

# Childhood Immunization

## Learning objectives

- To know the Iraqi immunization schedule
- To understand the details of each vaccine (type, route, doses, side effects)
- To recognize the differences between two types of polio vaccine
- To understand what to check before giving vaccine

## Vaccination schedule in Iraq

- At birth: BCG, OPV-0, HBV-1
- 2 months completed: Pentavalent vaccine (DTP-1, Hib1, and HBV-2), OPV1 and Rotavirus1.
- 4 months completed: Quadruple 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
- 15 months completed: MMR1
- 18 months completed: Quadruple vaccine (DTP, and Hib) OPV. (booster no.1)
- 4-6 years: DTP, OPV (booster no.2) and MMR2

## 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*. It lost its virulence in humans by being specially cultured in an artificial medium for years.

### Benefit:

- *No prevention of tuberculosis.*
- *BCG Prevents dissemination of the bacterium or the development of other life-threatening complications such as meningitis.*
- *BCG is effective at reducing morbidity and mortality in children but is less useful in the prevention of adult respiratory disease*

### 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.
- The insertion of deltoid is most frequently used because the 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. The insertion of deltoid is most frequently used because the local complication rate is smallest when that site is used.
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 or possible oral-oral, communicability 7-10 days before onset, the virus present in stool for 3-6 weeks.
- Entry into mouth
  - ✓ Replication in pharynx, GI tract, local lymphatics
  - ✓ Hematologic spread to lymphatics and central nervous system
  - ✓ Viral spread along nerve fibers leads to Destruction of motor neurons
- Most poliovirus infections are asymptomatic

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,
- ✓ Unable to replicate efficiently within nervous system tissue.
- ✓ Shed in stool for up to 6 weeks following vaccination

## **Pros and Cons of Oral Polio Vaccine**

- ✓ 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 vaccine

### Diphtheria

- Caused by Aerobic gram-positive bacillus; *Clostridium diphtheriae*
- Complication most attributable to toxin
- Severity generally related to extent of local disease
- Most common complications are myocarditis and neuritis, death occurs in 5%-10% for respiratory disease

### Tetanus

- Caused by Anaerobic gram-positive spore-forming bacteria; *Clostridium tetani*, *Spores found in soil, animal feces*
- Tetanus Complications: Laryngospasm, Aspiration pneumonia and Death

### Pertussis

- Highly contagious respiratory infection caused by *Bordetella pertussis*
- Complication: Pneumonia, Seizures, Encephalopathy

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

- DTP and DTaP 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)
- Minor reactions are quite frequent in 20–50% of vaccines. Local reactions include: Inflammation, induration or a painless nodule at the site of injection. These are progressively more common after the first injection
- Moderate reaction occur in 0.1% to 1.0% of children and include:
  - ✓ ongoing crying (for three hours or more in the first 12 hours),
  - ✓ a high fever (up to 40°C), and
  - ✓ an unusual (screaming), high-pitched crying
- Severe problems happen very rarely (1 in 140,000 doses of DPT). Include;
  - ✓ a serious allergic reaction,
  - ✓ prolonged seizures,
  - ✓ encephalopathy, or even death

## MMR vaccine:

**Measles;** Caused by Paramyxovirus (RNA)

- complication: Diarrhea, Otitis media, Pneumonia, Encephalitis

**Mumps;** caused by Paramyxovirus (RNA)

- Complication: CNS involvement, Orchitis, Pancreatitis, Deafness

**Rubella;** Caused by Togavirus (RNA)

- Complication in children; rare; arthralgia or arthritis, thrombocytopenic purpura, Encephalitis, Neuritis, Orchitis.
- Major concern is **Congenital Rubella Syndrome** as Up to 85% of infants affected during first trimester when placenta and fetus infected during viremia; Infection may affect all organs, may lead to fetal death or premature delivery, Deafness, Cataracts, Heart defects, Microcephaly, Mental retardation, Liver and spleen damage.

**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)A general rule of thumb is the “rule of 10” —about 10% of children get a rash approximately 10 days after vaccine administration.

### 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 infection: Caused by Hepadnaviridae family (DNA)

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, the second and third doses given 1 and 6 months, respectively, after the first dose (0, 1, 6).
- Three doses induce seroconversion in 90-95% of healthy infants, children and adults.

## **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**

- Severe pneumonia
- Meningitis and
- Other invasive diseases
- 15% to 30% of children who survive Hib meningitis may develop permanent neurological disability, including brain damage, hearing loss, and mental retardation
- 5% to 10% cases of Hib meningitis are at risk of dying.

## **Haemophilus influenzae type b vaccine**

- Type of vaccine: Conjugate
- Number of doses: three doses (2,4,6 months) and a booster shot at 18 months.
- Adverse reactions: Mild local reaction
- Injection site: Outer mid-thigh for infants.
- Injection type: Intramuscular
- Given as quadruple or pentavalent vaccine

## **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?

### Answer mother's questions:

1. **What are Immunizations?** Vaccines act by stimulating the body to make defenses against the infection
2. **Are childhood immunizations safe?** In general, most babies and toddlers do not have reactions to immunizations. If they do, the reactions are usually mild and of no long-term significance.
3. **What is the point of immunizing my baby against diseases that are not common where I live?** If the majority of people stop immunizing their children, we could be in a situation like Ethiopia where measles becomes a killer disease again.
4. **Can my child have immunizations if he is allergic to eggs?** 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.
5. **Should I delay immunizing my child if he is unwell?** If your child has a mild illness (say a runny nose) and doesn't have a fever, he can be immunized. Young children have so many viral infections (see Upper Respiratory Tract Infections), that to delay immunization for these would mean your child would not be protected from more serious infections.
6. **When should I start immunizations if my baby was born early?** Even if your baby is premature, the infant immunizations start at the baby's chronological age, not their gestational age
7. **Is it safe to have so many shots?** Multiple vaccines do not weaken the immune system
8. **Can all vaccines be given simultaneously?**  
 All childhood vaccines can be administered simultaneously. Thus, DTaP, Hib, IPV, hepatitis B, pneumococcal conjugate vaccine, MMR, varicella, and rotavirus vaccines can be administered simultaneously. Live virus vaccines should be given either simultaneously or at least 1 month apart.
9. **How effective is MMR?**  
 The first dose of MMR vaccine produces good immunity to measles (95–98%), mumps (97%), and rubella (95%). The second dose of MMR is intended to produce immunity in those who did not respond to the first dose, but a very small percentage of people may not be protected even after a second dose.

Thanks