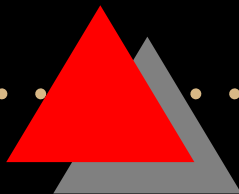


Streptococcus Pneumoniae

Vaccines, Serogroup Replacement, Carriage and Antibiotic Resistance

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S. Pneumoniae: What is it?

- Gram-positive bacteria
- Human pathogen
 - *Reservoir*: the nasopharynx of asymptomatic human carriers
 - *Transmission*: direct contact via respiratory droplets
 - *Period of transmissibility*: unknown
 - *Population at risk*: children <5 and adults 65+
 - *Period of immunity*: unknown, highest in ages 5-50 yrs then decreases
- 40 serogroups, 90+ known serotypes
 - 11+ serogroups account for invasive pneumococcal disease (IPD)



Invasive Pneumococcal Disease

Pneumococcal Bacteremia (blood infection)

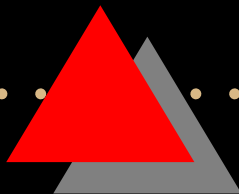
- 16,000-55,000 cases/yr
- fatality rate 20-60 percent (higher in elderly)
- at PCMC (1997-2003): 183 cases

Empyema (lung inf, pus accumulation in pleural cavity)

- at PCMC (1997-2003): 52 cases

Pneumococcal Meningitis (brain infection)

- 3,000-6,000 cases/yr
- fatality rate: 30-80 percent (higher in elderly)
- at PCMC (1997-2003): 42 cases
- *S. pneumoniae* is leading cause in children <5





IPD continued

Pneumococcal Pneumonia (lung infection)

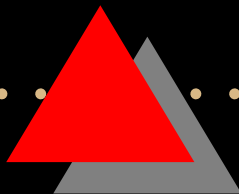
- 150,000-570,000 cases/yr
- fatality rate: 5-7 percent (1.2 million deaths/yr worldwide)
- at PCMC (1997-2003): 42 cases

Otitis Media (middle ear infections)

- 5-7 million cases/yr.
- fatality rate: very small

Other

- Peritonitis (inflammation of membrane of abdomen wall)
- Osteomyelitis/septic arthritis (inflammation in bones)
- Sinusitis (inflammation of lining of sinuses)



Vaccinations

23-Valent Polysaccharide Vaccine (PPV-23)

- 23 serotypes included
 - contains serotypes 1, 2, 3, 4, 5, 6B, 7F, 8, 9N, 9V, 10A, 11A, 12F, 14, 15B, 17F, 18C, 19F, 19A, 20, 22F, 23F, 33F
- used in people >3 yrs (polysaccharide vaccines not effective in children $<2-3$ yrs), but mostly used for people 65+
- 80-90 percent effective against IPD

7-Valent Conjugate Vaccine (PCV-7)

- 7 serotypes included
 - contains serotypes 4, 9V, 14, 19F, 23F, 18C, 6B
- used in children <3
- serotypes included account for approx 80 percent IPD (in children <6 yrs)



Serogroup Replacement: Evidence

Serogroup replacement: serogroups that were previously not major causes of IPD are "popping up" as causes after the introduction of vaccine.

- PCV-7 has been reported to decrease IPD in children, BUT...
- In Intermountain West (IMW) (UT, ID, MT, WY, portions of AZ and NV):
 - *Modest decline in IPD*
 - INCREASES in empyema (and other serious or life-threatening IPD) due to non-PCV-7 serogroups
 - *May be due to serogroup replacement (especially of serogroups 1, 3, 15)*
 - *Serotype/serogroup 1 is very invasive and is RARELY carried*
- Seems like serogroup replacement is taking place, we need to optimize vaccine selection



The Big Question...

- Q: Why does IMW, especially Utah, have different serogroup distribution than other areas?
- Things being considered:
 - IMW Age Structure (Utah's mean age is 18)
 - Household Crowding
 - Large population of Pacific Islanders (i.e. high risk people)
 - Missionaries returning from overseas
 - Competition levels of serotypes
 - Virulence factors (i.e. serotype 1 is highly virulent)
 - Transmission factors (intra- vs. inter-household)



Carriage and Antibiotic Resistance

Before we look at IPD, we need to understand CARRIAGE

- What serotypes are being most frequently carried?
- Who's carrying them?
- What's the duration of carriage?
- Antibiotic Resistance
 - Antibiotic resistant pneumococci seem to be transmitted
 - Indications that oral penicillins promote resistant carriage by clearing susceptible pneumococci
 - Indications that oral cephalosporins directly increase acquisition of resistant pneumococci

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