pm 0.64 18 45 67 91 100 Cephalexin 2.41 \pm 0.64 18 45 67 91 100 Cefaclor 2.90 \pm 0.95 27 45 54 73 73 Cefazolin 2.0 \pm 0.79 18 54 64 91 100 Cefaxolin 4.0 \pm 0.76 9 45 54 73 100 Cefoxitin 4.0 \pm 0.76 9 45 54 73 100 Cephalothin 0.30 \pm 0.21 83 95 100 00	Cefazonni	1.80 ± 0.50	27	30	02 45	100	100
10.00 \pm 1.4518276464Bifidobacterium (11)Cephalothin2.90 \pm 0.1427275491100Cephalexin2.41 \pm 0.6418456791100Cefaclor2.90 \pm 0.952745547373Cefazolin2.0 \pm 0.7918546491100Cefaxandole0.87 \pm 0.55456482100Cefoxitin4.0 \pm 0.769455473100Propionibacterium (85)Cephalexin0.30 \pm 0.218395100Cefaclor2.78 \pm 0.35 ^d 3227394100Cefazolin0.34 \pm 0.206299100Cefaxolin0.31 \pm 0.1869100Cefoxitin0.34 \pm 0.216595100100100100	Cefaminaluole	16.00 ± 1.45	19	10	40	91	100
Diplocation2.90 \pm 0.1427275491100Cephalexin2.41 \pm 0.6418456791100Cefaclor2.90 \pm 0.952745547373Cefazolin2.0 \pm 0.7918546491100Cefaxandole0.87 \pm 0.55456482100Cefoxitin4.0 \pm 0.769455473100Propionibacterium (85)Cephalexin0.30 \pm 0.218395100Cefaclor2.78 \pm 0.35 ^d 3227394100Cefazolin0.34 \pm 0.206299100Cefaxolin0.31 \pm 0.1869100Cefoxitin0.34 \pm 0.216595100100100100100	Rifidobacterium (11)	10.00 ± 1.45	10	10	21	04	04
Cephalotini2.00 \pm 0.1421210431100Cephalexin2.41 \pm 0.6418456791100Cefaclor2.90 \pm 0.952745547373Cefazolin2.0 \pm 0.7918546491100Cefaxandole0.87 \pm 0.55456482100Cefoxitin4.0 \pm 0.769455473100Propionibacterium (85)Cephalothin0.30 \pm 0.218395100Cephalexin0.91 \pm 0.22d88199100Cefaclor2.78 \pm 0.35d3227394100Cefazolin0.34 \pm 0.206299100Cefaxinin0.34 \pm 0.216595100	Cenhalothin	290 ± 014	97	97	54	91	100
$\begin{array}{cccc} 2.90 \pm 0.95 & 27 & 45 & 54 & 73 & 73 \\ Cefazolin & 2.0 \pm 0.95 & 27 & 45 & 54 & 73 & 73 \\ Cefazolin & 2.0 \pm 0.79 & 18 & 54 & 64 & 91 & 100 \\ Cefamandole & 0.87 \pm 0.55 & 45 & 64 & 82 & 100 \\ Cefoxitin & 4.0 \pm 0.76 & 9 & 45 & 54 & 73 & 100 \\ \hline Propionibacterium (85) & & & & \\ Cephalothin & 0.30 \pm 0.21 & 83 & 95 & 100 \\ Cephalexin & 0.91 \pm 0.22^d & 8 & 81 & 99 & 100 \\ Cefazolin & 0.34 \pm 0.20 & 62 & 99 & 100 \\ Cefaxandole & 0.31 \pm 0.18 & 69 & 100 \\ Cefoxitin & 0.34 \pm 0.21 & 65 & 95 & 100 \\ \hline \end{array}$	Cenhalevin	2.00 ± 0.14 2.41 + 0.64	18	45	67	01	100
Cefactor 2.00 ± 0.79 18 54 64 91 100 Cefazolin 2.0 ± 0.79 18 54 64 91 100 Cefaxin 0.87 ± 0.55 45 64 82 100 Cefoxitin 4.0 ± 0.76 9 45 54 73 100 Propionibacterium (85) Cephalothin 0.30 ± 0.21 83 95 100 Cefaclor 2.78 ± 0.35^d 3 22 73 94 100 Cefaclor 2.78 ± 0.35^d 3 22 73 94 100 Cefazolin 0.34 ± 0.20 62 99 100 Cefaxin $Cefax$ 65 100 Cefoxitin 0.34 ± 0.21 65 95 100 100 100	Cefaclor	2.41 ± 0.04 2.90 + 0.95	27	45	54	73	79
$\begin{array}{cccc} 100 \pm 0.10 & 10 & 04 & 04 & 01 & 100 \\ \hline Cefamandole & & & & & & & & & & & & & & & & & & &$	Cefazolin	2.00 ± 0.00	18	54	64	91	100
Cefanilitation 0.01 ± 0.30 40 0.7 00 100 Cefoxitin 40 ± 0.76 9 45 54 73 100 Propionibacterium (85) 0.30 ± 0.21 83 95 100 Cephalothin 0.30 ± 0.21 83 95 100 Cephalexin 0.91 ± 0.22^d 8 81 99 100 Cefaclor 2.78 ± 0.35^d 3 22 73 94 100 Cefazolin 0.34 ± 0.20 62 99 100 Cefamandole 0.31 ± 0.18 69 100 Cefoxitin 0.34 ± 0.21 65 95 100	Cefamandole	0.87 ± 0.15	45	64	82	100	100
Note 2 0.100.40100Propionibacterium (85)Cephalothin 0.30 ± 0.21 83 95 100 Cephalexin 0.91 ± 0.22^d 8 81 99 100 Cefaclor 2.78 ± 0.35^d 3 22 73 94 100 Cefazolin 0.34 ± 0.20 62 99 100 Cefamandole 0.31 ± 0.18 69 100 Cefoxitin 0.34 ± 0.21 65 95 100	Cefoxitin	40 ± 0.00	9	45	54	73	100
Cephalothin 0.30 ± 0.21 83 95 100 Cephalexin 0.91 ± 0.22^d 8 81 99 100 Cefaclor 2.78 ± 0.35^d 3 22 73 94 100 Cefazolin 0.34 ± 0.20 62 99 100 Cefamandole 0.31 ± 0.18 69 100 Cefoxitin 0.34 ± 0.21 65 95 100	Propionibacterium (85)	1.0 1 0.10	0	40	04	10	100
Cephalexin 0.91 ± 0.22^d 88199100Cefaclor 2.78 ± 0.35^d 3227394100Cefazolin 0.34 ± 0.20 6299100Cefamandole 0.31 ± 0.18 69100Cefoxitin 0.34 ± 0.21 6595100	Cephalothin	0.30 ± 0.21	83	95	100		
Cefaclor 2.78 ± 0.35^d 3 22 7394100Cefazolin 0.34 ± 0.20 62 99 100 Cefamandole 0.31 ± 0.18 69 100 Cefoxitin 0.34 ± 0.21 65 95 100	Cephalexin	0.91 ± 0.22^d	8	81	99	100	
Cefazolin 0.34 ± 0.20 62 99 100 Cefamandole 0.31 ± 0.18 69 100 Cefoxitin 0.34 ± 0.21 65 95 100	Cefaclor	2.78 ± 0.35^{d}	3	22	73	94	100
Cefamandole 0.31 ± 0.18 69 100 Cefoxitin 0.34 ± 0.21 65 95 100	Cefazolin	0.34 ± 0.20	62	99	100		
Cefoxitin 0.34 ± 0.21 65 95 100	Cefamandole	0.31 ± 0.18	69	100			
	Cefoxitin	0.34 ± 0.21	65	95	100		

^a SD, Standard deviation. ^b Significant difference compared with cephalothin; P < 0.01, t test analysis. ^c Significant difference compared with cephalothin; P < 0.05, t test analysis. ^d Significant difference compared with cephalothin; P < 0.001, t test analysis.

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Organism tested against various agents (no. of isolates)	Geometric mean MIC \pm SD $(\mu g/ml)^a$	Cumulative % strains inhibited by (µg/ml):					
		≤0.25	1	4	16	64	
Veillonella and Acidaminococcus (25)	·····						
Cephalothin	0.54 ± 0.39	68	68	100			
Cephalexin	0.73 ± 0.35	32	76	96	100		
Cefaclor	0.35 ± 0.22	61	96	100			
Cefazolin	0.32 ± 0.21^{b}	76	96	100			
Cefamandole	0.47 ± 0.39	72	80	96	100		
Cefoxitin	1.00 ± 0.36^{b}	12	68	88	100		
Bacteroides fragilis (51)							
Cephalothin	128 ± 0.29				4	33	
Cephalexin	$55.71 \pm 0.38^{\circ}$				29	61	
Cefaclor	134.36 ± 0.32			2	4	23	
Cefazolin	$49.18 \pm 0.34^{\circ}$				25	67	
Cefamandole	97 ± 0.27			2	2	51	
Cefoxitin	$12.81 \pm 0.29^{\circ}$			23	70	100	
Bacteroides species (53)							
Cephalothin	5.09 ± 1.61	28	41	51	60	83	
Cephalexin	2.82 ± 1.11	21	43	73	83	83	
Cefaclor	4.00 ± 1.42	28	43	53	72	87	
Cefazolin	2.94 ± 1.32	32	51	58	70	94	
Cefamandole	2.98 ± 1.46	32	47	60	75	87	
Cefoxitin	1.86 ± 0.75^{d}	28	45	75	90	96	
Fusobacterium (19)							
Cephalothin	0.80 ± 1.07	74	74	84	89	89	
Cephalexin	1.19 ± 1.28	47	79	79	79	89	
Cephaclor	2.00 ± 2.04	47	74	74	74	79	
Cefazolin	0.74 ± 0.79	58	74	89	89	95	
Cefamandole	0.77 ± 1.06	68	79	79	89	89	
Cefoxitin	1.65 ± 1.34	37	68	68	84	89	
Campylobacter (8)							
Cephalothin	4.75 ± 0.95	12	37	50	87	87	
Cephalexin	17.38 ± 0.27				75	100	
Cefaclor	11.31 ± 0.47			25	87	87	
Cefazolin	13.45 ± 0.40			25	75	87	
Cefamandole	7.31 ± 1.00		37	37	75	87	
Cefoxitin	12.29 ± 1.37		37	37	37	75	

TABLE 3. Comparative in vitro activity of cephalosporins against gram-negative anaerobic bacteria

" SD, Standard deviation.

^b Significant differences compared with cephalothin; P < 0.05, t test analysis.

^c Significant differences compared with cephalothin; P < 0.001, t test analysis.

^d Significant differences compared with cephalothin; P < 0.01, t test analysis.

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