CASE REPORT

Vaccine Associated Paralytic Poliomyelitis Unmasking Common Variable Immunodeficiency

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Background: Oral polio vaccine can rarely lead to Vaccine-associated paralytic poliomyelitis (VAPP). **Case characteristics**: A 2-year-old child with asymmetric paralysis of lower limbs following first booster of oral polio vaccine; type 2 Vaccine-derived poliovirus (VDPV) isolated. Subsequently, the child was diagnosed to have common variable immunodeficiency. **Outcome:** Paralysis gradually improved on follow-up; monthly intravenous immunoglobulin therapy started for primary immunodeficiency. **Message**: We need to evaluate children with VAPP for underlying immunodeficiency.

Keywords: *Immunization, Oral polio vaccine, Vaccine-derived poliovirus.*

Immunity to polioviruses and other human enteroviruses is mediated by neutralizing antibody [1]. Prolonged intestinal replication of the poliovirus from oral polio vaccine (OPV) in immunodeficient patients, increases the chances of reversion to neurovirulence and transmissibility characteristics typical of wild poliovirus strains. In immunocompetent persons, the duration of intestinal infection by poliovirus is typically limited to 4-8 weeks [2]. In contrast, in immunodeficient persons, particularly those with B-cell deficiency which is associated with hypogammaglobulinemia, poliovirus excretion can persist for as long as 3.5 years [3]. In India, till date, 43 cases of vaccine-derived polioviruses (VDPV) have been reported [4]. We herein describe occurrence of VAPP in a two-year-old child three months following the first booster of OPV.

CASE REPORT

A two-year-old girl presented with sudden-onset of weakness of left lower limb of one month duration. The weakness was preceded by fever and cough for one day. Weakness progressed over the next month to involve right lower limb and weakness of left half of face. The parents gave a history of administration of first booster of OPV one- and-a-half month prior to onset of weakness in the child. There was no significant past illness requiring any hospitalization or prolonged antibiotics intake in child except recurrent fever, with cough and coryza over the previous four months. There was no significant family history.

Examination revealed stable vitals and mild pallor. Child was conscious and well oriented. The child was not able to close left eye and nasolabial fold of left side was less prominent. Muscles of lower limbs were flabby to touch (right> left) with wasting of right lower limb, with decreased power in both lower limbs (1/5 in right lower limb and 2/5 in left lower limb) and diminished reflexes in right lower limb. Rest of examination was unremarkable.

Routine hematological and biochemical investigations, including muscle enzymes, were within normal limits. Asymmetric motor sensory predominantly axonal polyneuropathy was found on nerve conduction velocity assessment of both lower limbs, and MRI dorsolumbar spine was normal. The child was investigated as a case of Acute flaccid paralysis.

Stool sample collected on 3rd and 5th day of onset of paralysis showed VDPV type 2 virus with 24 nucleotide changes. Immunological workup suggested pan-hypogammaglobulinemia with IgG <0.187 g/L (3.7-15.8), IgA <0.068 g/L (0.3-1.3), and IgM 0.195 g/L (0.5-2.2). Markedly reduced isohaemagglutin titres suggested of an impaired antibody response to antigen with Anti-A titre of IgM : 1:1 ; IgG : 1:2 and Anti-B titre of IgM: 1:2; IgG: 1:4 and normal number of B and T lymphocytes with values of CD 19+ B- cells 18.94 % (14-33%), naïve B-cell count 94.8% (62-69%), memory B-cell 4.61% (8-22%), CD3+ T cells 74.5% (56-75%), helper T-cell count 37.15% (33-55%), cytotoxic T-cell 36.4% (14-26%) NK cell count 0.64% (4-17%). The findings of presence of normal number of B and T cells with panhypoglobulinemia were consistent with diagnosis of Common variable immunodeficiency.

The child's weakness did not progress and she was started on intravenous immunoglobulin (IVIg)(400 mg/kg/day for 5 days). Her weakness improved over the next month. She was continued on monthly IVIg. Eight months after diagnosis, the excretion of polio virus continues to persist.

DISCUSSION

Polio virus isolates are described as VDPV or wild type poliovirus based on the percent nucleotide sequence homology between its capsid protein VP1 and that of the corresponding OPV vaccine serotype. VDPVs are further subdivided as'' i-VDPV " that arise during persistence infection of immunodeficient individuals and "c-VDPV"or ''circulating VDPV" that evolve during continuous transmission of vaccine virus among unvaccinated individuals in populations with low vaccination coverage and sufficient numbers of unimmunized infants accumulate [5] and 'ambiguous VDPVs (aVDPVs)' which are either clinical isolates from persons with no known immunodeficiency, or sewage isolates of unknown source [6]. Occurrence of VAPP following OPV administration is rare, the incidence being rarer after subsequent doses compared to the first dose of oral vaccine. Paralytic disease in immunodeficient patients following their vaccination with OPV has been recognized for a long time [7], but only during the past decade has the phenomenon received the deserved scrutiny.

Aforementioned patient developed acute paralysis three months following booster dose of OPV. As the patient had underlying immunodeficiency, the vaccine virus likely reverted back to neurovirulence and resulted in development of paralysis. Kew, *et al*. [8] described a case of VDPP in a patient of common variable immunodeficiency, but this patient was a known case of CVID before paralysis onset, which occurred 6.9 years after vaccination and at least 2 years after diagnosis of CVID. This is unlike our case, where diagnosis of immunodeficiency was made after the isolation of vaccine polio virus. Type 2 vaccine virus is the predominant cause of VDPV worldwide, as well as in India [1].

Several strategies for eliminating poliovirus persistence in immunodeficient patients have been tried with equivocal results. Review of literature revealed that most persons with hypogammaglobulinemia who were fed OPV while receiving immunoglobulin replacement therapy cleared the infection within a few weeks [9]. In the present case, excretion of virus is persisting even months after monthly pulses of immunoglobulin.

This case further endorses the recommendation of the Government of India and WHO to switch from oral vaccine to inactivated vaccine to minimize the risk of paralysis, especially in immunocompromised children as screening for primary immunodeficiency is not possible prior to first dose of OPV. A step has already been taken in this direction with the introduction of one dose of IPV at 14 weeks of age in the National immunization program [10].

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