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Differences between Live Attenuated & Inactivated Vaccines by PRP Diyana

Immunity & Vaccines: An Overview

Immunity is the ability of the human body to tolerate the presence of material indigenous to the body ("self"), and to eliminate foreign ("non-self") material. This discriminatory ability provides protection from infectious disease, since most microbes are identified as foreign by the immune system. Immunity to a microbe is usually indicated by the presence of antibody to that organism. Immunity is generally specific to a single organism or group of closely related organisms. There are two basic mechanisms for acquiring immunity, active and passive.

Vaccine is a biological preparation that improves immunity to a particular disease. It typically contains an agent that resembles a disease-causing microorganism. The agent stimulates the body's immune system to recognize it as foreign, destroy it, and "remember" it, so that the immune system can easily recognize and destroy any of these microorganisms that it encounters later. The two basic types of vaccines are **LIVE** attenuated and **INACTIVATED** vaccines, which each have different characteristics that determine how the vaccine is used (Table 1).

Table 1: **LIVE** attenuated vaccine versus **INACTIVATED** vaccines

Characteristics	Live Attenuated Vaccines (LAV)	Inactivated Vaccines
Method of production	• Derived from "wild" or disease-causing viruses or bacteria which are attenuated or weakened in a laboratory, usually by repeated culturing.	• Made up of whole viruses or bacteria, or fractions of either. Fractional vaccines are either protein-based (toxoid/subunit) or polysaccharide-based (pure/conjugate). • Produced by growing the bacterium or virus in culture media, then inactivating it with heat and/or chemicals (usually formalin). • For fractional vaccines, further treatment is carried out to purify only those components to be included in the vaccine.
Ability to replicate	• Replicate in the vaccinated person to produce an immune response. • The immune response is virtually identical to that produced by a natural infection.	• Not alive and thus cannot replicate.
Ability to cause disease	• Usually do not cause disease such as what may occur with the "wild" form of the organism. If disease does occur, it is usually much milder than the natural disease.	• Made from killed microorganism thus cannot cause disease.
Safety in immuno-suppressed individuals	• Live attenuated vaccines may cause severe reactions as a result of uncontrolled replication (growth) of the vaccine virus/bacteria in immunosuppressed individuals.	• Inactivated vaccines cannot cause infections in immuno-suppressed individuals. • However, inactivated vaccines may not be optimally effective in these individuals.
Duration of Immunity	• Longer	• Shorter
Multiple dose	• The first dose usually provides protection. An additional dose is given to ensure seroconversion.	• Inactivated vaccines always require multiple doses. In general, the first dose does not produce protective immunity, but only "primes" the immune system. • A protective immune response is developed after multiple subsequent doses.

For clinically immunosuppressed individuals, live attenuated vaccines (LAV) should **NOT** be given because the vaccine strain could replicate excessively and cause an extensive, serious infection. This group of individuals includes:

- infants who have been exposed to immunosuppressive treatment from the mother in utero or via breastfeeding (e.g. TNF_{α} antagonists or other biologics).
- immunosuppressed elderly (due to drugs e.g. transplant medication, high-dose of corticosteroids; or underlying illness e.g. lymphoproliferative disorders).
- patients with a history of severe allergic reaction to a vaccine component or following a prior dose.
- pregnant women.

Local Scenario

There are currently 13 types of live attenuated vaccines registered in Malaysia: BCG, Oral Typhoid, Oral Polio, Measles, Rubella, Varicella, Yellow Fever, Shingles, Japanese Encephalitis, Rotavirus, Measles/Rubella, Measles/Mumps/Rubella, and Measles/Mumps/Rubella/Varicella. List of LAV and inactivated vaccines available in PPUKM is as per in Table 2.

Current local guidelines (Guidelines for Adult Immunisation 2nd edition & the Paediatric Protocols for Malaysian Hospitals 3rd edition) recommend NOT to give LAVs to immunosuppressed individuals. However, administration of rotavirus in this group of individuals is not contraindicated (contraindicated only in Severe Combined Immunodeficiency Disorder [SCID] patients) but it requires careful consideration of potential benefits and risks.

Table 2: List of vaccines available in PPUKM

Live Attenuated Vaccines	Inactivated Vaccines
Bacillus Calmette-Guerin (BCG)	Inactivated Influenza (Vaxigrip)
Live Attenuated Schwarz Measles, Mumps & Rubella Vaccine (Priorix)	*H.influenza* type B (Hiberix)
Rubella vaccine	Hepatitis B (Euvax-B) / Hepatitis-B (Engerix B)
Human Rotavirus RIX4414 strain (Rotarix)	Bivalent Human Papillomavirus Vaccine (Recombinant) Types 16 & 18 (Cervarix)
Live varicella virus vaccine (Varivax)	Quadrivalent Human Papillomavirus (Recombinant) Types 6, 11, 16, 18 (Gardasil)
Zoster Vaccine Live (Zostavax)	Pneumococcal vaccine (Pneumo 23)
	Diphteria, Pertussis, Tetanus & Inactivated Injectable Polio/HIB) Vaccine (DTAP-IPV/HIB (Pentaxim)
	DTP-Polio (Infanrix-IPV)
	Inactivated Quadrivalent Influenza Vaccine (Types A&B Split Virion), 0.5ML (Fluquadri)
	Meningococcal Group A, C, W135 & Y Conjugated Vaccine (Nimenrix)
	Streptococcus Pneumonia Vaccine (Synflorix)

Adverse Event Following Immunisation (AEFI) Reports

Since year 2000, the NPRA has received 572 AEFI reports related to live attenuated vaccines with 972 adverse events. Majority of the adverse events reported are mild in nature and no reports involving the administration of live attenuated vaccines in immunosuppressed individuals and subsequent development of infection caused by the vaccine strain.

Advice to Healthcare Providers

- Live attenuated vaccines should not be given to people who are clinically immunosuppressed (either due to immunosuppressive drugs or underlying illness).
- Any infant who has been exposed to immunosuppressive treatment from the mother either in utero during pregnancy or via breastfeeding should have any live attenuated vaccination deferred. For in utero exposure to TNF_{α} antagonists, live attenuated vaccination can only be given several months after the mother's last dose of TNF_{α} antagonists (i.e.: etanercept: 4 months; adalimumab & certolizumab: 5 months; infliximab & golimumab: 6 months).
- Close contacts of immunosuppressed individuals should be fully immunised to minimise the risk of vaccine-preventable diseases in these individuals.
- Please report any adverse events following immunisation to the NPRA using the forms available on the website http://npra.moh.gov.my.

References :

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