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CDC HEALTH ADVISORY

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Antimicrobial Susceptibility of Bacillus anthracis Isolates Associated with Intentional Distribution in Florida, New Jersey, New York, Pennsylvania, Virginia, and Washington, D.C., September - October, 2001

The antimicrobial susceptibility patterns of eleven *Bacillus anthracis* isolates associated with intentional exposures on the east coast have been determined. The susceptibility patterns of all the isolates were similar and are described below. CDC will be issuing updated treatment recommendations for anthrax and will disseminate them as soon as they are completed.

Ciprofloxacin ≤0.06 g/ml (susceptible)

Tetracycline = 0.06 g/ml (susceptible)

Doxycycline = 0.03 g/ml (susceptible)

Penicillin ≤0.06 g/ml - 0.12ug/ml (susceptible but see below)

Amoxicillin ≤ 0.03 g/ml (susceptible but see below)

Erythromycin = 1 g/ml (intermediate)

Azithromycin =2 g/ml (borderline susceptible)

Clarithromycin =0.25 g/ml (susceptible)

Rifampin = 0.5 g/ml (susceptible)

Clindamycin ≤0.5 g/ml (susceptible)

Vancomycin = 1-2 g/ml (susceptible)

Chloramphenicol = 4 g/ml (susceptible)

Ceftriaxone = 16 -32 g/ml (intermediate or resistant)

The penicillin MICs were ≤0.06 to 0.12 g/ml, which, using the NCCLS staphylococcal breakpoint for penicillin, would be considered susceptible (resistance is defined as ≥0.25 g/ml).

All of the *B. anthracis* isolates were also susceptible to ciprofloxacin (MIC≤ 0.06 g/ml), chloramphenicol (MIC = 4 g/ml), tetracycline (MIC=0.06 g/ml), doxycycline (MIC=0.06 g/ml), rifampin (MIC≤0.5 g/ml), and vancomycin (MIC 1-2 g/ml).

Although there are no amoxicillin breakpoints defined for staphylococci by NCCLS, the amoxicillin results (MIC ≤0.03 g/ml) were considered susceptible for *B. anthracis*. However, the erythromycin MICs of all eleven strains of *B. anthracis* would be categorized as intermediate (MIC= 1 g/ml). The MICs to clarithromycin (MIC=0.25 g/ml) and azithromycin (MIC=2 g/ml) are susceptible (but azithromycin MICs are at the susceptible breakpoint). Using the NCCLS ceftriaxone breakpoints designated for gram-negative organisms (since there are no breakpoints specifically for ceftriaxone for staphylococci) all isolates would be considered as intermediate (MIC =16 ug/ml) or resistant (MIC=32 g/ml). These MICs suggest the presence of a cephalosporinase in the isolates. Additional studies are in progress to define the beta-lactamases of *B. anthracis*.

Conclusions

The current *B. anthracis* strains associated with the intentional exposures are susceptible to ciprofloxacin and doxycycline, the two drugs approved for post-exposure prophylaxis to *B. anthracis* and recommended as part of initial therapy of inhalational or cutaneous anthrax.

The current strains also are susceptible to chloramphenicol, clindamycin, rifampin, vancomycin, and clarithromycin, but limited or no data exists regarding the use of these agents in the treatment or prophylaxis of *B. anthracis* infections.

Cephalosporins should not be used for post-exposure prophylaxis or treatment of *B. anthracis*infections.

The likelihood of a beta-lactamase induction event that would increase penicillin MICs is significantly higher in infections where high concentrations of organisms are present. Thus, treatment of known *B. anthracis* infections with a penicillin type drug alone (i.e., penicillin G, ampicillin, etc.) in the setting where high concentrations of organisms are present is a concern.

The likelihood of a beta-lactamase induction event that would increase penicillin MICs is lower when only small numbers of vegetative cells are present, such as during post exposure prophylaxis. Thus, amoxicillin or penicillin VK may be an option for post-exposure prophylaxis where ciprofloxacin or doxycycline are contraindicated.

Additional studies are in progress to assess the susceptibility of the penicillinase activity observed in these strains to beta-lactamase inhibitors.

Clinical experience is limited, but combination therapy with two or more antimicrobials may be appropriate in patients with severe infection.