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Unusual Case Leads to DNA Screening Test

VHUP's clinicians see many unusual cases. Sometimes patients have a disease that has not yet been described in a breed but occurs in other species. The task for the clinician then is to identify the disease and develop a treatment to help the patient. This is exciting but not easy. These cases usually are complex and can involve a lot of testing and consulting with specialists here and sometimes at other institutions. Frequently a breeder enters the picture, wanting to know whether the disease or condition is an inherited one and what can be done to prevent it.

A one-year old male miniature schnauzer came to VHUP's clinic in 1996 with complaints about difficulty swallowing, salivation, noisy breathing and a stiff gait; he was seen by the neurology service. During the examination Drs. Charles Vite and Francesca Cozzi noticed that the dog had enlarged skeletal muscles, a shortened lower jaw, dental abnormalities and a tongue that was large. The animal had difficulty rising from a sternal position and it took him a little while to stand properly and walk. He was stiff when he began to walk, and when asked to move at a faster pace, he bunny-hopped.

The clinicians suspected an abnormality in the skeletal muscles, a myopathy. To make a definitive diagnosis and to rule out other conditions such as myotonic myopathy, muscular dystrophy, myositis, or lysosomal storage disease, a number of tests were performed.

CBC and other blood tests were normal. Urine screening did not reveal any evidence of primary metabolic disease, and titers for antinuclear antibodies and Toxoplasma were negative. Radiographs, echocardiography and electrocardiography revealed no abnormalities. The next step was electrodiagnostic testing to measure the electric discharges in response to stimulation in the dog's muscles. Here abnormalities were found. Discharges, evoked by insertion of the recording needle, were not even, they waxed and waned and the frequency of amplitude gradually decreased and then ceased within 25 seconds. In normal

dogs, electrical activity is seen for less than a second following needle insertion.

The conduction velocity of the major motor nerves was also tested; these results were normal. The dog was anesthetized for the tests. A muscle biopsy was also performed. Some of the tissue was examined under a high power microscope and hypertrophic (enlarged) muscle cells were found.

Based on the tests, the clinicians made a diagnosis of myotonic myopathy. They suspected a biochemical defect as the cause of the abnormal muscle contractions. The dog was treated with oral



medication and he improved significantly. He could rise easily, breathe quietly, and eat and drink without trouble. His gait was less stiff and he could step onto a four-inch platform. He could not manage stairs. The patient was helped, but it was not the end of the case.

Dr. Vite investigated further. He had help from the breeder who provided information on the relatives of the affected dog. Pedigrees were furnished and information was given on other dogs with the same condition. Many of these animals and their healthy relatives were examined at VHUP. Dr. Vite consulted with members of the Section of Medical Genetics at the School, among them Drs. Melniczek, Patterson and Giger. Dental abnormalities were characterized by Dr. Margeurita Gracis of the Section of Dentistry. He also consulted with researchers at Penn's School of Medicine (Drs. Rich and Barchi), and Drs. Rhodes, Fahlke and George at Vanderbilt University Medical School because they had a strong interest in myotonias in humans.

During this time, he and Dr. Susan Volk studied the effect of procainamide in treating the disease in affected dogs.

The condition had only been reported in a strain of mice, the goat, the horse (identified by Dr. Sheldon Steinberg), the cat, the chow chow, as well other dog breeds. However, the cause of the disease in dogs had not been identified, and a good animal model for the study of the condition was lacking. The miniature schnauzer could serve as a model for other affected dogs, and studies could help in developing treatment for people who suffer from myotonia congenita.

Myotonia presents a significant medical problem in humans. Much research is devoted to understanding the cause and to finding treatment and a cure.

Drs. Vite, Cozzi, and Rich examined the muscle biopsy in vitro and studied the electrical properties of the muscle. These studies revealed abnormalities in chloride

ion conductance across the muscle membrane. They collected DNA samples from normal dogs and affected dogs. Because the gene sequence and location were known for the chloride channel in humans, researchers could focus on a particular area of the dog DNA. Collaborators at Vanderbilt University identified a genetic mutation that causes a defect in the chloride channels in the muscular membranes. This interferes with the transmission of electric impulses within the muscle and causes the abnormal actions of the muscles.

Members of the Section of Medical Genetics analyzed the pedigrees and concluded that the condition was inherited as an autosomal recessive trait. The group then focused on developing a DNA screening test that could be used to identify carrier animals. The collaborators at Vanderbilt had identified the gene, the mutation, location of the mutation, the actual mutation and they had developed the DNA test. The Josphine Deubler Genetic Disease Testing Laboratory in

the Section of Medical Genetics refined the test, which is capable of detecting affected dogs, carrier dogs, and “clear” dogs. In March of 2000 the DNA screening test for myotonia congenita in miniature schnauzers was ready. Since then numerous carriers have been detected

among the first 200 dogs tested. Breeders now have the tool to identify carrier animals which then can be dropped from the breeding pool. If everyone is diligent, the disease can be readily eliminated from the breed in a few generations.

The test for myotonia congenita in

miniature schnauzers is one of several tests for inherited diseases developed or refined by Penn’s Section of Medical Genetics and offered by the Josephine Deubler Genetic Disease Testing. These tests are not easy to develop, and frequently they are breed

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West Nile Virus Infection in Horses By Jonathan Palmer, VMD, DACVIM

West Nile Virus (WNV) primarily causes disease in birds and is usually spread by mosquitoes but it occasionally causes disease in horses. Horses become infected with WNV by the bite of a mosquito which previously (at least six to ten days earlier) fed on a bird infected with WNV. Infection does not always cause clinical disease in horses. In the recent outbreak of WNV on Long Island, NY, as many as a third of the horses on the outbreak farms may have been infected but only 14% developed disease. When horses have clinical signs, the disease can be very serious. Half of the clinically affected horses on Long Island died or were euthanized. This is the only outbreak of WNV in horses ever reported in North America, but the disease in horses has been frequently reported in Europe and Africa with similar results.


Horses with West Nile Fever can have a variety of clinical signs. They may have a mild flu-like syndrome with fever, depression, listlessness, and occasionally somnolence. When fever occurs it may be biphasic with the early fever associated with mild flu-like signs and a second fever a week later associated with the onset of more serious neurologic signs. Some cases will develop muscle fasciculations and an unusual muzzle twitching. They may show more serious neurologic signs including incoordination and ataxia (stumbling), circling, aimless wandering, head pressing, and hyperexcitability followed by convulsions, coma, and death. In some outbreaks a progressive hind limb paresis (incoordination, ataxia, stumbling) progressing to complete hind limb paralysis (inability to rise behind) and finally front leg involvement is reported as typical. Simultaneously, brain signs will be pro-

gressive (depression, somnolence or hyperexcitability, convulsions, coma). Death may occur within five to ten days of development of serious signs in half of the cases. The other half will recover with the most dramatic improvement within three weeks.

West Nile virus is primarily transmitted between birds by mosquitoes. Occasionally virus-carrying mosquitoes will bite mammals exposing them. The Veterinary Services section of APHIS, US Department of Agriculture, has concluded, based on experimental inoculations carried out on horses, that horses are not involved in the transmission cycle of WNV. That is, horses are terminal hosts because they do not maintain a sufficient viremia to infect mosquitoes or other mammals (see the USDA web site at <http://www.aphis.usda.gov/vs/ep/WNV/>). Previous studies in horses support this conclusion. This means, as stated by the Centers for Disease Control and Prevention, (see the CDC web site at http://www.cdc.gov/ncidod/dvbid/arbor/West_Nile_QA.htm) that infected horses will not transmit WNV to other horses or to people. So an infected horse is not a threat to other horses in contact with it and people cannot contract West Nile Fever by caring for an infected horse. However, special care should be taken when handling blood, spinal fluid, or nervous tissue from suspect animals since these may contain virus.

The virus has not yet been identified in Pennsylvania or Delaware; however it has been found in birds in New York, Connecticut, New Jersey, and in one bird in Maryland (see USDA web site for a map). The virus is introduced into an area through infected birds. In the outbreak last fall, some infected birds developed neurologic signs such as ataxia

(loss of coordination), tremors, abnormal head posture, circling, and convulsions followed by death. The appearance of dead birds in an area may be an early warning that the virus is present. When handling dead birds that may have died from WNV infection, care should be taken. There is no evidence that people can catch this disease from dead birds, but the Center for Disease Control and Prevention recommends that no one should ever touch any dead animal barehanded. Call your local health department for proper procedures for handling of dead birds.

How can horses be protected from WNV infection if the virus enters the area? The key is mosquito control to stop the bird-mosquito infection cycle. The primary mosquito vector is *Culex spp.* This mosquito spends its entire life within a range of about 1000 yards. Thus local control can be very effective in stopping WNV transmission. The most effective method of mosquito control is to destroy the mosquito larval habitat. *Culex* mosquitoes can breed in any puddle that lasts more than four days. So it is important to reduce the amount of standing water available for breeding such as water troughs (should be cleaned at least once or twice a week), water buckets not in use, plastic wading pools, bird baths, wheelbarrows, clogged roof gutters, discarded tires, tin cans, plastic containers, ceramic pots, or any water-holding container. Although less effective than preventing mosquito breeding, efforts to limit the horse’s exposure to adult mosquitoes can also be attempted. Horses should be stabled inside during peak mosquito feeding times which are dusk and dawn. Also, insect repellent approved for horses can be used (always follow label instructions). 

Scholarships

The Anne Linn White Dean's Scholarships were awarded to **Jamie Murphy, V'01, Shelly Rodewald, V'01, and Elizabeth Agnew, V'01.** **Christina Fuoco, V'01,** received the Westminster Kennel Foundation Scholarship. The Dr. J.E. Salisbury Scholarships were awarded to **Meredith Borokove, V'01, Dorian Haldeman, V'01, Katherine Wentworth, V'01, Carrie Hutchinson, V'01, and Christine Gebert, V'01.** The recipient of the Charles S. and Phyllis H. Wolf Dean's Scholarship was **Jennifer Marsden, V'01** and the Bruce J. Heim Dean's Scholarships were awarded to **Meryl Gupta, V'01, and Jennifer Tavares, V'01.** **Steve West, V'01,** received the Ethel G. and Allen H. Carruth Dean's Scholarship. The Samuel T. and Emily Rawnsley Dean's Scholarship was awarded to **Kimberly Johnston, V'03.** **Gina Cairone, V'03,** received the Edwin J. Andrews Dean's Scholarship and **Nathan Harvey, V'03,** was awarded the Class of 67' Dean's Scholarship. The J. Maxwell Moran, Sr. Dean's Scholarship was awarded to **Jennifer Gschwend, V'02.** **Lisa Meddock, V'03,** received

The Palace H. Seitz Dean's Scholarship. Dr. M. Josephine Deubler Dean's Scholarship were awarded to **Brian Young, V'02, Heather Lyons, V'02, Carlin Jones, V'02, and Daniel Schar, V'02.** The Jack Mara/Hill's Scholarship was awarded to **Andrew Greller, V'02** and the Hill's Pet Products Dean Scholarship's recipient were **Adrienne Hancock, V'02, Angie Cheek, V'02, and Katherine Masek, V'02.** **Tracy Filler, V'02, and Jeffrey Luetke, V'02,** received W.L. Montgomery Scholarships. The Clifford F. Wright, Jr. Scholarship was awarded to **Diane Gabriel, V'01.** **Katherine Bate, V'01,** received the Dr. Ginnie Lieblein Memorial Scholarship, and **Beth Adler, V'01,** was awarded the Richard A. Dorr, Jr. Memorial Scholarship. The Anna Live Endowment Fund Scholarship was awarded to **Rene Varela, V'01.** **Cailin Galvin, V'01,** received the Iris M. McGee Scholarship and the Hill's Dean's Scholarship was awarded to **Katherine Masek, V'02.** **Carlin Jones, V'02, and Lise Lund, V'00** were awarded the Csaba Vedlik Scholarships.

Jack Russell (10 to 12 inch).

Most breed experts agree that the Jack Russell Terrier is not the right choice for a first-time dog owner. The owner must understand terriers and how to establish dominance. Take time to study the breed, talk to owners and don't let the television "actors" influence your decision to make a Jack Russell Terrier part of the family.

Book Review

Lowell—The True Story of an Existential Pig by **Gay L. Balliet** (New Horizon Press. Hardcover. \$ 23.95).

This is a story of life with a Vietnamese pot-bellied pig. Lowell watches Oprah, listens to Gloria Estefan and in general has a remarkable life and relationship with his owner.

Although there are pet pigs in many households, they can become problems. When they grow up, they may not be as cute. A prospective owner should understand the care needed and proper man-

agement. Over-feeding must be avoided, many overweight pigs are abandoned. Pigs may be housebroken, even trained to use a litter box like cats. Pigs are highly intelligent. Their eyesight is poor but they have an excellent sense of smell and have been used for sniffing out drugs, locating landmines, and unearthing truffles.

Babe and Charlotte's Web are stories that have delighted many readers. Lowell is not a fictional pig and his true life story makes interesting reading.

DNA Screening Test *(continued from page 11)*

specific. Diseases may appear the same in a number of breeds, but closer examination at the molecular level often reveals differences in the type of DNA mutation from breed to breed. Thus breed specific tests are needed.

In VHUP's clinic, particularly through the pediatrics and genetics clinic, quite a few new inherited diseases have been identified, leading to a better understand-

Very Special Gift

For many years John and Dorothy Leonard of Berkeley Hills, CA bred and exhibited Yorkshire terriers under the Dorchester prefix. Mr. Leonard, a member of the Wharton Class of 1936, showed and handled his dogs until recently at California shows. Mr. and Mrs. Leonard made a gift to VHUP to name an examination room in memory of their Dorchester Yorkshire terriers. The Leonards have retired from breeding and exhibiting their Yorkies, though they do enjoy watching the breed from ringside.

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Devon Show Grounds,
Devon, PA

ing of the disease and, in some cases, to tests which help breeders reduce the incidence of a particular condition. The identification also has led to new animal models of human disease, helping scientists in the study of the disease process and in the development of treatment modalities. This benefits the animal and human patients. 🐾