

## 2006 MULTI-STATE OCCURRENCE OF EVA

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### Introduction

The 2006 occurrence of equine viral arteritis (EVA) in NM and several other states has increased awareness among horse owners and breeders of a disease that can have significant financial repercussions, especially for the breeding sector of the nation's equine industry. Economic losses directly or indirectly attributable to this infection include abortion, illness and death in very young foals, the carrier state in stallions, and denied export markets for certain categories of horses with prior exposure to this infection, as well as virus infective semen or embryos. <sup>[12,14]</sup>

Ever since 1984, when EVA occurred on a widespread scale in Kentucky, involving an estimated 41 Thoroughbred breeding farms, the disease has gained considerable international notoriety.<sup>[10]</sup> There is a growing awareness of the heightened risk of global spread of the causal agent, equine arteritis virus (EAV), inherent in the ever-increasing volume of trade in horses, semen and embryos.<sup>[11]</sup> Ironically, notwithstanding the huge economic impact of the horse industry on the national economy, to this day, the United States stands alone as the only country with zero import testing requirements or controls for EVA. Over the years, there have been numerous proven introductions of EAV into the resident US breeding population either from the

importation of carrier stallions or shipped virus infective semen. Regretfully, on occasion these have resulted in economically damaging outbreaks of EVA and the multi-state dissemination of strains of the virus of considerable pathogenic potential.<sup>[1]</sup>

Notwithstanding the widespread global distribution of EAV, from a historical perspective, relatively few confirmed outbreaks of EVA have been reported. This situation has been changing, however, in more recent years. The number of recorded occurrences of the disease has increased in the United States and Canada, due in part to greater awareness of EVA among veterinarians and members of the horse industry, as well as improved laboratory capability to diagnose the infection.<sup>[14]</sup> Two of these occurrences in particular which took place in 1988 and 1993, led to dissemination of the virus among a significant number of states, resulting from the movement of horses either incubating the infection or subclinically infected with EAV. The most recent was a major occurrence of EVA at Arlington Park Racetrack, Chicago, Illinois in 1993.<sup>[9]</sup>

### **Prevalence of Infection**

It has been known for many years that based upon the results of a range of serological surveys carried out in the United States, the prevalence of EAV infection varies widely among different horse breeds.<sup>[2,5,6,14]</sup> Highest rates of infection have been found in Standardbreds and Warmbloods and much lower rates in Thoroughbreds (Timoney & McCollum, unpublished data).<sup>[2]</sup> At the time of the NAHMS Equine 1998 study, there was very little evidence of circulation of EAV in a significant and representative sampling of the Quarter Horse population, with a seroprevalence of only

0.6 percent.<sup>[7]</sup> This indicated that the single most numerous horse breed in the country was essentially totally naïve with respect to prior contact with EAV and, therefore, fully susceptible should future exposure to infection occur.

In 2005, an outbreak of EVA was diagnosed retrospectively on a large Quarter Horse breeding farm in NM, which was characterized by a very high seroprevalence of infection, minimal clinical expression of disease but confirmed evidence that the virus strain involved was abortigenic. Such was the known background status of the Quarter Horse population in NM and various other western and some mid-western states prior to this year's major occurrence of EVA in the breed.

### **Primary Disease Outbreak**

Based on extensive epidemiological investigation, the 2006 multi-state occurrence of EVA originated on a large Quarter Horse breeding farm in NM that stood 4 Quarter Horse breeding stallions.<sup>[8]</sup> The first indication of a disease problem on the index premises occurred on June 4<sup>th</sup> during a routine 60 day pregnancy examination of a group of mares previously confirmed in foal. A number of mares sharing the same pasture were found to have lost their pregnancies. Over the ensuing 1 to 2 weeks, additional mares in this group and in several other groups, some at pasture and others kept in dry lots were also confirmed to have aborted. By June 16<sup>th</sup>, the significant pregnancy losses (up to 50 percent) which had occurred to that point, prompted the owner to seek advice as to the cause of the problem. Immediate contact was made with the M.H. Gluck Equine Research Center, University of Kentucky, and EVA was suggested as a likely cause of

the abortions. Upon request, a total of 26 sera, mostly from mares that had aborted, and semen samples from two of the breeding stallions were received for testing on June 20<sup>th</sup>. At the time, the recommendation was made to the farm owner to halt all shipments of semen from any of the breeding stallions to premises within NM or out of state, pending the outcome of the laboratory tests for EVA. By June 23<sup>rd</sup>, the serological results were available and these confirmed evidence of EAV infection in 24 of the 26 sera. This was followed on June 26<sup>th</sup> by detection of EAV in the semen of both stallions. These findings provided very strong circumstantial evidence of recent exposure to the virus; this was unequivocally confirmed upon subsequent examination of paired sera from individual horses. Upon notification of the NM State Veterinarian, the farm was placed under quarantine until further notice.

### **Disease Tracings**

On subsequent investigation, it was determined that fresh-cooled semen from one of the infected stallions had been shipped to premises in a significant number of other states prior to June 16<sup>th</sup>, when such shipments were suspended. The assistance of USDA-APHIS-VS professional staff was sought and promptly provided to help carry out a complete epidemiological investigation of the extent of spread of the infection from the index premises to states besides NM. Trace information for both mares and semen shipments was obtained from the owner of the affected farm and from Certificates of Veterinary Inspection. Fresh-cooled semen collected from the breeding stallions on the index premises in the late spring and early summer of 2006 together with mares (both donor and recipients) that had visited the premises during the same time-frame were

traced to premises in 6 eastern region states (AL, FL, IN, KY, MN, MS) and 12 states in the western region (CA, CO, ID, KS, LA, MO, MT, OK, SD, TX, UT, WY). The horses traced in States other than NM and UT were horses exposed on the index premises in NM or to potentially infective semen as described above and were considered direct exposures. A total of 69 direct exposures were identified, of which 48 (69.5 percent) were mares inseminated with shipped semen and 20 (29 percent) involved mares and foals that had visited the index premises for some period during the time-frame in question. One mare (1.5 percent) had been exposed through insemination with shipped semen and also as a result of visiting the index premises in NM. A summary of the outbreaks in NM and UT will be provided separately.

### **Diagnostic Criteria**

In attempting to identify animals that became infected in the course of this occurrence of EVA, two important points need to be borne in mind. Firstly, no matter how suggestive of EVA the clinical signs exhibited by an affected horse may be, they cannot *per se* serve as the basis for establishing a diagnosis of the disease. Simply stated, EVA can clinically mimic a range of other infectious and non-infectious equine diseases.<sup>[13]</sup> Consequently, a provisional clinical diagnosis of the disease must always be corroborated by appropriate laboratory findings. Secondly, the presence of a neutralizing antibody titer ( $\geq 1:4$ ) to EAV in a single serum sample, no matter how high, is not of itself diagnostic confirmation of recent exposure to infection. It must be emphasized that neutralizing antibody titers which develop following natural infection with EAV can persist at high levels for a year or more. Serological confirmation of EVA or EAV

infection is based upon demonstration of seroconversion or a significant (4-fold or greater) rise in antibody titer between paired (acute and convalescent) sera. A strict case definition was applied with respect to the epidemiological investigations surrounding the 2006 multi-state occurrence of EVA. A confirmed case of EAV infection was an animal that had had an epidemiological link to the index premises and met one or more of the following criteria:

- EAV detected in blood leukocytes, serum or semen,
- seroconversion or significant ( $\geq 4$ -fold) rise in serum neutralizing antibody titer to EAV between paired sera,
- a positive serum neutralizing antibody titer ( $\geq 1:4$ ) in a directly exposed animal with evidence of spread to other horses on the same premises based on virus detection, seroconversion, or a significant rise or decline in antibody titer.

### **Distribution of Infection**

In accordance with this case definition, diagnostic confirmation of recent EAV infection was established for 6 states, 5 in the western region (KS, MT, NM, OK and UT) and 1 in the eastern region (AL). Strongly suggestive but not confirmatory proof of recent spread of EAV infection was found in horses in an additional 4 states (CA, CO, ID, TX), each of which had one or more animals with epidemiological links to the index premises in NM and high antibody titers to EAV. No evidence of EAV infection was found in any of the 9 remaining states (FL, IN, KY, LA, MN, MO, MS, SD, WY) that received shipped fresh-cooled semen and/or had mares visit the index premises in NM.

Several important issues arose in the course of undertaking the epidemiological tracings connected with the 2006 multi-state occurrence of EVA which limited the completeness of the investigations. The lack of a national program for the prevention and control of EVA together with the lack of uniformity among states in reporting the disease hampered efforts to define more accurately the extent of spread of the infection in certain states. The situation was further complicated by the fact that in some states, owners were not required to share test results for EAV infection on their animals with federal or state animal health authorities.

### **Characteristics of Disease Outbreaks**

Based on detailed information provided by the index premises in NM, it was believed that EAV was initially introduced onto the farm at some point during the latter half of May 2006, most probably by means of an infected mare from a source as yet undetermined.<sup>[8]</sup> It is thought the virus circulated through various groups of mares, causing significant pregnancy losses before spreading to the 4 stallions on the farm, all of which became carriers and semen shedders of EAV. Serological examination of over 200 animals confirmed an extremely high seroprevalence of infection, with every mare, stallion and foal found positive. A third of the yearling colts were also seropositive. Notwithstanding the widespread dissemination of the virus on the farm, reported clinical evidence of infection was minimal. As already stated, the early pregnancy loss rate was very high. The principal mode of transmission of EAV on the index premises was almost certainly by the respiratory route; spread of the virus was undoubtedly facilitated by the

large number of animals kept under conditions of close physical contact with one another. Once the stallions became infected, venereal transmission would also have played a role in the spread of EVA.

Aside from the outbreak of EVA on the index premises, the reported incidence of clinical disease apart from abortion on the other affected farms in NM was low. This contrasts with the corresponding situation in UT, the other most severely affected state. The clinical attack rate was reported to be moderate to high on a significant number of affected premises in that state, not all of which were Quarter Horse breeding farms. Infection occurred on 3 boarding stables, 12 private farms, 1 breeding facility, 4 training stables and 1 veterinary clinic. While EVA was confirmed primarily in Quarter Horses, it also occurred in a range of other breeds, Warmbloods, Paint horses, Arabians and Thoroughbreds. Clinical signs observed in the majority of cases of the disease included fever, dependant edema of the hind limbs, mid-ventral edema of the sheath and scrotum in the stallion, and mammary glands in the mare, supra or peri-orbital edema and a variable degree of conjunctivitis. Less frequently encountered signs included a unilateral or bilateral serous nasal discharge, lacrimation, depression and anorexia and hives which was present in about 10 percent of affected animals. Clinical signs of EVA were more severe in older horses, greater than 20 years of age.

Of the 10 states in which there were confirmed cases of EVA or strong circumstantial evidence of infection, NM and UT had the greatest estimated number of affected premises. A total of 8 premises were placed under official quarantine at the

height of the occurrence in NM. The number of horses involved was 428. Additionally, 15 other premises in the state were placed under voluntary quarantine by the respective attending veterinarians and/or the farm owners. The total number of animals on these farms was 653. The last laboratory confirmed evidence of EAV infection on any premises in the state was July 29<sup>th</sup>. Restrictions have been lifted from all but one of these premises effective August 14<sup>th</sup>. There is no evidence of further circulation of or active infection with EAV since the end of the July, 2006.

In the case of UT, an estimated 591 horses on some 21 affected premises were placed under quarantine. Some 7 of the premises were involved through direct exposure either to shipped fresh-cooled semen from the index premises in NM or had mares (donor/recipient) visit that premises. A total of 14 (66 percent) of the known outbreaks of EVA were secondary/tertiary occurrences of the disease linked not directly to NM, but to one or other of the 7 affected premises in UT which had direct exposure to the index premises in NM. In the main, the morbidity rate on affected premises was very high, with clinical evidence of the disease observed in over 90 percent of at-risk horses. A quarantine was also imposed on an additional 350 horses on 6 premises, but restrictions were lifted once there was laboratory confirmation of absence of EAV infection in these animals. As of November 26<sup>th</sup>, the quarantine has been removed from the last remaining known EVA-affected premises on which there was evidence of virus circulation up to November 6<sup>th</sup>, 2006.

### **Laboratory Findings**

A range of laboratories (USDA-APHIS-VS, National Veterinary Services Laboratory, M.H. Gluck Equine Research Center [OIE designated reference laboratory for EVA] and various state veterinary diagnostic laboratories) were involved in testing samples from horses involved in the 2006 occurrence of EVA.

Based on available results, there was a very high seroprevalence ( $\geq 90$  percent) of antibodies to EAV on many affected farms. Isolations of EAV were obtained from 10 of 14 aborted fetuses from 4 affected breeding farms in NM and 1 in UT. All of the abortions occurred in mares between the third and seventh month of pregnancy. The virus was also recovered from blood leukocytes of 24 horses located in 4 states (KS, NM, OK, UT) and the serum of two additional animals, both in NM. It is worth noting that the dams of 4 of the virus positive fetuses were viremic at time of abortion. Persistent EAV infection (the carrier state) was confirmed in 8 stallions (6 Quarter Horses and 1 Warmblood). Five were located in NM and 2 in UT. Seroconversion or significant rises in antibody titers to EAV was demonstrated in 8 horses.

### **Salient Features of 2006 Occurrence**

The 2006 multi-state occurrence of EVA presented a number of significant features, some not encountered in previous outbreaks of the disease. Of overriding importance was the ease with which infection was very effectively spread among an immunologically naïve population through the use of semen from a stallion acutely and later, persistently infected with EAV. From this and past experience, the virus has been proven to be readily transmitted using either fresh-cooled or frozen semen<sup>[11,13,14]</sup>

This occurrence of EVA was the first in which there was widespread dissemination of EAV in Quarter Horses, a breed essentially not previously exposed to this virus. Aside from the major role shipped semen from one carrier stallion played in spread of the disease both within NM and to other states, movement of donor/recipient mares also contributed to transmission of the virus. The widespread practice of embryo transfer in the Quarter Horse breed and proliferation in the number of recipient mare farms in recent years, were significant industry-driven factors not previously recognized as playing a role in the epidemiology of EVA.

Another important factor that undoubtedly promoted spread of EAV during this occurrence of EVA was the very intensive "feed-lot" system of managing mares on many of the affected Quarter Horse breeding farms. The number of mares kept in close proximity to one another either in pasture or dry-lot situations, which was frequently significant, greatly facilitated transmission of the virus by the respiratory route.<sup>[8]</sup>

A final and very important point that, without question, has had a major influence on the continued circulation of EAV in states in which it was introduced was the lack of adequate supplies of the commercial MLV vaccine against EVA (Arvac®, Ft. Dodge Animal Health). From experience in dealing with previous large scale outbreaks of EVA both at racetracks and on breeding farms,<sup>[9,14]</sup> implementation of a widespread program of prophylactic vaccination of horses at risk of natural exposure to EAV would have rapidly

curtailed further dissemination of the virus and brought this year's occurrence to a more timely conclusion. Significant supplies of the vaccine are once more available.

It should be emphasized that in spite of the extended duration (approximately 5-6 months) of the 2006 multi-state occurrence of EVA, no restrictions were imposed at any time on the interstate movement of horses or shipment of semen from affected states. Hopefully, the significance of what has taken place will galvanize the horse industry and animal regulatory authorities in non-affected as well as affected states to address the issue of EVA in a more progressive and realistic manner. The USDA-APHIS-VS has developed Uniform Methods & Rules (UM&R) for EVA that provides minimum standards for detecting, preventing and controlling the disease. These minimum standards and requirements which were endorsed by the United States Animal Health Association, American Horse Council and the American Association of Equine Practitioners, represent a framework for states to develop their own control programs as well as serve as the basis for a national control program for EVA.<sup>[3,4]</sup> Only time will tell whether the 2006 occurrence of the disease has provided the necessary impetus for the parties concerned to address what has long been sorely needed, namely, a concerted effort at the level of the states to achieve greater prevention and control of EVA and lessen its economic impact on the nation's equine industry.

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