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A Case of Paralytic Poliomyelitis Associated with Poliovirus Vaccine Strains in Hokkaido, Japan

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On December 3, 2007 in Hokkaido, a male infant aged 6 months old presented with fever (39.0°C), and on December 6, subsequently developed acute flaccid paralysis of the lower extremities with reduced physical activity and sucking defect. The patient had received his first dose of oral poliovirus vaccine (OPV) 20 days before the onset of paralysis and had neither immunological abnormalities nor history of travel to foreign countries including polio-endemic areas. He was admitted to a regional hospital, and clinical information on the patient was reported to the Kamikawa Public Health and Social Welfare Office as a suspected case of poliomyelitis.

To address the possibility of vaccine-associated paralytic poliomyelitis (VAPP), clinical samples were collected from the patient 6–13 days after the onset of paralysis, and virus isolation and identification were conducted at the Hokkaido Institute of Public Health and the National Institute of Infectious Diseases. Polioviruses were isolated from stool samples, which were collected 6–9 days after the onset of paralysis (26–29 days after the OPV administration), and virus isolation was performed using Vero, A549, CaCo-2, RD, and HEp-2 cells. The inoculated cells were examined everyday for 14 days for evidence of a cytopathic effect. Furthermore, L20B cells, highly susceptible to polioviruses (1), were also used for virus isolation during the same period. All isolates from stool samples were finally identified as type 2 and type 3 polioviruses by the microneutralization test (1). For the intratypic differentiation of polioviruses to distinguish between vaccine and wild polioviruses, we determined the sequence of the entire VP1 region of the type 2 and type 3 poliovirus isolates. As shown in Table 1, sequence analysis demonstrated that the isolates have less than 1.0% nucleotide diversity from the parental Sabin strains. Thus, both type 2 and type 3 poliovirus isolates were identified as Sabin-like polioviruses, which were commonly found in the stool samples from OPV recipients and their close contacts, including healthy individuals and VAPP patients (2). Cerebrospinal fluid (CSF) was negative for viruses by virus isolation, and enterovirus-specific RNA was not detected from the CSF samples by a seminested reverse transcription-PCR either (3). During clinical follow-up, the patient continued to have residual paralysis. From clinical, epidemiological, and virological points of view, the patient was finally reported to the Public Health and Social Welfare Office as a suspected case of poliomyelitis.

Although Japan has maintained a polio-free status since the identification of a wild type 3 poliovirus in 1993, suspected VAPP cases have consistently been reported in OPV recipients and their close contacts (4–7). The overall risk for VAPP in Japan was estimated to be one case per 2.0 million OPV doses (7). To reduce the inherent risks of OPV, VAPP, and polio outbreaks due to vaccine-derived polioviruses, in 2003 the Subcommittee on Polio and Measles Vaccination recommended the introduction of inactivated poliovirus vaccine (IPV), instead of OPV, in Japan (8). However, as of 2009, no IPV containing vaccine products have been licensed in Japan (9). Further polio vaccination strategies in Japan, including early introduction of IPV, should be seriously and urgently considered to minimize the risk of VAPP (10).
Table 1. Characterization of poliovirus isolates from a suspected VAPP case in Hokkaido in 2007

<table>
<thead>
<tr>
<th>Virus</th>
<th>Date of sampling</th>
<th>Sample</th>
<th>Serotype</th>
<th>VP1 sequence</th>
<th>Final result</th>
</tr>
</thead>
<tbody>
<tr>
<td>#130/stool-1</td>
<td>Dec. 12, 2007²</td>
<td>Stool</td>
<td>Type 2</td>
<td>99.8% identity to Sabin 2</td>
<td>Sabin 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Type 3</td>
<td>99.7% identity to Sabin 3</td>
<td>Sabin 3</td>
</tr>
<tr>
<td>#130/stool-5</td>
<td>Dec. 15, 2007³</td>
<td>Stool</td>
<td>Type 2</td>
<td>99.8% identity to Sabin 2</td>
<td>Sabin 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Type 3</td>
<td>99.6% identity to Sabin 3</td>
<td>Sabin 3</td>
</tr>
</tbody>
</table>

¹: Nucleotide identity from the original Sabin strain in the entire VP1 region.
²: Six days after the onset of paralysis.
³: Nine days after the onset of paralysis.

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REFERENCES