Childhood Immunization

Learning objectives

- To know the Iraqi immunization schedule (2012 & 2015)
- To understand the details of each vaccine (type, route, doses, side effects & contraindications).
- To understand what to check before giving a vaccine.

Immunization

Active immunization induces immunity through the administration of a vaccine or toxoid (inactivated toxin).

Passive immunization includes transplacental transfer of maternal antibodies and the administration of antibody, either as immunoglobulin or monoclonal antibody.

Types of vaccine:

2 type of vaccine: Bacterial & Viral

1. Bacterial vaccine:
   a. Live attenuated: e.g. BCG.
   b. Killed vaccine: e.g. pertussis.
   c. Toxoid: e.g. tetanus.
   d. Polysaccharide: e.g. pneumococcus.

2. Viral vaccine:
   a. Live attenuated: (measles, mumps, rubella [MMR], varicella, nasal influenza)
   c. Recombinant products (hepatitis B, human papillomavirus), d. Reassortants (rotavirus)
Vaccination schedule in Iraq (2012)

- At birth: BCG, OPV-0, HBV-1
- 2 months completed: PENTA valent vaccine (DTP-1, Hib1, and HBV-2), OPV1 and Rotavirus1.
- 4 months completed: TETRA1 vaccine (DTP-2, and Hib2) OPV2 and Rotavirus2.
- 6 months completed: Pentavalent vaccine (DTP-3, Hib3, and HBV-3), OPV3 and Rotavirus3.
- 9 months completed: Measles + VIT A
- 15 months completed: MMR1
- 18 months completed: TETRA2 vaccine (DTP, and Hib) OPV. (booster no.1)
- 4-6 years: DTP, OPV (booster no.2) and MMR2

Vaccination schedule in Iraq (2015)

- At birth: BCG, OPV-0, HBV-1
- 2 months completed: HEXA1, ROTA1, PREV13-1+OPV1
- 4 months completed: HEXA2, ROTA2, PREV13-2 +OPV2
- 6 months completed: HEXA3, ROTA3, PREV13-3 +OPV3
- 9 months completed: Measles + VIT A
- 15 months completed: MMR1
- 18 months completed: DTP+ IPV+ Hib + OPV + VIT A
- 4-6 years: DTaP + IVP + OPV + MMR2

BCG: Bacillus Calmette-Guerin
DPT: Diphtheria, Tetanus, Pertussis
Hib: Haemophilus influenza type B
HEXA: HEXAVALENT Vaccine: (DPT +Hepatitis B (HBV) +Hib) + injectable Polio Vaccine (IPV).
PENTA: DPT + Hib + Hepatitis B
TETRA: Tetravalent Vaccine: DPT + Hib
MMR: Measles, Mumps, Rubella
OPV: Oral Polio Vaccine
PREV13: Pneumococcal Conjugate Vaccine (PCV13)
Bacille Calmette-Guérin (BCG) vaccine

The live attenuated strain of *Mycobacterium bovis* known as bacillus Calmette-Guérin (BCG) uses shared antigens to stimulate the development of cross-immunity to *Mycobacterium tuberculosis*.

**Benefit:**

- *No prevention of tuberculosis.*
- *BCG Prevents life-threatening complications such as meningitis and miliary TB.*

**Route of administration** BCG is given as a single *intradermal* injection at the insertion of the deltoid into the lateral aspect of the *left* upper arm. (local complication rate is smallest when that site is used).

**Successful BCG vaccination**

- A small bleb is raised and a successful vaccination leads to the development of a small local swelling within 2 weeks.
- The lesion progresses to a papule or shallow ulcer of approximately 10 mm diameter and heals within 12 weeks to form a small, flat scar.

**Adverse effects:**

1. Local ulceration and regional suppurative adenitis occur in 0.1-1% of vaccine recipients
2. Keloids: large, raised and ugly scars.
3. If BCG is accidentally given to an immunocompromised patient, it can cause disseminated or life threatening infection

**Polio vaccines**

**Poliovirus**

- Enterovirus (RNA), Three serotypes: 1, 2, 3
- Human is the reservoir, transmission by fecal-oral

The virus present in stool for 3-6 weeks.

The two vaccines have eradicated polio from most of the countries in the world and reduced the worldwide incidence from an estimated 350,000 cases in 1988 to less than 2000 cases in 2008.
Salk’s Polio vaccine “Inactivated Polio Vaccine” IPV, injectable;
Based on polio grown in a type of monkey kidney tissue culture, which is then inactivated with formalin.

- Contains 3 serotypes of vaccine virus
- The injected Salk vaccine confers IgG-mediated immunity in the bloodstream, which prevents polio infection from progress to viremia and protects the motor neurons, thus eliminating the risk of bulbar polio and post-polio syndrome.
- It offers no protection to the mucosal lining of the intestine, ie; people vaccinated with Salk's vaccine can still carry the disease and spread it to unvaccinated individuals.
- IPV has essentially no adverse effects associated with it other than possible rare hypersensitivity reactions to trace quantities of antibiotics.

Sabin's polio vaccine “Oral live-attenuated vaccine”;
- Sabin's “Oral Polio Vaccine” is a live-attenuated vaccine;
- Contains 3 serotypes of vaccine virus
- It replicates very efficiently in the gut, the primary site of infection and replication (confers local GI immunity).
- Unable to replicate efficiently within nervous system tissue.
- Shed in stool for up to 6 weeks following vaccination

Advantages & Disadvantages of Oral Polio Vaccines:
- The OPV proved to be superior in administration, and also provided longer lasting immunity than the Salk vaccine.
- The trivalent Oral Polio Vaccine (Sabin) on very rare occasions has been associated with paralysis (vaccine-associated paralytic poliomyelitis, about 1 case per 750,000 vaccine recipients).

DPT (Diphtheria, Pertussis, & Tetanus)vaccine

DPT: mixture of three vaccines, to immunize against Diphtheria, Pertussis, and Tetanus.

DTP and DTaP (acellular) are administered in a dose of 0.5 mL intramuscularly, five vaccinations before age 7 years (at 2, 4, 6, and 15–18 months and at 4–6 years).

Local reactions include: inflammation, induration or a painless nodule at the site of injection. These are progressively more common after the first injection.
Contraindications:

**Absolute contraindications** to DTP and DTaP:

1. *Immediate anaphylactic reaction*

2. *Encephalopathy within 7 days*. The latter is defined as a severe, acute central nervous system disorder unexplained by another cause, which may be manifested by major alterations of consciousness or by generalized or focal seizures that persist for more than a few hours without recovery within 24 hours.

**Precautions for immunization**: are adverse events that were formally contraindications but now require careful consideration before administration of additional doses.

*These reactions have not proven to cause permanent sequelae.* They are:

1. *Seizures* with or without fever, occurring within 3 days of immunization with DTP or DTaP.

2. Persistent, severe, inconsolable *screaming* or crying within 3 days for 3 or more hours within 48 hours.

3. Collapse or *shock-like* state (hypotonic-hyporesponsive episode) within 48 hours.

4. Temperature $\geq 40.5^\circ C$ (104°F), unexplained by another cause, within 48 hours.

**MMR vaccine (Measles, Mumps, Rubella):**

**MMR vaccine**: Composed of three live attenuated vaccines (Measles, Mumps & Rubella).

- This highly effective vaccine is administered subcutaneously in two doses.

- The first MMR dose is recommended at age 12 to 15 months and the second at the child's entry into school (age 4 to 6 years). A dose given before 12 months of age will not be counted.

- The purpose of the rubella portion of this vaccine is to protect against congenital rubella syndrome by preventing the occurrence of rubella which, by itself, is a mild disease.

- Because MMR is a live-attenuated vaccine, non–allergy-related side effects are noted 5 to 12 days following immunization.

- Fever and rash are relatively common, experienced by 5% to 15% of recipients.

- Transient arthritis has been reported.

- Thrombocytopenia (rare)

- Encephalopathy (very rare)
**Contraindications and Precautions**

1. Severe allergic reaction to vaccine component or following prior dose.
2. Pregnancy.
3. Immunosuppression.
4. Moderate or severe acute illness.
5. Recent blood product.

**Hepatitis B vaccine**

Hepatitis B vaccine consists of purified HBsAg particles produced through recombinant DNA technology in yeast.

Vaccine usually is given intramuscularly as a three-dose series.

**Rotavirus vaccine**

- In early childhood, the single most important cause of severe dehydrating diarrhea is rotavirus infection.
- Rotaviruses; Reoviridae family
- The Pentavalent vaccine protects against rotavirus gastroenteritis.
- Oral route
- Three doses; 2, 4, and 6 months.

**Haemophilus influenzae type b(Hib) vaccine**

- Type of vaccine: Conjugate.
- Adverse reactions: Mild local reaction
- Injection site: Given IM in the outer mid-thigh for infants.

**Immunodeficiency:**

Live-bacteria (e.g., oral typhoid) and live-virus vaccines (e.g., MMR, varicella, and rotavirus) are contraindicated in most circumstances involving clinically significant immunosuppression.
Vaccination check list:

Be sure to ask these questions before giving the vaccines:

1. Is your child sick today? (More than a common cold, earache, etc.)

2. Does your child have any severe (life-threatening) allergies?

3. Has your child ever had a severe reaction after a vaccination?

4. Does your child have a weakened immune system (because of diseases such as cancer, or medications such as steroids)?

5. Has your child gotten a transfusion, or any other blood product, recently?

6. Has your child ever had convulsions or any kind of nervous system problem?

7. Does your child not seem to be developing normally?

8. Children who are allergic to eggs can have all the usual childhood immunizations. The only immunization that should be avoided if your child is allergic to egg is influenza vaccine.

9. Even if your baby is premature, the infant immunizations start at the baby's chronological age, not their gestational age.