

An unusual case of vaccine-associated paralytic poliomyelitis

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The present article reports a case involving an immunocompetent, previously well child who, despite two previous doses of inactivated poliovirus vaccine, developed severe flaccid paralysis consistent with polio after receiving oral polio vaccine.

Key Words: MRI findings; Oral polio vaccine; Vaccine-associated poliomyelitis

CASE PRESENTATION

A previously well child who was almost one year of age, born in Canada to Chinese parents, presented to his pediatrician with acute flaccid paralysis of his left leg. He had received his first two sets of immunizations at his local public health unit. This included: diphtheria, tetanus and acellular pertussis (DTP); inactivated poliomyelitis vaccine (IPV); and *Haemophilus influenzae* type b (Pentacel; Sanofi-Pasteur, Canada) and Pevnar (Pfizer, Canada). He did not experience any adverse events associated with either of these immunizations. At five months of age, the child and his family went to China to visit friends and relatives. At six months of age, his parents continued his immunizations according to the local immunization schedule. He received a dose of DTP and oral poliovirus vaccine (OPV) and, one week later, received a dose of hepatitis B vaccine. Approximately three weeks after immunization with DTP and OPV, he presented to the local children's hospital with fever and limb weakness. On history, he had not experienced any preceding cough or rhinorrhea, nor did he have diarrhea, vomiting or rashes. He had no known sick contacts. His parents had noted a regression in his motor skills, specifically in his ability to stand with support and also difficulty with using his upper extremities.

In China, he was diagnosed with Guillain-Barré syndrome (GBS) based on the presentation of acute flaccid paralysis that was assessed to be symmetrical in nature. Further investigations at the time of presentation included a normal immune work-up, a cerebrospinal fluid white blood cell count of $12 \times 10^6/L$ with a protein level of 1.43 g/L and glucose level within normal limits. Cerebrospinal fluid viral culture and polymerase chain reaction were not conducted. Magnetic resonance imaging (MRI) performed in China showed enhancement of the cauda equina.

He was treated with a course of intravenous immunoglobulin (1 g/kg/day for three days) and steroids (tapering 5 mg, 3 mg and 1.5 mg over six days). He was discharged from hospital within two weeks, having experienced an improvement in his upper extremity

Un cas inhabituel de poliomyélite paralytique associée au vaccin

Le présent article rend compte du cas d'un enfant immunocompétent auparavant en santé qui, malgré deux doses antérieures de vaccin inactivé contre le poliovirus, a contracté une grave paralysie flasque qui cadrait avec la polio après s'être fait administrer le vaccin antipoliomyélique oral.

strength and improvement most notably of his right leg. Two weeks after discharge, his family returned to Canada.

On return to Canada, he was seen by his pediatrician. On examination, he had left leg weakness with absent deep tendon reflexes and his sensorium was intact. Urinary stream and anal sphincter tone were normal. His pediatrician recommended further follow-up with a pediatric neurologist and rehabilitation services to help with muscle strength. He was seen at the regional Children's Hospital. At that time, the physical findings were confirmed, a diagnosis of post-GBS was given and further rehabilitation was suggested.

Six weeks later, the child was seen again by a pediatric neurologist and was noted to have asymmetric weakness of his left leg. Because this did not appear to be improving, further treatment and investigations were initiated. The child received three additional days of intravenous immunoglobulin (0.4 mg/kg/day for five days). Subsequently, he underwent electromyography and MRI of his spinal cord. The electromyography showed denervation to muscles of the left leg with an absent peroneal nerve response, tiny motor responses with very slow conduction of the tibial nerve and fibrillation potentials suggesting active denervation in the muscles tested.

Repeat MRI revealed bilateral symmetric increased signal within the anterior horns of the spinal cord gray matter, with abnormal signal identified in two locations (C2 through C5 and T10 through T12) (Figure 1). The multifocal increased signal within the ventral horns of the spinal cord gray matter was highly suggestive of poliomyelitis.

Further investigation revealed his immunization history in China. Follow-up of stool culture showed no nonpolio enteroviral growth and no presence of polio type 1 or type 2 viruses, but did show presence of poliovirus type 3. At the national laboratory in China, the strain was sequenced and was found to be a Sabin poliovirus type 3 strain with 99.7% homology with the parent OPV strain.

In Canada, further testing included repeat stool culture and throat swab, both negative for poliovirus, polio antibody titres of <1:8 for

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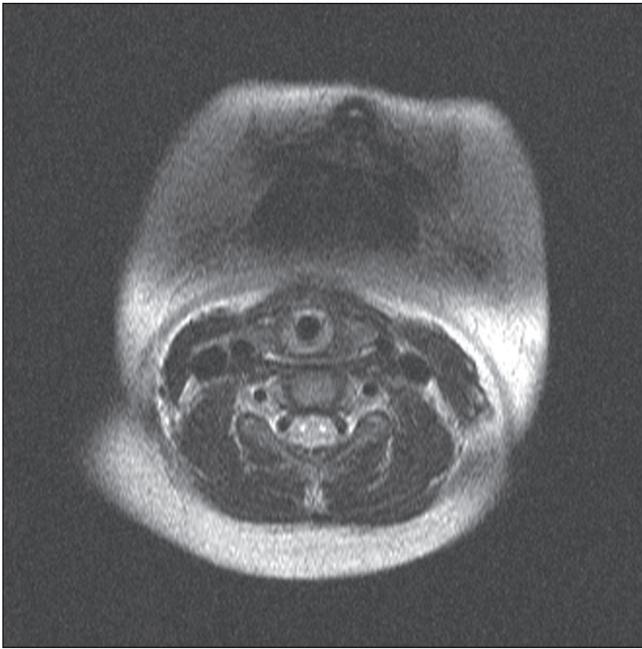


Figure 1) Magnetic resonance image obtained in Canada showing bilateral symmetric increased signal within the anterior horn

poliovirus 1, 1:32 for poliovirus 2 and 1:128 for poliovirus 3. Immunoglobulin subclass analysis showed no abnormalities and an HIV test was negative. Repeat polio serology was performed seven months after the first set and showed a 1:8 titre for poliovirus 3.

This suspected case of vaccine-associated paralytic poliomyelitis (VAPP) was reviewed by an expert committee in vaccine-related adverse events – the Advisory Committee Causality Assessment (ACCA) – and was determined to be a probable case of VAPP.

DISCUSSION

In 1955, the IPV was introduced, with the subsequent introduction of the trivalent OPV being introduced in 1962. The oral vaccine has been used as the major vaccine in the fight to eradicate polio. As countries have been able to control the incidence of polio, the issue of VAPP has represented a larger burden of disease than wild-type virus (1). In light of this information, countries such as Canada have switched from OPV to IPV. Canada was certified polio free in 1994 (2). IPV for routine immunizations was recommended in 1995/1996 and a switch to this occurred across the country (1). The most recent case of VAPP in Canada was reported in 1995 (3). In other countries, such as China, OPV has continued to be used for routine immunizations. China was certified free of wild-type poliovirus in 2000, with their last endemic case occurring in 1994 (4). Ongoing cases of VAPP have been reported including case clusters (5), although there were no further cases of VAPP observed within the region that the child received the dose of OPV in this instance.

We describe a case that initially was consistent with the diagnosis of GBS. Few MRI scans are performed early in the course of polio

infection. From the evolution of disease in our patient, it can be demonstrated that he progressed to develop poliomyelitis.

In considering the differential diagnosis, other possibilities would include GBS, nonpolio enteroviral infection, West Nile Virus infection, wild poliovirus infection and, finally, VAPP. GBS is an unlikely diagnosis given that the child had developed persistent one-limb weakness and these deficits persisted despite appropriate therapy for GBS. Nonpolio enteroviral infections were a possibility; however, they were ruled out by two stool cultures performed at the time of onset of clinical illness and both were negative. West Nile virus is observed in the area of Canada where the child lived, but his serology (immunoglobulin M) was negative. The diagnosis of wild poliovirus was discarded because the polio strain isolated from the child's stool showed 99.7% homology with the strain used in OPV.

Further clinical, laboratory and radiological findings made this a probable case of VAPP. This case was unusual because the child appeared to be immunocompetent and had received two previous doses of IPV. In the United States, during the transition from an all-OPV schedule to a mixed OPV/IPV schedule, no cases of VAPP associated with the mixed schedule were reported (6). All cases of VAPP reported in the United States were in children who received the OPV vaccine. The estimates of risk for VAPP range from one in 750,000 with the first dose of OPV to one in 2.4 million for all doses of OPV (6,7). From the literature, it is evident that two doses of IPV provide high levels of protection (>90%) for poliovirus 1 and 2, but only 75% protection against poliovirus 3 (8).

The issue of OPV and its ability to cause VAPP has been intensely debated in countries in which the ability to maintain cold chains and other logistical as well as financial issues has continued to be debated (9). As the international efforts for polio eradication move forward, issues such as the present case arise as discussion points.

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