PROTECTION TO CHALLENGE IN ANIMALS IMMUNIZED WITH EXPERIMENTAL VACCINE AGAINST FMD TYPE O, SEA TOPOTYPE

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Introduction:
The SEA topotype occurred in FMD-susceptible animals, such as cattle and swine, in the East Asian region (such as Korea, Japan, and North Korea) in 2010–2011. FMD spread in Korean livestock rapidly in late 2010, but nationwide vaccinations prevented its further expansion. The immunological relationship between O Manisa vaccine and field strains was an r value of approximately 0.3. The development of a new vaccine using field isolates caused large-scale outbreaks was required. In particular, since more viruses are excreted from pigs than from cattle in general, vaccines should be developed that can be effectively used for pigs.

Materials and methods:
FMDV strains O/Andong/ SKR/2010 (AD-P) for the SEA topotype, O Manisa and O/SKR/2002 for the ME–SA topotype, and O/ASP/Cathay for the Cathay topotype were used for the cross-virus neutralization test (VNT) or challenge test. The two or five of 3-month-old pigs with FMD antibody-free per group were vaccinated intramuscularly in the neck with an experimental vaccine containing the AD-P strain or the commercial vaccine containing the O Manisa strain. The pigs (7.5, 10, 15 μg per dose) were immunized with the experimental (AD-P) vaccine for 4 weeks. All pigs of the experiment were challenged with the virus O/Andong/ SKR/2010 (10⁵.0 TCID₅₀/0.1 ml) on each footpad (0.1 ml/animal) to identify protective effects with clinical signs at 30 days post vaccination (DPV).

Results:
High levels of neutralizing antibodies were detected in the groups vaccinated with high-dose antigens (7.5, 10, 15, 20-μg) from day 14 after vaccination; clinical signs except vesicle lesions in the inoculated leg in the 7.5-μg groups were not identified after the direct challenge inoculation. The group inoculated with the O–ME–SA topotype vaccine (a commercial vaccine using the O Manisa strain) showed relatively low levels of antibodies against O–SEA topotype viruses. The negative control animals showed typical FMD symptoms from 2 days post challenge (DPC), and viremia and virus excretion were detected from 1 DPC. However, viruses in pigs of the 10-μg antigen group were only detected from serum or nasal discharges for a short time (3 or 6DPC). A few of the vaccinated pigs had vesicle lesions on the injected site of the footpad from 3–4 DPC.

When the O Manisa vaccine was administered to the pigs, the neutralizing antibody against O/Andong/ SKR/2010 and O/SKR/2002 showed a relatively lower level than that against O Manisa. Interestingly, the neutralizing antibody against O/SKR/2002, ME–SA topotype to the same group as O Manisa showed a relatively lower level than that against the O/Andong/ SKR/2010, SEA topotype. However, all pigs immunized with AD-P were completely protected against O/SKR/2002.

Discussion:
Although the 146S antigens used as vaccines are generally inoculated in a range of 1 to 10-μg, in the case of O serotype antigens, larger amounts are required to obtain the same potency
compared to other serotypes. Since antigen concentrations do not perfectly coincide with potency, the correlation between the concentration of 146S antigen and potency cannot be easily determined when the concentration is greater than 10-μ g. In our experiment, animals vaccinated with 2 or 5-μ g of 146S antigens partially induced neutralizing antibody, whereas those vaccinated with 7.5–15-μ g antigens induced protectable antibody and were clinically protected from homologous or heterologous challenge, indicating that the efficacy of vaccine could be improved at higher antigen concentrations.
Biography Jong-Hyeon PARK, PhD, DVM

Dr. Jong-Hyeon Park is the current chief of the Vaccine Research Laboratory of the FMD Division, the Animal and Plant Quarantine Agency (QIA) under the Ministry of Agriculture, Food and Rural Affairs, Republic of Korea.

He obtained a Doctor of Veterinary Medicine (DVM) from the Department of Veterinary Medicine of Chungnam National University, Daejeon, Korea, in 1989. Also, he completed his PhD at the same university in 2002 with the thesis entitled “Studies on DNA-Based Vaccines of Japanese Encephalitis.”

He was appointed as the chief of the FMD laboratory in 2002. He has been extensively involved in preventive diagnosis, nationwide surveillance and vaccination of FMD and research on the disease in the ROK since 2002.

Dr. Jong-Hyeon Park has published 58 articles in peer-reviewed journals. Most of the articles are about diagnosis of FMD and vaccines against foot-and-mouth disease. His current research focuses on the development of FMD vaccine for the national vaccination, and development of new diagnostic methods and serological differentiation on NSP antibody. Dr. Park has been involved in active surveillance (serological and virological) of FMD in swine, sheep, cattle and wild animals as well in the Republic of Korea since 2000 to prevent the reemergence of foot-and-mouth disease virus.

Recently, he has carried out research projects associated with development of inactivated FMDV vaccine using Korean FMDV isolates from 2010/2011 outbreaks. In addition, he has developed anti-viral agents (adenovirus expressing IFN alpha/gamma fusion protein, adenovirus si-RNA, chemicals) as a FMD control tool to inhibit replication of FMDV and tried to devise successful strategies to minimize the outbreak of FMDV in swine.