

# Minimum Inhibitory Concentration Determinations for Ceftiofur Against *Escherichia Coli*, *Arcanobacterium Pyogenes*, and *Fusobacterium Necrophorum* Isolated from Cases of Acute Puerperal Metritis in Cows

Sarah A. Salmon and Eric J. Schmitt,  
Pharmacia Animal Health, Worldwide Product Development, Kalamazoo, MI, USA  
and Puurs, Belgium

---

## Introduction

Postparturient metritis of the cow is a difficult to treat and potentially life threatening disease. Bacteria commonly isolated from cases of bovine metritis include *Escherichia coli*, *Arcanobacterium pyogenes*, and *Fusobacterium necrophorum*. Ceftiofur (XNL) is a broad-spectrum cephalosporin antimicrobial agent that is approved for use in dairy cows with minimal withdrawal time. A trial was conducted to evaluate the efficacy of XNL for the treatment of acute puerperal metritis in dairy cows. As part of the efficacy determination trial, minimum inhibitory concentrations (MICs) were determined for ceftiofur and comparators against *E. coli*, *A. pyogenes*, and *F. necrophorum* isolated from dairy cows with acute puerperal metritis.

## Materials and Methods

Minimum inhibitory concentrations (MICs) were determined for XNL and comparator antimicrobial agents against 123 *A. pyogenes*, 188 *E. coli*, and 2 *F. necrophorum*. All strains tested were isolated from the bovine uterus following clinical diagnosis of acute metritis. MICs for *A. pyogenes* and *E. coli* were determined using a broth microdilution method that conforms to the guidelines of the National Committee for Clinical Laboratory Standards (NCCLS) (NCCLS 1999). *Fusobacterium necrophorum* MICs were determined using the agar dilution procedure that conforms to the guidelines of the NCCLS (NCCLS

1997). In addition to the test strains appropriate NCCLS recommended quality control strains were tested (NCCLS 1999, NCCLS 1997).

## Results and Conclusions

Summary MIC data are presented in Table 1. Ceftiofur was highly active against the strains of *A. pyogenes* with MIC values  $\leq 0.5$   $\mu\text{g/ml}$  against all strains. MIC<sub>90</sub> values for XNL, ampicillin (AMP), gentamicin (GEN), neomycin (NEO), spectinomycin (SPC) and trimethoprim/sulfamethoxazole (SXT) were 0.25,  $\leq 0.03$ , 2.0, 1.0, and 0.13  $\mu\text{g/ml}$ , respectively. Tetracycline (TE) exhibited strain dependent activity against *A. pyogenes* with MIC<sub>90</sub> value  $> 32.0$   $\mu\text{g/ml}$ . XNL was also highly active against strains of *E. coli* with MICs for all but two strains  $\leq 4.0$   $\mu\text{g/ml}$ . MIC<sub>90</sub> values for XNL, AMP, GEN, NEO, and SXT against *E. coli* were 0.5,  $> 32.0$ , 1.0, 2.0, and 2.0  $\mu\text{g/ml}$ , respectively. Although SPC exhibited *in vitro* activity much lower than XNL and other comparators against the *E. coli*, only 14 of the 188 strains tested (7.4%) yielded MIC values  $\geq 64.0$   $\mu\text{g/ml}$ . TE exhibited very limited, strain dependent activity against the *E. coli*. Against *F. necrophorum*, XNL yielded MIC values of 0.03 and 0.06  $\mu\text{g/ml}$ , for both strains. MIC values for AMP, and TE against the two strains were 0.25 and 0.13  $\mu\text{g/ml}$ , respectively. In conclusion, XNL was highly active against the strains of *A. pyogenes*, *E. coli* and *F. necrophorum* tested. Exhibiting similar activity to that of XNL were AMP, GEN, and SXT.

*continued*

**Table 1. Summary of Minimum Inhibitory Concentration Determinations for Ceftiofur and Comparators against Organisms Isolated from Cases of Bovine Metritis in Europe**

Organism Name	No. tested	Minimum inhibitory concentration (µg/ml)		
		MIC <sub>50</sub>	MIC <sub>90</sub>	Range
<i>Arcanobacterium pyogenes</i>				
Ceftiofur	123	0.25	0.25	≤0.03-0.5
Ampicillin	123	≤0.03	≤0.03	≤0.03-0.5
Gentamicin	123	0.25	0.5	≤0.03-32.0
Neomycin	123	2.0	2.0	0.25-8.0
Spectinomycin	123	≤0.5	1.0	≤0.5-16.0
Trimethoprim/sulfamethoxazole	122	0.03	0.13	≤0.015->16.0
Tetracycline	113	32.0	>32.0	0.03->32.0
<i>Escherichia coli</i>				
Ceftiofur	188	0.5	0.5	0.13->32.0
Ampicillin	188	4.0	>32.0	0.5->32.0
Gentamicin	188	0.5	1.0	0.25->32.0
Neomycin	188	1.0	2.0	0.5->128.0
Spectinomycin	188	16.0	32.0	4.0->512.0
Trimethoprim/sulfamethoxazole	188	0.06	2.0	≤0.015->16.0
Tetracycline	184	2.0	>32.0	0.5->32.0
<i>Fusobacterium necrophorum</i>				
Ceftiofur	2	ND	ND	≤0.03-0.06
Ampicillin	2	ND	ND	0.25*
Tetracycline	2	ND	ND	0.13*

\*No range, all strains yielded the same value.

## References

National Committee for Clinical Laboratory Standards. 1997. Methods for Antimicrobial Susceptibility Testing of Anaerobic Bacteria; Approved Standard – Fourth Edition. M11-A4. Wayne, PA

National Committee for Clinical Laboratory Standards. 1999. Performance Standards for Antimicrobial Disk and Dilution Susceptibility Testing for Bacteria Isolated from Animals; Approved Standard. M31-A. Wayne, PA