

Babylon University – College Of Medicine
Department of Community Medicine

*Lectures in Community Medicine
For 4th Stage Students
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2010 – 2011*

Lecture 20

The Expanded Program on Immunization (EPI)

Most of the vaccines used currently were introduced in the 1960s. During the early 1980s the EPI was introduced in most countries.

What determines a high immunization coverage rate?

1. Integrity of the health services (vaccine availability on regular basis, functional cold chain system)
2. Awareness of the parents of the availability of the vaccines and the program and their motivation to vaccinate their child.
3. Motivation and dedication of the health workers.

Note: If we attain 90-95% vaccine coverage of children against a certain disease we are virtually attaining a 100% protection of children, & this is the concept of “Herd immunity” which means that those who are vaccinated will protect those who are not through cutting the cycle of transmission.

Basic Data on EPI Vaccines

Vaccine against	Nature	Form	Dose	Route	Heat Stability	Type of Immunity
Diphtheria	Toxoid	Fluid	0.5ml	IM*	High	IgG
Tetanus	Toxoid	Fluid	0.5ml	IM*	High	IgG
Hepatitis B	HBs Ag**	Fluid	0.5ml	IM	High	IgG
Pertussis	Whole killed Bac.	Fluid	0.5ml	IM*	Medium	IgG,A,M
Measles	Attenuated live V.	Freeze-Dried	0.5ml	S.C.	High/dri Low/reco	IgG,A,M
T.B.	Attenuated live BCG	Freeze-Dried	0.1ml	I.D.	Medium/dried -Low/reco	T cell Mediated
Polio-myelitis	Attenuated live V.	Fluid	3 drops	oral	Low	IgG,A,M intestinal + circulating
Polio-myelitis	Killed V.	Fluid		IM	Medium	Same only circulating
Rubella	Attenuated live V.	Freeze-Dried	0.5m	S.C.	High/ Low	IgG,A,M

The National Immunization Schedule in Iraq

Age/Population Group	Vaccine
First week after birth	BCG, TOPV0 , HBV1
End of the 2nd month	DPT1, TOPV1 , HBV2
End of the 4th month	* DPT2 , TOPV2
End of the 6th month	DPT3 , TOPV3 , HBV3
End of the 9th month	Measles
End of the 15th month	MMR
Boosters	
End of the 18th month	DPT + TOPV (1st booster)
School entry age (4-6 years)	DPT + TOPV (2nd booster)
Every 10 years	Td (full dose of tetanus toxoid and a reduced dose of diphtheria toxoid after the age of 6 years)
Other Vaccines	
12 year old girls	Rubella vaccine
Pregnant Women (Tetanus Toxoid)	1st: 16 weeks of preg. (no protection)
	2nd: 4-6weeks later (3year protection)
	3rd: 6 months later (5 year protection)
	4th: 1 year later (10 year protection)
	5th: 1 year later (protection throughout the reproductive life)

* If the infant develops a severe reaction to a prior dose, give DT not DPT, because the pertussis component is responsible for this severe reaction .

Contraindications to Killed Vaccines & Toxoids:

Diphtheria:

full dose to children over 6 years of age

Pertusis

- Any abnormality of the CNS e.g. Spina bifida
- Acute febrile illness
- Severe local or general reaction to a previous dose (give DT)
- History of convulsions in a child
- Family history of convulsions (*controversial*)

Contraindications to Live Vaccines

General

- Within 3 weeks of another live vaccine (not absolute)
- Pregnancy
- Acute febrile illness
- Immunological dysfunction e.g. hypo-gamma-globulinaemia
- Malignant disease, e.g. Leukaemia, Hodgkin's disease
- Steroid therapy, immuno-suppressants & radiotherapy

Specific

- Oral Poliomyelitis: diarrhoea & vomiting
- Measles: Active TB, allergy to polymyxin & neomycin, family history of convulsions.
- BCG: Local septic condition, premature & LBW baby, chronic skin disease
- Rubella: pregnancy, allergy to neomycin & polymyxin, thrombocytopenia.

Characteristics of Vaccines:

1. BCG

It has an efficacy of 60-90% which can be lower when the infection is due to an antigenic variant. BCG prevents the forms of TB developing through haematogenous spread of bacteria (TB meningitis & miliary TB). Efficacy is particularly high in high incidence situations where protection may last for up to 20 years.

Side Effects

1. Small Red papule at the site of injection, which appears 6-8 weeks after vaccination, and progresses to a scar after 12 w.
2. If given subcutaneously (instead of the usual intra-dermal route) it will lead to abscess formation & regional lymphadenopathy.
3. If the child is Tuberculin positive, it will lead to a severe reaction.

Storage: Sensitive to sunlight & heat. It should be stored at refrigerator temperature (4-8 0C) for up to 2 years.

Note: Physiological neonatal jaundice is not a contraindication to BCG vaccination.

2. DPT

- Efficacy is 90% (after 3 doses).

Side Effects & Adverse reactions

- Swelling, tenderness & redness develop at the site of injection with fever lasting for about 24 hours.
- Increase in frequency and severity with increasing age, so we give Td (full dose of Tetanus & reduced dose of Diphtheria toxoids) after the age of 6 years.
- Severe Side effects include screaming attacks, convulsions, collapse, and brain damage.

- The incidence of such complications is about 1/180,000 doses, which is much rarer than the complications of the diseases targeted by these vaccines.
- Pertussis vaccine is a killed vaccine the components of which may cause a reaction.
- Currently, an acellular vaccine is being developed to minimize these side effects.

Storage: Refrigerator temperature.

3. Poliomyelitis Vaccines

There are two types of poliomyelitis vaccine, Salk and Sabin.

Comparison Between Salk and Sabin Poliomyelitis Vaccines:

	Salk (IPV)	Sabin (OPV)
1	Inactivated (killed)	Live attenuated
2	Injectable	Oral
3	In developed countries	In developing countries
4	Prevents spread of wild polio virus to the nervous system through blood	Limits multiplication of wild poliovirus in the intestine and therefore reduces faecal transmission.
5	No shedding of vaccine virus in the stool	Shedding of vaccine leading to passive immunity of close contacts
6	Expensive (needles & syringe)	Cheap & Easy
7	No side effects	Side effects: vaccine associated paralysis (1/3,000,000 doses)

Storage:

OPV: -20 oC (up to 2 years), 0 – 8 oC (up to 1 year), 37 oC (1 day).

IPV: 0 - 8 oC (18 months), 37 oC (4 weeks).

Eradication of Polio Virus

Global eradication of poliomyelitis is possible because the virus can only survive in humans. The principle for eradication is that we need 3 years to pass by from the last case registration in order to announce eradication. The last case reported in Iraq was on the 28th of January 2000.

Strategies

1. Routine Immunization: We must have a coverage rate of at least 90% at both national & district level.

2. Polio National Immunization Days (NIDs): Two round of vaccination (one month apart) are done nationwide during the low transmission season (spring and autumn)

The aim is to interrupt the circulation of poliovirus by immunizing every child. A child can take up to 15 doses of OPV without side effects. These campaigns can be implemented at the same time in neighbouring countries (cross-border), so that virus transmission is cut between countries.

3. Acute Flaccid Paralysis (AFP) Surveillance: Any case with Acute & Flaccid paralysis in children under the age of 15 years must be reported & checked by taking two stool samples to detect the presence of the wild polio virus in the stool. The case is followed up for 60 days (if the child dies, lost for follow up or remains paralyzed for more than 60 days then this is assumed to be a case of Poliomyelitis). There should be at least one case detected per 100,000 children under the age of 15 years to ensure good and reliable surveillance.

4. Mopping Up (cleaning up): When even one case occurs in a previously polio clean area, or in high risk areas, we implement door-to-door immunization in limited areas.

Measles:

Two factors are considered when determining the age at which the vaccine is given; **age incidence** and **maternal antibody** interference. Maternal antibodies disappear at the age of 6 months and cases start to appear at the age of one year, so the best age to

give the vaccine in Iraq is 9 months. The vaccine is 95% effective when given at the age of 9 months & provides a longer lasting immunity.

Side Effects

- Mild fever and rash develop after 8-12 days, and last for 1-3 days in about 15% of vaccinated children.
- The risk of encephalitis 1/106 but the risk of developing encephalitis as a complication of measles is 1/1000 so by vaccinating children, we have diluted the incidence of encephalitis by 1000 times.
- Other complications of measles are diarrhoea, bronchitis, pneumonia, conjunctivitis and malnutrition. These are also prevented by vaccination.

Storage:

Being a live attenuated virus it must be kept in deep freeze at a temperature of -20°C , while if it is in a powder form we can store it at room temperature for 4 weeks. Once diluted it must be used within 24 hours. When diluted, the diluent should be kept at the same cold temperature as the vaccine to prevent vaccine inactivation by high temperatures.

HB Vaccine:

- Three doses are effective.
- **Side effects:** local reaction, with no contraindications. It should be stored at refrigerator temperature.

The Cold Chain

Vaccines are effective only if maintained at the recommended temperatures throughout their journey from the manufacturer to the consumer. Exposure to high temperatures will lead to the damage of these vaccines. To keep them cold we need equipment (freezer, refrigerator, cool boxes, vaccine carriers, thermometers & cold

rooms) & people who know how to keep the vaccines at the recommended temperature.

Methods used for detecting heat exposure:

1. **CCM (Cold Chain Monitor):** there is a colour index with the vaccine that changes its colour when exposed to higher temperatures than recommended.
2. **VVM (Vaccine Vial Monitor):** used only in polio vaccine vials, where each one has a sticker (a square & a circle in it) one is purple & one is white, and when exposed to high temp both the circle & the box become purple.

Destruction of Unused Vaccines:

When vaccines are not used, because they were kept at room temperature during a vaccination session, and can not be re-refrigerated, they should be destroyed. This is done by incineration. If thrown with the wastes, or into the sewerages, they may regain their potency and cause an epidemic.