Vaccine Response With OPV: Should We Worry?

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Polio infection plagued children all over the globe and resulted in significant mortality and neuro-morbidity till eradication was achieved with effective vaccination strategies using oral (Sabin) and or killed (Salk)/ inactivated polio vaccines (IPV). India was declared Polio free in March, 2014 for which oral polio vaccine (OPV) played an instrumental role. However, efficacy, immunogenicity and safety data with OPV had been under purview. The present study,published in February 1970, documents an early report about the immunogenicity of OPV vaccine in Indian children. This landmark paper paved the way for further research on immunization strategies against polio to outline the present revised National immunization strategy.

THE PAST

The reviewed paper reported antibody responses to oral polio vaccine (OPV) in 87 infants (29 babies less than three mo) from Delhi who received three doses of OPV[1]. The study was done to assess the seroconversion rates with OPV in Indian children and if concurrent prevalence of enteroviruses affected the uptake of OPV. All enrolled children received three doses of trivalent OPV at 4-6 weeks interval and antibody titers were compared between baseline and a second sample drawn 4-8 weeks after third OPV dose. Positive transferred maternal antibodies were present at baseline in 17.4%, 26.5% and 16.1% of infants against serotype 1, 2 and 3 respectively. The post-immunization seroconversion rate was 40.2%, 74.7% and 50.5% for seroptype 1, 2 and 3, respectively. Around 16% children were negative for all three antibodies post-immunization while only 27.6% tested positive for antibodies against all three seroptypes. The enterovirus isolation rate was 7.8% out of 296 rectal swabs and similar in pre and post-immunization samples. The study showed poor seroconversion rates following OPV in Indian infants and suggested for alternatives like increasing the dose or frequency of OPV or an additional dose of killed polio vaccine.

Historical Background

Polio continued to afflict lakhs of children despite the OPV being given as per Universal immunization schedule ever since 1985. Therefore, to decrease the paralysis related to polio, Government of India rolled out the Pulse polio program in 1995 in India so as to achieve polio elimination. OPV was provided as mandatory pulses in addition to routine immunization services and further the house to house campaign was done to leave no child unprotected. However, OPV scored over IPV as a vaccination strategy in developing countries as it was effective in providing local gut immunity and herd immunity, was cheaper, easily made available and easier to administer. Seroconversion rates were known to be superior with IPV than OPV with best protection against serotype 2 of polio virus [2]. The seroconversion rates with OPV were poorer in tropics possibly due to concurrent malnutrition and altered gut microbiota, feeding patterns, diarrhea and repeated gut inflammation with poor sanitation [3]. Additional possible dangers of neuro-virulence seen as vaccine-associated paralytic polio and vaccine-derived poliovirus with live attenuated polio strains in OPV had emerged.

THE PRESENT

Initial Indian data of effectiveness on IPV showed intramuscular dose to be most effective than intradermal dose or OPV in infants 6-9 months of age, with maximum seroprotection against serotype 2 of virus which is the most neuro-virulent strain [4]. This suggested for the need to introduce IPV with OPV to improve seroconversion. WHO launched the 'Polio Eradication and Endgame Strategic Plan 2013-2018' [5,6] which recommended switching of trivalent OPV to bivalent OPV and introduction of IPV with OPV. IPV has now been introduced

in the National Immunization schedule of India [7]. The seroconversion rates were higher with IPV when administered as a single intramuscular dose [8]or as fractional dose [9]. The continuation of OPV during PPI visits maintains mucosal immunity and is recommended [7]. A recent community survey in infants in post-polio eradication era across high risk areas for polio virus transmission in India, reported high seroprotection rates (>95%) for type 1 and 2 poliovirus and >88-90% for type 3 poliovirus. All enrolled children had received three routine doses of OPV and median four additional doses during polio campaigns [10]. Rotavirus vaccine has also been introduced in National Immunization schedule to decrease the burden of diarrheal infections. The co-administration of rotavirus vaccine has not shown to affect the seroprotection provided by OPV vaccines [11].

A trial from Southern India evaluated the effect of bacterial and viral intestinal microbiota on immunogenicity of OPV in 704 infants. Non-polio enterovirus and recently acquired enteroviral diarrheal infection were associated with a lower OPV response (OR 0.45, 95% CI 0.35,0.67 and OR 0.38, 95% CI 0.25, 0.59, respectively). Bacterial microbiota did not have any effect on seroconversion [12]. Recent data on poor antibody responses to different oral vaccines has been analyzed. A systematic review [13] analyzed the risk factors with poor performance of vaccines in low-middle income countries. Among 46 studies (25 Asian) on 8838 participants, there was no advantage of supplementation of vitamin A, zinc or probiotic or of withholding breastfeeding on seroconversion with OPV. There was no advantage either with addition of buffer or increasing vaccine inoculums of OPV. However, the seroconversion was higher with use of monovalent or bivalent vaccine instead of a trivalent vaccine (RR 1·51, 95% CI 1·20–1·91) and with use of additional birth dose of OPV (RR 1.1.2, 95% CI 0·96–1·30) [13].

THE FUTURE

The Government of India has been successful to roll out fractional IPV throughout the country. However, the challenges which stay ahead are need to maintain quality polio surveillance, improving injectable vaccine delivery systems, development of indigenous vaccines, newer research for IPV valence and composition and ensuring quality and accountability of services for safety of the masses [14]. A bigger unconquered problem remains poor water, sanitary and hygiene services and practices, which if persistent will further compound the problem of poor vaccine efficacy in Indian children.

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