Meningococcal Disease and and Meningococcal Vaccine

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

Neisseria meningitidis
• Severe acute bacterial infection
• Cause of meningitis, sepsis, and focal infections
• Epidemic disease in sub-Saharan Africa
• Current polysaccharide vaccine licensed in 1978
• Conjugate vaccine licensed in 2005

Neisseria meningitidis
• Aerobic gram-negative bacteria
• At least 13 serogroups based on characteristics of the polysaccharide capsule
• Most invasive disease caused by serogroups A, B, C, Y, and W-135
• Relative importance of serogroups depends on geographic location and other factors (e.g. age)

Meningococcal Disease Pathogenesis
• Organism colonizes nasopharynx
• In some persons organism invades bloodstream and causes infection at distant site
• Antecedent URI may be a contributing factor

Meningococcal Disease Clinical Features
• Incubation period 3-4 days (range 2-10 days)
• Abrupt onset of fever, meningeval symptoms, hypotension, and rash
• Fatality rate 9%-12%; up to 40% in meningococcemia
### Neisseria meningitidis Clinical Manifestations*

- **Bacteremia**: 43.3%
- **Pneumonia**: 6.0%
- **Arthritis**: 2.0%
- **Otitis media**: 1.0%
- **Epiglottitis**: 0.3%
- **Meningitis**: 47.3%

*1992-1996 data

### Meningococcal Meningitis
- Most common pathologic presentation
- Result of hematogenous dissemination
- Clinical findings
  - fever
  - headache
  - stiff neck

### Meningococcemia
- Bloodstream infection
- May occur with or without meningitis
- Clinical findings
  - fever
  - petechial/purpuric rash
  - hypotension
  - multiorgan failure

### Meningococcal Disease Laboratory Diagnosis
- Bacterial culture
- Gram stain
- Non-culture methods
  - Antigen detection in CSF
  - Serology

### Neisseria meningitidis Medical Management
- Initial empiric antibiotic treatment after appropriate cultures are obtained
- Treatment with penicillin alone recommended after confirmation of *N. meningitidis*

### Meningococcal Disease Epidemiology
- Reservoir: Human
- Transmission: Respiratory droplets
- Temporal pattern: Peaks in late winter–early spring
- Communicability: Generally limited
Meningococcal Disease—United States, 1972-2005*

![Graph showing cases of meningococcal disease from 1970 to 2005.](image)

*2005 provisional total

Meningococcal Disease, 1998
Incidence by Age Group

![Bar chart showing incidence by age group.](image)

*Rate per 100,000 population

Rates of Meningococcal Disease* by Age, United States, 1991-2002

![Graph showing rates of meningococcal disease by age.](image)

* Serogroups A/C/Y/W135

Meningococcal Disease in the United States

• Distribution of cases by serogroup varies by time and age group
  • In 1996-2001:
    – 31% serogroup B
    – 42% serogroup C
    – 21% serogroup Y
    – 65% of cases among children <1 year of age due to serogroup B

Neisseria meningitidis
Risk factors for invasive disease

• Host factors
  – Terminal complement pathway deficiency
  – Asplenia
  – Genetic risk factors

• Exposure factors
  – Household exposure
  – Demographic and socioeconomic factors and crowding
  – Concurrent upper respiratory tract infection
  – Active and passive smoking

Meningococcal Disease Among Young Adults, United States, 1998-1999

• 18-23 years old: 1.4 / 100,000
• 18-23 years old not college student: 1.4 / 100,000
• Freshmen: 1.9 / 100,000
• Freshmen in dorm: 5.1 / 100,000

Bruce et al, JAMA 2001;286:688-93
Meningococcal Outbreaks in the United States
- Outbreaks account for <5% of reported cases
- Frequency of localized outbreaks has increased since 1991
- Most recent outbreaks caused by serogroup C
- Since 1997 outbreaks caused by serogroup Y and B organisms have also been reported

Meningococcal Polysaccharide Vaccine (MPSV)
- Menomune® (sanofi pasteur)
- Quadrivalent polysaccharide vaccine (A, C, Y, W-135)
- Administered by subcutaneous injection
- 10-dose vial contains thimerosal as a preservative

Meningococcal Conjugate Vaccine (MCV)
- Menactra® (sanofi pasteur)
- Quadrivalent polysaccharide vaccine (A, C, Y, W-135) conjugated to diphtheria toxoid
- Administered by intramuscular injection
- Single dose vials do not contain a preservative

MPSV Recommendations
- Approved for persons ≥2 years of age
- Not recommended for routine vaccination of civilians
- Should be used only for persons at increased risk of N. meningitidis infection who are 2-10 years or >55 years of age, or if MCV is not available

MCV Recommendations
- Routinely recommended for:
  - All children at 11-12 years of age
  - Unvaccinated children at entry to high school (age 15 years)
  - All college freshmen living in a dormitory
  - Other persons 11-55 years of age at increased risk of invasive meningococcal disease

Meningococcal Vaccine Recommendations
- Use of MCV is preferred for persons 11-55 years of age for whom meningococcal vaccine is recommended
- MPSV should be used for persons 2-10 years and >55 years
- Use of MPSV is an acceptable alternative for persons 11-55 years of age if MCV is not available

MMWR 2005; 54(RR-7):1-21
**Meningococcal Vaccine Recommendations**

- Recommended for persons at increased risk of meningococcal disease:
  - Microbiologists who are routinely exposed to isolates of *N. meningitidis*
  - Military recruits
  - Persons who travel to and U.S. citizens who reside in countries in which *N. meningitidis* is hyperendemic or epidemic
  - Terminal complement component deficiency
  - Functional or anatomic asplenia

*MMWR 2005; 54(RR-7):1-21*

**Meningococcal Vaccine Recommendations**

- Both MCV and MPSV recommended for control of outbreaks caused by vaccine-preventable serogroups
- Outbreak definition:
  - 3 or more confirmed or probable primary cases
  - Period \(<3\) months
  - Primary attack rate \(\geq 10\) cases per 100,000 population*

*Population-based rates should be used rather than age-specific attack rates

**Meningococcal Vaccine Revaccination**

- Revaccination may be indicated for persons at increased risk for infection*
- Revaccination may be considered 5 years after receipt of the MPSV
- MCV is recommended for revaccination of persons 11-55 years of age although use of MPSV is acceptable
- Revaccination after receipt of MCV is not recommended at this time

*e.g., asplenic persons and those who reside in areas in which disease is endemic (does not include college settings)*

**Meningococcal Vaccines Adverse Reactions**

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<th>MPSV</th>
<th>MCV</th>
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<tr>
<td>Local reactions</td>
<td>4%-48%</td>
<td>11%-59%</td>
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<tr>
<td>Fever (\geq 100^\circ F)</td>
<td>3%</td>
<td>5%</td>
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<tr>
<td>Systemic reactions (headache, malaise, fatigue)</td>
<td>3%-60%</td>
<td>4%-62%</td>
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**Meningococcal Vaccines Contraindications and Precautions**

- Severe allergic reaction to vaccine component or following prior dose of vaccine
- Moderate or severe acute illness
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<th>National Immunization Program Contact Information</th>
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<tr>
<td>• Telephone 800.CDC.INFO</td>
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<tr>
<td>• Email <a href="mailto:nipinfo@cdc.gov">nipinfo@cdc.gov</a></td>
</tr>
<tr>
<td>• Website <a href="http://www.cdc.gov/nip">www.cdc.gov/nip</a></td>
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