Childhood Immunization

objectives:

- Understand the milestones of vaccines
- Understand the ultimate goal of vaccination
- Know our national vaccination schedule
- Know the international vaccination schedule
- The types of immunization
- the Adverse effect of vaccination

Note: I only added what the doctor mentioned as important, i didn't put the whole materials. click here if u want to view the whole material

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Notes

Important

Book

IMMUNIZATION

- Vaccines are defined as whole, or parts of microorganisms administered to prevent an infectious disease.
- They can induce adaptive immunity through stimulation of antibody formation, cellular immunity, or both.

IMMUNITY:

1. Passive immunity: The protection is immediate but for a brief duration. It is acquired through:
a. Natural - Maternal Antibodies (through placenta)
b. Artificial - Immunoglobulin or Antitoxins

2. Active immunity: Here immunity can be acquired when the antigen is introduced to the host (Human body), which produces its own antibodies. This type of protection takes 1-2 weeks to develop but is of **longer duration**. It occurs through:
a. Natural – Infection.
b. Artificial - Immunization with vaccines.

Vaccines

- Vaccines could be divided into **inactivated (killed) and live attenuated vaccines.**
- The characteristics of each are discussed in the following table:

	Live	**Killed**
VIRULENCE	Attenuated	Non-infectious
Replication	Yes	No
Effect of passive immunity	May prevent successful immunization	No inhibition effect
Duration of immunity	Longer	Shorter
Booster	Usually, no need	Yes
Adverse reaction	Can produce disease especially in immunocompromised children **MCQ: Do not give LA vaccines with Immunoglobulin therapy**	Low incidence of adverse reaction

IMMUNIZATION

TYPES OF VACCINES:

1. **Live attenuated microorganisms**: (organisms are still a life but weakened) e.g., BCG, measles, mumps, rubella, varicella, rotavirus, and live attenuated influenza vaccine.
2. **Whole inactivated microorganisms:** (killed organisms) e.g., polio & HAV.
3. **Parts of the organism:** e.g., acellular pertussis, HBV, & human papilloma virus (HPV).
4. **Polysaccharide capsules:** e.g., pneumococcal & meningococcal polysaccharide vaccines.
5. **Polysaccharide capsules conjugated to protein carriers** e.g., pneumococcal, meningococcal, & Hib conjugate vaccines.
6. **Toxoids** (processed toxin of the organisms) e.g., tetanus & diphtheria.

★★★	**Live**	**Killed**
Whole cell bacteria	BCG	Pertussis
Whole-cell virus	Measles Mumps Rubella Oral Polio (OPV) Rotavirus Varicella Life attenuated influenza vaccine	Injectable polio Hepatitis A vaccine
Toxoids		Tetanus, Diphtheria
Polysaccharide		pneumococcal & meningococcal polysaccharide vaccines
conjugated Polysaccharide		pneumococcal, meningococcal, & Hib conjugate vaccines.
Recombinant protein		Hepatitis B acellular pertussis human papillomavirus (HPV)

Know the examples, Can come in the OSCE as an empty table

- ❖ Most vaccines are given by deep IM injection (anterolateral aspect of thigh in infants and young children & deltoid muscle of arm in adolescents and adults); MMR & Varicella are given subcutaneously, whereas **BCG is given intradermally.**
- ❖ **Live attenuated vaccines** tend to induce long-term immune responses. They replicate like the natural infections, until they eradicated by the immune system. Thus, most live vaccines are administered as single (or twice) dose schedule.
- ➢ **Note:** The suspending fluid of the vaccine usually contains a preservatives, stabilizers, adjuvants, and antimicrobial agents.

IMMUNIZATION

- Vaccines can be divided into 2 types according to their induced response:

- **T lymphocyte dependent** vaccines contain protein moieties which induce a good immune response even in young infants.
- **T lymphocyte independent** vaccines contain polysaccharide which induce the B lymphocytes only which lead to poor immune response in children younger than 2 yr. Therefore, these polysaccharides have been conjugated to proteins to render them T lymphocyte dependent vaccines.

- Serum antibodies (usually IgM) may be detected after 7–10 days after vaccine injection & as IgM weaned off the IgG increases and usually peaks around 1 month after vaccination, then slowly decreased, but loss of detectable IgG over time does not necessarily mean susceptibility to infection.
- Booster vaccines result in rapid immune response due to rapid proliferation of memory B & T lymphocytes that result in rapid increase of IgG level.

CONTRAINDICATIONS & PRECAUTIONS OF VACCINATIONS:

1. Anaphylaxis to the vaccine (or any of its constitution) in the prior dose is an **absolute contraindication** to that vaccine. However, patient with history of allergy to eggs can be given MMR because it contains very small amount of egg protein. Anaphylaxis is a contraindication, allergy is not.

2. Immunodeficiency: patients with Cellular immune deficiency, whether primary "hereditary" or secondary "acquired" **should not be given Live attenuated vaccines** but can receive all other types of vaccines (although the response is suboptimal). However, Live attenuated vaccines can only be given in 2 situations:
a. Patients with HIV disease can receive MMR if he/she asymptomatic or symptomatic but without evidence of severe disease. **They also can receive Varicella vaccine if CD4 lymphocytes ≥ 15%.**
b. Patients on Steroid therapy in dose <2 mg/kg/day (or <20 mg/day) of prednisone "or equivalents" can receive LAV during therapy, whereas patients on higher dose of steroid for <2 wk can receive LAV once steroid is discontinued and patients on higher dose for >2 wk should receive LAV only after cessation of steroid for at least 1 mo. The calculation is important.

★ Patients with **Phagocytic disorders** can receive all vaccines **except LA** bacterial vaccines (e.g., BCG); whereas patients with **Complement deficiency** disorders can receive all types of vaccines (including LAV).

3. Patient with fever associated with **moderate or severe** (but **not** mild) acute illness should not be vaccinated until recovery.

IMMUNIZATION

CONTRAINDICATIONS & PRECAUTIONS OF VACCINATIONS:

4. **Preterm** infants can be vaccinated at the same schedule of the full term infants, except the birth dose of HBV can be deferred for 1 month after birth if his **weight is <2 kg** & his mother has **HBsAg –ve.**
5. **Immunoglobulins** may interfere with some vaccines as follows; IG should be administered at least **2 weeks** after measles vaccine & if given before vaccination of measles (or MMR), they should be deferred for as long as **3–11 mo** (depend on the dose of IG). in case patient was diagnosed with kawasaki disease you should give the vaccine after 11mo. because they require high doses of IG.
Rotavirus vaccine also should be deferred for **6 wk** following IG (but not for >13 wk of age).
6. Generally, all vaccines can be given simultaneously except that different LAV **if not given simultaneously**, they should be given at least 1 month apart due to a theoretical concern about viral interference!
7. Patient with **tuberculosis** should not receive **measles** vaccine unless you prove his TB and **start him on full treatment** for TB.

FALSE OR INVALID CONTRAINDICATION TO IMMUNIZATION:

- **Mild** acute illness with or without fever.
- Mild-moderate local reaction (i.e., swelling, redness, soreness); low-grade or moderate fever after previous dose. but in case of **arthus reaction** you should treat first then give the vaccine.
- Recent exposure to an infectious disease.
- Current antimicrobial therapy (Exceptions: **intranasal influenza and varicella and typhoid vaccines** with specific antiviral e.g. acyclovir and varicella vaccine and antimicrobial medications e.g. gentamicin with typhoid vaccine).
- Convalescent phase of illness.
- Breastfeeding.
- Preterm birth (Exception: hepatitis B vaccine in specific circumstances).
- History of penicillin allergy, other non vaccine allergies, relatives with allergies, or receiving allergen extract immunotherapy.
- History of GBS (Exception: within 6 weeks of influenza or tetanus toxoid containing vaccine).

VACCINATION IN SPECIAL CIRCUMSTANCES

- **Children whose immunization status is unknown:**
  - No harm to vaccinate immune children.
- **Children whose immunization schedules were not completed:**
  - Continue and do not start from the beginning.

IMMUNIZATION

Preterm infants:

- Vaccinate according to chronological and not gestational age. (Do not reduce or divide the dose.)
- At time of birth, hepatitis b vaccine should be hold if birth weight **less than 2 kg** and mother is **HBsAg negative**. Exception: If the mother is **HBsAg positive**, give hepatitis B vaccine **but do not count this birth dose** plus immunoglobulin within 12h. remember we don't count the dose, we wait until the baby reaches 2kg then we give him/her the birth dose
- Consider influenza vaccine in infants with bronchopulmonary dysplasia.

Children with congenital or acquired immunodeficiency:

- Do not give **live attenuated vaccines**. Under certain conditions, BCG, MMR may be given to children with asymptomatic HIV infection; Infectious diseases consultation is needed. live attenuated can be given in acquired immunodeficiency unless it's AIDs or CD4 is less than 15%.
- Injectable polio vaccine (IPV) should be given instead of oral polio to those infants and their contacts.

Hospitalized patients:

- Do not give **OPV or Rotavirus** vaccine during hospitalization. if prolonged hospitalization is expected, give IPV.

DIPHTHERIA, TETANUS & PERTUSSIS

Contraindication:

- An immediate anaphylactic reaction to vaccine or vaccine component
- Encephalopathy (including coma or status epilepticus) within 7 days of administraϴon of prior dose of DTaP/Tdap not attributable to another identifiable cause.

POST EXPOSURE PROPHYLAXIS

Pertussis:

- Immunize all unimmunized or partially immunized close contacts based on the recommended schedule. Azithromycin, erythromycin, or clarithromycin recommended for household contacts and other close contacts.

DIPHTHERIA, TETANUS & PERTUSSIS

POST EXPOSURE PROPHYLAXIS

- **Tetanus:** ★ ★ ★

Prior Tetanus Toxoid doses.	Clean, Minor Wounds		All Other Wounds	
	Tetanus Vaccine	TIG	Tetanus Vaccine	TIG
Unknown or <3 doses.	yes	no	yes	yes
≥3 doses, last dose was <5 years ago.	no	no	no	no
≥3 doses, last dose was 5–10 years ago.	no	no	yes	no
≥3 doses, last was ≥10 years ago.	yes	no	yes	no

HAEMOPHILUS INFLUENZAE TYPE B

Contraindication:

- An anaphylactic reaction to vaccine or vaccine component.

★ Post Exposure prophylaxis:

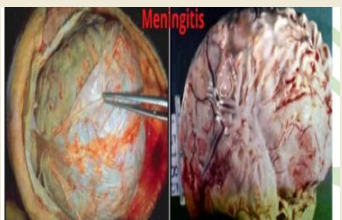
- **Vaccine:**

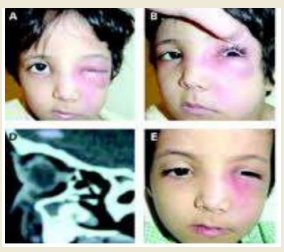
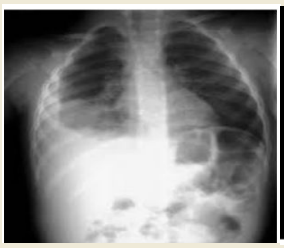
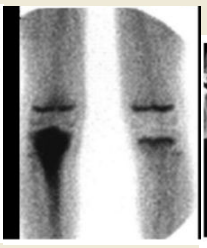
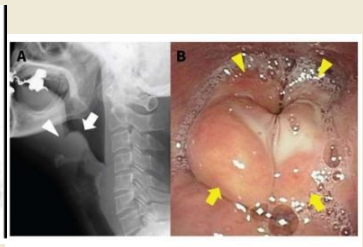
o Invasive Hib ≤24 months: Initiate 1 month after acute illness and continue immunization series as if previously unimmunized.
o Not required if invasive Hib disease develops in children >24 months.
o Consider immunologic workup for any child with invasive Hib disease after completing immunization series.

- **Chemoprophylaxis:**

o Rifampin prophylaxis recommended for household contacts.

HIB Vaccine will prevent these complications:



HEPATITIS A VACCINE

International travel:

- ❖ Age ≥12 months: 1 dose before departure
- ❖ Age 6–11 months: give 1 dose before departure and revaccinate with 2 doses starting at 12 months.
- ❖ If given with immunoglobulin, give at a different site.
- ❖ if the child is ≥12 months and the family plans to travel in **2 days** you should give vaccine **and** immunoglobulin because the vaccine needs at least **2 weeks** to take effect, but if the family presented 2 weeks before the departure you only give vaccine

★ Post Exposure prophylaxis:

- ❖ **Vaccine:**
- ➢ Indicated for children ≥12 months if ≤2 weeks since exposure OR if >2 weeks since exposure **and the exposure is ongoing.**

- ❖ **intramuscular immunoglobulin (IMIG):**
- ➢ For children <12 months if ≤2 weeks since exposure.
- ➢ Immunocompromised children with exposure.
- ➢ Dosing: 0.1 mL/kg IM.

HEPATITIS B VACCINE

Contraindication:

- ❖ Anaphylaxis to yeast

Precaution:

Defer for infants <2,000 g if mother HBsAg negative.

Post Exposure prophylaxis:

- ❖ **Vaccine:**
- ➢ Give series to any previously unimmunized person with percutaneous blood exposure.
- ➢ Give within 12 hr after birth to any infant with maternal HBsAg status positive/unknown.
- ➢ In premature newborn < 2 kg the dose given at birth is not counted. The infant should receive 3 further doses after his/her weight is > 2kg or > 2 months.

- ❖ **HBIG** (Prepared from plasma containing high-titre anti-HBsAg antibodies):
- ➢ Give within 12 hr after birth to infants with maternal HBsAg positive or when maternal HBsAg unknown.
- ➢ Give to any previously unimmunized person or known non responder with percutaneous blood exposure to HBsAg positive blood.
- ➢ Dosing:

o 0.5 mL IM for infants <12 months
o 0.06 mL/kg IM for children ≥12 months

MEASLES, MUMPS & RUBELLA (MMR)

Side Effects:

- High fever (>39.4°C) in 5%–15%, usually 6–12 days after immunization, and may last ≤5 days; febrile seizures may occur 5–12 days after the first dose (rare) Other reactions include transient rash (5%), transient thrombocytopenia (1 in 22,000–40,000), encephalitis, and encephalopathy (<1 in 1 million).

Precaution:

- History of thrombocytopenia or TTP.
- Recent blood product or **immunoglobulin** administration (within 3–11 months, depending on product and dose).
- Need for tuberculosis testing (If PPD skin testing for tuberculosis is required, it should be done on the same day as immunization or delayed for **4-6 weeks**)
- Other **live vaccines** in past 4 weeks.

NOT Contraindication or Precaution:

- Positive tuberculin skin test (PPD) Simultaneous PPD or interferon-γ release assay (IGRA) testing: may be done on the day of immunization but otherwise should be postponed 4–6 weeks.
- **Non anaphylactic** reactions to gelatine or neomycin
- anaphylactic reaction to egg (consider observation for 90 min; skin testing not predictive)

ROTA VIRUS VACCINE

Side Effects:

- Diarrhoea (24%), vomiting (15%), otitis media (14.5%), nasopharyngitis (7%), and bronchospasm (1%). Small risk of intussusception (1 excess case per 30,000–100,000 vaccinated infants) usually within 1 week of vaccination.

Contraindications:

- SCID (severe combined immunodeficiency)
- History of intussusception
- Severe allergic reaction to latex (Rotarix only)

NOT Contraindication or Precaution:

- Prematurity (but given upon hospital discharge)

MENINGOCOCCAL VACCINE

- ❖ Quadrivalent conjugate vaccine A/C/Y/W 135

Side Effects:

- ❖ Mild localized tenderness or erythema, irritability, sleepiness, Guillain-Barre Syndrome, transverse myelitis (very rare)

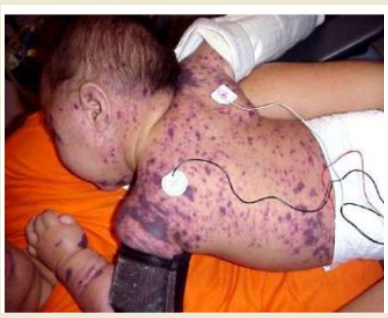
Contraindications:

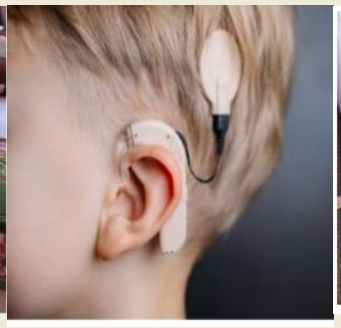
- ❖ Anaphylaxis to tetanus or diphtheria toxoid

Post Exposure prophylaxis:

- ❖ **Vaccine:**
- ➢ Adjunct to chemoprophylaxis when an outbreak is caused by vaccine-preventable serogroup.
- ★ **Chemoprophylaxis indications:**
- ➢ Direct exposure to an infected person's oral secretions (including unprotected healthcare workers)
- ➢ Close contact in the 7 days prior to onset of disease (e.g., childcare, preschool, and household
- ➢ contacts and passengers seated next to the index patient during airline flights ≥8 hr)
- ➢ Initiate within 24 hr of index patient diagnosis.

- ❖ Meningococcal vaccine will prevent these complications: refer to our lecture "serious pediatric infections to understand the disease in details :)





VARICELLA VACCINE

Contraindications and precautions:

- ❖ Anaphylaxis to neomycin or gelatine
- ❖ **Pregnancy.**
- ❖ **On aspirin or aspirin-containing products;** avoid using salicylates for 6 weeks after vaccination
- ❖ Recent blood product or **immunoglobulins** administration (within 3–11 months, depending on product and dose)
- ❖ Tuberculosis or positive PPD
- ❖ Other live vaccines in past 4 weeks
- ❖ Receipt of antiviral drugs (acyclovir, famciclovir, or valacyclovir) 24 hr before vaccination and avoid these kind of medicines for 14 days after vaccination.

Basic Vaccination schedule in K.S.A.

★★★★★ ممكن اهم من حياتك

Age	Vaccines
At Birth	Hepatitis B
2 months	IPV, DTaP, Hib, PCV13, Hepatitis B, Rotavirus (1st Rotarix or 1st Rotateq)
4 months	IPV, DTaP, Hib, PCV13, Hepatitis B, Rotavirus (2nd Rotarix or 2nd Rotateq)
6 months	BCG, OPV, IPV, DTaP, Hib, PCV13, Hepatitis B, Rotavirus (3rd Rotateq)
9 months	Measles, MCV4
12 months	OPV, MMR, Varicella, PCV13, MCV4
18 months	OPV, DTaP, Hib, MMR, Hepatitis A
24 months	Hepatitis A
4-6 years	OPV, DTaP, MMR, Varicella
11 years	Tdap, HPV for female
12years	HPV for female

Doctor said this is important for the OSCE too

PATIENTS WITH IMMUNODEFICIENCIES.

Specific Immunodeficiency	Contraindicated Vaccines	Effectiveness and Comments
B LYMPHOCYTE (HUMORAL) (e.g., X-linked agammaglobulinemia)	OPV Live attenuated influenza vaccine BCG MMR Varicella	The effectiveness of other type of vaccines is uncertain if it depends only on the humoral response
T LYMPHOCYTE (e.g., SCID,DiGeorge syndrome)	All live vaccines	Other Vaccines likely to be effective
COMPLEMENT	None	All routine vaccines likely effective
PHAGOCYTIC FUNCTION (Chronic granulomatous disease)	All live bacterial vaccines	Live viral vaccines likely safe and effective
HIV/AIDS	OPV BCG Live attenuated influenza vaccine MMR and varicella: • Withhold MMR and varicella in severely immunocompromised persons secondary to HIV.	MMR and varicella vaccine in those with mild immunosuppression, rotavirus, and all inactivated vaccines as per routine vaccination schedule are effective.
Generalized malignant neoplasm, transplantation, immunosuppressive or radiation therapy.	Live viral and bacterial depending on immune status.	Effectiveness of any other vaccines depends on degree of immunosuppression.
Asplenia	Live attenuated influenza vaccine	All other routine vaccines likely effective.
Chronic renal disease	Live attenuated influenza vaccine	All other routine vaccines likely effective.

Questions

No questions found in self assessment

1- Vaccines are defined as whole or parts of microorganisms administered to prevent an infectious disease. **Which of the following is a live attenuated vaccine?**
A. hepatitis A
B. hepatitis B
C. pneumococcal
D. varicella
E. diphtheria

2-**Which of the following is a T-lymphocyte independent vaccine?**
A. hepatitis A
B. hepatitis B
C. pneumococcal
D. varicella
E. diphtheria

3- **Rotavirus vaccine should not be initiated for infants older than**
A. 11 wk
B. 13 wk
C. 15 wk
D. 17 wk
E. 19 wk

4- Hepatitis A vaccine, licensed for administration to children 12 mo of age and older. **The 2 doses in the series should be separated by at least**
A. 2 mo
B. 4 mo
C. 6 mo
D. 1 yr
E. 2 y

5- **Which of the following vaccines is contraindicated for a patient with chronic renal disease?**
A. pneumococcal
B. hepatitis B
C. live attenuated influenza
D. varicella
E. hepatitis A

Answers

1- **D**
2- **C**
3- **B**
4- **C**
5- **C**