Induction of mucosal immunity by plasmid DNA and synthetic peptide vaccine

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Local immunity plays a critical role in protection of animals from mucosal infections. To develop a safe and effective mucosal vaccine, immunization of animals with plasmid DNA or synthetic peptides by mucosal route was evaluated for the potential to induce antibody response and to confer protective immunity. In addition, neutralization epitopes of Aujeszky's disease virus (PrV) glycoproteins B and D were investigated.

Mice were immunized with plasmids expressing PrV glycoproteins, gB, gC, and gD by intranasal administration or intramuscular injection. Anti-PrV specific IgG antibodies were detected in the sera and trachea-lung washes of mice immunized with gB-expressing plasmid intramuscularly. Both IgG and IgA antibodies were detected in the nasal washes of mice immunized with gB-expressing plasmid intranasally. In contrast, only IgA antibodies were detected in the trachea-lung washes of mice immunized with gD-expressing plasmid intranasally. Mice immunized intranasally with plasmid DNA expressing gC or gD resisted to intranasal challenge with a lethal dose of virus, as show in their prolonged survival days and partial protection.

Pigs were immunized intranasally with a peptide containing neutralization epitope of the influenza virus (Aichi/2/68) hemaggulutinin or inactivated virus. In the sera and nasal swabs of pigs immunized with inactivated virus, specific IgG and IgA antibodies were detected. Virus was scarcely recoverd from their nasal secretion after virus challenge. On the other hand, low level of specific IgA was detected in the nasal swabs of pigs immunized with the peptide vaccine. Virus titers in their nasal secretion were less than those of control pigs.

To develop a peptide vaccine against Aujeszky's disease, neutralization epitopes on gB and gD molecule were analyzed by using synthetic peptides. The result suggests that amino acid residues 610–625 of gB, 1–19 and 22–42 of gD were the sites recognized by specific antibodies but not neutralization epitopes.

The present results suggest that intranasal immunization of animals with plasmid DNA expressing virus surface glycoproteins and a synthetic peptide containing neutralization epitope confer protective immunity to animals by inducing local secretory antibody production on their mucosal surface which is the most vulnerable sites for infection.