

Importance of Antimicrobial Susceptibility Testing of *Streptococcus pneumoniae*

MARTHA TARPAY

Department of Pediatrics, Oklahoma Children's Memorial Hospital, University of Oklahoma Health Sciences Center, Oklahoma City, Oklahoma 73190

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Six of 36 strains of *Streptococcus pneumoniae* isolated in our laboratory during 1977 showed relative resistance to penicillin G. This level of resistance was detectable only by the broth dilution method. Using the disk diffusion method, all six strains appeared susceptible (zone size > 29 mm).

Streptococcus pneumoniae has been regarded as an organism uniformly susceptible to penicillin G. In 1967 the first *S. pneumoniae* strain with relative resistance to penicillin was isolated (5). Relative resistance is defined as a minimal inhibitory concentration between 0.1 and 2.0 µg/ml (8). Surveillance studies of different populations from New Guinea and Australia showed the presence of similar strains both in healthy carriers and in patients with *S. pneumoniae* infection (7, 8). Similar strains have only occasionally been isolated in the United States (9, 10).

We report the frequent occurrence of a relatively resistant strain of *S. pneumoniae* in our clinical isolates. Strains of *S. pneumoniae* were identified by typical colony morphology and alpha hemolysis. All strains showed uniform susceptibility to Optochin (ethylhydrocupreine hydrochloride) and remained bile soluble. Antibiotic susceptibility testing was performed by the disk diffusion technique, using a 10-U penicillin G disk on Mueller-Hinton agar with 5% sheep blood. Minimal bactericidal concentration was routinely determined by the recommended technique (2). Serotyping of the strains was not routinely performed in our laboratory, but five of the six strains found relatively resistant in our laboratory were sent to the Center for Disease Control for typing and independent testing of susceptibility. Data on the six strains of *S. pneumoniae* which exhibited resistance to penicillin G are summarized in Table 1.

The six strains with relative resistance were recovered from young infants 4 to 18 months of age, who were not related, did not attend nursery school, and lived in different parts of Oklahoma. Two of the patients had meningitis. One of them died, and the other had a protracted febrile course. In the first case, delay in the diagnosis and treatment was probably the major factor in the patient's demise. The protracted course of

the second patient with meningitis could possibly be related to the relative resistance of the isolated strain. Three other patients had bacteremia, and one other had otitis media; all had uneventful recoveries with penicillin therapy.

During 1975 and 1976, all strains of *S. pneumoniae* isolated in our laboratory required ≤0.04 µg of penicillin per ml for inhibition of growth. In 1977, the six strains (of 36 tested) were inhibited by 0.2 to 0.39 µg/ml, which is within the range of relative resistance. Five of these six strains were tested for antibiotic susceptibility by the Center for Disease Control, and their findings confirmed our results. The minimal bactericidal concentration was equal to the minimal inhibitory concentration in each of the six strains.

The relative resistances of the six strains of *S. pneumoniae* were detected by the microdilution method, but not by the standard disk diffusion test.

The criterion for penicillin susceptibility is a zone size of >29 mm. All of our six strains were penicillin susceptible according to this criterion, with zones of inhibition ranging from 30.5 to 35 mm.

For the last few months we have analyzed the zones of inhibition of *S. pneumoniae* by penicillin and have found a trend of differences between susceptible and relatively resistant strains (confirmed by minimal inhibitory concentration results). With the penicillin-susceptible strains of *S. pneumoniae* there usually is a zone inhibition of >40 mm. None of the relative resistant strains had a zone size of >35 mm.

This finding should be confirmed by testing a larger number of isolates. At the present time, routine antimicrobial susceptibility testing of *S. pneumoniae* is not recommended because the organism is regarded as uniformly susceptible to penicillin. Hospitals performing susceptibility testing at the present time use the disk diffusion

TABLE 1. Six relatively resistant clinical isolates of *S. pneumoniae*

| Date of isolation | Patient | | Clinical diagnosis | Source of isolate | Serotype ^a | Antibiotic susceptibility | |
|-------------------|----------|----------|--------------------|---------------------|-----------------------|---|---|
| | Initials | Age (mo) | | | | Disk diffusion method ^b (mm) | Minimal inhibitory concn ^c (µg/ml) |
| 1/17/77 | DH | 4 | Pneumonia | Blood | ND | 29 | 0.2 |
| 4/14/77 | VM | 14 | Meningitis | Cerebrospinal fluid | 14 | 32 | 0.2 |
| 9/29/77 | CL | 14 | Pneumonia | Blood | NT | 35 | 0.39 |
| 11/20/77 | SK | 8 | Otitis media | Blood | 14 | 34 | 0.39 |
| 11/21/77 | TG | 6 | Meningitis | Cerebrospinal fluid | 14 | 30.5 | 0.39 |
| 12/ 3/77 | EH | 18 | Otitis media | Middle ear | 14 | 31 | 0.39 |

^a NT, Nontypable; ND, not done.

^b Zone of inhibition; susceptible strain has a zone size of >29 mm.

^c Broth dilution method.

technique with a 10-U penicillin disk. In view of recent reports of resistant strains of *S. pneumoniae* (1, 3) and our recent findings of increasing numbers of strains with relative resistance, along with similar reports from Australia (4), we suggest routine susceptibility testing of all *S. pneumoniae* isolated from clinical specimens.

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