Equine infectious anemia virus: replication mechanisms and vaccinology

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China has a big horse population and a long history of horse-raising. Horses played an important role on the economic development and national defence in the early days of the establishment of the People's Republic of China. Equine infectious anaemia (EIA) is infectious viral diseases of horses, mules, and donkeys. EIA was once widely prevalent in the Mainland China in 1950-1980. In 1973, a live attenuated EIA viral vaccine was developed and had been widely used in mainland China in 1973-1983, which leaded to a successful control of the disease. The EIA live attenuated vaccine is the only widely used live lentiviral vaccine and has good protection efficiency against virulent EIA virus challenge. EIA vaccine is a great model for other lentiviral vaccine study including HIV-1. In recent years, our study focuses on the mechanism of viral replication, attenuation, and immune protection. We have revealed serials of important cellular factors that involved in viral life cycle and their interactions with virus. At same time, the molecular basis of viral evolution, attenuation, and immune protection has been investigated and the results provide a new insight into lentiviral vaccine development.

The Development of Competitive ELISA for Detection of the Antibodies against EIAV

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Equine infectious anemia (EIA) is a blood-borne infectious disease caused by Equine infectious anemia virus (EIAV), belonging to the genus Lentivirus of the family Retroviridae. The capsid antigen (p26) represents the majority of EIAV proteins, is highly conserved among EIAV isolates and contains group-specific determinants. In our previous study, one monoclonal antibody (MAb 1G11) against p26 has been demonstrated as a broad-spectrum monoclonal antibody and its recognized epitope on p26 might be a common B-cell binding epitope of EIAV antibodies. In view of the above-mentioned results, a competitive ELISA (cELISA) was established in this study. The MAb 1G11 was coat in microtiter plates as the competitive antibody and the p26 protein was labeled with horseradish peroxidase (p26-HRP) as reactive antigen. The sample serum reacted with p26-HRP before adding the conjugation into the plate. This assay was demonstrated to have good specificity, sensitivity and repeatability and might be a useful tool for screening anti-EIAV serum clinically.

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Development of inactivated vaccine against equine influenza

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Equine influenza (EI) was one of the most common equine infectious diseases caused by equine influenza virus. The frequent outbreak of EI in China caused great loss to the horse industry, which has over 6 million horses in China. Vaccination was an effective means to prevent the occurrence of EI. At present, there was no independent intellectual property rights of the equine influenza vaccine in China, however, the foreign EI vaccines were expensive and unknown effects to horses in China. The development of the EI vaccine in China not only has important social significance, but also has a broad market prospect. In this study, the genetic evolutions of the equine influenza strains isolated from 1994 to 2010 was studied. One epidemic strain isolated in Xinjiang in 2007 was used to develop the inactivated vaccine. Main work included: 1.Identification of the seed virus (purification and Characteristics of the seed virus); 2.EIV challenging model on horses (dose of challenging virus, methods of challenging, standard of the disease, et al.); 3. Product quality research (cultivation conditions, inactivation, adjuvant, purification method, et al.); 4. Safety of the vaccine (safe dose, in different horses, et al.); 5. Immune potency tests (Immune dose, protection, immune duration, et al.).

Latest technologies were performed in this inactivated vaccine research. One highly pathogenic, highly virulent pure strain was screened, and a standard artificial model of EIV attack was established for the first time in China. A purification method was established to produce the better vaccine, which has the least waste proteins in the vaccine, the final protein concentration was less than 300mg/ml. A most suitable adjuvant for the inactivated vaccine was screened through the comparison of several kinds of new and old adjuvants. The vaccine has very little side effects on horses, which were included six months ponies, adult horses, pregnant mares, Arabian horses, thoroughbreds and Akhal-teke horses. Horses could effectively resist the EIV infection after the vaccination. The duration of the antibody protection could last more than8 months. Our study proved that the inactivated vaccine has no side effect on the horses, it could introduce long duration of EIV antibodies and protect horsed from EIV infection. In 2018, the clinical trial work under GCP (good clinical practice) rules has completed in 3 provinces of China, and the vaccine were safe used in 300 different kinds of horses. In 2019, the vaccine was applying for certificate of new veterinary drug in MOA (Ministry of Agriculture of China).