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General Article

INACTIVATED POLIO VACCINE: NEED OF THE HOUR

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ABSTRACT
Poliomyelitis, often called polio or infantile paralysis, is an acute, viral, infectious disease spread from person to person, primarily via the fecal-oral route. Polio epidemics have crippled thousands of people, mostly young children; the disease has caused paralysis and death for much of human history. The world has seen tremendous gains in polio eradication over the past years. In fact, no case has been reported in India since February 2011, and India may be on the verge of eradicating polio. However, there is always a risk of Vaccine associated paralytic poliomyelitis (VAPP) as long as oral polio vaccine (OPV) is in use. There is hope in the future that on one day the use of oral polio vaccine will be stopped and no child will suffer from VAPP. As we step near the eradication of polio, it is the high time to shift from OPV to OPV-IPV schedule in India. It can only be achieved if the non-infectious inactivated poliovirus vaccine (IPV) is introduced in UIP, very high (~90%) coverage achieved and then OPV is withdrawn from use.

Key Words: *Poliomyelitis, Vaccine Associated Paralytic Poliomyelitis (VAPP), Oral Polio Vaccine (OPV), Inactivated Polio Vaccine (IPV), Vaccine-Derived Polioviruses (VDPVs)*

INTRODUCTION
Poliomyelitis, often called polio or infantile paralysis, is an acute, viral, infectious disease spread from person to person, primarily via the fecal-oral route (Cohen, 2004). Although approximately 90% of polio infections cause no symptoms at all, affected individuals can exhibit a range of symptoms if the virus enters the blood stream (Ryan and Ray, 2004). In about 1% of cases, the virus enters the central nervous system, preferentially infecting and destroying motor neurons, leading to muscle weakness and acute flaccid paralysis. Different types of paralysis may occur, depending on the nerves involved. Spinal polio is the most common form, characterized by asymmetric paralysis that most often involves the legs. Bulbar polio leads to weakness of muscles innervated by cranial nerves. Bulbospinal polio is a combination of bulbar and spinal paralysis (Atkinson *et al.*, 2009).

Polio epidemics have crippled thousands of people, mostly young children; the disease has caused paralysis and death for much of human history. By 1910, much of the world experienced a dramatic increase in polio cases and epidemics became regular events, primarily in cities during the summer months. These epidemics, which left thousands of children and adults paralyzed—provided the impetus for a "Great Race" towards the development of a vaccine. Developed in the 1950s, polio vaccines have reduced the global number of polio cases per year from many hundreds of thousands to under a thousand today (Aylward, 2006).

The world has seen tremendous gains in polio eradication over the past years. In fact, no case has been reported in India since February 2011, and India may be on the verge of eradicating polio (AFP Surveillance Bulletin, 2013). Technically, absence of WPV for 3 years in the face of sustained high quality surveillance is necessary for global acceptance of elimination. However, there is always a risk of Vaccine associated paralytic poliomyelitis (VAPP) as long as oral polio vaccine (OPV) is in use. There is hope in the future that on one day the use of oral polio vaccine will be stopped and no child will suffer from VAPP.

Vaccine-derived polioviruses (VDPVs) are a greater threat to polio eradication itself. Vaccine viruses are transmissible and genetically unstable, with a tendency to revert genotypically and phenotypically to become increasingly wild-like. Any virus isolate that is of vaccine virus lineage and had shown sufficient genetic deviation from the original vaccine virus to show its continued replication in human intestine for

more than 6 months, is called VDPV. It causes polio and tends to spread rather like WPV. When one genotype of VDPV is found in at least 2 children with polio, we know that it has circulated very widely – and is called circulating VDPV (cVDPV). If allowed to evolve, it can circulate like WPVs, thus negating the very eradication of polio. Thus any case of paralysis due to VDPV is counted as polio. Even though polio due to VDPV does not negate the success of eliminating WPVs, its presence is epidemiologically risky as it can spread widely in the community. Further emergence of VDPVs must be preempted in future and if that fails then intercepted and eliminated before it spreads widely into new geographic areas (John and Vashishtha, 2012).

Since today VAPP overwhelmingly outnumbers polio due to WPVs, OPV has to be discontinued as early as feasible, for ethical reasons. When OPV is withdrawn, there will be a time overlap when children shedding vaccine viruses may transmit infection to immunity-naive infants and children, seeding the emergence of VDPV uninhibited by immunity. Such early lineages of VDPV will remain hidden in silent circulation until conditions are right for them to cause polio outbreaks. By then, their containment will be difficult. Thus, allowing the emergence and circulation of cVDPV is unwise and irresponsible. The emergence of VDPVs should be pre-empted using IPV. The elimination of VDPVs using IPV has been called phase 2 of polio eradication. For countries using OPV to eradicate WPVs, the need for a second phase is essential for the eradication of vaccine polioviruses (John and Vashishtha, 2013).

Inactivated Polio Vaccine (IPV) and its Schedule

IPV is formaldehyde-killed poliovirus grown in monkey kidney cell/human diploid cells. Old IPV contained 20, 8 and 32 D antigen units of type 1, 2 and 3 polioviruses respectively. All currently used IPV vaccines are enhanced potency IPV vaccines (eIPV) which contains 40, 8 and 32 D antigen units of type 1, 2 and 3 respectively. The vaccine should be stored at 2–8°C and the dose is 0.5 mL intramuscularly/ subcutaneously. It is highly immunogenic. Sero-conversion rates are 90–100% with two doses given after the age of 2 month and at a 2-month interval or in the Expanded Program on Immunization (EPI) schedule of three doses at 6, 10 and 14 weeks. IPV can be administered along with all other childhood vaccines and can be used in combination with DTwP/DTaP, Hib and hepatitis B vaccines without compromising seroconversion or increasing side effects. The vaccine is very safe. Since IPV contains trace amounts of streptomycin, neomycin and polymyxin B, allergic reactions may be seen in individuals with hypersensitivity to these antimicrobials (Vaccine Schedule, 2013).

For children who have completed a primary series of OPV, IPV may be offered as catch-up vaccination for children less than 5 y of age. IPV can be given as two doses at a 2-mo interval. OPV need not be given with these IPV doses. OPV should be given with the 1st and 2nd boosters of DTP and on all NID's and SNID's. For immune-deficient children and their close contacts, IPV should be the preferred vaccine especially in patients with B-cell immunodeficiency if resources permit; OPV should be avoided (Vaccine Schedule, 2013).

As we step near the eradication of polio, it is the high time to shift from OPV to OPV-IPV schedule in India. It can only be achieved if the non-infectious inactivated poliovirus vaccine (IPV) is introduced in UIP, very high (~90%) coverage achieved and then OPV is withdrawn from use. These are challenges facing India as we celebrate the interruption of WPV transmission in India.

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