

Meningococcal Disease and Meningococcal Vaccines

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Meningitis

- A serious, sometimes fatal infection causing inflammation of the membranes that protect the brain and spinal cord.
 - **Bacterial**
 - comparatively rare, but far more dangerous than viral
 - abrupt onset
 - rapid course
 - can be fatal or debilitating
 - **Viral (aseptic)**
 - most common cause of meningitis
 - often resolves without treatment

Bacterial Meningitis (3 main types)

- **Meningococcal (*Neisseria meningitidis*)**
 - most common cause of bacterial meningitis
 - 5 main serogroups- A, B, C, Y and W-135
 - resides in the nose and throats of 15% of the general population
- **Pneumococcal (*Streptococcus pneumoniae*)**
 - attacks younger children
 - shown some resistance to antibiotic therapy
 - vaccine available for age 2mo.-2y. --high risk to age 5y. and >65y.
- **Hib (*Haemophilus influenzae* type b)**
 - attacks the very young
 - nearly eradicated since mid 1980s- introduction of Hib vaccine

Epidemiology

- Rates highest in infancy with second peak in adolescence
- 3000 cases/year in the US alone
- Seasonal, cases peaking November -March
- 97% of cases are sporadic
- 3% of cases are associated with outbreaks
- College freshman living in dorms are at a higher risk than a similar age population

Causative Bacteria

- Meningococci are only carried by humans in the nasopharynx-- their only reservoir
 - adolescents and young adults have the highest carriage rates
 - few carriers develop the disease
 - 20% of cases occur among adolescents and young adults
 - 16% of cases occur among infants under the age of 1 year
- Transmission occurs when close face to face contacts permits the exchange of salivary secretions
- In the US, almost all cases are caused by serogroups B, C, and Y; there is currently no vaccine that protects against B

Transmission

- The bacteria cannot live outside the body for very long, so the disease is not as easily spread as a cold virus
- Poor hygiene
- Crowded living conditions
- Direct contact with an infected person
- Kissing
- Coughing
- Sneezing
- Sharing utensils, beverages, or items that have been in one's mouth

Symptoms--can be progressive can be sudden and severe

- Flu- like symptoms
- High Fever
- Fatigue
- Nausea/Vomiting
- Severe headaches
- Neck stiffness
- Photophobia
- Altered mental status
- Seizure activity
- Development of a rash
 - purple in color on extremities
 - does not blanch
 - indicative of septicemia
 - medical emergency

Diagnosis

- Early signs and symptoms can be non-specific and similar to those of the flu or other viral infections
- Lumbar puncture
 - In CSF: decreased glucose, increased WBC's, high protein levels
 - Culture to lab to identify infectious organism, may take up to 48 hrs.

Complications

- Can occur within hours of the first symptoms:
 - septic shock
 - acute tubular necrosis leading to kidney damage
 - brain damage
 - deafness
 - limb amputation
 - death

Treatment

- Immediate and aggressive
 - essential to reduce risk of death
 - does not guarantee a full recovery
- Antibiotic therapy -- penicillin family
- Steroid therapy may be necessary to reduce irritation of meninges
- Antibiotic therapy to those in close contact

Who is at Risk?

- The following populations are considered high risk for meningococcal (neisseria) meningitis:
 - college freshmen living in dorms
 - microbiologists who are frequently exposed
 - military recruits
 - persons with anatomic or functional asplenia
 - persons who travel or reside in countries where N. meningitis is epidemic, especially those with prolonged contact with the local population. Sub-Saharan Africa is known as the “meningitis-belt”
 - refugees
 - household contacts of case patients
 - people exposed to active and passive cigarette smoke

Prevention: Menomune

- **Meningococcal polysaccharide vaccine (MPSV4) -less frequently used**
 - licensed in 1981
 - good short protection (3-5yrs.) in older children and adults
 - covers serogroups A, C, Y, and W-135
 - revaccination every 3-5 yrs. for high risk population
 - revaccination of serogroup A and C may cause hyporesponsiveness
 - not protective in children under 2yrs.
 - antibody levels decrease rapidly in 2-3 yrs.
 - given SQ as a single dose

Prevention: Menactra

■ Meningococcal conjugate vaccine (MCV4)

- licensed in the US in Jan. 2005 for persons 11-55 yrs.
 - Covers serogroup A,C, Y, and W-135
 - it is likely that this or a similar vaccine will be licensed for younger age groups in the future
 - a decrease carriage rate is also expected
- need for revaccination not yet known
- longer duration of protection and similar efficacy as compared to MPSV4
- given IM as a single dose

Similarities of Menomune and Menactra

- Adverse reactions:
 - mild injection site pain
 - brief fever noted in 5% of the population
 - severe reaction $<.01 / 100,000$
- Inactivated vaccines, may be administered to persons who are immunosuppressed due to illness or medications
- Can be administered concomitantly with other vaccines
- Protective levels of antibodies reached within 7-10 days
- Manufactured by Sanofi Pasteur Inc, Swiftwater, PA

CDC Recommendation

- The Advisory Committee on Immunization Practices (ACIP) which advises the CDC on national vaccination policy met on Feb. 10, 2005 and developed new recommendations calling for routine meningococcal meningitis immunization at the pre-adolescent visit (11-12 yr.), adolescents at high school level entry and college freshman living in dormitories.

Other Recommendations

- The American College Health Association (ACHA), the American Academy of Pediatrics (AAP) and the American Academy of Family Physicians (AAFP), guided by the CDC, are in the process of adopting similar recommendations.

Pennsylvania State Regulations

- As of 2002, Pennsylvania state legislature requires all PA Colleges and Universities to provide information about the risks of meningococcal meningitis disease and immunization to all students. It also mandates vaccination to all incoming freshmen who will live in dormitories.

Areas of Future Research

- Potential new targets of study in developing the previously poor immunogenic serogroup B vaccines (d/t similar cellular protein structure)
 - focusing on common proteins of epidemic strains
 - conjugation of a modified to a recombinant protein
 - new genes encoding protein membranes have been identified
- Planned studies to evaluate the duration of the MCV4 antibody response and possible need for revaccination
- Evaluate indirect effects of vaccine on disease rates among unvaccinated population
- Better immunogenicity among infants
- Single dose azithromycin safe for eradicating carriage of N. meningitis
- Potential for developing microbial resistance if widely used prophylaxis of antibiotics for carriers of N. meningitis

Conclusion

- Although the signs and symptoms of meningococcal disease are frequently nonspecific, increasing awareness for meningococcal disease can result in earlier medical care-seeking behavior and improved clinical outcomes. In addition, educating adolescents and their parents about the benefits of receiving MCV4 is key to preventing a substantial number of cases of meningococcal disease. Finally, educating policy makers and the general public about the benefits of receiving MCV4 vaccine might improve vaccination coverage rates and substantially decrease the burden of meningococcal disease in the United States. -CDC, 2005

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