# Immunizations

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# Changes in the 1997 Immunization Schedule

- Incorporation of inactivated polio vaccination (IPV)
- Use of DTaP
- Combination vaccines: DTaP/Hib conjugate, HBV/Hib
- Initiation of HBV at any age
- Second MMR is given at 4-6 yrs
- Adolescent visit vaccinations are recommended

# Polio: Background

- **Inapparent infection:** paralytic disease 1:100-1000
- Case fatality rate in paralytic polio is 2-10%.
- **Goal of global eradication by year 2000**
  - Last wild-type case occurred in the Americas in 1991; last imported case was detected in 1993
  - Western hemisphere has been free of indigenous polio virus since 1994
- Vaccine associated paralytic polio (VAPP) is the only indigenous form of disease in the US since 1979; 8-9 cases per year are detected.

# Advantages and Disadvantages of the Three Poliovirus Vaccination Options

| Attribute | OPV* | IPV | IPV-OPV in Sequence |
|---|---|---|---|
| Occurrence of VAPP | 8-9 cases/yr | None | 2-5 cases/yr |
| Other serious adverse events | None known | None known | None known |
| Systemic immunity | High | High | High |
| Immunity of GI mucosa | High | Low | High |
| Secondary transmission of vaccine virus | Yes | No | Some |
| Extra injections or visits needed | No | Yes | Yes |
| Compliance with immunization schedule | High | Possibly reduced | Possibly reduced |
| Current cost | Low | Higher | Intermediate |

# Options For Providing Poliovirus Vaccine

**1. Sequential use of IPV and OPV** (preferred by ACIP)

- Estimated 95% reduction in vaccine associated paralytic polio (VAPP) amongst recipients
- Predicted reduction in VAPP amongst household and community contracts
- Continued use of OPV induces intestinal immunity and resistance to transmission of wild type virus if reintroduced
- Fewer injections in the second year of life

**2. IPV Only (IPOL, Poliovax)**

- Immunocompromised persons or recipients of immunosuppressive chemotherapy and their household contacts
- Children for whom adult household members are inadequately immunized against polio.

**3. OPV Only**

- Preference to minimize number of injections
- Initiation of vaccination regimen after 6 months of age
- Children for whom accelerated protection is required if OPV not contraindicated
- Contraindicated for primary vaccination of persons >18 years of age

# Acellular Pertussis Vaccine Antigens

- Included in all acellular pertussis vaccines: inactivated pertussis toxoid (PT)
- Variation in inclusion and concentration:
  - Filamentous hemagglutinin *(FHA)*
  - pertactin *(PRN)*
  - non-fimbrial protein (69-kd *OMP)*
  - 2 fimbrial proteins *(FIM* types 2 and 3)

# DTP Adverse Events that are Decreased With DTaP

- **Minor Reactions: L**ocal reactions, drowsiness, irritability, anorexia, fever
- **Serious Reactions:** Hypotonic-hyporesponsive episodes (HHE), persistent crying >3 hrs, temp >40° C, seizures
- The effect of vaccine on the incidence of rare adverse events of immediate anaphylaxis or encephalopathy within 7 days is unknown.

# Recommend Use of Pertussis Vaccine

- DTaP is preferred for 5 doses, beginning at 6-8 weeks of age; DTP is an acceptable alternative in transition
- DTaP can be used to complete regimen in children who received DTP previously.
- DTaP is recommended if immunization is to be completed in those with a history of serious DTP event.
- **True Contraindications to Pertussis Vaccine**
  - **Encephalopathy:** DT is recommended
  - **Anaphylaxis:** DT should be deferred; consider allergy testing and desensitization.

# Pertussis Vaccine: Special Considerations

- **Personal or Family History of Seizures**
  - DTaP is the vaccine of choice for these patients.
  - Personal history of seizures: Delay administration until the neuro-logic condition is stable.
  - Family history of seizures is not a contraindication.
  - Acetaminophen should be given q4h x 24 hrs after the vaccination.
- **History of Pertussis Disease:** DT is given for all; DTaP is recommended by some experts
- **7 years of age:** Reformulation is required for adults because diptheria toxoid content is too high for persons older than 7 years.

# Combination Vaccines

- **Benefit.** Minimize number of injections, thereby decreasing associated pain, costs, provider visits, decreased compliance
- **Problems**
  - Need to stock many different products
  - Potential for extra vaccinations, increased costs,
  - Decreased reimbursement
  - Tracking problems, especially with frequently changing health care providers

# Combination Vaccine Types

- **Diphtheria, Tetanus, Acellular Pertussis (DTaP)**
  - Tripedia, Infanrix licensed for first 4 doses
  - ACEL-IMUNE licensed for all 5 doses
  - TriHIBit (ActHIB reconstituted with Tripedia) licensed only for the 4th dose of the series
  - Recommendations: Use same product to complete series whenever possible; any of the licensed products may be used to complete series when previous information unavailable
- **Hib-Hep B (COMVAX)**
  - Monovalent Pedvax HIB and monovalent RECOMBIVAXHB.
  - Most efficient for immunization of infants of HBs Ag negative women whose Hep B vaccine may safely be deferred until 2 months of age.
  - Birth dose of Hep B enhances protection in infants of HBs Ag pos women.
  - Extra dose (at birth) of Hep B required in absence of screening or if mother HBs Ag positive.

# Prevention of Perinatal HBV Infection

- **Risk of Perinatal Transmission**
  - $Hb_e$ Ag pos 70-90%
  - $Hb_e$ Ag neg 10-25%
- **Sequelae of Perinatal Infection**
  - Chronic infection in 90%
  - Death caused by chronic liver disease in 25%
- Increased risk of horizontal transmission in first 5 years of life
- **Universal screening of pregnant women for HBs Ag**
  - Repeat late in pregnancy if high risk
  - Screen at delivery if HBs Ag unknown
- **Infants of HBs Ag positive mothers:** HBIG and hep B vaccine within 12 hours of birth.

# Immunizations at the Adolescent Visit

- Establish visit to provider age 11-12 for immunization and other preventive services
- Vaccines for all adolescents
  - Hepatitis B, MMR (2nd dose), varicella, Td
  - Td booster now may be given at 11-12 or 14-16 y
- Vaccines for adolescents at high risk for specific infections
  - Influenza
  - Pneumococcal
  - Hepatitis A

# Varicella Vaccine

- **Sequelae of Varicella Infection**
  - Complications: 150,000-200,000/yr
  - Hospitalizations: 5,000-6,500/yr severe GAS, MRSA recently
  - Deaths: 100/yr
  - 4-15 times higher complication rates, especially in adults
- **Efficacy of Vaccination**
  - 95% effective against severe disease
  - 70-80% complete protection for 10 yrs
- **Vaccine-related Epidemiologic Changes**
  - Persistent immunity has been documented for 20 years in Japan and for ten years in United States.
  - Unknown effect of absence of circulating while varicella virus.
  - Potential need for adolescent booster.
  - Universal childhood immunization required to prevent shift.
- **The risk of zoste**r is reduced by vaccination.
- **Transmission of Vaccine Virus to Contacts**
  - infection, but not significant disease may be transmitted to close contacts.
  - The risk is decreased compared with wild type varicella virus in susceptible persons.

# Adverse Effects of Varicella Vaccine

| | 12 months-12 years | ≥13 years | |
|---|---|---|---|
| **Adverse Effect** | | **dose 1** | **dose 2** |
| Fever | 14.7 % | 10.2% | 9.5% |
| Injection site pain | 19.3% | 24.1% | 32.5% |
| Varicella rash at injection site (8-19 days) | 3.4% | 3.0% | 1.0% |
| Non-localized varicella rash (5-26 days) | 3.8% | 5.5% | 0.9% |
| Febrile seizures | <0.1% | N.A. | N.A. |

# Consequences of Influenza in Children

- The attack rates among healthy children is 10-40%, and hospitalization occurs in 1%.
- Risk of pneumonia or bronchiolitis is 0.2-25%.
- Other complications include myositis and encephalitis.
- Excessive rates of hospitalization occur for neonates or children with sickle cell disease, bronchopulmonary dysplasia, asthma, cystic fibrosis, malignancies, diabetes, chronic renal disease, cyanotic heart disease.
- Children may transmit into influenza to high-risk household members.
- Infection is associated with an increased morbidity in pregnancy after the first trimester.

# Influenza Vaccine

- Inactivated whole cell virus vaccine is produced in embryonated eggs. Subvirion or purified surface antigen vaccines (i.e., split virus vaccines) are used in children <13 years of age.
- Vaccine strains change each year.
- Efficacy at > six months of age is 70-80%.
- Adverse events
  - Febrile reactions occur at 6-24 hours most frequently in children < 2 years of age 6.
  - Local reactions occur in 10 % over 13 years of age.
  - Guillain-Barre syndrome is not associated with influenza immunization in children.

# Influenza Vaccine Recommendations

- Targeted high-risk groups: Asthma, chronic lung disease, hemodynamically significant cardiac disease, sickle cell anemia, hemoglobinopathies.
- Other high-risk groups that may be vaccinated: HIV infection/AIDS, diabetes mellitus, chronic renal disease, metabolic diseases, recipients of long-term aspirin therapy, members of households with high-risk adults.
- Vaccination may be considered in families who desire to decrease illness even in no risk factors for severe disease.

# Hepatitis A Vaccine: Epidemiology

Incidence 1994

- 26,796 cases reported
- estimated 80,000 cases/134,000 infections

- 30% reported cases <15 yrs of age

Serologic evidence of prior infection of U.S. 33%

Source of infection

- household or sexual contact 22-26%
- day care center 14-16%
- international travelers 4-6%
- food/waterborne outbreaks 2-3%
- no identifiable source 50%

- Case fatality rate 0.3%; 1.8% >50 yrs of age

# Hepatitis A Vaccine Administration

- **Inactivated:** HAVRIX, VAQTA
- Dosage Schedule 2-18 yrs
  - 0, 6-12 mos
  - Concentration doubled >17, 18 yrs
- **Efficacy:** 94-100%
- Effective in chimps post-exposure
- **Duration of Protection**
  - Documented 3 years
  - Estimated to be 20 years or longer

# Indications for Hepatitis A Vaccine ≥2 Yrs

- Travel to work in a country with high or intermediate rate of endemic infection
- Reside in a community with a high rate of infection and periodic out-breaks
- Recipients of clotting factor concentrates
- Chronic liver disease
- High risk occupation:
  - Exposure to HAV-infected primates, HAV research
  - Some food handlers
- High risk behaviors: Illegal drug users, men who have sex with men

# Immunizations in Individuals With Egg Hyper-sensitivity

- **Vaccines containing egg proteins:** Measles, mumps, influenza, yellow fever
- Anaphylactic reactions following MMR are more likely related to other antigens (eg, neomycin, gelatin).
- Skin-testing with vaccine is not predictive of allergic reaction to vaccine.
- Children with egg hypersensitivity may receive a routine dose of MMR without preliminary skin testing; 90 minutes observation in a clinic with emergency treatment available is recommended.

# Vaccine Classification: Live or Inactivated

| Live | Inactivated |
|---|---|
| OPV | DTP, DTaP, DT, Td |
| MMR | IPV |
| Varicella | HBV |
| BCG | Hib |
| Typhoid-oral | Influenza |
| | Pneumococcal |
| | Meningococcal |
| | Rabies |
| | Cholera |