Pneumococcal Disease and Pneumococcal Vaccines

Epidemiology and Prevention of Vaccine-Preventable Diseases
National Immunization Program
Centers for Disease Control and Prevention
Revised January 2006

Note to presenters:
Images of vaccine-preventable diseases are available from the Immunization Action Coalition website at http://www.vaccineinformation.org/photos/index.asp

Pneumococcal Disease
• *S. pneumoniae* first isolated by Pasteur in 1881
• Confused with other causes of pneumonia until discovery of Gram stain in 1884
• More than 80 serotypes described by 1940
• First U.S. vaccine in 1977

Pneumococcal Disease Clinical Syndromes
• Pneumonia
• Bacteremia
• Meningitis

Streptococcus pneumoniae
• Gram-positive bacteria
• 90 known serotypes
• Polysaccharide capsule important virulence factor
• Type-specific antibody is protective

Pneumococcal Pneumonia Clinical Features
• Abrupt onset
• Fever
• Shaking chills
• Pleuritic chest pain
• Productive cough
• Dyspnea, tachypnea, hypoxia
**Pneumococcal Pneumonia**
- Estimated 175,000 hospitalizations per year in the United States
- Up to 36% of adult community-acquired pneumonia and 50% of hospital-acquired pneumonia
- Common bacterial complication of influenza and measles
- Case-fatality rate 5%-7%, higher in elderly

**Pneumococcal Bacteremia**
- More than 50,000 cases per year in the United States
- Rates higher among elderly and very young infants
- Case-fatality rate ~20%; up to 60% among the elderly

**Pneumococcal Meningitis**
- Estimated 3,000 - 6,000 cases per year in the United States
- Case-fatality rate ~30%, up to 80% in the elderly
- Neurologic sequelae common among survivors

**Pneumococcal Disease in Children**
- Bacteremia without known site of infection most common clinical presentation
- S. pneumoniae leading cause of bacterial meningitis among children <5 years of age
- Common cause of acute otitis media

**Burden of Pneumococcal Disease in Children**

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacteremia</td>
<td>13,000</td>
</tr>
<tr>
<td>Meningitis</td>
<td>700</td>
</tr>
<tr>
<td>Death</td>
<td>200</td>
</tr>
<tr>
<td>Otitis media</td>
<td>5,000,000</td>
</tr>
</tbody>
</table>

*Prior to routine use of pneumococcal conjugate vaccine

**Children at Increased Risk of Invasive Pneumococcal Disease**
- Functional or anatomic asplenia, especially sickle cell disease
- HIV infection
- Alaska Native, African American, American Indian
- Child care attendance
**Pneumococcal Disease Epidemiology**

- **Reservoir** Human carriers
- **Transmission** Respiratory Autoinoculation
- **Temporal pattern** Winter and early spring
- **Communicability** Unknown Probably as long as organism in respiratory secretions

**Invasive Pneumococcal Disease Incidence by Age Group—1998**

*Rate per 100,000 population
Source: Active Bacterial Core surveillance/EIP Network

**Invasive Pneumococcal Disease by Age and Year—Children <5 Years, 1998-2003**

*2003 data are preliminary.
Source: Active Bacterial Core Surveillance/EIP Network

**Pneumococcal Disease Outbreaks**

- Outbreaks not common
- Generally occur in crowded environments (jails, nursing homes)
- Persons with invasive disease often have underlying illness
- May have high fatality rate

**Pneumococcal Vaccines**

- **1977** 14-valent polysaccharide vaccine licensed
- **1983** 23-valent polysaccharide vaccine licensed (PPV23)
- **2000** 7-valent polysaccharide conjugate vaccine licensed (PCV7)

**Pneumococcal Polysaccharide Vaccine**

- Purified capsular polysaccharide antigen from 23 types of pneumococcus
- Account for 88% of bacteremic pneumococcal disease
- Cross-react with types causing additional 8% of disease
**Pneumococcal Conjugate Vaccine**

- Pneumococcal polysaccharide conjugated to nontoxic diphtheria toxin (7 serotypes)
- Vaccine serotypes account for 86% of bacteremia and 83% of meningitis among children <6 years of age

**Pneumococcal Polysaccharide Vaccine**

- Purified pneumococcal polysaccharide (23 types)
- Not effective in children <2 years
- 60%-70% against invasive disease
- Less effective in preventing pneumococcal pneumonia

**Pneumococcal Conjugate Vaccine**

- Highly immunogenic in infants and young children, including those with high-risk medical conditions
- >90% effective against invasive disease
- Less effective against pneumonia and acute otitis media

**Pneumococcal Polysaccharide Vaccine Recommendations**

- Adults ≥65 years of age
- Persons ≥2 years with
  - chronic illness
  - anatomic or functional asplenia
  - immunocompromised (disease, chemotherapy, steroids)
  - HIV infection
  - environments or settings with increased risk

**Pneumococcal Conjugate Vaccine**

- Routine vaccination of children age <24 months and children 24-59 months with a high-risk medical condition
- Doses at 2, 4, 6, months of age, booster dose at 12-15 months of age
- Unvaccinated children >7 months of age require fewer doses

**Pneumococcal Conjugate Vaccine**

- Children aged 24-59 months at high risk and previously vaccinated with PPV23 should receive 2 doses of PCV7
- Children at high risk who previously received PCV7 should receive PPV23 at age ≥2 years
**Pneumococcal Polysaccharide Vaccine Revaccination**

- Routine revaccination of immunocompetent persons is not recommended
- Revaccination recommended for persons age ≥2 years at highest risk of serious pneumococcal infection
- Single revaccination dose ≥5 years after first dose

**Pneumococcal Polysaccharide Vaccine Candidates for Revaccination**

- Persons ≥2 years of age with:
  - functional or anatomic asplenia
  - immunosuppression
  - transplant
  - chronic renal failure
  - nephrotic syndrome
- Persons vaccinated at <65 years of age

**Pneumococcal Vaccines Adverse Reactions**

- Local reactions
  - polysaccharide 30%-50%
  - conjugate 10%-20%
- Fever, myalgia
  - polysaccharide <1%
  - conjugate 15%-24%
- Severe adverse reactions rare

**Pneumococcal Vaccines Contraindications and Precautions**

- Severe allergic reaction to vaccine component or following prior dose of vaccine
- Moderate or severe acute illness

**Pneumococcal Polysaccharide Vaccine Coverage**

- Healthy People 2010 goal: 90% coverage for persons ≥65 years
- 2003 BRFSS: 64% of persons ≥65 years of age ever vaccinated
- Vaccination coverage levels were lower among persons 18-64 years of age with a chronic illness

**Pneumococcal Polysaccharide Vaccine Missed Opportunities**

- >65% of patients with severe pneumococcal disease had been hospitalized within preceding 3-5 years yet few had received vaccine
- May be administered simultaneously with influenza vaccine
National Immunization Program
Contact Information

• Telephone 800.CDC.INFO
• Email nipinfo@cdc.gov
• Website www.cdc.gov/nip