**Family and Community Medicine Dept**

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**Fourth Grade/ 2018-19 (1st term)**

**Principles of Communicable Diseases Epidemiology**

**Lec – 3**

**Objectives**

- Recognize the types of immunity and vaccines

- Recall common combination vaccines for childhood immunizations

- Describe routine vaccine schedules for common childhood vaccines in Iraq

- Recall application of active vaccination

- principles and components of cold chain

**Immunization**

Why are vaccines so special?

* Vaccines promote health: unlike many other health interventions, they help healthy people stay healthy, removing a major obstacle to human development.
* Vaccines have an extensive reach: they protect individuals, communities, and entire populations.
* Vaccines have rapid impact: the impact of most vaccines on communities and populations is almost immediate. For example, between 2000 and 2008, vaccination reduced global deaths from measles by 78% (from 750 000 deaths to 164 000 deaths per year.

**Immunization:** is the process whereby a person is made immune or resistant to an infectious disease, typically by the administration of a vaccine. Vaccines stimulate the body’s own immune system to protect the person against subsequent infection or disease.

Immunization procedure called vaccination and the immunizing agent called vaccine.

**IMMUNIZING AGENTS:** The immunizing agents may be classified as vaccine, immunoglobulin and antisera.

**A vaccine** is a biological preparation that improves immunity to a particular disease. A vaccine typically contains an agent that resembles a disease –causing microorganism, and is often made from weakened or killed forms of the microbe or its toxins. The agent stimulates the body’s immune system.

**Characteristics of Effective Vaccines:**

* Safety
* Protection
* Long-lasting effects
* Cost Inexpensive to produce and deliver
* Administration easy to deliver with no side-effects

**TYPES OF VACCINES**

**1-LIVE VACCINE:** Only small pox vaccine is no more in uses at present .

**2- LIVE ATTENUATED VACCINE:** a virulent vaccine, virulent pathogenic organisms cannot be used as such, but so treated to become attenuated and avirulent, but remain antigenic. In general, live attenuated vaccines are more potent immunizing agents than killed vaccines. Such vaccines produce a durable immunity, but not always as long as that of natural infection.

Live attenuated vaccines should not be administered to persons with immune deficiency diseases or to persons whose immune response may be suppressed because of leukemia, lymphoma or malignancy or because of therapy with corticosteroids, alkylating agents, anti -metabolic agents, or radiation.

Pregnancy is another contraindication. When two live vaccines are required, they should be given either simultaneously at different sites or with an interval of at least 3 weeks. In the case of live vaccines, immunization is generally achieved with a single dose.

**Available live attenuated vaccines are:**

**BCG,** **OPV (oral polio vaccine),** **Measles,** **MMR (measles, mumps, rubella),** **Rubella. (0.5 ml,** **Subcutaneous -arm).**

**Rotavirus vaccine:** protects children from rotaviruses, which are the leading cause of severe diarrhea among infants and young children. Rota virus vaccine is a live, oral pentavalent vaccine that contains five rotaviruses.

**3-INACTIVATED VACCINES (killed vaccine)**

live attenuated vaccines cannot be prepared for some infectious diseases, where killed organisms are used. Though inactivated (by heat& chemicals), they are antigenic and stimulate immune response. Examples of such vaccines TAB (ENTERICA), Pertussis, cholera, Salk (parenteral) for polio, hepatitis A and rabies vaccine. They tend to provide a shorter length of protection than live vaccines, and are more likely to require boosters to create long-term immunity.

**4-Cellular fractions**

prepared from extracted cellular fractions, e.g., meningococcal vaccine from polysaccharide of the cell wall, they are available for: Meningococcal, Pneumococcal, & Homophiles influenza vaccine (Hib). Hepatitis B poly peptide vaccine (new). Polysaccharide vaccine prevents disease, but can’t prevent carrier state.

**5-SURFACE – ANTIGEN VACCINE (subunit)**: protein subunit –rather than introducing an inactivated or attenuated microorganism to immune system, a fragment of it can create an immune response. Examples include the sub unit vaccine against Hepatitis B virus that is composed of only the surface proteins of the virus.

\*Yeast – recombinant hepatitis B vaccine; Hbs Ag needed to prepare the vaccine is produced by recombinant DNA in yeast cell, it is the vaccine used at present.

Virus –like particle (VLP) vaccine against human papilloma virus (HPV).

**TOXOIDS:** Some bacterial diseases are not directly caused by a bacterium itself, but by a toxin produced by the bacterium. They are detoxicated exotoxins preparations which stimulate formation of humoral antitoxin immunity.

Diphtheria toxoids & tetanus toxoids are widely used for active immunization, each by itself or in combinations (DPT& DT), Pertussis toxoids (less reaction), Cholera toxoid; oral, against cholera exotoxin, which is the major pathogenic factor of cholera vibrios.

**Combination Vaccines:** Combination vaccines take two or more vaccines that could be given individually and put them into one shot. Combination vaccines defines as “a product whose components can be equally divided into independently available routine vaccines.”

**Some examples of combination vaccines**

DPT; MMR; DT; DTaP-Hib-polio; DTaP-hepatitis B- IPV; DTP-HB-Hib –IPV.

**SCHEDUALE of ACTIVE IMMUNIZATION in IRAQ (CHILDREN)**

|  |  |
| --- | --- |
| Age &dose | Vaccine |
| After birth (1st week | BCG, OPV (0 dose), HBV (within 24hr) |
| 2 Months  1st dose | [DPT, Hib, HBV, IPV] & Rota virus & OPV  (السداسي) |
| 4Months  2nd dose | [DPT, Hib, HBV, IPV] & Rota virus &OPV |
| 6Months  3rd dose | [DPT, Hib, HBV, IPV] & Rota virus &OPV |
| 9Months | Measles vaccine + vit A (100 IU) |
| 15 Months {1st dose} | MMR |
| 18 Months | [ DPT, Hi b, HBV], OPV {1ST booster dose} + vit A (200IU) |
| 4- 6 Years | DPT, Hib, HBV), OPV (2N D booster dose),  MMR ( 2nd dose) |

**Protective period of full primary & booster immunization:**

* short period of some months; cholera & plague vaccines which are protective for about 6M.
* 3- 5 years: DPT, Tetanus toxoids
* 5 or more years: BCG
* Solid, life time immunity: Measles, MMR, Mumps.

**What are the factors determining effectiveness of active immunization of a particular infectious disease in the community?**

**1-Vaccine or toxoids:**

**\*** Protective (immunologic) value.

\* How handled since prepared until used, including the cold chain.

\* For organisms characterized by frequent antigenic changes – influenza vaccine must be prepared from the prevailing organisms of outbreak or epidemic.

**2-Process of immunization:** requirements of primary & booster immunization, or revaccination, including doses, spacing & route of administration must be fulfilled.

**3-Vaccination coverage:** it is the percent of individuals of at-risk group or population, who has been fully immunized. For satisfactory benefit of a given vaccine, coverage must be not less than 80- 85%.

**Why an actively immunized individual may get disease when exposed to infection?**

1-Causes related to the vaccine/ toxoids & process of immunization: inactivation of live attenuated vaccine used; not using updated vaccine of antigenic ally changing organisms, moderate protective value of vaccine

**2- Host factors:**

**\*** Unsatisfactory or impaired immune response.

\* Serum antibody level at time of immunization; the higher the level, less immune response to active immunization & vice versa.

**Application of active immunization**

* Infants and children expanded immunization program (schedule)
* Active immunization for adult females (MMR vaccine is given in adolescence girls, or rubella vaccine. Tetanus toxoid in pregnancy.
* Vaccination for special occupations:
* Health care workers: hepatitis B, influenza, MMR, polio
* Public safety personnel (police, fire fighters) and staff of institutions for the developmentally disabled: hepatitis B, influenza
* Vets and animal handlers: rabies, plague and anthrax
* Sewage workers: DT, hepatitis A, polio, TAB
* Food handlers: TAB
* Military troops and camp dwellers: pneumococcal, meningococcal, influenza, BCG (for non-reactors), tetanus.
* Vaccinations for special health status persons:
* Immuno-compromised persons (Leukemia, lymphoma, HIV, malignancy…)
* Hemodialysis and transplantation

Should receive the following vaccines according to their situation:

* HBV, Influenza, Pneumococcal vaccines.
* Vaccinations in travel: Haj for instance necessities meningococcal vaccination from all over the world, TAB, YF from places like south Africa, and cholera from places like India.

**cold chain:** The cold chain is standard practice for vaccines throughout the pharmaceutical industry. Maintaining the cold chain ensures that vaccines are transported and stored according to the manufacturer's recommended temp range +2C to +8C until point of administration.

Polio vaccine is the most sensitive vaccine to heat.

Vaccine sensitivity to freezing: **Most sensitive**

**DTaP**

**DTaP-hepatitis B-Hib-IPV (hexavalent)**

**Hepatitis B**

**These vaccines are not damaged by freezing are:** **Bacillus Calmette- Guérin,** **Measles, Measles, mumps, rubella, Oral poliovirus, Rabies, Rotavirus, Rubella.**

**Light Sensitive vaccines:** Sensitive to strong light, sunlight, ultraviolet, fluorescents (neon).

**{most sensitive} BCG**

**MMR**

**Varicella**

**Meningococcal C Conjugate**

**Most DTaP containing vaccines**

Vaccines should always be stored in their original packaging until point of use to protect them from light.

**Vaccine vial monitors:** Every vial is also shipped with a temperature-sensitive label, that health workers monitor during vaccination sessions.

**SAFE**If the inner square is lighter than the outer ring and the expiration date is valid, the vaccine is usable.

**SPOILED**  
If the inner square matches or is darker than the outer ring, the vaccine must be discarded.

**The shake test**DPT, hepatitis B and tetanus toxoid vaccines can all be damaged by freezing.

By shaking two vials, side-by-side, one that might have been frozen and one that has never been frozen, health workers can determine if a vaccine has spoiled.

**What damages the Vaccines?**

**1.** Any defect in the cold chain.

**2.** Out date expiry.

**3**. Using skin antiseptic at the site of injection (e.g. BCG).

**4**. Using the reconstituted vaccine (MMR, measles, BCG) after the recommended period (6 hours).

**5.** Exposure of the vaccine to unacceptable temperature during the immunization session. **6.** Exposure of the vaccine to direct sunlight.

Polysaccharide vaccine prevents disease, but cant prevent carrier state