Introduction

When called upon to examine an acutely neurologic horse, the possibility of rabies should be kept in mind until proven otherwise, as well as the risk of injury to the patient, other animals or humans. If rabies is a possibility, the number of people attending the animal should be minimized, and a list of people having been in contact with the horse should be kept. Gloves should be worn by all attendants, and if possible only people that have been vaccinated and have a current titer should attend the horse. If the horse is unsteady, it should not be moved until knowledgeable personnel are available.

Examination

The goals of the examination in acute neurologic disease are to:
1- Confirm that the nervous system is involved
2- Rule out involvement of other body systems
3- Arrive at a list of possible differentials
4- Initiate treatment and supportive care until further diagnostic tests can be performed
5- Facilitate referral of the horse for further diagnostic and/or treatment

Data base

Signalment
- Age
  Weanlings are more at risk for cranial trauma during halter breaking or handling. Young horses (<2 y-o) suffering from ataxia without cranial nerve signs should be examined for CVI/CVM, although lower cervical vertebral lesions (C6 to T1) are more common in older horses. Equine protozoal myelitis (EPM) is more common in young adult horses, and is rarely seen in horses <2 years of age.
- Breed
  Arabian foals are at risk for cerebellar atrophy. Miniature horses can suffer from narcolepsy, which can mimic neurologic disease. EPM is more common in Thoroughbreds, Stanndardbreds and Quarter horses.
- Sex
  There is no sex predisposition for neurologic disease, although males are more at risk for CVI/CVM.

History
  The geographic location of the animal should be ascertained. For example, encephalitides are more common in the southern states such as Florida. Rabies is more
endemic in certain states, as is botulism. A complete vaccination history should be obtained, including particularly rabies, herpes virus and encephalitides if in an endemic area. Stabling practices, access to pasture, quality of pastures, need to be documented. The possibility of wound botulism through recent injections, wounds or castration should be documented. Although many neurologic diseases may appear acute in onset, careful questioning can reveal the presence of subtle deficits that were overlooked.

Physical examination
A complete physical exam should be performed, paying attention to all body systems, as acute laminitis or rhabdomyolysis can mimic neurologic disease. Similarly, horses that are affected with botulism and are unable to stand for long periods can appear to have abdominal pain. Horses that have been recumbent, are blind or have facial nerve damage can have corneal ulcers that will require treatment. Finally, neurologic deficits such as inability to urinate will need to be addressed as part of the treatment.

Neurologic examination
The purpose of the neurologic examination is to arrive at a neuroanatomic localization, and formulate a list of differentials that will dictate further diagnostics and allow implementation of initial treatment. The basis of the neurologic examination has been well described elsewhere. Essentially, the neurologic examination is divided into:

1- Assessment of mental status and behavior
2- Cranial nerve examination
3- Evaluation of gait and posture
4- Neck and forelimbs
5- Trunk and hindlimbs

Laboratory data
Initial laboratory data include PCV/TP and creatinine for assessment of hydration status. If the physical examination indicates it, CK and AST can be evaluated to rule out rhabdomyolysis, SDH, GGT, Alk Phos and bile acids and ammonia levels to evaluate the possibility of hepatoencephalopathy. Ancillary diagnostics include radiography, myelography, CSF analysis, electromyography and EEG. These procedures are performed as indicated by the physical and neurological exam findings. CSF analysis is usually not performed on an emergency basis, as cytologic examination of spinal fluid needs to be performed on a fresh sample.

The following is brief description of conditions that can result in acute ataxia in horses.

NEUROLOGIC DISEASES

When called upon to examine a neurologic horse, the clinician should rule out diseases that can mimic neurologic diseases such as laminitis (specially if recumbent), rhabdomyolysis (recumbency, stiff gait), colic (recumbency), HYPP (acute recumbency) or hypocalcemia.
Cranial trauma

Cranial trauma most commonly follows falling over backwards and hitting the pole of the head. The most common fracture accompanying this injury is a basisphenoid fracture. The following signs can help localize the location and severity of the injury.

*Cerebral syndrome:* Transient unconsciousness followed by aimless wandering and temporary blindness. PLR and cranial nerves are normal, and if no progression, recovery is complete.

*Midbrain syndrome:* depression, recumbency, mydriasis, absent plr, irregular respiratory pattern, arrhythmia, bradycardia. Poor prognosis.

*Medullary-inner ear syndrome:* Head-tilt, ear hemorrhage, facial nerve paralysis, intention tremors. Prognosis guarded.

Spinal trauma

Spinal trauma can manifest as an acute accidental injury, or can be initiated by an underlying CVI/CVM lesion. Spinal shock not well documented in horses. Clinical signs depend on location of the lesion. In cervical localization, a myelogram may be indicated to evaluate the presence of an underlying problem. Cases of spinal trauma are best managed with anti-inflammatory drugs, time, and nursing care. If a cervical lesion is identified on the myelogram ventral cervical stabilization can provide enough improvement in gait to render the horse useful for athletic endeavours (usually an 1 to 2 grade improvement is expected with surgery).

Vascular disorders

Intra-carotid injection is the most common cause for an acute neurologic event of vascular origin. The most common clinical signs include: rearing over, convulsions, and unconsciousness. Recovery is usual. If the injury was from an air embolism, unilateral blindness may result.

Although hematomyelia has been documented in the caudal thoracic and lumbar spine of horses following general anesthesia, it is a rare disorder, and usually results in complete paralysis for which there is no cure.

Infectious disorders

Viral encephalitides

Viral encephalitides are fortunately uncommon. The common diseases include EEE, WEE, VEE (not reported in the US since 1971, but reported in Mexico in 1993), rabies and West Nile Virus. They usually manifest as fever (West Nile can be afbrile), depression and ataxia, and depending on the disease, have a variable mortality rate. Rabies should be suspected and ruled out in all cases.
Bacterial

Tetanus is a neurologic disease caused by Clostridium tetani. The organism releases a neurotrophic exotoxin that inhibits inhibitory neurotransmitters resulting in hypertonia and spasms. Botulism, caused by Clostridium botulinum (8 different toxins), is a progressive flaccid paralysis resulting from blocking of acetylcholine release at neuromuscular junctions.

Protozoal

Equine protozoal myeloencephalitis is a multifocal progressive neurologic disease caused by Sarcocystis neurona. It causes inflammation and necrosis of the brainstem and spinal cord. Although asymmetric ataxia and focal loss of lower motor neuron function are the classic signs of the disease, a wide range of signs have been described including lameness or acute recumbency.

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<thead>
<tr>
<th>Ataxia</th>
<th>Ataxia and cranial nerve signs</th>
<th>Ataxia and bladder paralysis</th>
<th>Ataxia and VII-VIII involvement</th>
<th>Ataxia, abnormal mentation</th>
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<tbody>
<tr>
<td>CVI/CVM</td>
<td>Herpes-virus 1</td>
<td>Herpes-virus 1</td>
<td>Stylohyoid arthropathy</td>
<td>Herpes virus 1</td>
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<td>EPM</td>
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<td>EPM</td>
<td>Encephalitides</td>
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<tr>
<td>Trauma</td>
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<td>Trauma</td>
<td>Hepatoencephalopathy</td>
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<tr>
<td>Rabies</td>
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<td>Leukoencephalomalacia</td>
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Initial stabilization

The goals of initial stabilization are to prevent further deterioration, initiate treatment of possible diseases as dictated by the exam, provide supportive care, and facilitate transportation to a referral facility for further diagnostics and treatment.

1. Decrease CNS inflammation

DMSO as a 10% solution, at a dose of 1 mg/kg once a day for 3 days is often used. At higher concentrations, DMSO may cause hemolysis. Administration of DMSO is accompanied by few problems and is relatively safe. In cases of observed trauma, or if the ataxia is so severe that recumbency is a possibility, one dose of corticosteroids (usually dexamethasone) at 0.1 mg/kg IV is used. The use of corticosteroids is controversial, as benefits are observed only in the early stages following trauma. Corticosteroid therapy is also beneficial in cases of suspected Herpes virus-1 encephalomyelitis. Other therapies that have been proposed to decrease CSF pressure include mannitol and hypertonic (3%) saline. Mannitol is relatively well documented to decrease ICP, but the use of hypertonic saline is still under investigation.
2- Initiate specific therapy
   a. EPM is always a possibility in the acutely ataxic horse, so anti/protozoal therapy is indicated until results of the CSF analysis are available. Trimethoprim-sulfa and pyrimethamine were the mainstays of treatment for several years. Ponazuril, a new anti/protozoal treatment is now available.
   b. If Herpes-1 encephalomyelitis is suspected, corticosteroid therapy is recommended if the horse is severely ataxic or recumbent. Corticosteroids are usually not indicated if EPM is suspected, as they are immunosuppressive.
   c. If stylohyoid arthropathy is diagnosed, antibiotics are recommended. Trimethoprim-sulfa has been used although there is no clear evidence of an etiologic agent. Surgical excision of a segment of the stylohyoid bone has been used with good results in severely affected horses

3- Provide supportive care
   a. Ensure hydration
      i. Many ataxic horses and particularly recumbent horses, do not meet their daily water intake. These can initially be met using replacement intravenous balanced electrolyte solutions such as Lactated Ringers or Plasmalyte. Careful monitoring of creatinine is indicated to ensure renal function. Monitoring of CK is also indicated, to avoid renal damage when muscle damage is present in recumbent horses. Over-hydration should be avoided, as this can also worsen CNS edema and predispose to pulmonary edema particularly in recumbent horses. A good alternative to IV fluids, once the horse is stabilized, is the use of oral maintenance fluids, using a small nasogastric feeding tube. Maintenance electrolytes can be provided using the following formula:
   b. Nutritional support
      i. Many ataxic or recumbent horses continue to have a good appetite. Providing good quality hay and making it accessible at all times is important. If the horse is dysphagic, nutritional support may be necessary until return of swallowing. This can be provided by the use of nutritional supplements such as Osmolite. Usually 50 to 75% of nutritional requirements only are provided, as diarrhea and laminitis can occur when 100% of caloric needs are met. Alternatively, parenteral nutrition could be used, but can be expensive in adult horses. Parenteral nutrition composed of electrolytes, dextrose, amino acids and trace minerals is well tolerated. Use of intravenous lipids to increase caloric input is
fraught with more complications and is not used if nutritional supplementation is only needed for a short period.

c. Nursing care
   i. Ensure urine and fecal output
      1. Monitoring urine output is particularly important in the recumbent horse, or in the horse with bladder paralysis (Herpes).
      2. Recumbent horses cannot exert abdominal press and can become constipated. Manual evacuation of feces can become critical to avoid impaction colic.
   ii. Provide support
      1. Adult horses cannot withstand long periods of recumbency. If the horse is recumbent, it is important to turn it over approximately every 4 to 6 hours to avoid or decrease the onset of pressure sores. Although some horses may require heavy sedation to accomplish this, they often become accustomed to this procedure and tolerate it without sedation.
      2. If the horse is unable to stand on its own but appears to have some strength, providing support by means of a sling can often accomplish unexpected benefits. Horses often learn to use the sling for support and are able to eat, urinate and defecate with greater ease when standing. The horse must be able to support itself to some degree. Complete support by a sling will lead to significant respiratory impairment. Even partial support can lead to significant pressure sores.
   iii. Mechanical ventilation
      1. In horses with botulism, where respiratory muscle failure is impending, ventilatory support by means of mechanical ventilation can be a life saving measure until recovery of muscle function. Ventilatory support is possible only in horses that are less than 600 lbs, as heavier horses are unable to withstand prolonged periods of recumbency. Newer modes of mechanical ventilation are able to support oxygenation with minimal injury to the normal lung. These modes include volume-controlled assist/control modes, synchronous intermittent mandatory ventilation modes, and pressure support modes.

d. Wound and eye care
   i. Recumbent horses often develop pressure sores at bony prominences including the tuber coxae, the point of the shoulder, the TM joint, the fetlock and carpus. These sores are difficult to prevent, but careful attention to clean, dry bedding, preferably straw, frequent cleaning of the stall, getting the horse up as often as possible, will help delay their onset. Although use of a pad would
be ideal, unless the horse has botulism, most horses move around enough that they do not stay on the pad. When pressure sores become apparent, twice daily cleaning and application of an antibiotic or antiseptic ointment can help control infection. Use of an ointment that repells flies is essential in warm weather. If deep sores and cellulitis develop, establishment of drainage is often necessary to avoid pockets.

ii. Recumbent horses should also be monitored for development of corneal ulcers. Treatment with topical antibiotics and atropine should be instituted as needed.