Immunization

Immunization is the process by which a person is made immune or resistant to an infectious disease, usually by administering them with a vaccine. Vaccines are used to stimulate the body's own immune system to protect the person against subsequent infection/disease.[1]

Importance

There are 3 main reasons why immunization is important: Eradication, Elimination and Control. Newborn babies are immune to many, but not all, diseases, as they have received antibodies from their mothers. However this immunity only lasts for a month to a year. Unvaccinated children are not strong enough to fight off serious diseases on their own.

Herd immunity: Vaccinations, not only protect the people who receive them but also protect the unvaccinated individuals around them. These people include those who are too young to be vaccinated, those who cannot be vaccinated for medial reasons (e.g. children with leukemia) and those who cannot make an adequate response to the vaccination. This is known as herd immunity.

Immunity

Immunity is the ability to tolerate 'self' antigens and eliminate foreign 'non self' material. This provides protection against infectious diseases. There are 2 basic methods for acquiring immunity: passive and active.

Passive Immunity

Passive immunity happens when antibodies are produced by an animal or human, and transferred to another human. Protection is usually temporary as the antibodies degrade over a period of weeks to months. The most common example of this is passing of antibodies from a mother to an infant. They can be transported across the placenta, and this will protect the infant for up to a year. Another example is in blood transfusion. All types of blood products contain antibodies.

Active immunity

Active immunity is the stimulation of the person's own immune system to produce antigen specific antibodies. Unlike passive immunity, it usually last for many years, often a lifetime. One way to acquire active immunity is to be exposed to the natural disease. Once a person recovers from the infectious disease they will be immune for the rest of their lives. Memory B cells will circulate in the blood, and upon reexposure to the disease memory cells begin to replicate and produce antibodies very rapidly. Another way is by vaccination. The vaccine interacts with the immune system and produces a response similar to that produced by the natural infection.

Vaccine types

Live attenuated vaccine

This uses pathogens that are active but have reduced virulence so they don't cause the disease. The wild viruses/bacteria have been weakened. The vaccine must replicate in a vaccinated person in order to produce an immune response. It is usually effective with one dose as they replicate in the host for a long time. There may be problems with this type such as severe or fatal reactions as a result of uncontrolled growth. May not develop due to interference from circulating antibodies. Or it can be damaged by heat and light; therefore they must be stored and handled safely. Examples:Measles, Mumps, Rubella, Varicella, OPV (oral polio vaccine), Yellow fever, BCG, Oral typhoid vaccine, Oral live cholera vaccine

Inactivated Vaccine

These vaccines are produced by growing the bacteria or virus in culture medium, then inactivating it with heat and/or chemicals. It is not alive and cannot replicate, therefore can't cause the disease, even in an immunodeficient person. It is not affected by circulating antibodies and requires multiple doses. Antibody titres decrease after a few years so requires 'boosting' to raise the antibody levels back to a protective level. Examples: influenza, inactivated polio vaccine, rabies, hepatitis A, pertussis, [[hepatitis B], diphtheria, tetanus.

Polysaccharide vaccines

It is an inactivated vaccine composed of long chain of sugar molecules that make up surface capsule of certain bacteria. The predominant antibody produced is IgM. Conjugating vaccine changes immune response from T cell independent, where the B cells are stimulated without the help of T cells, to T cell dependent.

Toxoid Vaccines

This type of vaccine is used when the bacteria secrete toxins or harmful chemical and this is the main cause of the illness. They are made from inactive toxic compounds. When the immune system recognizes the harmless toxoid, it reacts and produces antibodies that will fight off the natural toxin. Examples: Diphtheria and Tetanus.

Adverse reactions

This is a harmful and undesired effect following the vaccination. There are 3 types: Local: These are generally less severe. Symptoms include pain, swelling, and redness at site of injection. Most common in inactivated vaccines. May develop an Arthus reaction, which is an exaggerated reaction that is severe and believed to be due to very high titres of antibody. Systemic: Symptoms include fever, malaise, myalgia, headache and loss of appetite. It is more common after live attenuated vaccine and is usually mild. It occurs a week or two after the vaccine Allergic reaction: This is caused by the vaccine antigen or another component of the vaccine. It is severe and life threatening but also very rare.

Contraindication and Precautions

A contraindication is when there is a condition in the recipient that greatly increases the chance of having an adverse reaction. For example, an allergy to a vaccine component, pregnancy and immunosupression. A precaution is when the vaccine is given if its benefit of protection outweighs the risk of an adverse reaction. For example, moderate/severe acute illness, or if the recipient has recently received an antibody-containing blood product .

Requirements for vaccines

It needs to meet quality requirements as defined in current WHO policy statement on vaccine quality. It must be safe and have significant impact against actual disease in all target populations. If intended for infants or young children, must be easily adapted to schedules and timing of national childhood immunisation programmes. It mustn’t interfere significantly with immune response to other vaccines given simultaneously. Be formulated to meet common technical limitations (refrigeration and storage capacity). It must be appropriately priced.

Links

Related articles

- Immunization in Travelling Medicine
- Immunization in Your Country

External links

- http://www.nlm.nih.gov/medlineplus/immunization.html
- http://www.who.int/topics/immunization/en/
- http://www.medterms.com/script/main/art.asp?articlekey=10091
- http://www.niaid.nih.gov/topics/vaccines/understanding/pages/typesvaccines.aspx#toxoid

References

1. WHO. *Immunization* [online]. ©2012. [cit. 2012-01-25]. <http://www.who.int/topics/immunization/en/>.

Bibliography

- BENCKO, Vladimir, et al. *Hygiene and epidemiology : selected chapters.* 2. edition. Prague. 2004. ISBN 9788024607931.