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Streptococcus Pneumoniae Susceptibility from 1995-2001: Results of the Antimicrobial Resistance Management (ARM) Program

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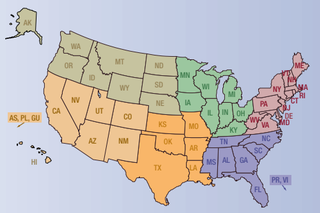
What is the Antimicrobial Resistance Management (ARM) Program?

PURPOSE

- The Antimicrobial Resistance Management (ARM) Program is an ongoing study to document trends in antimicrobial susceptibility patterns in inpatient and outpatient isolates and to identify relationships between antibiotic use and resistance rates
- Hospitals can delineate if and when antimicrobial resistance occurs
  - Allows strategic intervention
  - Provides data for local, regional, national benchmarks
  - Has potential to reduce costs of antibiotics associated with inappropriate use
- A total of 135 hospitals have enrolled to date
  - 101 (74.8%) nonteaching
  - 34 (25.2%) teaching
- For the purposes of comparison, US hospitals are grouped in 6 geographic regions (see map, below)



- The number of hospitals included from each region is as follows:
  - North Central: 20 (14.8%)
  - Northeast: 35 (25.9%)
  - South Central: 15 (11.1%)
  - Southeast: 60 (44.5%)
  - Southwest: 5 (3.7%)

DATA COLLECTION

- Each hospital provides a minimum of 3 years of antibiogram or sensitivity report data
- Individual antibiotics and organisms are captured in the database
  - 46 antibiotics
  - 19 organisms
- A Web-based analysis tool allows comparisons between antibiotic use and resistance rates for any number of parameters
  - One year with another year
  - Groups of years to other groups of years
    - Hospital to hospital
    - Hospital to hospital system
    - Hospital to state
    - Within a state
    - Hospital to region
    - Hospital to national
    - State to state
    - State to region
    - State to national
    - Region to national

Abstract

PURPOSE: S pneumoniae is the leading cause of community-acquired pneumonia and pneumococcal bacteremia. Using data from the ongoing ARM program, this study examined national and regional susceptibility rates of S pneumoniae to two third-generation cephalosporins, cefotaxime and ceftriaxone, historically regarded as being therapeutically equivalent.

METHODS: The ARM program has collected nearly 15 million inpatient and outpatient isolates from 121 hospitals in 5 US regions: North Central, Northeast, South Central, Southeast, Southwest. Antibiograms and sensitivity reports of pneumococcal isolates collected from 1995-2001 were reviewed for susceptibility to cefotaxime and ceftriaxone and compared using a Web-based analysis tool.

RESULTS: From 1995-2001 nationally, S pneumoniae isolates were more susceptible to ceftriaxone (80.9%, n=16,944) than to cefotaxime (71.7%, n=4336). This difference was accounted for primarily in the Southeast (cefotaxime, 65%; ceftriaxone, 77.7%). Rates were consistently lower for cefotaxime for each of the years reviewed. In 1995, susceptibility was 54.7% (n=347), compared with 75.2% (n=997) for ceftriaxone; and, for 2001, 73.6% (n=338) compared with 82.3% (n=499) for ceftriaxone. Regionally, this trend was seen in all areas except in Northeast, where rates were comparable, with the exception of 2001: susceptibility to cefotaxime was 70.2% (n=212), compared with 80.7% for ceftriaxone (n=285).

CONCLUSIONS: These data suggest that cefotaxime and ceftriaxone may not be therapeutically equivalent for the treatment of S pneumoniae. Given the recent change in recommended breakpoints for these two third-generation cephalosporins, this information may have clinical relevance.

Background

- Community-acquired pneumonia and pneumococcal bacteremia are most often caused by *S pneumoniae*, which is also the leading cause of death from infectious diseases[1]
- For the empiric treatment of adults with community-acquired pneumonia, cefotaxime and ceftriaxone are generally regarded as therapeutically equivalent, especially if drug-resistant *S pneumoniae* (DRSP) is suspected
- However, nonsusceptibility among *S pneumoniae* isolates to the fluoroquinolone levofloxacin and the subsequent reduced susceptibility to cefotaxime, as well as the recent change in recommended breakpoints for cefotaxime and ceftriaxone, suggest these agents should be used more selectively

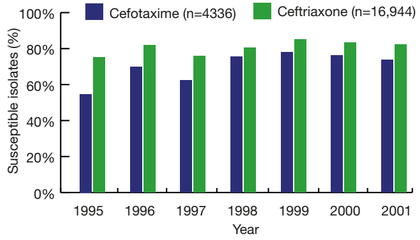
Methods

- Antibiograms and sensitivity reports for *S pneumoniae* isolates in the ARM database were examined for susceptibility to cefotaxime or ceftriaxone
- Using a Web-based analysis tool, isolates were compared nationally and regionally (Southeast, North Central, South Central, Northeast) for the years 1995 through 2001, both collectively (ie, 1995-2001 inclusive) and for each individual year

Results

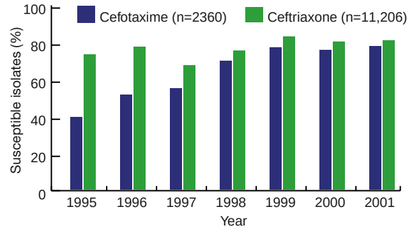
- Nationally, pneumococcal isolates collected from 1995-2001 were found to be more susceptible to ceftriaxone (80.9%) than to cefotaxime (71.7%)
- This difference was observed consistently for each year analyzed (Figure 1)

Figure 1.* S pneumoniae *susceptibility to cefotaxime and ceftriaxone, 1995-2001



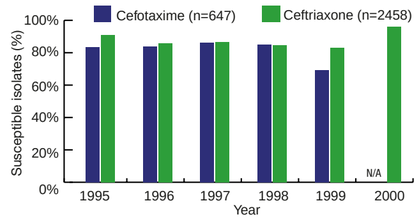
- The difference seen at the national level was attributed primarily to isolates collected from 1995-2001 in the Southeast, which showed an overall susceptibility of 65% to cefotaxime and 77.7% to ceftriaxone
- Data from the years 1995 and 1996 showed the widest range in susceptibility rates (Figure 2)

Figure 2.* S pneumoniae *susceptibility to cefotaxime and ceftriaxone in the Southeast, 1995-2001



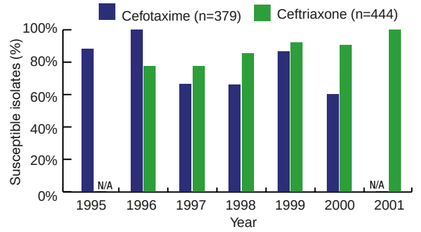
- The trend seen in the Southeast was also seen in the North Central and South Central regions (Figures 3 and 4)

Figure 3.* S pneumoniae *susceptibility to cefotaxime and ceftriaxone in the North Central region, 1995-2000*



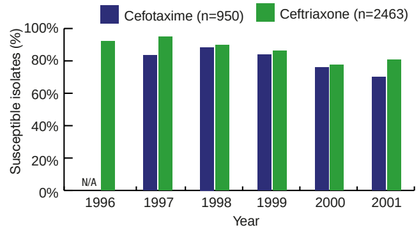
*no data collected for 2001

Figure 4.* S pneumoniae *susceptibility to cefotaxime and ceftriaxone in the South Central region, 1995-2001



- In the Northeast, susceptibility rates for cefotaxime and ceftriaxone were generally comparable, with the exception of the years 1997 and 2001 (Figure 5)

Figure 5.* S pneumoniae *susceptibility to cefotaxime and ceftriaxone in the Northeast, 1996*-2001



*no data collected for 1995

Conclusion

- National and regional differences seen in pneumococcal isolate susceptibility to cefotaxime and ceftriaxone suggest these two third-generation cephalosporins may not be therapeutically equivalent, which may have clinical implications given the currently recommended breakpoints
  - Sensitivity numbers for both agents are artificially suppressed, since they reflect old breakpoints (ie, all data are pre-2002)
  - Even with the new breakpoints, both cephalosporins are still considered microbiologically equivalent; these data suggest this might not be true
- For example, ceftriaxone may offer greater coverage for community-acquired pneumonia, especially in patients with suspected drug-resistant *S pneumoniae*

REFERENCE

1. Guidelines for the management of adults with community-acquired pneumonia. Diagnosis, assessment of severity, antimicrobial therapy, and prevention. *Am J Respir Crit Care Med.* 2001;163:1730-1754.

ACKNOWLEDGMENTS

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