ADULT IMMUNIZATION

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IMMUNITY

- Immunity refers to protection against infections.

- Immune system is the collection of cells and molecules that are responsible for defending us against the countless pathogenic microbes in our environment.

- Deficiencies in immune defenses result in an increased susceptibility to infections, which can be life-threatening if the deficits are not corrected

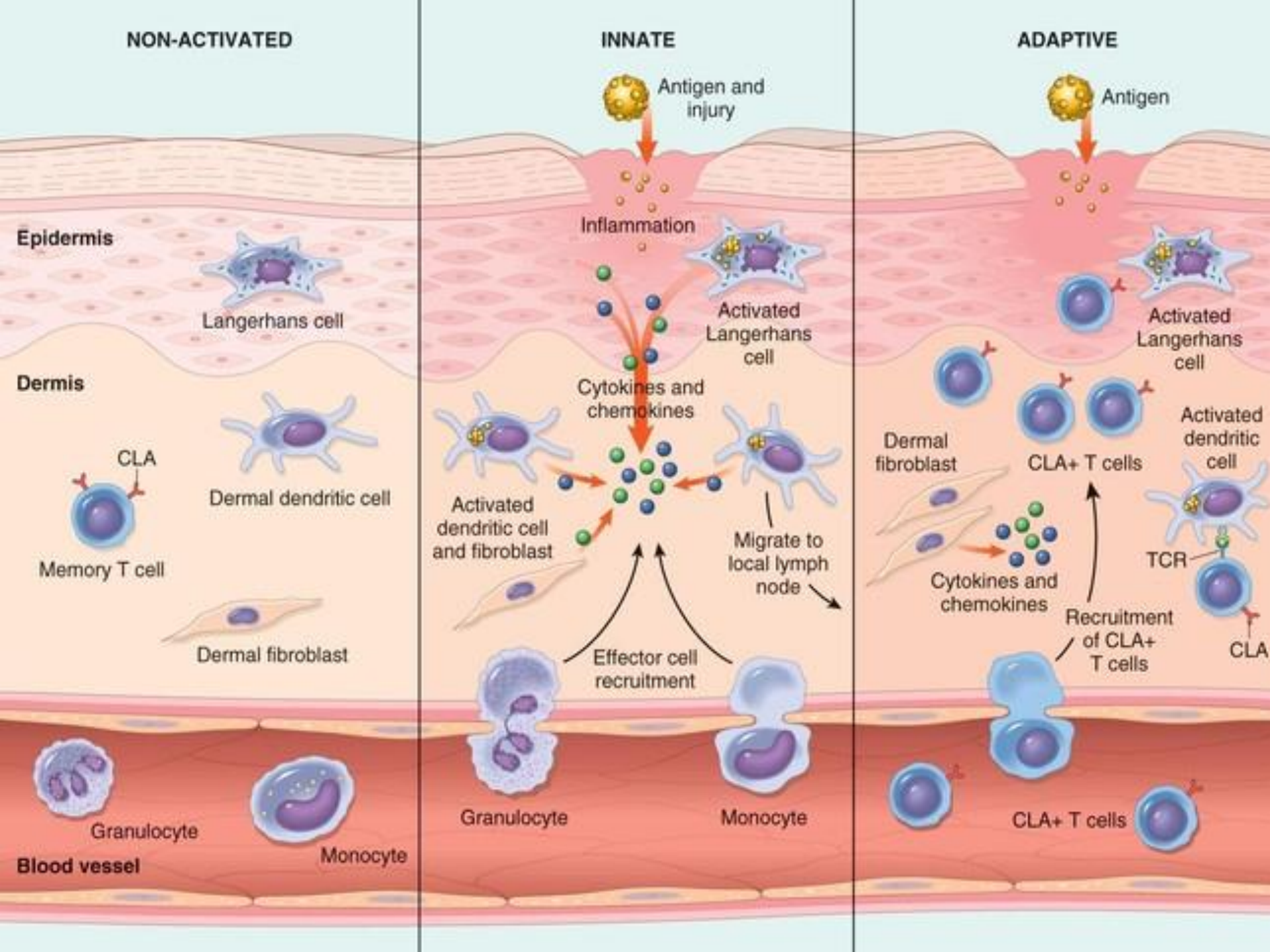
Defense against microbes consists of two types of reactions.

Innate immunity (**also called natural, or native, immunity**) major components are

- epithelial barriers of the skin
- gastrointestinal tract
- respiratory tract, which prevent microbe entry (and have to be breached for a microbe to establish infection)
- phagocytic leukocytes (neutrophils and macrophages)
- a specialized cell type called the natural killer (NK) cell
- circulating plasma proteins, the most important of which are the proteins of the complement system

Adaptive immunity (**also called acquired, or specific, immunity).**

- Normally silent and responds (or "adapts") to the presence of infectious microbes by becoming active, expanding, and generating potent mechanisms for neutralizing and eliminating the microbes.
- The components of the adaptive immune system are lymphocytes and their products
- There are two types of adaptive immune responses **humoral immunity,** mediated by soluble antibody proteins that are produced by B lymphocytes (also called B cells), and **cell-mediated (or cellular) immunity**, mediated by T lymphocytes (also called T cells)


NON-ACTIVATED
INNATE
ADAPTIVE
Epidermis
Langerhans cell
Dermis
CLA
Dermal dendritic cell
Memory T cell
Dermal fibroblast
Granulocyte
Monocyte
Blood vessel
Antigen and injury
Inflammation
Activated Langerhans cell
Cytokines and chemokines
Activated dendritic cell and fibroblast
Migrate to local lymph node
Effector cell recruitment
Granulocyte
Monocyte
Antigen
Activated Langerhans cell
Dermal fibroblast
CLA+ T cells
Activated dendritic cell
TCR
CLA
Cytokines and chemokines
Recruitment of CLA+ T cells
CLA+ T cells

Innate *vs* adaptive immunity

	innate	adaptive
self / non-self discrimination	present, reaction is against foreign	present, reaction is against foreign
lag phase	absent, reponse is immediate	present, response takes at least a few days
specificity	limited, the same response is mounted to a wide variety of agents	high, the response is directed only to the agents that initiated it.
diversity	limited, hence limited specificity	extensive, and resulting in a wide range of antigen receptors.
memory	absent, subsequent exposures to agent generate the same response	present, subsequent exposures to the same agent induce amplified reponses


VACCINES

- **Immunization**: a procedure designed to increase concentrations of antibodies and/or effector T-cells which are reactive against infection (or cancer).

- Immunization procedure called vaccination and the immunizing agent called vaccine

Discovery of Vaccination

- Discovered in 1796 by Dr. Edward Jenner
- Tested empirical knowledge: mild cattle disease cowpox protects against deadly human disease smallpox
- scratching liquid from cowpox sores into the boy's skin -> full protection against smallpox

Immunization

- When performed before exposure to an infectious agent (or soon after exposure in certain cases), it is called **immunoprophylaxis**,
  - intended to **prevent** the infection.

- When performed during an active infection (or existing cancer), it is called **immunotherapy**, intending to **cure** the infection (or cancer)

- Two mechanisms by which immunization can be achieved

- **Passive immunization**:
  - Transfer of active humoral immunity in the form of ready-made antibodies, from one individual to another. ..
  - Protective Abs --> non immune recipient
  - No immunological memory

- **Active immunization**:
  - Give host a foreign organism/protein in non-infectious form
  - Induction of adaptive immune response, with protection and memory.

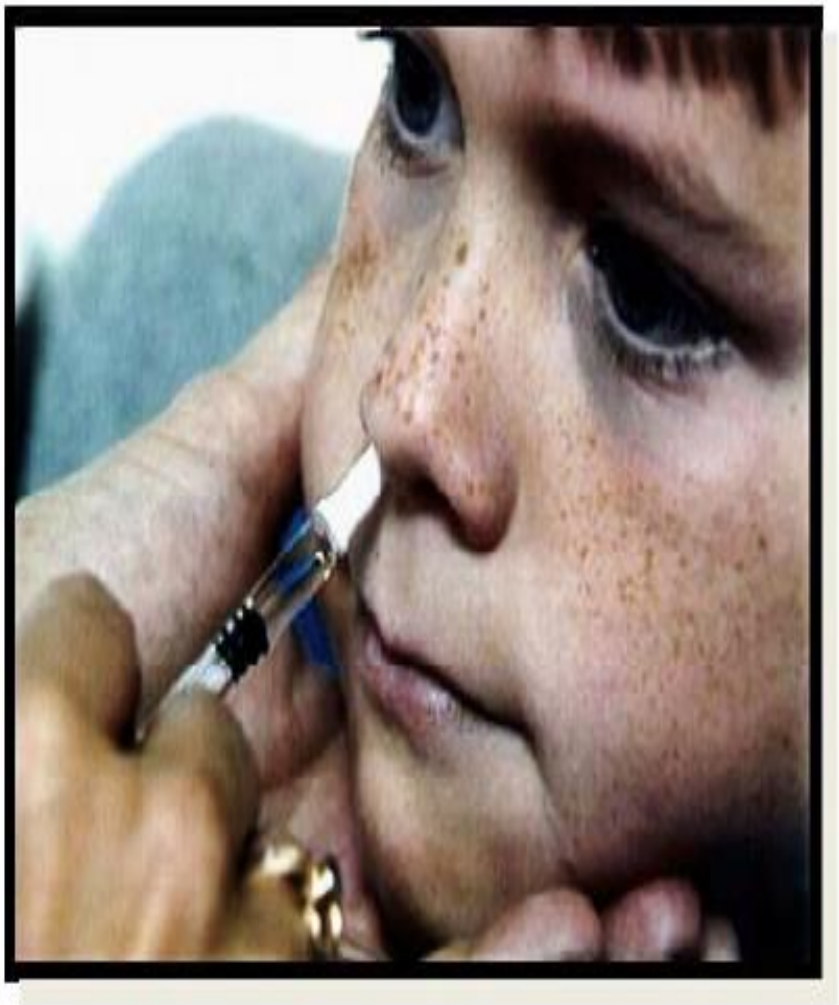
METHODS OF ADMINISTRATION

- **Oral (PO) Route** - Rotavirus vaccines (RV1/Rotarix, RV5/RotaTeq) and oral typhoid vaccines that are administered by the oral route.
- Oral vaccines should generally be administered prior to administering injections or performing other procedures that might cause discomfort.
- Administer the liquid slowly down one side of the inside of the cheek (between the cheek and gum) toward the back of the infant's mouth.
- Care should be taken not to go far enough back to initiate the gag reflex. Never administer or spray (squirt) the vaccine directly into the throat

INTRANASAL ROUTE

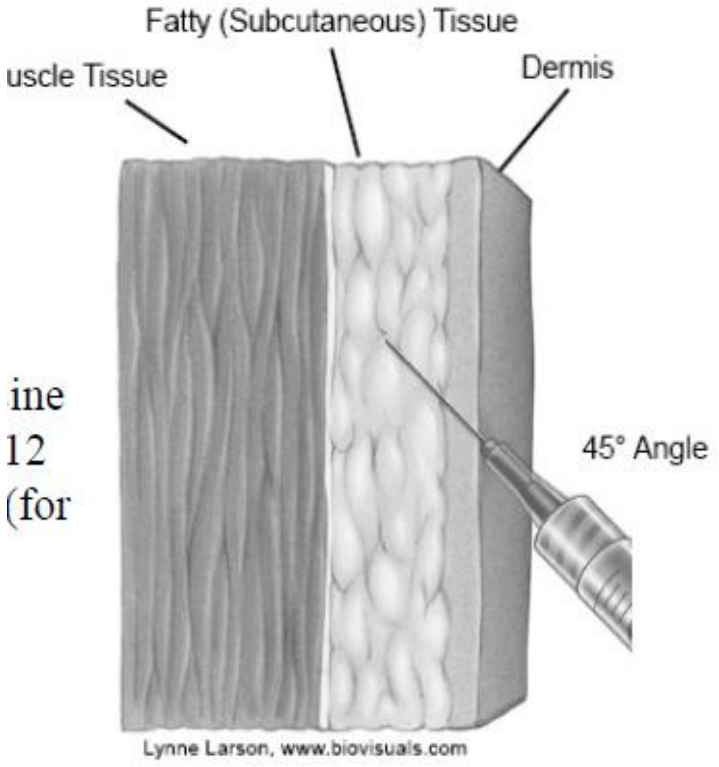
- The live attenuated influenza vaccine (LAIV, FluMist) is currently the only vaccine administered by the nasal route.

- The vaccine dose (0.2 mL) is inside a special sprayer device



SUBCUTANEOUS ROUTE

- Subcutaneous injections are administered into the fatty tissue found below the dermis and above muscle tissue.



- **-Site - The recommended subcutaneous sites for vaccine administration are the thigh (for infants younger than 12 months of age) and the upper outer triceps of the arm (for persons 12 months of age and older). If necessary, the upper outer triceps area can be used to administer subcutaneous injections to infants.**
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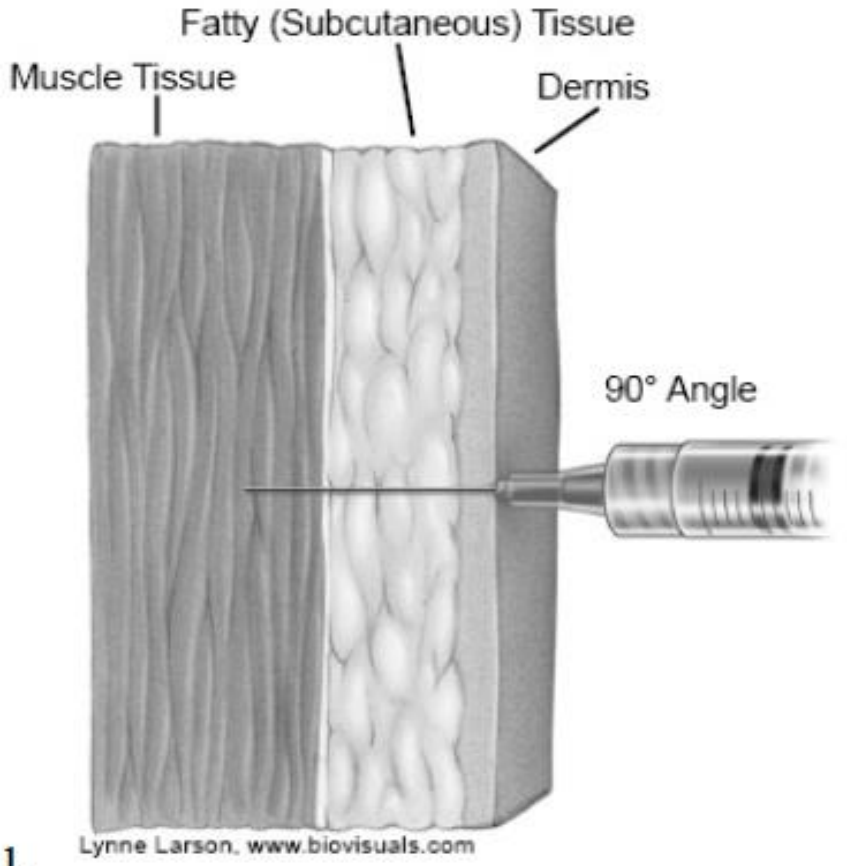
INTRAMUSCULAR ROUTE

- Intramuscular injections are administered into muscle tissue below the dermis and subcutaneous tissue.
- There are only two routinely recommended IM sites for administration of vaccines, the vastus lateralis muscle (anterolateral thigh) and the deltoid muscle (upper arm). Injection at these sites reduces the chance of involving neural or vascular structures. The site depends on the age of the individual and the degree of muscle development.



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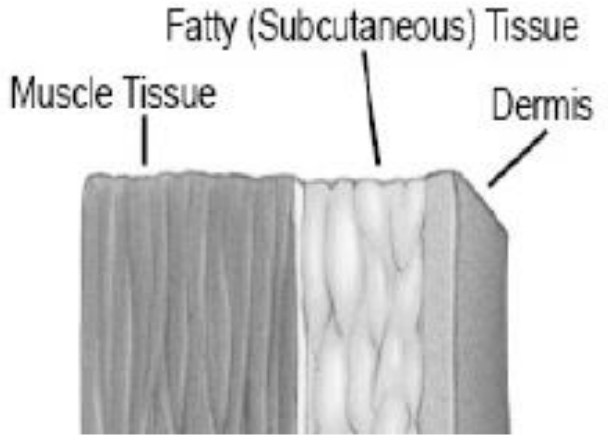
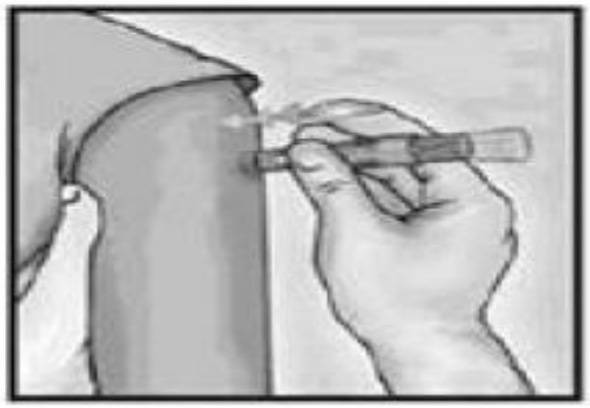
INTRADERMAL ROUTE

- Site - The site of administration is the deltoid region of the upper arm. The patient should be seated with the arm bent at the elbow and the hand on the hip to ensure that the site of administration is prominent.





Live vaccines

- attenuated strains which replicate in host
- attenuation means the virus or bacterium has been weakened to reduce virulence so it cannot cause disease in healthy people

- act like natural infection
- live vaccines are the closest to actual infection and therefore elicit good, strong, long-lasting immune responses

Live vaccines

- Advantages
- Single dose often sufficient to induce long-lasting immunity
- Strong immune response evoked
- Local and systemic immunity produced

- *Disadvantages*
- *Potential to revert to virulence*
- *Contraindicated in immunosuppressed patients*
- *Interference by viruses or vaccines and passive antibody*
- *Poor stability*
- *Potential for contamination*

Inactivated vaccines

Either:

- suspensions of whole intact killed organisms
  - e.g. whole cell pertussis, influenza, rabies, HepA
- acellular and sub-unit vaccines
  - contain one or a few components of organism important in protection
  - e.g. acellular pertussis vaccine contains between 2-5 components of the whole cell pertussis bacteria
  - e.g. diphtheria toxoid
  - e.g. Hib polysaccharide

Inactivated vaccines

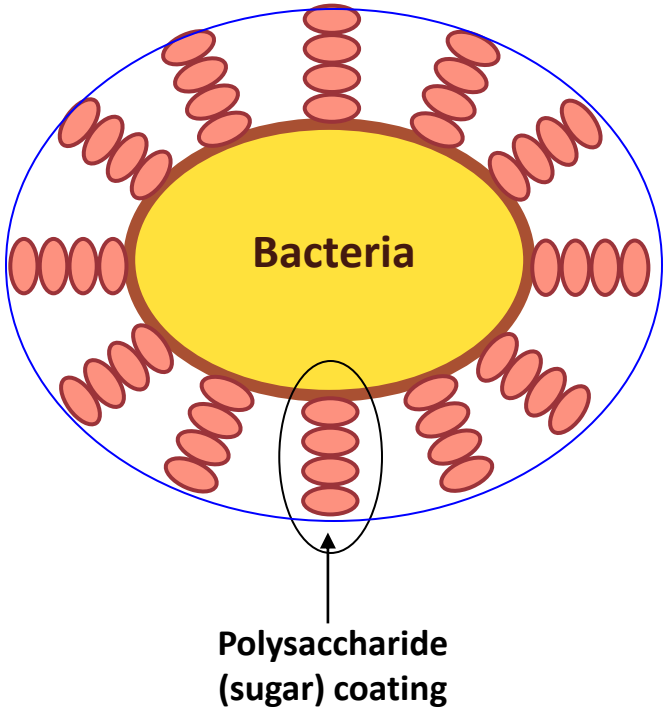
- Advantages
- Stable
- Constituents clearly defined
- Unable to cause the infection

- Disadvantages
- Need several doses
- Local reactions common
- Adjuvant needed
  - keeps vaccine at injection site
  - activates antigen presenting cells
- Shorter lasting immunity

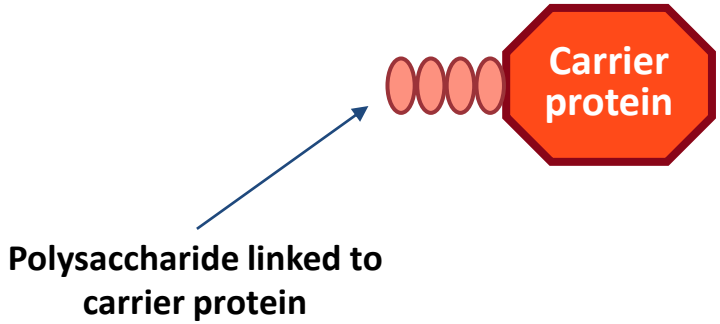
Conjugation

- Some bacteria (e.g. Haemophilus influenzae type b, Neisseria meningitidis, Streptococcus pneumoniae) have an outer coating of sugar molecules (called polysaccharides)
- Polysaccharide coatings make it difficult for a baby or young child's immature immune system to see and respond to the bacterium inside
- Polysaccharide vaccines are poorly immunogenic in children under 2 years old and do not stimulate long term immunological memory
- Conjugate vaccines have enabled us to effectively protect children against Hib, and pneumococcal diseases

Conjugation



Conjugate vaccine



Conjugation is the process of attaching (linking) the polysaccharide antigen to a protein carrier (e.g. diphtheria or tetanus) that the infant's immune system already recognises in order to provoke an immune response

Combination Vaccines

- Many vaccines are combined to make it easier to give several vaccines at one time
- Combination vaccines reduce both number of clinic visits and number of injections needed
- Before combination vaccines are licensed, studies are carried out to ensure that:
- the immune response to any of the combined antigens is just as good as the response to the individual vaccines
- the rates of adverse reactions are the same as they would be if the vaccines were administered separately

Vaccine composition

- In addition to the antigen, vaccines may contain some or all of
- the following components:

Component	Purpose	Example
Adjuvants	enhance the immune response to a vaccine	aluminium salts
Preservatives	prevent bacterial or fungal contamination of vaccine	thiomersal
Additives	stabilise vaccines from adverse conditions such as freeze-drying or heat, thereby maintaining a vaccine's potency	gelatine
Residuals from manufacturing process	Inactivating agents Antibiotics - prevent bacterial contamination during manufacturing process Egg proteins- some vaccine viruses are grown in chick embryo cells Yeast proteins	formaldehyde neomycin, streptomycin, polymyxin B influenza, yellow fever HepB vaccine

Adult Immunization recommended in india

- Tdap
- Influenza
- Hepatitis B
- Varicella
- Meningococcal
- MMR
- Pneumococcal
- Hepatitis A
- HPV (cervical cancer)
- Herpes Zoster

Diphtheria, Tetanus, Pertussis

Vaccines

- Two Tdap Vaccines are available for use in those who are more than 10 years of age.

  -Efficacy of Tdap vaccine - 92%

Recommendations

- for all adults who have not received Tdap or for whom vaccine status is not known

Measles, Mumps And Rubella

Vaccines

- In India the measles, mumps, rubella (MMR) live attenuated vaccine is manufactured using the following strains:

- The measles and the rubella components are produced using human diploid cells while the mumps component is produced from chick embryo.
- The MMR vaccine should be administered subcutaneously into the upper arm.

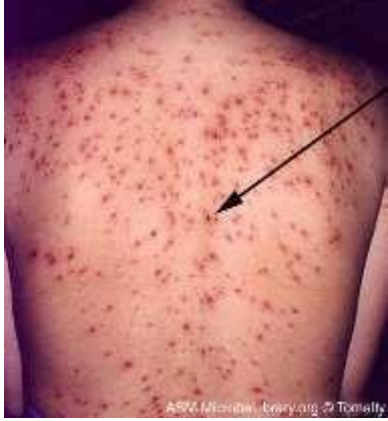
Indications

- Adolesents and adults
- Women of childbearing age who is not pregnant

FREQUENCY

- Two doses at interval of 4 weeks
- Subcutaneously in upper arm

Varicella (Chickenpox)



Vaccines

- Two Live attenuated VZV (Oka strain) vaccines for varicella virus are currently available in India.

Schedule

- Interval between 2 doses should be4–8wks.

Recommendations

- All susceptible adults and adolescents should be vaccinated.(18-49yrs)
- It is especially important to susceptible persons
  - Health care workers
  - Family contacts of immunocompromised persons
  - High risk of exposure (e.g., teachers, day care employees, military personnel, and international travelers).

Human Papilloma Virus

- Papilloma virus infection is precursor to cervical cancer
  - Types 16, 18 account for 70% of cervical cancers

Vaccines

- Two types HPV vaccines are available.
  - a quadrivalent vaccine containing HPV virus L1 protein like particles of HPV 6,11,16, and 18
  - is a bivalent vaccine containing L1 VLPs of HPV 16,18.

Recommendations

- The vaccine has to be delivered prior to exposure to the HPV virus. Therefore, the immunization must precede the sexual debut.
- Age for initiation for vaccination to be 10 - 12 years.
- Catch-up vaccination can be advised up to the age of 26 years for Gardasil vaccine and 45 years for Cervarix vaccine.

- Schedule
  - BHPV – 0,1,6 months
  - QHPV – 0,2,6 months

For male HPV 4 is recommanded

Hepatitis B

Vaccines

- For immunocompetent adults, 1ml (20 µg) of recombinant vaccine is administered at 0, 1, and 6 months as an intramuscular.
- Protection (anti-HBs antibody titer of 10mIU/ml or higher) after recombinant vaccine
  - After first dose - 20% to 30%
  - After second dose - 75% to 80%
  - After third doses - 90% to 95%

Recommendations

- All unvaccinated adult risk for HBV infection and
- All adults seeking protection from HBV infection including post-exposure prophylaxis.

- Booster doses of HBV vaccine are not indicated in persons with normal immune status .
- For CKD patients, the need for booster doses should be assessed by annual anti-HBs antibody titre testing.
- A booster dose should be administered when anti-HBs levels decline to less than 10 mIU/ml & <100 mIU/ml in patients on dialysis.

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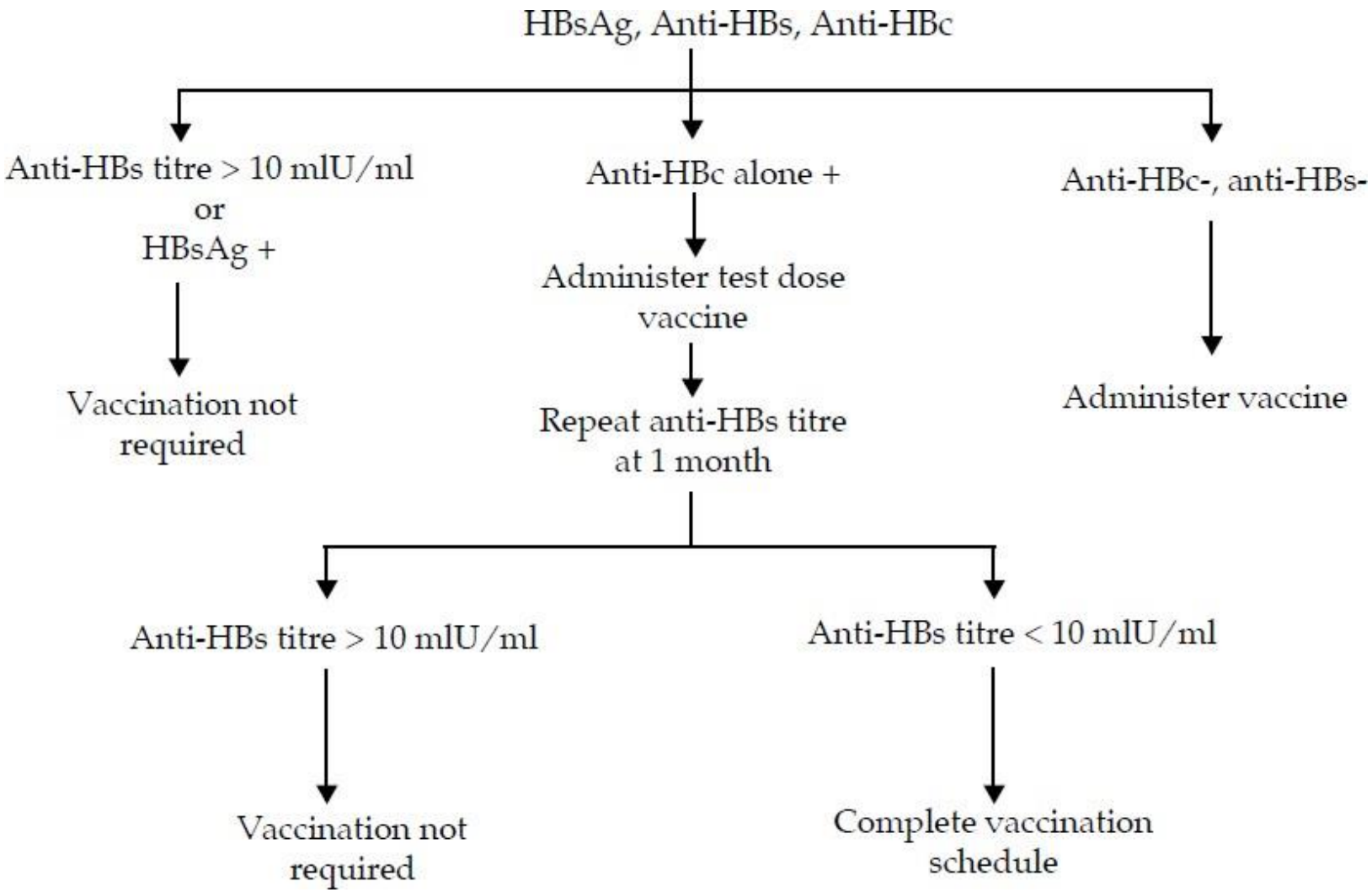

Fig. 1 : Expert Group-recommended prescreening protocol for hepatitis B virus infection.
HBsAg = hepatitis B surface antigen; anti-HBs = anti-hepatitis B antibody; anti-HBc = anti-hepatitis B core antibody; + = positive; - = negative

Hepatitis A

- Vaccines
- Inactivated-single antigen (HAV antigen) vaccine
- Schedule
- Two doses of 1ml at 6 month interval.
- Immune status for hepatitis A should be checked

Pneumococcal Infection

Vaccines

Two types

- The pneumococcal polysaccharide vaccine (PPV23), contains 25 µg each of purified capsular polysaccharide from 23 serotypes of Streptococcus pneumoniae.
- Pneumococcal conjugate vaccine (PCV 13)
  - This vaccine can be co-administered with live vaccines such as the influenza vaccine.

Schedule

- A single standard dose (0.5 ml) is administered by the intramuscular or subcutaneous route.
- Revaccination: 0.5ml IM or SC at least after 5 years of 1st dose in case of High risk people.

Influenza

Vaccines

- Trivalent inactivated influenza vaccine (TIV) and
- Live attenuated influenza vaccine (LAIV)

- The TIV contains
  - A/17/California/2009/38(H1N1),
  - A/Brisbane/ 10/2007 (H3N2), and
  - B/Brisbane/60/2008 strains.
- Live attenuated influenza vaccine (LAIV) – Nasovac contains
  - A/17/California/2009/38 like strain
- Schedule
  - The TIV - annual, single dose of 0.5 ml IM.
  - The LAIV – 0.5 ml intranasal (spray 0.25 ml per nostril)

Meningococcal Meningitis

Vaccines

- Types
  - Polysaccharide vaccines
    - Bivalent (A&C)
    - Quadrivalent (A,C,Y & W135)
  - Conjugate vaccines.
- The vaccine does not induce herd immunity and has no effect on nasopharyngeal carriage.
- Containing 50 µg of polysaccharide per dose.
- After reconstitution use within 8-12 hours.

Schedule

- A single dose of 0.5 ml SC in deltoid region.
- Used in selected population
- Age 2- 3 yrs
- Congenital deficiencs in complement components
- Travellers to hajj
- Lab persons

OTHER VACCINES

YELLOW FEVER

- Yellow fever caused by virus belonging to family called flaviviridae.
- Yellow fever vaccine is live attenuated vaccine
- Single s.c dose of 0.5ml given and seroconversion is >95%.
- Protection stats from 10th day and last till 10yrs.

RABIES

• Two regime available

- intramuscular
- intradermal

•Cholera vaccine

oral cholera – WC, WC-rBS, CVD-103HgR

injectable – not used now

• Typhoid

Vi polysaccharide vaccine

ty21a vaccine

• Tuberculosis

- BCG vaccine currently available

ACIP Adult Immunization Schedule, Age-Based Recommendations, INDIA

Vaccine / Age group	19-26 yrs	27-49 yrs	50-59 yrs	60-64 yrs	≥ 65 yrs
Tetanus, Diptheria, Pertussis (Tdap)	**Substitude one time dose of Tdap with Td, then booster with Td every 10 years**				**Td booster every 10 yrs**
Human Papiloma Vaccine	**3 doses**				
Varicella	2 doses				
Zoster				1 dose	
Measles, Mumps, Rubella	1 or 2 doses		1 dose		
Influenza			1 dose annually		
Pnemococcal (Polysaccharide)	1 or 2 doses				1 dose
Hepatitis A	2 doses				
Hepatitis B	3 doses				
Meninngicoccal	1 or more doses				

- Recommended if some risk factor is present
- All persons who meet the age criteria
- No recommendation

Adult Immunization based on medical and other indications (INDIA)

Indications / Vaccine	Pregnancy	Immunocompromised conditions (Excluding HIV)	HIV infection with CD4 count <200 cells/ µl	HIV infection with CD4 count ≥200 cells/ µl	Diabetes, heart disease, chronic lung disease	Asplenia (excluding elective splenectomy)	Chronic liver disease	Kidney failure, end stage renal disease, on hemodialysis	Health care professionals
Tetanus, Diptheria, Pertussis (Tdap)	Td	Substitute one time dose of Tdap with Td, then booster with Td every 10 years							
Human Papilloma Vaccine		3 doses for females through age 26 years							
Varicella	Contraindication			2 doses					
Zoster	Contraindication				1 dose				
Measles, Mumps, Rubella	Contraindication			1 or 2 doses					
Influenza	1 dose TIV annually								1 dose TIV or LAIV
Pnemococcal (Polysaccharide)		1 or 2 doses							
Hepatitis A	2 doses								
Hepatitis B				3 doses					
Meninngicoccal	1 or more doses								

Recommended if some risk factor is present

All persons who meet the age criteria

Contraindication

Contraindications and Precautions

Vaccine	Contraindication	Precautions
All vaccines (live and inactivated)	•A confirmed anaphylactic reaction to a previous dose of the vaccine or to a component of the vaccine	•If individual acutely unwell on day of vaccination, postpone until recovered •Pregnancy
DTP	•As above	•If evidence of evolving neurological abnormality or current neurological deterioration, including poorly controlled epilepsy, immunisation should be deferred until condition stabilised
Influenza	•As above and additionally: •Individuals with confirmed anaphylactic hypersensitivity to egg products	•Where possible, thiomersal free influenza vaccines recommended for pregnant women and infants
Live vaccines (MMR, varicella)	•As above and additionally: •Immunocompromising treatment or condition •Pregnancy	•If ITP following previous MMR vaccine, perform antibody test •If confirmed anaphylactic reaction to egg, seek further advice with view to immunisation under controlled conditions

Adult Immunization Challenges

- Inadequate funding for vaccines and administration in public programs
- Lack of knowledge – both patients and providers
- Poor public health and private infrastructure for vaccine delivery.
- Lack of availability of vaccine.
- High cost of vaccine.