Anbar University

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Vaccination

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Virology, Stephen N.J. Korsman, Gert U. van Zyl, ... Wolfgang Preiser 2012

Jawetz Melnick & Adelbergs Medical Microbiology, Stefan Riedel (Author), Stephen Morse (Author), Timothy Mietzner (Author), Steve Miller.

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Vaccination

There are three types of viral vaccine currently available:

1- Live attenuated vaccine
2- Killed or inactivated vaccine
3- Messenger RNA (mRNA) vaccines

1.Live attenuated vaccine

Live attenuated vaccines contain whole viruses which have been "weakened" (attenuated) so that they create a protective immune response but do not cause disease in healthy people. For most modern vaccines this "weakening" is achieved through genetic modification of the pathogen either as a naturally occurring phenomenon or as a modification specifically introduced by scientists.

Live vaccines tend to create a strong and lasting immune response and include some of our best vaccines. However, live vaccines may not suitable for people whose immune system doesn't work, either due to drug treatment or underlying illness. This is because the weakened viruses could in some cases multiply too much and might cause disease in these people.

They should be

a. they are identical with wild or virulent type
b. lacking virulence

Advantages of this type are:

1- produce immunity similar to the immunity that produced by natural infection
2- Simulate production of longer lasting Ab
3- Induce good cell-mediated immunity

Disadvantages

1- Risk of reversion to greater virulence during multiplication within the host cell.
2- Using of culture substrate like eggs, leading to unrecognized adventitious agent latently infection.
3- The storage and limited half life
4- It may produce persistent infection in the host
5- Interference by naturally occurring wild type virus, it may lead to inhibit the vaccine.

Preparation

a. Host range mutant which may be obtained by isolation of the virus from human then culturing on tissue culture leading to decreasing of virulence of the virus so not produce disease ex. Yellow fever, measles, mump, and rubella.
b. Temperature sensitive mutant: they obtain by isolation of the virus from human then culturing the virus under low temperature ($32C^{o}$) which cause mutation and changes in amino acids of essential protein which acts its function normally at $32C^{o}$ but not at 37 C^{o}. respiratory viruses in upper RT $32C^{o}$ but not in lower RT $37C^{o}$ (no pneumonia).

c. Deletion mutants (genetic manipulation).

2-killed or inactivated vaccine

An inactivated vaccine (or killed vaccine) is a vaccine consisting of virus particles that have been grown in culture and then killed to destroy disease. Pathogens for inactivated vaccines are grown under controlled conditions and are killed as a means to reduce infectivity and thus prevent infection from the vaccine.

Inactivated vaccines are further classified depending on the method used to inactivate the virus. Whole virus vaccines use the entire virus particle, fully destroyed using heat, chemicals, or radiation, although only formaldehyde and beta-Propiolactone exposure are widely used in human vaccines. It stimulates humeral immunity.

Advantages

1. There is no risk of reversion to virulence
2. It could be used when there is no available of acceptable attenuated vaccine.

Disadvantages

1. Required extreme care during preparation or manufacturing of this vaccine to avoid present any residual live virulence virus.
2. Produce short brief duration of immunity
3. Not stimulate of cell mediated immunity

Preparation

Destroying nucleic acid but antigenicity and immunogenicity are remaining.

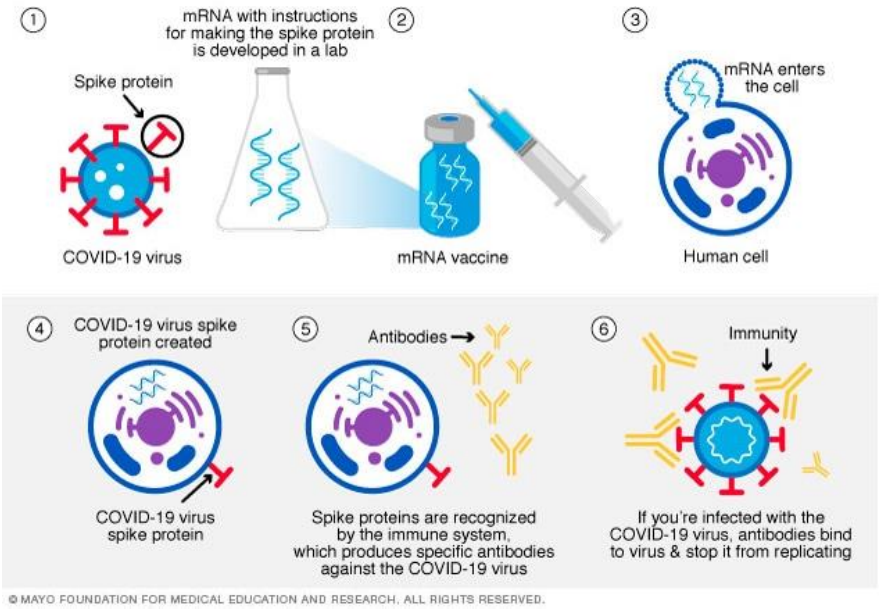
There are two types of killed vaccine:

A- Subunit vaccine: also called sub viral vaccine:
   1- Inactivate of virulent virus by formaldehyde, b-pincopioton, and ethylenamines
   2- Added of lipid solvent to disrupt the lipid like ether or lipid detergent.
   3- Ultracentrifugation in order to purification of viral protein using ether.

B- Whole virus vaccine

3-Messenger RNA (mRNA) vaccines

An mRNA vaccine is a new type of vaccine that protects against infectious diseases. mRNA vaccines teach our cells how to make a protein – or a piece of a protein – that triggers an immune response (antibodies) in our bodies. These antibodies then protect us from future infections.



Vaccine adjuvant

They are materials added to vaccine in order to potentiate of immune response by antigen presenting cells lead to produce Abs with less quantity of Ags and doses.

Types of vaccine adjuvant

1-inorganic salt: aluminum hydroxide, Al phosphate, calcium phosphate.

2-delevery system: liposome

3-bacterial product: oil, nuramyl dipeptrde

New approaches to vaccine design

-Synthetic peptide vaccine: identify of relevant interesting Ags in virulence and determined of its amino acid sequence and synthetic in vitro lead to formation of viral proteins of interest antigenic determinant. Ex. HB v., polio v influenza v.

-Recombinant DNA technique or gene cloning vaccine: made by cleave of protein of the viral genome that carry code for protective Ag. Ex. Influenza v., herps v., rabies.

-Edible vaccine: which are genetically engineered plants to produce foreign protein by using plants (ex. banana).