Principles of Vaccination

Epidemiology and Prevention of Vaccine-Preventable Diseases

National Immunization Program
Centers for Disease Control and Prevention
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Principles of Vaccination

Immunity
• Self vs. nonself
• Protection from infectious disease
• Usually indicated by the presence of antibody
• Very specific to a single organism

Principles of Vaccination

Active Immunity
• Protection produced by the person's own immune system
• Usually permanent

Passive Immunity
• Protection transferred from another person or animal
• Temporary protection that wanes with time

Principles of Vaccination

Antigen
• A live or inactivated substance (e.g., protein, polysaccharide) capable of producing an immune response

Antibody
• Protein molecules (immunoglobulin) produced by B lymphocytes to help eliminate an antigen

Passive Immunity

• Transfer of antibody produced by one human or other animal to another
• Temporary protection
• Transplacental most important source in infancy

Sources of Passive Immunity

• Almost all blood or blood products
• Homologous pooled human antibody (immune globulin)
• Homologous human hyperimmune globulin
• Heterologous hyperimmune serum (antitoxin)
Monoclonal Antibody

• Derived from a single type, or clone, of antibody-producing cells (B cells)
• Antibody is specific to a single antigen or closely related group of antigens
• Used for diagnosis and therapy of certain cancers and autoimmune and infectious diseases

Antibody for Prevention of RSV

• RSV-IGIV
  — human hyperimmune globulin
  — contains other antibodies
• Palivizumab (Synagis)
  — monoclonal
  — contains only RSV antibody

Vaccination

• Active immunity produced by vaccine
• Immunity and immunologic memory similar to natural infection but without risk of disease

Classification of Vaccines

• Live attenuated
  — viral
  — bacterial
• Inactivated

Inactivated Vaccines

Whole
• viruses
• bacteria

Fractional
• protein-based
  — toxoid
  — subunit
• polysaccharide-based
  — pure
  — conjugate

Principles of Vaccination

General Rule
The more similar a vaccine is to the disease-causing form of the organism, the better the immune response to the vaccine.
Live Attenuated Vaccines

- Attenuated (weakened) form of the "wild" virus or bacterium
- Must replicate to be effective
- Immune response similar to natural infection
- Usually effective with one dose*

*except those administered orally

Live Attenuated Vaccines

- Severe reactions possible
- Interference from circulating antibody
- Fragile – must be stored and handled carefully

Viral
- measles, mumps, rubella, vaccinia, varicella, yellow fever, intranasal influenza, (oral polio) (rotavirus)

Bacterial
- BCG, oral typhoid

Inactivated Vaccines

- Cannot replicate
- Less interference from circulating antibody than live vaccines
- Generally require 3-5 doses
- Immune response mostly humoral
- Antibody titer diminishes with time

Viral
- polio, hepatitis A, rabies (influenza)

Bacterial
- (pertussis) (typhoid) (cholera) (plague)

Whole-cell vaccines

Fractional vaccines

- Subunit hepatitis B, influenza, acellular pertussis, (Lyme) (HPV)

- Toxoid diphtheria, tetanus

Vaccines in (parenthesis) are not available in the United States.
**Polysaccharide Vaccines**

Pure polysaccharide
- pneumococcal
- meningococcal
- *Salmonella* Typhi (Vi)

Conjugate polysaccharide
- *Haemophilus influenzae* type b
- pneumococcal
- meningococcal

**Pure Polysaccharide Vaccines**

- Not consistently immunogenic in children <2 years of age
- No booster response
- Antibody with less functional activity
- Immunogenicity improved by conjugation

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**National Immunization Program**

Contact Information

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