

PNEUMOCOCCAL DISEASE

INTRODUCTION

Pneumococcal disease is a bacterial infection caused by *Streptococcus pneumoniae* also known as pneumococcus. It is a leading killer of both children and adults around the globe.

Pneumococcus is generally found in the upper respiratory tract of healthy infants and adults. The bacteria are usually spread person-to-person by the respiratory route, though an infection can migrate through the bloodstream causing distal secondary infections. If bacteria are present in a part of the body that is normally sterile, such as the blood or cerebrospinal fluid, it is called invasive pneumococcal disease (IPD).

Non-invasive pneumococcal infections, such as acute otitis media (middle ear infection), sinusitis, and certain pneumonias are more common than IPD clinical syndromes like bacteremia, pneumonia, and meningitis. However, clinical syndromes of invasive pneumococcal disease are more serious than non-invasive infections and require more attention and resources to treat. Bacteremia, the presence of viable bacteria in the bloodstream, can cause a life-threatening reaction known as severe sepsis as well as spread the infection to other parts of the body. The most serious IPD clinical syndrome is meningitis, an infection of the membranes protecting the brain and spinal cord also known as meninges. Pneumonia, an infection of the lungs, is the most common IPD clinical syndrome and responsible for the most vaccine-preventable deaths in the world.

Although pneumococcal disease kills more children than AIDS, malaria and measles combined, it is under-diagnosed. Part of the problem in identifying pneumococcus is the complexity and costs of lab tests as well as the inappropriate use of antibiotics.

In addition to masking pneumococcus as the source of an infection, inappropriate antibiotic use is leading to rising antibiotic resistance. Increased antibiotic resistance is a major concern because antibiotics are the mainstay of pneumococcal disease treatment.

Fortunately, vaccines exist that are safe and effective at preventing pneumococcal infections, even in young children. The current pneumococcal polysaccharide vaccine (PPV) is currently effective against 23 different serotypes. PPV is effective for the elderly but does not elicit enough

of an immune response in young children to impart protection. The immune systems of young children, however, do respond well to a pneumococcal conjugate vaccine (PCV), including HIV-infected children. The current PCV is PCV-7, a heptavalent vaccine that covers 7 serotypes and is safe and effective.

DISEASE OVERVIEW

Risks

- Ethnicity
- Crowding
- Family size
- Smoking exposure
- Recent antibiotic use
- Children under 2 years of age
- Persons over 65 years old
- HIV positive persons
- Those who are malnourished
- Those with sickle cell anemia
- Asplenia, a lack of a spleen, usually resulting from sickle cell disease

Symptoms

Invasive Pneumococcal Disease can range from a mild, usually transient, occult bacteremia without a focus of infection to a severe disease with a focus of infection such as pneumonia or meningitis or full-blown clinical sepsis with cardiovascular compromise.

- Pneumonia

Pneumonia

- Nonspecific fever
- Nonspecific cough
- Increased respiratory rate
- Difficulty breathing

Severe Pneumonia, along with cough or difficulty breathing

- Lower chest wall indrawing
- Nasal flaring
- Grunting in young infants

Very Severe Pneumonia

- Central cyanosis, a blue or purple hue of the central portion of the body (e.g. head, lips, mouth, and torso) associated with poor oxygenation of the blood
- Inability to breastfeed or drink
- Vomiting all food intake
- Convulsions, lethargy or unconsciousness
- Severe respiratory distress

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- Meningitis
 - Stiff neck
 - Repeated convulsions
 - Fever
 - Sleepiness/depressed level of consciousness
 - Confusion/delirium
 - Severe headache
 - History of vomiting, inability to drink or breastfeed
 - In infants, a tense or bulging fontanelle
- Bacteremia
 - Fever
 - Lethargy or irritability
 - No focal signs of infection
 - Pallor, mottling of skin
 - Cold hands or feet
 - Delayed capillary refill time
 - Tachycardia or hypotension (if severe)
- Otitis Media and Sinusitis
 - Ear pain
 - Fussiness
 - Fever
 - Pus draining from ear

Transmission

- Pneumococcus is spread by contact with respiratory droplets containing the bacteria
- Sometimes pneumococcus spreads via the respiratory tract to cause primary infections such as otitis media, sinusitis and pneumonia
- Pneumococcus may also spread via the blood to cause a distal secondary infection
- Any person carrying the pneumococcus in their nasopharynx and some persons with disease (such as pneumonia who can cough up secretions containing bacteria) can spread the bacteria to others
- Not everyone exposed to contaminated respiratory droplets will develop disease
- Some persons exposed will become carriers of the pneumococcus, and a subset of these persons will progress from nasopharyngeal (NP) colonization to disease manifestation

Treatment

- Antibiotics are the primary course of treatment for pneumococcal disease
- Inappropriate antibiotic use has led to an increase in

- antibiotic-resistant pneumococcal strains
- The antibiotic used depends on:
 - Clinical syndrome (site of infection)
 - Age of the patient
 - Local resistance patterns
- Antibiotics can be administered orally or by an injection, depending on the illness
- Antibiotics may be administered for 3 to 10 days, or even longer in some cases
- Prevention of pneumococcal disease is the best option and include: adequate nutrition, zinc, and immunization

DISEASE BURDEN

Prevalence

- Pneumococcal disease is the leading killer of children and adults around the globe
- Over 50% of children under 3 years old are nasopharyngeal (NP) carriers of pneumococcus
- Pneumococcal disease is under-diagnosed and morbidity is under-estimated
- The number of invasive pneumococcal disease cases involving meningitis is about 2-fold higher among young children compared to older children and adults in Asia and Africa
- Pneumonia is the most common serious clinical syndrome of pneumococcal disease
- Pneumococcal pneumonia is more frequent than can be confirmed by positive blood cultures
- 37-39% of all pneumonia cases in children are caused by pneumococcus
- 25-45% of pneumonia deaths in children are attributed to pneumococcus
- 30-50% of all cases of otitis media are attributed to the pneumococcus

Disease Impact

- An estimated 1.6 million people die annually from the disease worldwide including more than 800,000 children under age five
- 85% of child pneumonia deaths occur in Africa and Southeast Asia
- In Latin America alone, pneumococcal disease costs US\$333 million or an average of US\$28 per child born, while other regions like Africa and Southeast Asia have an even larger burden
- Pneumococcal disease incurs direct and indirect medical costs and leads to lost productivity

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EFFORTS AT CONTROL

Preventing pneumococcal disease is the best strategy for reducing its disease burden. Although current vaccines are effective, the pneumococcal conjugate vaccine (PCV) is expensive and somewhat limited in its regional applicability. As newer vaccines make their way through the development pipeline covering more serotypes, they will have a greater impact on pneumococcal disease in the developing world.

In an effort to raise awareness of pneumococcal disease, the Sabin Vaccine Institute launched the Pneumococcal Awareness Council of Experts (PACE) in 2006. PACE works through government and media outreach in an effort to educate policymakers and the general public about pneumococcal disease and the need for PCV introduction.

FACTS AT A GLANCE

- Pneumococcal disease ranges in severity from acute otitis media (middle ear infections) to meningitis, an infection of the membranes covering the brain and spinal cord
- An estimated 1.6 million people die annually from the disease worldwide including more than 800,000 children under age five
- Pneumonia is the most common serious clinical syndrome of invasive pneumococcal disease
- Pneumococcus is only one of several bacteria that cause pneumonia, but is responsible for up to 45% of pneumonia deaths in children
- Pneumonia kills more children than AIDS, malaria, and measles combined
- Rising antibiotic resistance poses a challenge for effectively treating Invasive Pneumococcal Disease
- Immunization is the best option for preventing pneumococcal disease
- By 2030, 7 million childhood deaths could be prevented by pneumococcal conjugate vaccines

SOURCES

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US Centers for Disease Control and Prevention

World Health Organization