Equine Protozoal Myeloencephalitis

By Kenton Morgan, DVM, DACT (Presented during Horseman's Day 2003, New Orleans, La.) and Dr. Rob MacKay

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Equine protozoal myeloencephalitis (EPM) is a disease of horses that affects the central nervous system. Equine obviously refers to the horse, protozoal refers to the type of organism that causes the disease and myeloencephalitis refers to that portion of the animal, which is damaged. “Myelo” refers to the spinal cord and “encephalitis” refers to an infection/inflammation of the brain. So, EPM is a disease of the brain and/or spinal cord of the horse, which is caused by a protozoan organism.

What Is A Protozoa?

Protozoa are the smallest and most simplistic members of the animal kingdom. They are single-celled organisms. The name given to the protozoan organism shown to be the primary causative agent for EPM is Sarcocystis neurona. Sarcocystis refers to the type of protozoan parasite and neurona refers to the nervous system where this organism was first isolated.

The disease was described in the 1960s as segmental myelitis. By 1974 we determined this disease was caused by a protozoan organism. In 1976 it was concluded that some type of Sarcocystis organism was the culprit. This organism (Sarcocystis neurona) was first isolated from the spinal cord of a horse with clinical signs of EPM in the early 1990s. In the mid-1990s, another organism called Neospora hughesi was shown to cause EPM in horses. This organism, however, is very rare in comparison to S. neurona as a cause of EPM and is considered to be inconsequential and will not be discussed here. EPM is a disease primarily of the Western Hemisphere and is not commonly seen in other parts of the world. We find this disease in
horses that reside in North or South America or in horses that once spent time in the Western Hemisphere.

We do know that many horses are exposed to the *S. neurona* parasite. We know this is true by doing specific testing on blood samples taken from horses around the country. The blood sample is evaluated to determine if it contains antibodies specific to the *S. neurona* organism. If the sample contains these antibodies, then we know the horse has been exposed to this parasite and has mounted an immune response. We say the horse is “sero-positive” with antibodies against *S. neurona*. It does not tell us if the horse will ever develop EPM. It just tells us the horse has been exposed. Most horses in the United States will demonstrate this antibody in their blood. In some areas of the country over 90 percent of horses can be “sero-positive.” Luckily, only a very small percentage of horses ever develop the disease we call EPM.

The actual disease rate or incidence is difficult to estimate. Results from a very large equine survey completed by the USDA a few years ago estimated the actual disease incidence to be approximately 0.14 percent in the general equine population. So, even though the majority of the equine population is exposed to this parasite, only a very small percentage ever develops clinical disease.

**Parasite Life Cycle**

Although much has been learned in recent years with respect to the life cycle of *S. neurona*, there is still much we do not know. *Sarcocystis neurona* has a complex, two-host life cycle. This life cycle includes both definitive hosts and intermediate hosts. For clarification, the **definitive host** is that animal, which sheds an infective form of the parasite, *S. neurona*. The **intermediate host** is that animal, which does not shed an infective form but is a host where the parasite resides and is necessary for the parasite to complete its life cycle.
It was not until 1995 that the opossum was determined to be the definitive host of this parasite (there may very well be other definitive hosts for this organism and we have just not yet identified them). The opossum sheds the infective form of the parasite in the feces; we call this infective form a “sporocyst.” The sporocyst is then ingested or eaten by the horse. Once inside the horse, there is much that we do not know regarding what occurs next. The parasite does go through a maturation or reproductive phase and eventually produces a form of the parasite we call “merozoites.” Eventually (in only a very small percentage of horses) the merozoites reach the central nervous system, damage this vital area and create the disease condition we call EPM.

As for intermediate hosts, there are several; currently we know that skunks, armadillos, raccoons, cats and sea otters can serve as intermediate hosts for the *S. neurona* parasite. This list undoubtedly will continue to grow as we learn more about this protozoan parasite. Since we do not believe the horse is a “normal” host for this parasite, we refer to the horse as an aberrant, intermediate host. However, more recent work may suggest that the horse can serve as a true intermediate host for this parasite in certain circumstances.

**What Does EPM Look Like?**

Since EPM is a disease of the central nervous system (brain and spinal cord) and it can affect multiple locations within the brain and spinal cord, the signs and severity of this disease can vary dramatically. Though EPM can affect both the brain and spinal cord, it is more common for the signs of disease to be associated with damage to the spinal cord, but we can and do see insult to the brain.

We typically refer to the 3 “A”s of this disease: Asymmetry, Ataxia and Atrophy.

- Asymmetry is a term we use to describe a symptom that is worse on one side of the body than on the opposite side. In other words, with EPM, the
signs are generally worse on the left side than on the right or visa versa.

- Ataxia is a term we use to describe incoordination or the inability of the horse to move its legs and trunk normally.

- Atrophy describes a condition where the muscles decrease from their normal size. With EPM, this results from damage to the nerves that normally control or “innervate” these muscles. Muscle atrophy is not seen in all cases of EPM, so it is not as consistent a sign of disease as is the asymmetrical ataxia.

So, with this disease we will see horses that are incoordinated and this incoordination is worse on one side of the body as compared to the other side. These horses may or may not develop muscle atrophy. It is also common to see muscle weakness in these horses. Some horses may display abnormal gaits, lameness and loss of sensation along the face, neck or body. Paralysis of the muscles of the eyes, face or mouth may occur and this will be evident by drooping eyes, ears or lips. Horses may also demonstrate a head tilt, poor balance and difficulty in swallowing or vocalizing. On rare occasion even seizures and collapse may occur. This disease may progress rapidly or very slowly. Horses generally deteriorate over time but some animals may “level off” or plateau for a period of time only to worsen days, weeks or even months later. Most horses afflicted with this debilitating disease continue to have a bright, alert temperament.

How Do We Diagnose EPM?

As you can see from the preceding discussion, clinical signs of this disease can vary significantly, and no two horses with EPM will look exactly the same. That is one of the factors that make the accurate diagnosis of this disease such a challenge. Another factor is that there are several diseases of the central nervous system of the horse that can look very similar to EPM, especially in the early stages of the disease process. Finally, there is no single “test” that can be done, which is 100 percent accurate in the live horse that can tell us if a particular animal is suffering from EPM. There are
tests that can be utilized by your veterinarian, and these are used to support his or her diagnosis of EPM as well as to rule out other diseases, which may look like EPM. It is important to remember that we can never be absolutely sure a particular horse has EPM.

The most important evaluation done by your veterinarian as he or she begins their diagnostic work-up for a suspected case of EPM is the neurologic examination. This is a specialized exam that is done to evaluate the function of the central nervous system of the horse. It may also be necessary that radiographs be taken of the neck region of the horse. This is done to determine if there is any type of compression on the spinal cord. Clinical signs from pressure on the spinal cord of the horse can look very much like EPM. This type of condition has several names but the most common term used is “wobblers.” This is an important “rule out” when evaluating a horse for EPM. Your veterinarian may also draw blood during the examination process. In some cases, he or she may decide to collect spinal fluid from the horse by doing a spinal tap. This can be useful to support the diagnosis of EPM and also to help rule out other diseases of the central nervous system.

EPM is a challenging diagnosis, and in certain cases treatment of the horse may be part of this process. In other words, a horse may be treated for EPM with only minimal diagnostic efforts expended. If the animal improves, then it is concluded the horse did have EPM. If the horse does not improve, then further diagnostic efforts may be necessary. This approach should only be considered after careful consultation with your veterinarian.

**How Do We Treat EPM?**

Just as with our diagnostic efforts, treatment of EPM should only be done under the direct supervision of your veterinarian. With all types of life-threatening disease, it is important that you recognize, diagnose and treat early for the best possible outcome. Currently, there are two FDA-approved treatments for EPM available for use in the United States. These are
prescription drugs and can be used only by or on the order of a licensed veterinarian.

- The first is a product called Marquis, which is manufactured by Bayer Animal Health. The active ingredient is ponazuril. This product is a paste formulation and is given once daily for 28 consecutive days. The drug has demonstrated effectiveness in treating horses with EPM and has a very favorable safety profile.

- The second is a product called PROTAZIL Antiprotozoal Pellets manufactured by Merck Animal Health. This is pelleted product designed to top dress feed. Protazil has safety and effectiveness profiles similar to Marquis and is also to be given once daily for 28 consecutive days.

Since the early days of EPM, veterinarians have used a combination of two drugs, sulfadiazine and pyrimethamine (SDZ/PYR), as treatment. There currently is no FDA-approved product of this type marketed in the USA; however, this combination of drugs can be provided by your veterinarian on a case by case basis. SDZ/PYR is relatively inexpensive but treatment occasionally causes unwanted side-effects and the drug must be given daily on an empty stomach for 3 to 6 months.

It is also common for veterinarians to use other supportive or ancillary drugs while treating EPM. These treatments can include anti-inflammatory products such as corticosteroids, bute, Banamine, DMSO and others. Some practitioners may also supplement with vitamin E while treating neurologic disease. Others may try to stimulate the immune system by using one of several immune-modulating products on the market. It is also recommended that horses be removed from stressful environments and activities while receiving treatment for EPM.

It is important to remember that successful treatment may eliminate the parasite, but the effects from damage to the central nervous system by the parasite can be permanent.
What Can I do to Help Prevent or Minimize the Risk of EPM?

Horse owners can take advantage of some basic husbandry practices and good common sense to help reduce the risk factors that can contribute to disease incidence. One thing that all of us can do is to keep our feed storage areas neat and clean. Untidy areas with spilled feed invites unwanted guests such as opossums.

- Keep your feed in sealed or closed containers.
- Cover your hay storage area if possible.
- Keep rodents under control on your property.
- Discourage visits by opossums.
- Check with local authorities with respect to trapping and relocating opossums or eliminating them.
- Properly dispose of any animal carcasses that you may see on or near your property.
- Clean your equine water sources on a regular basis.
- Do not feed on the ground.
- When transporting horses, make them as comfortable as possible. Transportation stress can be a contributing factor for EPM.

Currently there are no USDA approved vaccines available for use in horses to aid in the prevention of this disease.

Equine Protozoal Myeloencephalitis (EPM) Summary Points

General comments:
- EPM is an acronym for Equine Protozoal Myeloencephalitis
- Disease of the brain and/or spinal cord in the horse
- Caused by a protozoan parasite that is transmitted by the opossum
- Difficult to accurately diagnose
- Early diagnosis and treatment very important
- Sarcocystis neurona is the protozoan pathogen of EPM
- No horse-to-horse transmission
- Circulating antibodies to S. neurona indicate the horse has been exposed to the parasite, but does not indicate active disease (we call this sero-positive)
- In some geographic locations, over 90 percent of horses may be sero-positive, in others far less
- A large equine survey indicated only about 0.14 percent of horses will develop clinical disease

**Life Cycle of Sarcocystis neurona**

- S. neurona has a complex, two-host life cycle
- The opossum has been identified as a definitive host of *S. neurona*
- The opossum ingests sarcocysts from the tissues of the intermediate hosts
- The parasite undergoes a form of sexual reproduction within the opossum which produces the sporocyst
- Sporocysts are shed in the feces of the opossum
- Sporocysts can survive in the environment for several months
- The horse is an aberrant, intermediate host
- The horse is exposed by ingesting feed or water contaminated with opossum feces that contain sporocysts
- The parasite undergoes a form of asexual reproduction in the horse and eventually gains access to the brain and spinal cord

**Intermediate host**

- The armadillo, striped skunk, cat, raccoon and sea otters can serve as intermediate hosts
- Recent work has demonstrated sarcocysts in the horse; therefore, the horse may serve as a true intermediate host
- The intermediate host picks up the parasite from ingesting sporocysts
- The parasite goes through an asexual reproduction stage and produces tissue sarcocysts (cysts in the muscle tissue)
- This stage then is the source of infection for the opossum, which ingests these infected tissues containing sarcocysts) and the life cycle is completed
**Clinical Signs**

- Progressively debilitating disease affecting the CNS (brain and spinal cord)
- Can be acute or gradual onset
- Disease may involve brain, brain stem, spinal cord or any combination thereof
- Disease may progress very rapidly or slowly
- Disease may stabilize only to resume progression days, weeks or months later
- Horses are usually bright and alert during course of disease
- Horses typically do not have elevated temperatures

Signs may include any of the following:

- Subtle lameness
- Weakness
- Ataxia, incoordination
- Usually asymmetrical, one or all limbs
- Muscle atrophy
- Head tilt
- Head shaking
- Cranial nerve signs, such as asymmetrical facial paralysis, head tilt or swallowing difficulties
- Behavioral abnormalities, seizures
- Recumbency

**Diagnosis**

- A thorough physical and neurologic exam is the most important part of the diagnostic process
- Radiographs of the neck region if indicated by your veterinarian
- Blood work if indicated by your veterinarian
- Spinal tap if indicated by your veterinarian
- Differential Diagnosis (Rule outs)
• Any instability or abnormality of the vertebrae of the neck, such as “wobblers”
• Equine Herpes virus infection of the brain and spinal cord
• Other viral disease of the brain and spinal cord such as rabies, EEE, WEE, West Nile virus
• EMND (equine motor neuron disease)
• Injury/trauma of the spinal cord or brain
• EDM (equine degenerative myeloencephalopathy)
• Polyneuritis Equi (PNE, including cauda equina)
• Tumor or abscess of the brain or spinal cord

**FDA Approved Treatments currently available**

Marquis oral paste
PROTAZIL pellets

**Legally Compounded Treatment**

Sulfadiazine-pyrimethamine combination

**Prevention**

• Decrease presence of opossums
• Keep grain stored and feed area clean
• Keep water sources clean
• Keep hay covered if possible
• Rodent control
• Do not feed on the ground
• Immediately remove and bury carcasses of skunks, armadillos, cats and raccoons whenever possible
• Currently there are no USDA approved vaccine products available to aid in the prevention of EPM

*A commercial FDA-approved product containing SDZ/PYR was marketed for several years but currently is withdrawn from the market.