SIS 2012
P12

Antimicrobial Activity of the New Cephalosporin Ceftaroline Tested Against Bacterial Isolates From Surgical Skin and Skin Structure Infections in USA Medical Centers (2008-2011)

HS SADER[1], D BIEK[2], I CRITCHLEY[2], RK FLAMM[1], RN JONES[1]

[1]JMI Laboratories, North Liberty, Iowa, USA; [2]Cerexa, Inc., Oakland, California, USA (a wholly owned subsidiary of Forest Laboratories, Inc., New York, New York, USA)

Helio S. Sader, M.D., Ph.D.
JMI Laboratories
North Liberty, IA, USA
www.jmilabs.com
ph. 319.665.3370, fax 319.665.3371
helio-sader@jmilabs.com

Abstract

Background: Ceftaroline, the active form of ceftaroline fosamil, is a cephalosporin with *in vitro* activity against many common Gram-positive and -negative bacteria, including methicillin-resistant (R) *S. aureus* (MRSA), multidrug-R streptococci, and commonly isolated (non-ESBL-producing) Enterobacteriaceae.

Hypothesis: To assess the activity of ceftaroline and comparator agents against pathogens isolated from surgical skin and skin structure infections (SSSI).

Methods: Clinically significant strains (1/patient) were consecutively collected from 64 medical centers in the USA in the 2008-2011 period and tested for susceptibility (S) by reference CLSI broth microdilution methods against ceftaroline and >20 antimicrobials currently available for treatment of surgical SSSI.

Results: 1,564 strains were tested. Ceftaroline was very active against oxacillin-S *S. aureus* (MSSA; MIC_{90}, 0.25 µg/mL) and MRSA (52.4%; MIC_{90}, 1 µg/mL). Against MSSA, ceftaroline was 16-fold more potent than ceftriaxone and the highest ceftaroline MIC was only 0.5 µg/mL. 97.9% and 100.0% of MRSA were inhibited at ≤1 and ≤2 µg/mL of ceftaroline, respectively. β-haemolytic streptococci (BHS) were very S to ceftaroline and the highest ceftaroline MIC was only 0.03 µg/mL among Groups A and B BHS. Ceftaroline was also active against CoNS (MIC_{90}, 0.5 µg/mL), including methicillin-R strains, and 4-fold more potent than ceftriaxone against viridans group streptococci. High R rates to levofloxacin and clindamycin were observed among MRSA and CoNS. Ceftaroline activity against the most common Enterobacteriaceae ($MIC_{50/90}$, 0.12/4 µg/mL) was similar to ceftriaxone and ceftazidime. ESBL phenotypes were observed in 8.5% of *E. coli* and 9.5% of *Klebsiella* spp., and all cephalosporins tested showed limited activity against these strains.

Conclusions: Ceftaroline exhibited potent activity against Gram-positive, including MRSA, and many Enterobacteriaceae. Ceftaroline appears to be an optimal agent for the treatment of patients with surgical SSSI in USA hospitals.

Introduction

Ceftaroline, the active form of the prodrug ceftaroline fosamil, is a broad-spectrum cephalosporin that has *in vitro* bactericidal activity against resistant Gram-positive pathogens, including methicillin-resistant *Staphylococcus aureus* (MRSA), and commonly occurring Gram-negative pathogens. Ceftaroline fosamil was approved by the United States Food and Drug Administration (USA-FDA) in 2010 for the treatment of adult patients with acute bacterial skin and skin structure infections and community-acquired bacterial pneumonia.

S. aureus is considered the most important pathogen associated with surgical skin and skin structure infections (SSSI). Ceftaroline has demonstrated excellent *in vitro* activity against *S. aureus* as well as against β-haemolytic streptococci, coagulase-negative staphylococci (CoNS), and viridans group streptococci, which are occasionally associated with surgical SSSI. Ceftaroline provides additional *in vitro* activity against commonly isolated Enterobacteriaceae species, excluding those that produce extended-spectrum β-lactamase (ESBL), stably derepressed AmpC, or carbapenemases such as KPC.

As part of the Assessing Worldwide Antimicrobial Resistance Evaluation (AWARE) Program, a global ceftaroline surveillance study, we evaluated the spectrum of antimicrobial activity of ceftaroline and several comparator agents when tested against clinical isolates recovered from surgical SSSI in medical centers throughout the USA.

Methods

A total of 1564 clinically significant, consecutively collected, nonduplicate isolates from hospitalized patients with surgical SSSI in 2008-2011 were evaluated in this study. There were 64 participating medical centers that contributed isolates for testing and analysis.

Broth microdilution methods conducted according to the Clinical and Laboratory Standards Institute (CLSI) were performed to determine antimicrobial susceptibility of ceftaroline and numerous antimicrobial agents currently available for treatment of surgical SSSI. Validated MIC panels were manufactured by ThermoFisher Scientific (formerly TREK Diagnostics; Cleveland, Ohio, USA). Staphylococci, *Enterococcus faecalis*, and Gram-negative strains were tested in cation-adjusted Mueller-Hinton (CA-MH) broth and streptococci were tested in CA-MH broth supplemented with 2.5-5% lysed horse blood according to the CLSI guidelines (M07-A9, 2012).

Concurrent quality control (QC) testing was performed to assure proper test conditions and procedures. QC strains included: *S. aureus* ATCC 29213, *E. faecalis* ATCC 29212, *Escherichia coli* ATCC 25922, *Pseudomonas aeruginosa* ATCC 27853, and *Streptococcus pneumoniae* ATCC 49619. Susceptibility percentages and validation of QC results were based on the CLSI guidelines (M100-S22) and susceptibility breakpoints were used to determine susceptibility/resistance percentages. USA-FDA interpretive criteria for ceftaroline susceptibility were used when available.

Results

- *S. aureus* was the most frequently recovered pathogen (731 strains; 46.7% of total), and 52.4% of those strains were resistant to oxacillin (MRSA). The next most common pathogens were β-haemolytic streptococci (14.8%), *E. coli* (9.0%), and *Klebsiella* spp. (5.4%; Table 1)
- Methicillin-susceptible *S. aureus* (MSSA) isolates had slightly lower ceftaroline MIC values ($MIC_{50/90}$, 0.25/0.25 µg/mL) compared with MRSA isolates ($MIC_{50/90}$, 0.5/1 µg/mL; Tables 1 and 2). Against MSSA, ceftaroline was 16-fold more potent than ceftriaxone ($MIC_{50/90}$, 4/4 µg/mL) and the highest ceftaroline MIC value was only 0.5 µg/mL. The highest ceftaroline MIC result observed among MRSA strains was 2 µg/mL (97.9% inhibited at ≤1 µg/mL; Table 1)
- The most active agents tested against MRSA isolates were: ceftaroline ($MIC_{50/90}$, 0.5/1 µg/mL; 97.9% susceptible [S]), linezolid ($MIC_{50/90}$, 1/2 µg/mL; 100% S), vancomycin ($MIC_{50/90}$, 1/1 µg/mL; 100% S), daptomycin ($MIC_{50/90}$, 0.25/0.5 µg/mL; 100% S), and tigecycline ($MIC_{50/90}$, 0.12/0.25 µg/mL; 100% S). In contrast, the highest resistance rates were observed for levofloxacin (64.8%) and clindamycin (30.5%; Table 2)
- Ceftaroline demonstrated excellent activity against the β-haemolytic streptococci (MIC_{90}, 0.03 µg/mL) and the highest ceftaroline MIC was only 0.03 µg/mL among Groups A (*S. pyogenes*; $MIC_{50/90}$, ≤0.015/≤0.015 µg/mL) and B (*S. agalactiae*; $MIC_{50/90}$, ≤0.015/0.03 µg/mL) streptococci. All comparators exhibited complete activity (100.0% S) against β-haemolytic streptococci, except for clindamycin (77.5% S) and levofloxacin (99.1% S; Tables 1 and 2)
- Ceftaroline activity against CoNS ($MIC_{50/90}$, 0.25/0.5 µg/mL) was slightly greater (two-fold) than that observed against *S. aureus* ($MIC_{50/90}$, 0.5/1 µg/mL; Tables 1 and 2). Oxacillin (methicillin) resistance was observed in 68.8% of CoNS strains (Table 2)
- Ceftaroline was also active against viridans group streptococci ($MIC_{50/90}$, 0.03/0.06 µg/mL), and modestly elevated MIC values were observed for ceftaroline ($MIC_{50/90}$, 2/4 µg/mL) against *E. faecalis* isolates compared with other Gram-positive species tested (Tables 1 and 2)
- Ceftaroline activity against the most common Enterobacteriaceae ($MIC_{50/90}$, 0.12/4 µg/mL) was similar to that of ceftriaxone and ceftazidime. ESBL phenotypes were observed in 8.5% of *E. coli* and 9.5% of *Klebsiella* spp., and all cephalosporins tested showed limited activity against these strains (Table 2).

Table 1. Frequency of Occurrence of Ceftaroline MIC Values for Bacterial Strains Collected from Surgical Infections in USA Medical Centers

	Number of isolates (cumulative %) inhibited at ceftaroline MIC (µg/mL) of:								
Organism (no. tested)	≤0.015	0.03	0.06	0.12	0.25	0.5	1	2	4
S. aureus (731)	-	-	2(0.3)	51(7.3)	281(45.7)	224(76.3)	165(98.9)	8(100.0)	-
MSSA (348)	-	-	2(0.6)	51(15.2)	278(95.1)	17(100.0)	-	-	-
MRSA (383)	-	-	-	-	3(0.8)	207(54.8)	165(97.9)	8(100.0)	-
β-haemolytic streptococci (231)	192(83.1)	36(98.7)	3(100.0)	-	-	-	-	-	-
Group A (72)	71(98.6)	1(100.0)	-	-	-	-	-	-	-
Group B (119)	96(80.7)	23(100.0)	-	-	-	-	-	-	-
Others (40)	25(62.5)	12(92.5)	3(100.0)	-	-	-	-	-	-
CoNS (80)	1(1.3)	0(1.3)	17(22.5)	11(36.3)	30(73.8)	17(95.0)	4(100.0)	-	-
Viridans group streptococci (55)	20(36.4)	25(81.8)	6(92.7)	2(96.4)	0(96.4)	2(100.0)	-	-	-
E. faecalis (82)	-	-	-	-	-	-	21(25.6)	42(76.8)	14(93.9)
Enterobacteriaceae (385)	1(0.3)	21(5.7)	101(32.0)	95(56.6)	67(74.0)	29(81.6)	20(86.8)	9(89.1)	4(90.1)
E. coli (141)	-	12(8.5)	50(44.0)	35(68.8)	17(80.9)	5(84.4)	4(87.2)	2(88.7)	2(90.0)
Klebsiella spp. (85)	1(1.2)	3(4.7)	21(29.4)	26(60.0)	20(83.5)	4(88.2)	1(89.4)	2(91.8)	1(92.9)
Enterobacter spp. (56)	-	1(1.8)	5(10.7)	14(35.7)	18(67.9)	7(80.4)	2(83.9)	0(83.9)	1(85.7)

MSSA = methicillin-susceptible *S. aureus*; MRSA = methicillin-resistant *S. aureus*; CoNS = coagulase-negative staphylococci

Table 2. Antimicrobial Activity of Ceftaroline and Comparator Agents Tested Against Organisms Collected from Surgical Skin and Skin Structure Infections in USA Medical Centers (2008-2011)

Organism (no. tested) / Antimicrobial agent	MIC (µg/mL) MIC_{50}	MIC_{90}	Range	%S / %R[a]
Staphylococcus aureus (731)				
Ceftaroline[b]	0.5	1	0.06 – 2	98.9 / -
Oxacillin	>2	>2	≤0.25 – >2	47.6 / 52.4
Cefuroxime	2	>16	≤0.12 – >16	47.6 / 52.4
Ceftriaxone[c]	>8	>8	0.5 – >8	46.6 / 52.4
Clindamycin	≤0.25	>2	≤0.25 – >2	80.8 / 19.2
Levofloxacin	≤0.5	>4	≤0.5 – >4	61.0 / 37.8
Linezolid	1	2	0.5 – 4	100.0 / 0.0
Tigecycline[d]	0.12	0.25	≤0.03 – 0.5	100.0 / -
Daptomycin	0.25	0.5	≤0.06 – 1	100.0 / -
Vancomycin	1	1	0.5 – 2	100.0 / 0.0
MSSA (348)				
Ceftaroline[b]	0.25	0.25	0.06 – 0.5	100.0 / -
Cefuroxime	1	2	≤0.12 – >16	99.5 / 0.5
Ceftriaxone[c]	4	4	0.5 – 16	97.7 / 0.3
Clindamycin	≤0.25	≤0.25	≤0.25 – >2	93.4 / 6.6
Levofloxacin	≤0.5	1	≤0.5 – >4	90.8 / 8.0
Linezolid	1	2	0.5 – 2	100.0 / 0.0
Tigecycline[d]	0.12	0.25	≤0.03 – 0.25	100.0 / -
Daptomycin	0.25	0.5	≤0.06 – 1	100.0 / -
Vancomycin	1	1	0.5 – 2	100.0 / 0.0
MRSA (383)				
Ceftaroline[b]	0.5	1	0.25 – 2	97.9 / -
Cefuroxime	16	>16	2 – >16	0.0 / 100.0
Ceftriaxone[c]	>8	>8	1 – >8	0.0 / 100.0
Clindamycin	≤0.25	>2	≤0.25 – >2	69.5 / 30.5
Levofloxacin	4	>4	≤0.5 – >4	33.9 / 64.8
Linezolid	1	2	0.5 – 4	100.0 / 0.0
Tigecycline[d]	0.12	0.25	≤0.03 – 0.5	100.0 / -
Daptomycin	0.25	0.5	0.12 – 1	100.0 / -
Vancomycin	1	1	0.5 – 2	100.0 / 0.0
β-haemolytic streptococci[e] (231)				
Ceftaroline[b]	≤0.015	0.03	≤0.015 – 0.06	- / -
Ceftriaxone[c]	≤0.25	≤0.25	≤0.25 – 0.5	100.0 / -
Penicillin	≤0.06	≤0.06	≤0.06 – 0.12	100.0 / -
Clindamycin	≤0.25	>2	≤0.25 – >2	77.5 / 22.1
Levofloxacin	≤0.5	1	≤0.5 – >4	99.1 / 0.9
Linezolid	1	1	0.25 – 1	100.0 / -
Tigecycline[d]	≤0.03	0.06	≤0.03 – 0.12	100.0 / -
Daptomycin	0.12	0.25	≤0.06 – 0.5	100.0 / -
Vancomycin	0.5	0.5	0.25 – 1	100.0 / -
Group A (*S. pyogenes*; 72)				
Ceftaroline[b]	≤0.015	≤0.015	≤0.015 – 0.03	98.6 / -
Penicillin	≤0.06	0.06	≤0.06 – 0.06	100.0 / -
Ceftriaxone[c]	≤0.25	0.25	≤0.25 – 0.25	100.0 / -
Clindamycin	≤0.25	≤0.25	≤0.25 – >2	91.7 / 8.3
Levofloxacin	≤0.5	1	≤0.5 – >4	98.6 / 1.4
Linezolid	1	1	0.25 – 1	100.0 / -
Tigecycline[d]	≤0.03	≤0.03	≤0.03 – 0.06	100.0 / -
Daptomycin	≤0.06	≤0.06	≤0.06 – 0.12	100.0 / -
Vancomycin	0.25	0.5	0.25 – 1	100.0 / -
Group B (*S. agalactiae*; 119)				
Ceftaroline[b]	≤0.015	0.03	≤0.015 – 0.03	100.0 / -
Penicillin	≤0.06	≤0.06	≤0.06 – 0.12	100.0 / -
Ceftriaxone[c]	≤0.25	0.25	≤0.25 – 0.25	100.0 / -
Clindamycin	≤0.25	>2	≤0.25 – >2	63.9 / 35.3
Levofloxacin	1	1	≤0.5 – >4	99.2 / 0.8
Linezolid	1	1	0.5 – 1	100.0 / -
Tigecycline[d]	≤0.03	0.06	≤0.03 – 0.12	100.0 / -
Daptomycin	0.25	0.25	0.12 – 0.5	100.0 / -
Vancomycin	0.5	0.5	0.25 – 1	100.0 / -
Other (40)[e]				
Ceftaroline[b]	≤0.015	0.03	≤0.015 – 0.06	- / -
Ceftriaxone[c]	≤0.25	≤0.25	≤0.25 – 0.5	100.0 / -
Penicillin	≤0.06	≤0.06	≤0.06 – 0.12	100.0 / -
Clindamycin	≤0.25	≤0.25	≤0.25 – >2	92.5 / 7.5
Levofloxacin	≤0.5	1	≤0.5 – 2	100.0 / 0.0
Linezolid	1	1	0.25 – 1	100.0 / -
Tigecycline[d]	≤0.03	0.06	≤0.03 – 0.12	100.0 / -
Daptomycin	≤0.06	0.25	≤0.06 – 0.5	100.0 / -
Vancomycin	0.5	1	0.25 – 1	100.0 / -
CoNS (80)				
Ceftaroline[b]	0.25	0.5	0.015 – 1	- / -
Oxacillin	1	>2	≤0.25 – >2	31.3 / 68.8
Cefuroxime	2	>16	≤0.5 – >16	31.3 / 68.8
Ceftriaxone[c]	8	>8	0.5 – >8	31.3 / 68.8
Clindamycin	≤0.25	>2	≤0.25 – >2	67.5 / 31.3
Levofloxacin	≤0.5	>4	≤0.5 – >4	60.0 / 36.3
Linezolid	0.5	1	0.25 – 2	100.0 / 0.0
Tigecycline[d]	0.12	0.25	≤0.03 – 0.5	- / -
Daptomycin	0.25	0.5	0.12 – 1	100.0 / -
Vancomycin	1	2	0.5 – 2	100.0 / 0.0
Viridans group streptococci (55)[f]				
Ceftaroline[b]	0.03	0.06	≤0.008 – 0.5	- / -
Penicillin	≤0.06	0.25	≤0.06 – >4	87.3 / 1.8
Ceftriaxone[c]	≤0.25	0.5	≤0.25 – 4	96.4 / 3.6
Clindamycin	≤0.25	>2	≤0.25 – >2	87.3 / 10.9
Levofloxacin	1	2	≤0.5 – >4	92.7 / 7.3
Linezolid	1	1	0.25 – 2	100.0 / -
Tigecycline[d]	≤0.03	0.06	≤0.03 – 0.12	100.0 / -
Daptomycin	0.25	1	≤0.06 – 4	98.2 / -
Vancomycin	0.5	1	0.25 – 1	100.0 / -
Enterococcus faecalis (82)				
Ceftaroline[b]	2	4	1 – 8	- / -
Ampicillin	≤1	2	≤1 – 2	100.0 / 0.0
Levofloxacin	1	>4	≤0.5 – >4	79.3 / 20.7
Linezolid	1	2	0.5 – 2	100.0 / 0.0
Tigecycline[d]	0.06	0.25	≤0.03 – 0.25	100.0 / -
Daptomycin	1	1	0.25 – 2	100.0 / -
Vancomycin	1	2	0.5 – >16	97.6 / 2.4
Enterobacteriaceae (385)[g]				
Ceftaroline[c]	0.12	4	≤0.008 – >16	81.6 / 13.2
Ceftriaxone	≤0.25	1	≤0.25 – >8	90.1 / 9.1
Ceftazidime	≤1	≤1	≤1 – >16	92.2 / 7.0
Ampicillin/sulbactam	8	>16	≤2 – >16	57.7 / 22.9
Piperacillin/tazobactam	2	8	≤0.5 – >64	93.5 / 4.2
Meropenem	≤0.12	≤0.12	≤0.12 – >8	99.5 / 0.5
Levofloxacin	≤0.5	>4	≤0.5 – >4	84.4 / 15.1
Gentamicin	≤2	≤2	≤2 – >8	91.2 / 8.1
Tigecycline[d]	0.25	1	0.06 – >4	97.9 / 0.3
Escherichia coli (141)				
Ceftaroline[b]	0.12	4	0.03 – >16	84.4 / 12.8
Ceftriaxone[c]	≤0.25	≤0.25	≤0.25 – >8	91.5 / 8.5
Ceftazidime	≤1	≤1	≤1 – >16	92.2 / 7.1
Ampicillin/sulbactam	4	>16	≤2 – >16	57.4 / 22.0
Piperacillin/tazobactam	2	16	≤0.5 – >64	91.5 / 5.7
Meropenem	≤0.12	≤0.12	≤0.12	100.0 / 0.0
Levofloxacin	≤0.5	>4	≤0.5 – >4	69.5 / 30.5
Gentamicin	≤2	>8	≤2 – >8	83.0 / 17.0
Tigecycline[d]	0.12	0.25	0.06 – 0.5	100.0 / 0.0
Klebsiella spp. (85)[h]				
Ceftaroline[b]	0.12	2	≤0.008 – >16	88.2 / 10.6
Ceftriaxone[c]	≤0.25	≤0.25	≤0.25 – >8	90.6 / 9.4
Ceftazidime	≤1	≤1	≤1 – >16	92.9 / 7.1
Ampicillin/sulbactam	8	>16	≤2 – >16	77.6 / 12.9
Piperacillin/tazobactam	2	8	≤0.5 – >64	94.1 / 5.9
Meropenem	≤0.12	≤0.12	≤0.12 – >8	97.6 / 2.4
Levofloxacin	≤0.5	≤0.5	≤0.5 – >4	96.5 / 3.5
Gentamicin	≤2	≤2	≤2 – >8	96.5 / 1.2
Tigecycline[d]	0.25	0.5	0.12 – 1	100.0 / 0.0
Enterobacter spp. (56)[i]				
Ceftaroline[b]	0.25	>16	0.03 – >16	80.4 / 16.1
Ceftriaxone[c]	≤0.25	>8	≤0.25 – >8	83.9 / 16.1
Ceftazidime	≤1	>16	≤1 – >16	85.7 / 12.5
Ampicillin/sulbactam	16	>16	4 – >16	41.1 / 32.1
Piperacillin/tazobactam	2	32	1 – >64	87.5 / 5.4
Meropenem	≤0.12	≤0.12	0.12 – 0.25	100.0 / 0.0
Levofloxacin	≤0.5	≤0.5	≤0.5 – 1	100.0 / 0.0
Gentamicin	≤2	≤2	≤2	100.0 / 0.0
Tigecycline[d]	0.25	0.5	0.12 – 2	100.0 / 0.0

a. Percentage susceptible/resistant according to the criteria published by the CLSI [2012].
b. USA-FDA breakpoints were applied when available (Teflaro Product Insert, 2010).
c. USA-FDA breakpoints were applied when available (Rocephin Product Insert, 2010).
d. USA-FDA breakpoints were applied when available (Tygacil Product Insert, 2010).
e. Includes: *Streptococcus dysgalactiae* (4 strains), Group C *Streptococcus* (15 strains), Group F *Streptococcus* (7 strains), and Group G *Streptococcus* (14 strains).
f. Includes: *Streptococcus anginosus* (9 strains), *S. constellatus* (8 strains), *S. equinus* (1 strain), *S. mitis* (1 strain), *S. mitis* (6 strains), *S. oralis* (1 strain), *S. parasanguinis* (1 strain), and unspecified viridans group streptococci (26 strains).
g. Includes: *Citrobacter braakii* (1 strain), *C. freundii* (10 strains), *C. koseri* (1 strain), *C. sedlakii* (1 strain), *Enterobacter aerogenes* (6 strains), *E. cloacae* (50 strains), *Escherichia coli* (141 strains), *Hafnia alvei* (1 strain), *Klebsiella oxytoca* (31 strains), *K. pneumoniae* (53 strains), *Morganella morganii* (23 strains), *Proteus mirabilis* (40 strains), *P. vulgaris* (2 strains), *Providencia rettgeri* (1 strain), *Serratia liquefaciens* (1 strain), *S. marcescens* (22 strains), and unspecified *Klebsiella* (1 strain).
h. Includes: *Klebsiella oxytoca* (31 strains), *K. pneumoniae* (53 strains), and unspecified *Klebsiella* (1 strain).
i. Includes: *Enterobacter aerogenes* (6 strains) and *E. cloacae* (50 strains).

Conclusions

- Ceftaroline demonstrated high *in vitro* activity against the most common pathogens isolated from surgical SSSI in USA medical centers (2008 – 2011), including Gram-positive pathogens (particularly MRSA) and non-ESBL-producing Enterobacteriaceae
- Ceftaroline activity against staphylococci that caused surgical SSSI was similar to that of vancomycin, daptomycin, and linezolid; streptococcal activity was most similar to that of penicillin and ceftriaxone
- Ceftaroline demonstrated good *in vitro* activity against bacterial species frequently associated with contemporary surgical SSSIs in USA hospitals.

References

1. Clinical and Laboratory Standards Institute (2012). *M07-A9. Methods for dilution antimicrobial susceptibility tests for bacteria that grow aerobically; approved standard: ninth edition.* Wayne, PA: CLSI.
2. Clinical and Laboratory Standards Institute (2012). *M100-S22. Performance standards for antimicrobial susceptibility testing: 22nd informational supplement.* Wayne, PA: CLSI.
3. File TM, Jr., Low DE, Eckburg PB, Talbot GH, Friedland HD, Lee J, Llorens L, Critchley IA, Thye DA (2011). FOCUS 1: A randomized, double-blinded, multicentre, Phase III trial of the efficacy and safety of ceftaroline fosamil versus ceftriaxone in community-acquired pneumonia. *J Antimicrob Chemother* 66 Suppl 3: iii19-iii32.
4. Jones RN, Farrell DJ, Mendes RE, Sader HS (2011). Comparative ceftaroline activity tested against pathogens associated with community-acquired pneumonia: Results from an international surveillance study. *J Antimicrob Chemother* 66 Suppl 3: iii69-iii80.
5. Jones RN, Mendes RE, Sader HS (2010). Ceftaroline activity against pathogens associated with complicated skin and skin structure infections: Results from an international surveillance study. *J Antimicrob Chemother* 65 Suppl 4: iv17-iv31.
6. Laudano JB (2011). Ceftaroline fosamil: A new broad-spectrum cephalosporin. *J Antimicrob Chemother* 66 Suppl. 3: iii11-iii18.
7. Low DE, File TM Jr, Eckburg PB, Talbot GH, Friedland HD, Lee J, Llorens L, Critchley IA, Thye DA (2011). FOCUS 2: a randomized, double-blinded, multicentre, Phase III trial of the efficacy and safety of ceftaroline fosamil versus ceftriaxone in community-acquired pneumonia. *J Antimicrob Chemother* 66 Suppl 3: iii33-iii44.
8. Teflaro Package Insert (2010). Available at http://www.frx.com/pi/Teflaro_pi.pdf. Accessed April 14, 2011.
9. Wilcox MH, Corey GR, Talbot GH (2010). CANVAS 2: The second Phase III, randomized double-blind study evaluating ceftaroline fosamil for the treatment of patients with complicated skin and skin structure infections. *J Antimicrob Chemother* 65: iv53-iv65.

Acknowledgment

This study was supported by Forest Laboratories, Inc. Forest Laboratories, Inc. was involved in the study design and in the decision to present these results. Forest Laboratories, Inc. had no involvement in the analysis, collection, and interpretation of data.

Scientific Therapeutics Information, Inc. provided editorial coordination, which was funded by Forest Research Institute, Inc.