Emergence of PCV13 nonvaccine-specific Streptococcus pneumoniae serogroups 15, 23, 33, and 35 isolated from children in Kansas City, Missouri

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ABSTRACT

Background: The 13-valent pneumococcal conjugate vaccine (PCV13) was licensed in February 2010 for the prevention of pneumococcal disease in children. This study examined the frequency of pneumococcal serotypes isolated from children aged 0-19 years in the Kansas City metropolitan area, with particular focus on emerging PCV13 nonvaccine-specific serogroups (e.g., serogroups 15, 23, 33, and 35). METHODS: Specimens were collected from children enrolled in 2010 and 2015 in an active surveillance system in the Kansas City metropolitan area (KCMO). Independent laboratories participating in the surveillance study analyzed all isolates by serogroup using capsular swelling tests and PCR. RESULTS: Invasive pneumococcal disease cases were studied from February 2010 to February 2015. A total of 3061 invasive disease cases were reviewed. The non-vaccine-specific serogroup 15 was the most common serotype, followed by serogroups 23, 35, 25, 33, and 31. CONCLUSIONS: Surveillance efforts are important for monitoring the emergence of non-vaccine-related serotypes to ensure the development of future pneumococcal vaccines.

BACKGROUND

- Streptococcus pneumoniae is a common cause of invasive bacterial infections such as meningitis, bacteremia, and pneumonia in children. It is also an important etiology of local respiratory tract infections, such as acute otitis media and sinusitis.
- The heptavalent pneumococcal conjugate vaccine (PCV7), licensed in the USA in Feb 2000, and PCV13 licensed in Feb 2010, have resulted in decreased rates of pneumococcal invasive disease in children. However, nonvaccine serotypes have emerged.

OBJECTIVES

- Examine the frequency of pneumococcal serotypes isolated from patients at Children’s Mercy Hospital, a 554-bed tertiary care pediatric medical center in Kansas City, Missouri.
- Identify possible temporal changes in vaccine distribution or antibiotic susceptibility patterns.

METHODS

- Active pneumococcal surveillance was conducted at Children’s Mercy Hospital in Kansas City, MO from 2010 through 2015.
- All pneumococcal isolates from clinical specimens were serogrouped by the Quellung capsule swelling reaction and specific antisera (Statens Serum Institut, Denmark).
- Medical records of all patients were reviewed and demographic, clinical, and laboratory data were abstracted.

DEFINITIONS

- IPD (invasive pneumococcal disease): isolation of S. pneumoniae from a normally sterile site, including middle ear fluid, unabsorbed fluids.
- PCV13 serotypes: 1, 3, 5, 7F, 9V, 14, 18C, 19A, 19F, and 23F.
- Penicillin-resistant S. pneumoniae (PRSP).

RESULTS

- 415 pneumococcal clinical isolates were evaluated.
- 116 (28%) invasive isolates and 358 (72%) non-invasive isolates.
- Most common serogroups/serotypes identified (Table 1):
  - Non-PCV13 serogroup 15 (15%), 23 (15%), 25 (13%), and 35 (8%).
  - PCV13 serotypes: 3 (3%), 19A (3%), and 19F (3%).
  - Serogroup 19A cases decreased from 21 isolates (13% of the total isolate) in 2010 to 3 isolates in 2015.
  - Serogroup 19F cases increased from 5 (3%) in 2011 to 12 (10%) in 2015.
- Overall, 62% of nonvaccine isolates and 70% of invasive disease isolates were non-PCV13 serotypes.
- Serogroup/serotypes 15, 23, 19A, and 31 often had decreased penicillin susceptibility (Table 2).
- Invasive pneumococcal disease was much less likely to occur in the 2nd quartile compared to other yearly quartiles (p<0.05).

CONCLUSIONS

- PCV13 nonvaccine-specific Streptococcus pneumoniae serogroups/serotypes cause a considerable burden of infections in children from the Kansas City area.
- Penicillin-non-susceptible IPD is less of a concern with the decline in 13A-related IPD cases.
- IPD due to 19F strains appears to be on the rise, even in children vaccinated with all 3 primary doses of pneumococcal conjugate vaccine.
- Continued surveillance of pneumococcal serotype distribution is important to guide the development of future pneumococcal vaccines.