Failure of Foal Seroconversion Following Equine Influenza Vaccination

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Commercial equine influenza vaccine failed to stimulate significant hemagglutination-inhibiting antibody titers in foals of immunized dams when the vaccination schedule was started at 2, 3, 4, or 6 months of age. Maternal antibodies, even at low levels, might interfere with the active immunization of foals against equine influenza. Authors' addresses: Castleton, Inc., 2469 Iron Works Pike, Lexington, KY 40511 (Conboy and Berry); Hagyard-Davidson-McGee Inc., 4520 Iron Works Pike, Lexington, KY 40511 (Fallon); and Gluck Equine Research Center, Dept. of Veterinary Science, University of Kentucky, Lexington, KY 40546-0099 (all other authors).

1. Introduction
Equine influenza is a common respiratory disease of young horses, for which vaccines exist and are heavily used. Previous results from our laboratory and others1 showed that repeatedly vaccinated 1- to 3-year-old horses often had little or no antibodies and remained at risk from equine influenza. Possible causes include the induction of vaccine tolerance rather than immunity by an unknown mechanism correlated with maternal antibodies.2–4 As a preliminary to studies of potential vaccine tolerance, we investigated the serological status of 128 foals in four independent series of equine influenza vaccinations, using commercial vaccines now in use in the U.S.

2. Materials and Methods
Sera from four independent groups of vaccinated horses were analyzed: group A, 56 foals, in which the foals received three doses of vaccine at ages 3 months, 4 months, and 7 months; group B, 35 foals, in which the foals were vaccinated with two doses of vaccine at ages 6 and 7 months; group C, six foals, receiving two doses of vaccine at ages 2 and 3 months; and group D, 31 foals, receiving four doses of vaccine at ages 4, 5, 10–11, and 11–12 months.

All dams were booster vaccinated within 1 month prior to parturition. Serum samples were taken at the time of each vaccination and approximately 1 month following each vaccination. The same vaccine, a commercial influenza–equine herpesvirus 4 combination vaccine, was used in groups A and B. A different vaccine by the same manufacturer was used for group C and for the first two doses in group D. The last two doses in group D used vaccines from three different manufacturers.

Serological analyses were done by using the hemagglutination-inhibition (HI) test on trypsin-periodate-treated sera. Equine influenza virus antigens used in HI testing included the strains Prague/56 (equine-1 subtype), Miami/63 (equine-2 subtype), and either Kentucky/95 (equine-2) for
groups A or B, or Kentucky/92 (equine-2) for groups C or D.

3. Results
Significant levels of influenza-specific maternal antibodies were detected in sera of foals after birth (mean HI titers of 140 to Prague/56, 34 to Miami/63, 69 to KY/95). Titers subsequently declined with group B showing mean titers of <10 against all antigens at 6 months of age prior to vaccination.

Following vaccination, foals in groups A and C showed no significant increases in antibody titers to any antigen. Group B foals showed significantly increased titers for Prague/56 antigen only. Group D foals had no significant increases following two doses of vaccine. Following the third dose given when horses were then yearlings, there were increases in titers for Prague/56 antigen in 2/3 of the horses, but the mean titer was still only 11. The means of HI titers for Miami/63 and KY/92 antigens also rose, but these were attributable to real rises in only four of 31 horses. A fourth vaccination of group D did not stimulate further increases. Final mean titers in group D were still <10 for Miami/63 and KY/92 antigens. Using ether-disrupted instead of whole-virus antigens in the HI test did not affect the conclusion except to raise mean HI titers slightly to Prague/56 antigen (to 22 in group D, and ~16 in groups A and B). Final mean titers to equine-2 viruses (Miami/63 and Kentucky strains) remained <10 in all groups.

4. Discussion
Others have previously reported a lack of effectiveness of foal vaccinations with equine influenza vaccines and suggested that vaccination should be done no earlier than 6 months of age. Our results, obtained with vaccines now in use in the U.S., substantiate those findings and indicate that influenza vaccinations of foals as old as 6 months age, from vaccinated dams, are generally not effective in eliciting serum antibody titers needed for protection (i.e., >40). This correlates with previous findings that multiply vaccinated yearlings were still susceptible to equine-2 influenza infection. Others have suggested that maternal antibodies interfere with vaccination and that this might induce immune tolerance to vaccine, which can persist for several months. If so, it is important to determine schedules for equine influenza vaccination of foals and dams that are effective for induction of immunity, rather than tolerance, in the foal. Package labels for existing commercial equine influenza vaccines are not informative on this issue.

References