

Isolation of Antibiotic-Resistant *Salmonella krefeld* from Clinical Veterinary Materials

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Six isolations of *Salmonella krefeld* were made from clinical veterinary specimens. These isolates were multiply resistant to several antimicrobial agents commonly used to treat salmonellosis.

Salmonella krefeld is a member of the salmonella serogroup E₄ (4). This serotype has not been commonly recovered from human or animal specimens in the United States (2). Between September, 1979, and August, 1980, six isolations of *S. krefeld* were made from clinical veterinary specimens at the Clinical Microbiology Laboratory of Texas A & M University Veterinary

Enterobacteriaceae (9). All six strains had the typical reactions of members of the genus *Salmonella*, and their biochemical properties were identical. The isolates were serologically grouped as salmonella E₄ with commercial salmonella antiserum (Difco Laboratories, Detroit, Mich.). Complete serotyping was done by the National Veterinary Services Laboratories,

TABLE 1. Antibigrams and sources of six strains of *S. krefeld*

Antimicrobial agent	Minimal inhibitory concn (μg/ml) for isolate no.:					
	129 (feline urine) ^a	174 (canine urine)	1075 (bovine feces)	2164 (canine feces)	2680 (equine feces)	3116 (equine feces)
Ampicillin	>16 (R) ^b	1 (S)	>16 (R)	1 (S)	>16 (R)	>16 (R)
Cephalothin	16 (I)	8 (S)	32 (R)	4 (S)	32 (R)	8 (S)
Gentamicin	16 (R)	16 (R)	>16 (R)	16 (R)	16 (R)	8 (R)
Tetracycline	>16 (R)	1 (S)	>16 (R)	2 (S)	>16 (R)	>16 (R)
Carbenicillin	>512 (R)	16 (S)	>512 (R)	≤8 (S)	>512 (R)	>512 (R)
Chloramphenicol	>32 (R)	>32 (R)	>32 (R)	>32 (R)	>32 (R)	>32 (R)
Kanamycin	>64 (R)	64 (R)	>64 (R)	64 (R)	>64 (R)	>64 (R)
Streptomycin	NT ^c (R)	NT (S)	NT (R)	NT (S)	NT (R)	NT (R)
Tobramycin	>16 (R)	>16 (R)	>16 (R)	16 (R)	16 (R)	8 (R)
Amikacin	4 (S)	4 (S)	8 (S)	8 (S)	4 (S)	2 (S)
Trimethoprim-sulfa	>32/608 (R)	>32/608 (R)	>32/608 (R)	>32/608 (R)	>32/608 (R)	>32/608 (R)
Cefoxitin	16 (I)	2 (S)	4 (S)	≤1 (S)	2 (S)	2 (S)
Cefamandole	>16 (R)	2 (S)	>16 (R)	2 (S)	>16 (R)	4 (S)

^a Source is shown within parentheses.

^b S, Susceptible; R, resistant; I, intermediate.

^c NT, Not tested. Interpretation is on the basis of disk diffusion test.

Hospital. All of these isolates were resistant to several antimicrobial agents commonly used in the treatment of salmonellosis. These cultures of *S. krefeld* were recovered from infectious processes of the urinary and gastrointestinal tracts of several animal species (Table 1).

Biochemical characteristics of these isolates were determined with the aid of the API 20E system (Analytab Products, Inc., Plainview, N.Y.), which has been reported to be accurate in the identification of veterinary isolates of Ames, Iowa.

Minimum inhibitory concentrations were obtained for all antimicrobial agents except streptomycin by using a commercial microdilution system (MicroScan, Inc., Campbell, Calif.). Susceptibility to streptomycin was determined by a single disk diffusion method. The antibigrams of the *S. krefeld* isolates are shown in Table 1. All isolates were resistant to chloramphenicol, gentamicin, kanamycin, tobramycin, and trimethoprim-sulfa. Four of the six cultures were resistant to ampicillin, carbenicillin, and streptomycin. The strains all had variable resistance

to the cephalosporin class. All isolates were susceptible to amikacin, which has not been extensively employed in veterinary medicine.

This group of *S. krefeld* isolations is considered to be interesting for several reasons. Six isolations of this serotype within 1 year in one laboratory is in itself unusual and implies either an increase in prevalence or a common source of infection. There is no reason to suspect a common source in these cases because there were no relationships existing among the infected animals. Little literature exists on this organism or the disease processes associated with it. A single isolate of a gentamicin-resistant *S. krefeld* strain has been reported from a canine urinary tract infection (6). Drug resistance in *Salmonella* species has been well documented for both human and animal isolates (3, 7, 8). Higher rates of multiple resistance have been found in animal isolates of *Salmonella typhimurium* than in human isolates (1, 5). The resistance shown by these animal isolates of *S. krefeld* suggests that a high frequency of multiple resistance also occurs in this serotype.

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