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vaccination

- types
  - Killed or inactivated vaccines
    - The bacteria or virus killed while retaining its immunogenicity
    - virus processed by either conventional technology by passing the virus through animal or human cells leading mutation or by chemical substances (most commonly formaldehyde and heat) that make it less virulent
    - Less effective than live so it is given with adjuvants amd is short lasting and need booster dose
    - They can be used with immuno-deficient patients
    - Safety problems; contamination with endotoxins, vaccine not killed,
    - damaged by freeze
    - examples
      - polio (given by injection), influenza (IM) and Hep. A and rabies viruses. Pertuses, typhoid and cholera bacteria
      - for COVID-19
        - : Covaxin (Bharat Biotech) and (Sinopharm).
  - Living attenuated
    - Alive microbe; by using a technique (reverse genetics) induce certain changes in gene that stop the virus pathogenic activity
    - the immunity response includes all the aspects of the immune response (innate and adaptive).
    - these vaccines require a longer time to develop, which delays the process.
    - Fear of reversal of microbe activity and causing disease mainly in immunocompromized,
    - and not for pregnant woman as it may cause fetal damage
    - May cause allergy to those allergic to egg as it is prepared in chick embryo
    - Can be freezed or refrigerated
    - Examples; oral polio vaccine, measles, mumps, rubella, Hep. A viruses. TB bacteria (BCG vaccine), flu virus by nasal spray
  - Purified antigen (subunit, Toxoids)
    - composed of antigens purified from microbes or inactivated toxins and are usually administered with an adjuvant
    - Purified toxins (usually exotoxins)
      - given with Polysaccharides (adjuvant) for longer and stronger stimulation
      - as tetanus and diphtheria toxins
    - Polysaccharides-protein vaccines (conjugate vaccines)
      - stay in body for long time as they are difficult to digest by microphages. Long term B cells stimulation
      - H. influenzae, pneumococcal, and meningococcal vaccines
  - Synthetic Antigen Vaccines
    - synthesize most immunogenic epitope in the laboratory
      - by recombinant DNA technology
    - hepatitis virus, herpes simplex virus, foot-and-mouth disease virus human papillomavirus, and rotavirus.
    - hepatitis B surface antigen (HBsAg) is produced by yeast cells
    - Manufacturing S protein. They inserted the gene into a different virus, called a baculovirus, and allowed it to infect moth cells then collect the resulting S protein (Novavax)
    - Damaged by freeze
  - Live viral vectors
    - DNA encoding the antigen inserted in non cytopathic virus and injected in human
    - examples
      - vaccinia vector where smallpox vaccine virus is vector for HIV and malaria
      - Canary pox virus is tried to carry HIV vectors
      - COVID-19
        - (Oxford/AstraZeneca) Replicating viral vectors (Chimpanzee adenovirus:)
        - Human adenoviruses, Johnson&Jonhson, US
  - DNA vaccines
    - Inoculation of plasmid containing complementary DNA (cDNA) injected in human, encoding a protein inside the host antigen leads to humoral and cell-mediated immune responses to the protein
    - APCs, such as dendritic cells, are transfected by the plasmid
    - are highly stable and do not require refrigeration
    - mainly in tumour vaccine
  - mRNA vaccines
    - mRNA is injected into humans to synthesize S proteins
    - Can be freeze if storage is for long time
    - COVID-19
      - (BionTech/Pfizer) was approved, (Moderna), and Univ Oxford, UK
  - Form antibodies that bind tumor antigens in mice then these antibodies are isolated and injected into another mice forming antibodies against the injectable antibody idiotype"anti-idiotypic

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- **vaccines**
  - **vaccines for special groups**
    - BCG for TB risk,
    - Hep.B: health workers
    - Rabies for animal worker
    - Meningitis, typhoid, cholera and hep.A for traveler
    - Influenza who at risk and elderly
    - Varicella zoster for leukemia children
    - Pneumococcal pneumonia for elderly, immuncompromized and spleen dysfunction and chronic heart or lung diseases
  - **Passive immunity**
    - Natural passive immunity; transfer of antibodies from mother to fetus (IGG) and IGA through breast milk
      - Give protection for 6 months after birth
    - in emergency
      - Tetanus antitoxin
        - after dirt wound , and has never or not for a long time (10 years) been actively immunized with tetanus toxoid
      - Antivenoms
        - raised in horses or sheep
        - provide immediate protection to people bitten by a venomous animal
    - Other uses of antibodies
      - collecting IG from thousands of donors on the that this pool will contain some IG that can me used against some diseases such as
        - X-linked agammaglobulinemia
        - unable to manufacture antibodies because of a mutation in their single gene for Bruton's tyrosine kinase.
      - Intravenous injections of IG have helped patients with such autoimmune disorders as
        - immune hemolytic anemia
        - -immune thrombocytopenic purpura
    - Rh immune globulin (RhIg) or Rhogam
      - is used to prevent Rh-negative mothers from becoming sensitized to the Rh antigen of their newborn child
      - Shortly after each birth (72 hrs) of an Rh+ baby, the mother is given an injection of anti-Rh antibodies.
      - destroy any fetal cells that got into her circulation before they can elicit an active immune response in her
      - may also be used in the treatment of immune thrombocytopenic purpura (ITP).
  - **the eradication of diseases by vaccines is dependent on properties of the microbes**
    - effective if the infectious agent does not establish latency, (HIV)
    - if it does not undergo much or any antigenic variation, (FLU and HIV)
    - most effective against infections that are limited to human hosts and do not have animal