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Opinion Article

Impact of Thermostability in Vaccines

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DESCRIPTION

Varying amounts of vaccination stability exist. The most heat-resistant vaccines are the hepatitis B vaccine, diphtheria and tetanus toxoids, measles, yellow fever and BCG-TB vaccines. The least heat-resistant vaccine is the oral poliomyelitis vaccine. Vaccines against measles, yellow fever and TB (BCG) that have been reconstituted are unstable and should be used as soon as feasible. Knowing a vaccine's stability, particularly the rate at which its efficacy degrades at a particular temperature, can help determine the appropriate storage conditions. The vaccinations frequently used in UIP, adsorbable diphtheria and tetanus toxoids are the most stable, whereas OPV is the most heat-sensitive. When using preservative-containing vaccines, open vials that have not been fully utilized after reconstitution should be discarded within one hour if no preservative is present (most live virus vaccines), or within three hours or at the end of the session if no preservative is present. Reconstituted vaccine with warm diluent may be hazardous, and the vaccine loses potency within hours.

Toxoids for diphtheria and tetanus

The most stable vaccines are adsorbable diphtheria and tetanus toxoids in monovalent form or as components of combined vaccines. They are stable at high temperatures, even over long periods of storage, but when frozen, their appearance and potency may change. The freezing of adsorbed vaccines (DPTT, DT, TT and HB) is an absolute contraindication for their use because it has been linked to a reduced immune response or an increased incidence of local reaction. This is due to an aluminum-based adjuvant, which changes the structure of the toxoids rather than the toxoids themselves. Adsorbed DTP vaccine has a freezing point -5°C and -10°C. The freezing time is determined by the number of doses in the vial as well as the temperature. At -10°C, it takes about 110 to 130 minutes. When the vaccine is frozen, the colloidal structure of the aluminium oxide breaks down and is broken down into crystalline parts, which can cause aseptic abscesses at the injection site and render the vaccine ineffective.

Vaccination against measles

Because of the WHO criteria outlined below and the use of effective stabilizers, significant progress has been made in recent years in improving the heat stability of the measles vaccine. The criteria are as follows:

1. The freeze-dried vaccine must retain at least 1000 live virus particles in each dose after seven days of incubation at 37°C
2. If the titer is reduced during this process, it must be reduced by no more than 1 log10.

Vaccine distribution without a cold chain would simplify the delivery system and make integration with drug distribution easier in developing countries. Sugar-glass drying technology enables the production of vaccines that can be stored and transported at tropical room temperatures on a regular basis. Temperature extremes can be monitored by Vaccine Vial Monitors (VVMs).

Trehalose, a disaccharide with long-term stabilizing ability, is used in vaccine manufacturing through drying and stabilizing technology. Dried measles vaccine stabilized with trehalose is found to be stable at room temperature for two months and DTP for 12 weeks at 60°C. Only OPV has failed to dry properly.

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