Duration of Immunity Against Experimentally Induced West Nile Virus Encephalomyelitis in Horses Using a West Nile Virus Chimera Vaccine

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Using a model in which grave, reproducible neurological disease was induced, a West Nile virus vaccine showed a 12-mo duration of protection against West Nile virus encephalomyelitis. Authors’ addresses: Large Animal Clinical Sciences, College of Veterinary Medicine, University of Florida (Long, Seino, Gibbs, Beachboard, Bourgeois, Dixon); and Intervet, Inc., 35500 W. 91st Street, DeSoto, KS 66018 (Mellencamp, Zhang); e-mail: Longm@mail.vetmed.ufl.edu (Long). © 2006 AAEP.

1. Introduction
West Nile virus (WNV), a mosquito-borne flavivirus that has been endemic in the United States since 1999, has caused encephalitis in >20,000 horses with case-fatality rates ~35%. A new chimera vaccine was tested in an intrathecal model that reproduces disease in horses.

2. Animals
Twenty horses of mixed sex that were between 6 and 10 mo of age were randomized into three blinded vaccination/challenge trials for testing of a live attenuated WNV chimera vaccine.

3. Materials and Methods
A 12-mo duration-of-immunity (DOI) trial was undertaken in which 12-mo protective immunity was tested. Ten horses served as unvaccinated controls (CON), and 10 horses (VAC) were vaccinated with 1 ml of a serial-release dose of vaccine. Horses received virulent WNV intrathecally (1 × 10^5 PFU/ml) 12 mo after vaccination and were monitored for 21 days after challenge. For all trials, a daily physical examination was performed (increased body temperature: rectal temperature > 39.2°C [102.5°F]). A neurological evaluation was performed weekly after vaccination and daily after virulent challenge. Plasma and tissues were collected from experimental subjects for virus isolation. Blood for serum was collected before vaccination, after vaccination, and after infection for serology. Horses challenged with virulent WNV were euthanized if there were persistent or acute signs of WNV disease coupled with recumbency or inability to locomote independently.

4. Results
For the DOI trials, no horses in the VAC group met the criteria for euthanasia, and all survived to the
end of the observation period. No clinical disease was observed in 8 of 9 vaccinated horses; the tenth horse exhibited delayed onset of muscle fasciculations and stiffness. Eight of ten CON horses developed severe clinical signs requiring euthanasia; the remaining two horses showed depression and mild ataxia. Gross necropsy and histopathological changes were observed in the brain and spinal cord of all CON horses: eight had severe changes and two had mild changes. Moderate changes were observed in one vaccinated horse. Virulent WNV was not isolated from the plasma of any of the horses in the VAC group (0 of 10), but it was isolated from 8 of 10 horses in the CON group. Virus-neutralizing antibody titers were detectable in all horses in the VAC group by 14 days post-vaccination and remained positive until challenge for 12 mo post-vaccination.

5. Discussion
Using a model that induced severe clinical signs of neurologic disease, a WNV chimera vaccine showed 95% protection against WNV disease for up to 12 mo post-vaccination. Previous work reported at the Annual Convention of the American Association of Equine Practitioners showed that the intrathecal model reliably reproduces disease. This work further shows the utility of this model for long-term immunity studies.

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