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Commentary

Evolution of Vaccines

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DESCRIPTION

The history of vaccination ranges as far back as an era. In 900 AD the Chinese used inoculation techniques against smallpox. Inoculation was based on the remark that those who survived smallpox were resistant for life, and involved presenting dried pus, vesicular fluid or scabs from diseased individuals into the skin or nasal cavity of healthy persons. While effective in inducing defensive immunity, inoculation caused in severe disease and death in a percentage of recipients. Edward Jenner is attributed as being the first to determine through experimentation that vaccination could protect from disease without transmitting the disease itself.

This was achieved in the late 18th century by taking benefit of the cross-protective properties of clinically minor cowpox infection in preventing smallpox. Since these first attempts human vaccines targeting several dozen viral and bacterial pathogens of global significance have been developed and used in clinical practice, and many more investigational vaccines continue to be designed and tested. Vaccination is one of the most fruitful public health interventions ever applied, and continues to have massive impacts in avoiding disease and death due to infectious disease worldwide.

The key principle underlying immunization is the induction of an immune response capable of providing specific protection from infection or disease, and where the risk of acquiring the disease from vaccination has either been reduced or removed. The vaccinated individual is reduced immune to disease on future exposure, and side-effects from the pathogen-induced disease are evaded. Initial vaccines were live-attenuated or whole-pathogen preparations. Attenuation is attained by repeated passage in culture such that the virulence of a pathogen is reduced but the organism remains viable.

Whole-pathogen preparations have inactivated pathogens, firstly attained using exposure to high temperatures. While numerous live-attenuated and whole-pathogen vaccines continue to be used in the 21st century, some of these vaccines have previously faced complications in terms of reactogenicity or in attaining adequate potency and efficacy. Furthermore, the potential for return to virulence of live-attenuated vaccine strains, and partial inactivation of bacteria or viruses controlled in vaccines, has rarely caused cases of disease after vaccination, temporarily eroding confidence in these approaches.

In early 20th century several advances were there. The identification of bacterial toxins that could be altered to non-toxic forms while retaining high immunogenicity; the usage of cell culture for bacterial and virus propagation and attenuation; and the initiation of the first systematic, national, vaccination programs as we know them today.

The introduction of vaccination, enhanced hygiene, progression in medicines and upgraded access to health care in many countries was escorted by marked reductions in morbidity and mortality due to infectious diseases. In some situations, reactogenicity and serious contrary reactions attributed to vaccination were no longer considered acceptable by the general public.

CONCLUSION

The response of the scientific community was to search for disinfected antigens capable of tempting a protective immune response and with improved reactogenicity profiles. The resulting acellular pertussis vaccines comprising between one and five purified antigens verified lower rates of local and systemic responses after vaccination compared with whole-cell vaccines. Yet, the duration of immunity started by acellular pertussis vaccines seems to be shorter than predictable, underlining the need for regular booster doses in older children as well as in adolescents, adults and the elderly.

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