

Antimicrobial susceptibility of clinical isolates of *Pseudomonas aeruginosa* from dogs in Grenada

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Abstract

A total of 44 isolates of *Pseudomonas aeruginosa* were recovered from various clinical conditions during the last 5 years from dogs in Grenada. The majority of isolates originated from otitis, and skin conditions including dermatitis, wounds, and abscesses. The isolates were tested for their susceptibility to 6 antibiotics using a standard disk diffusion test. Resistance was least to gentamicin (9.8%), followed by enrofloxacin (15.8%), and neomycin (41.8%). Resistance to tetracycline was 85.3%, and all isolates showed inherent resistance to amoxicillin-clavulanic acid and cephalothin.

Key words: *Pseudomonas aeruginosa*, dogs, clinical, drug resistance, Grenada

Introduction

Unlike other Gram-negative bacterial pathogens, *Pseudomonas aeruginosa* is intrinsically insensitive to many antimicrobial drugs due to the low rate of passage of antibiotics across its outer membrane¹. Though antipseudomonal drugs, such as amikacin, gentamicin, and carbenicillin, are used against infections caused by this organism, comparatively less expensive drugs, such as tetracycline, do have application in veterinary medicine². Monitoring of drug susceptibility trends may help to determine the possible use of a drug or a group of drugs in a specific animal species³. Though individual antibiograms are necessary for successful therapy, knowledge of general susceptibility patterns may be helpful in certain situations. Lack of response of a Gram-negative bacterial infection to drugs such as amoxicillin clavulanic acid and trimethoprim-sulfa may sometimes indicate possible *Pseudomonas* infection. Empirical therapy may be required when culture and sensitivity tests are not done or not feasible.

There have been no published surveys on antibiotic susceptibilities of *P. aeruginosa* strains associated with clinical diseases in dogs in Grenada. For this reason, we conducted a retrospective study of all consecutive isolates of *P. aeruginosa* from clinical cases in dogs during the last 5 years by reviewing the reports of the Bacteriology Diagnostic Laboratory of the School of Veterinary Medicine, St. George's University (SGU), Grenada, which receives specimens for routine culture

and sensitivity testing from the clinics in Grenada, including the SGU Small Animal Hospital.

Materials and Methods

Clinical specimens were cultured aerobically on blood agar (Columbia agar with 5% sheep blood, Remel, Lennexa, KS, USA) and MacConkey agar (Remel) at 37°C. Isolates of *Pseudomonas aeruginosa* were identified by the methods described by Quinn *et al.*⁴. Antimicrobial susceptibility testing was performed on Mueller-Hinton agar (Remel) by the Kirby-Bauer disk diffusion method as outlined by Quinn *et al.*⁴. The disks used were: amoxicillin-clavulanic acid, cephalothin, enrofloxacin, gentamicin, neomycin, and tetracycline. The zone-sizes were interpreted according to the criteria set by the National Committee for Clinical Standards (NCCLS) for bacteria isolated from animals⁵. An *E. coli* strain ATCC 25922 (American Type Culture Collection), susceptible to all drugs was used as a control. For the purpose of analysis, intermediate susceptibility was also regarded as susceptible.

Results

Of a total of 44 clinical samples from dogs, 21 (47.7%) were from cases of otitis externa, 10 (22.7%) from cases of dermatitis, wounds and abscesses, 8 (18.2%) from urine samples, 3 (6.8%) from uterine or vaginal swabs,

and 1 (2.2%) each from an eye swab, and diarrhoeic faeces.

Among 6 antibiotics tested against, resistance was least to gentamicin (<10.0%) followed by enrofloxacin (15.8%) (Table 1). Inherent resistance (100.0%) to

cephalothin and amoxicillin-calvulanic acid was evident in all isolates. Most isolates (>85.0%) were resistant to tetracycline. Two isolates had simultaneous resistance to gentamicin and enrofloxacin; one was recovered from a wound infection, and the other from a case of dermatitis.

Table 1. Antibiotic resistance of clinical isolates of *Pseudomonas aeruginosa* from dogs in Grenada

Drug	No. Tested	No. (%) Resistant	P-R segment
Gentamicin	41	4 (9.8)	153-164
Enrofloxacin	19	3 (15.8)	160 153
Neomycin	24	10 (41.8)	47 65
Tetracycline	34	29 (85.3)	
Cephalothin	37	37 (100.0)	
Amoxicillin-clavulanic acid	36	36 (100.0)	

Discussion

Infections caused by *P. aeruginosa* in dogs include otitis externa, deep pyoderma, wound infections, urinary tract infections, and corneal ulcers. This environmentally stable organism can acquire multidrug resistance including resistance to quinolones more rapidly than other bacteria in the hospital surroundings⁶. Gentamicin and enrofloxacin are two popular drugs in small animal practice, with results in infections of the urinary tract, skin and soft tissue, and ear infections^{7,8}. The appearance of strains resistant to both gentamicin and enrofloxacin is of some concern. Alternate antipseudomonal drugs available include amikacin, tobramycin, and carbenicillin. *P. aeruginosa* strains are inherently resistant to first and second generation cephalosporins such as cephalexin, cefoxitin, respectively. Resistance to cephalothin, the class representative indicates resistance to all first generation cephalosporins⁹. Ceftazidime, a third generation/group 6 antipseudomonal parenteral cephalosporin, can be used in dogs with multidrug resistant *P. aeruginosa* strains. Resistance to ceftazidime is rare in *P. aeruginosa*¹⁰. Although a great majority of our isolates were resistant to tetracycline, systemic administration of this drug results in very high concentrations in the urine; therefore this drug may still be efficacious in treating urinary infections caused by *P. aeruginosa*².

In summary, our results show that gentamicin is still very effective against *P. aeruginosa* strains of canine origin in this geographic area. Enrofloxacin has application

in some cases of otitis, and urinary infections in dogs, because concentrations of the drug much higher than the serum levels can be achieved in these sites; interpretation of the disk diffusion assay being based on serum levels⁴.

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