Knowing the *Pneumococcus*

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Respiratory infections are most prevalent during the winter months. The two major villains include the influenza virus and *Streptococcus pneumoniae*, the focus of November's **Bug of the Month**.

Streptococcus pneumoniae appears as Gram-positive diplococci in gram stained sputum and grows in chains in liquid media. While pneumonia is the invasive infection most commonly caused by pneumococcus, the bacteria can also cause:

- acute sinusitis,
- otitis media,
- meningitis,
- osteomyelitis and septic arthritis,
- peritonitis,
- endocarditis,
- pericarditis,
- cellulitis,
- brain abscess, and
- bacteremias.

S. pneumoniae is the most common cause of bacterial meningitis in adults.

What are the risk factors?

The pneumococcus possesses a polysaccharide capsule that may help it evade the hosts immune system. The populations at highest risk of developing pneumococcal infections include those with:

- suboptimal or defective antibody formation (*e.g.*, agammaglobulinemia, multiple myeloma, chronic lymphocytic leukemia, infection with HIV);
- insufficient or poorly functioning polymorphonuclear cells (*e.g.*, neutropenics, alcoholism, corticosteroid use, renal insufficiency);
- defective clearance of pneumococcal bacteremias (*e.g.*, splenic abnormalities); and
- chronic organ dysfunction (*e.g.*, renal, heart, lung, liver).

Other individuals at high risk include those in crowded conditions (*e.g.*, daycare centre attendees, military recruits, prison inmates, residents of homeless shelters). Prior respiratory infection, such as those caused by influenza and other respiratory tract viruses, can damage the respiratory mucosa, allowing *S. pneumoniae* entry into the body. Cigarette smoke and chronic obstructive pulmonary disease will predispose the patient to pneumococcal infections by altering ciliary function in the respiratory tract.

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Table 1

Indications for Pneumococcal Vaccination

- Anatomic or functional asplenia (over 2 years)
- Anyone 65 years and older
- Adults and children with chronic diseases (over 2 years):
  - lung (excluding asthma)
  - liver/cirrhosis
  - renal failure (and nephrotic syndrome)
  - diabetes mellitus
  - heart disease
  - sickle cell anemia
- Immunocompromised (over 2 years)
  - hematologic malignancy
  - AIDS/HIV
  - transplant recipients
- Alcoholics
- Chronic cerebrospinal fluid leak

What makes pneumococcus an effective pathogen?

There are multiple serotypes of the pneumococcus based on its polysaccharide capsule. Immunity against one serotype or capsule strain does not protect against infection with other serotypes, thus allowing the pneumococcus to evade the hosts' intrinsic immunity.

How is community-acquired pneumonia treated?

The best treatment is prevention of the actual infection. *S. pneumoniae* is the most frequent cause of bacterial community-acquired pneumonia. A variety of different antibiotic agents are available for the management of community-acquired pneumonia. The usual treatment for pneumococcal infections includes:

- penicillin, amoxicillin,
- the macrolides,
- the tetracyclines,
- cephalosporins, and
- quinolones.

In the 1960s, nearly all strains of *S. pneumoniae* were susceptible to penicillin. Since then, however, antibiotic resistance to penicillin is being increasingly observed in laboratory specimens. Some macrolide resistance is also being observed in laboratory isolates. The exact clinical significance of increasing antibiotic resistance rates among laboratory isolates of the pneumococci is unclear, as the in vitro testing cannot completely mimic the environment within the host.

It is important to know the epidemiology of isolates in your community, so as to select the best possible therapy. It may also be prudent to obtain sputum specimens from patients with pneumonia for pathogen identification and susceptibility profiles. It is always desirable to use the narrowest spectrum antibiotic possible, such as the ß-lactams, macrolides, and doxycycline.

An antibiotic history is critical in the management of all patients with actual or suspected community-acquired pneumonia, as it would be unwise to represcribe antibiotic agents within the same class within a three month period. The rationale for the use of different antimicrobial agents relates to the possibility of previous treatment failure based on clinically significant antimicrobial resistance.

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Who should receive the pneumococcal vaccine?

Pneumococcal vaccination may be an effective means to potentially prevent invasive pneumococcal disease. Table 1 outlines individuals who would benefit from the pneumococcal vaccine.

There are two pneumococcal vaccines derived from the most common strains of *S. pneumoniae* causing invasive disease. For adults, the vaccine consists of the capsular polysaccharides from the 23 most common strains that cause invasive disease; approximately 90% of the cases of pneumococcal bacteremia and meningitis are caused by these 23 strains. The serotype-specific antibody levels in adults decline after five to 10 years. The duration of immunity is not precisely known, however, vaccination is generally given once in a lifetime to eligible individuals. Reimmunization may be necessary in selected groups.

The vaccine for children is a pneumococcal conjugate vaccine consisting of the capsular antigens of seven of the most common *S. pneumoniae* serotypes. It is conjugated to a non-toxic mutant of diphtheria toxin. This vaccine can be given to children under 23 months, but it also recommended for those 24 to 59 months who are at higher risk of invasive pneumococcal disease. This includes those with:

- sickle cell disease,
- functional or anatomic asplenia,
- HIV infection and other immunocompromising conditions (*e.g.*, immunodeficiencies, malignancies, immunosuppressive therapy, organ transplant recipients, long-term corticosteroid recipients, nephrotic syndrome), or
- chronic medical conditions (*e.g.*, cardiac, pulmonary, diabetes).

The polysaccharide vaccine is not recommended for children under two years, as it is relatively ineffective due to the child's insufficiently developed immune system.

Please consult with health authorities in your region for the local recommendations for the various pneumococcal vaccines. CME

References available—contact the *Canadian Journal of CME* at **cme@sta.ca**.

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