AAEP BOTULISM DISEASE GUIDELINES

Summary
Botulism is a disease characterized by progressive, flaccid paralysis resulting from *Clostridium botulinum* toxin production and absorption that can be rapidly fatal if not aggressively treated from the first signs of intoxication.

Clostridium botulinum is an anaerobic, spore-forming bacterium that is found ubiquitously in soil. There are four distinct groups of *C. botulinum* (groups I-IV), and eight different toxins (A, B, C [C1, C2], D, E, F, and G). Only types A, B, and C have been reported in horses in the US. Type A is prevalent in the soil in the western US. Type B spores are typically found in the soil east of the Mississippi River, particularly in the Northeast and Appalachian regions (Mid-Atlantic states and Kentucky). Type C is found in carrion and sporadically found throughout the US. Clinically, Type B is the most reported intoxication (responsible for greater than 85% of cases).

Botulism is a rapidly progressive neurologic disease with a high mortality rate in untreated animals. Early administration of botulism antitoxin can substantially improve prognosis.

Clinical Signs

Regardless of the mechanism or route by which intoxication occurs, the pathophysiology of the toxicity and therefore the clinical signs are the same. The course of the disease can be very rapid, with death occurring within 24 to 48 hours depending on the level of toxin ingestion or production. Wound contamination and toxicoinfectious cases may have variable and prolonged periods from inoculation of the organism until toxin absorption precipitating clinical signs.

Clinical signs include:

- Dysphagia
    - Hyporexia/Anorexia
    - Reflux of feed (milk if foal) and saliva from nostrils or mouth
    - Prolonged chewing without swallowing
    - Weak tongue and esophageal tone and poor tongue retraction
    - Dunking nose into bottom of water bucket in attempt to drink
- Weak eyelid, tail, and anal tone
- Mydriasis and slow pupillary light reflexes
- Progressive, diffuse muscle weakness
    - Muscle trembling/fasciculation, particularly over triceps and hindquarters, that worsens with increased movement or time standing
    - Increased time in recumbency
    - Difficulty rising or standing still
    - Agitation, tachycardia, and frequent weight-shifting if forced to stand

    - Complete recumbency with inability to stand
    - Flaccid paralysis with normal mentation
- Decreased gastrointestinal motility and colic
- Hypoventilation, respiratory arrest
- Sudden unexplained death, potentially of multiple horses

Risk Factors

Both the total amount of toxin exposure and the interval between the onset of clinical signs and initiation of treatment are extremely important with respect to outcome. Immediate referral to a facility equipped to handle recumbent horses and access to antitoxin significantly improves prognosis.

Risk factors include:

- Lack of vaccination against botulism in endemic areas
- Decaying vegetable matter in food and water
- Silage or haylage that has not been properly prepared and stored
- Access to round bales or large square bales of hay, particularly if improperly prepared or stored
- Old uneaten grain and feed that collects around or under feeding areas may also support *C. botulinum* growth
- Animal carcass contamination (bird, fish, rodents, etc.) of feed (including processed), or standing water

Transmission

Three clinical scenarios are possible:

- **Forage poisoning** (food-borne botulism)—consuming feed or forage containing preformed toxins of *C. botulinum*.
- **Wound contamination** (wound botulism)—contaminated wounds with anaerobic areas that allow germination of spores and absorption of toxin.
- **Toxicoinfectious botulism** ('shaker foal syndrome')—foals with immature gastrointestinal tracts ingest bacteria or spores, which subsequently germinate and release toxin within the foal's gastrointestinal tract, allowing toxin absorption and subsequent intoxication. Neonates with gastric ulceration or other gastrointestinal disease might be predisposed due to necrotic or hypoxic foci that provide an optimal environment for *C. botulinum* colonization.

Diagnosis and Treatment

Botulism should be the primary concern for horses with dysphagia, lack of tongue tone, and signs of diffuse weakness in endemic regions. It is also a top differential for outbreaks of sudden death or weakness in groups of horses.

Diagnosis is based on clinical signs and exclusion of other neurologic diseases that cause weakness and recumbency. Differential diagnoses may include EPM, EHM, EMND, arboviral encephalitides, rabies, metabolic derangements, myopathies, and other intoxications. Routine blood tests show no disease-specific derangements, and evaluation for other neurological diseases are negative. Currently, there is no commercially available antemortem test that provides results quickly enough to be useful in the diagnosis of a single case.

Useful clinical tests that have been described include the tongue tone (stress) test, which involves gently withdrawing the tongue to the side of the horse's mouth while the jaws are held closed; and the grain test, which involves feeding 8 oz grain in a bucket and timing consumption. Normal horses retract their tongue with 1 or 2 tugs and consume the grain within 2 minutes, while affected horses are delayed. Additionally, typical prehension of grain and biting into it due to lip paresis may be present. The practitioner should use caution and wear appropriate personal protective equipment (PPE) when performing any diagnostics tests, especially those near mucous membranes due to the risk of exposure to other zoonotic diseases prior to confirmatory diagnosis.

As soon as clinical suspicion arises for botulism, antitoxin treatment should be pursued if finances allow. Every hour delay in antitoxin treatment will reduce survival; prognosis is poor, even with treatment, once the affected horse has lost the ability to stand. There is no cross-protection between toxin types, so antitoxin treatment should be selected based on known type prevalence in the horse's region. Currently, there are two commercial sources of antitoxin: Lake Immunogenics in Ontario, N.Y., which has a trivalent antitoxin against types A, B, and C (http://www.lakeimmunogenics.com/index.php/product/antigen-select-botulism-a-b-c-toxins/); and Plasvacc USA in Templeton, Calif., which has antitoxin against type B (https://plasvaccusa.com/equine/equiplas/).

Antitoxin treatment is the only specific treatment for botulism in horses. Provision of adequate supportive care (hydration and nutrition) is imperative for recovery, particularly in horses with prolonged dysphagia. After antitoxin administration, treatment efforts focus on supportive care and preventing complications from prolonged recumbency while recovery from disease occurs. Survivors usually regain the ability to swallow within two weeks but can take up to a month to regain the ability to rise without assistance.

As mentioned previously, the most likely toxin type affecting a horse with suspected botulism can be deduced based on the known type of prevalence in a geographic region and suspected route of exposure. Definitive toxin type diagnosis requires laboratory testing, which is currently performed at the National Veterinary Services Laboratory in Ames, Iowa. Laboratory tests include the mouse bioassay for toxin detection and typing, and PCR assays for detecting genes of *C. botulinum*.

Sample	Test	Shipping	Handling
20 grams fresh feces	Identification of *C. botulinum* spores	Leak-proof container	Chilled overnight
20 grams or 2 ounces of stomach contents or intestinal contents	Identification of *C. botulinum* spores	Leak-proof container	Chilled overnight
Dead animal from feed OR water source	Identification of *C. botulinum* spores or toxin	Leak-proof container	Chilled overnight
Soil from under affected areas	Identification of *C. botulinum* spores	Leak-proof container	Chilled overnight
Serum** *It is very difficult to isolate toxin from horses' sera. Send additional samples along with sera.	Minimum of 5cc. Provide as much as possible to increase detection of preformed toxin	Leak-proof container	Centrifuge clotted red top tube, separate serum and freeze prior to shipping overnight
Feed samples (hay samples or grain) *Note: toxin may be sporadically dispersed in feed samples, and false negatives occur*	Identification of *C. botulinum* spores or toxin	Leak-proof container	Chilled overnight

Definitive diagnosis is achieved by identification of the toxin in plasma, liver, or gastrointestinal tract contents.

- Tentative diagnosis is based on identification of *C. botulinum* spores in gastrointestinal contents or wounds
- Animals that recover from the disease do have antibody present, but commercially available testing is limited

There is no demonstrable shedding of *C. botulinum* once clinical signs occur, particularly if the source of infection is a wound or an infected umbilicus.

There are no gross lesions associated with botulism; post-mortem exam serves mainly to exclude other potential differential diagnoses and sometimes to permit collection of gastrointestinal samples for testing. No pathologic findings are directly attributable to the effects of botulism toxin. Horses that have been recumbent may have pressure sores or self-trauma.

Recumbency and respiratory paralysis may cause nonspecific signs in the lungs. There may be evidence of aspiration pneumonia secondary to dysphagia.

Toxicoinfectious (shaker foal syndrome): the most consistent lesions are excess pericardial fluid with strands of fibrin, pulmonary edema, and congestion.

Collection of intestinal contents at necropsy may be helpful for further testing; however, confirmatory diagnosis is difficult to achieve.

Environmental Management

- Remove old hay from around feeders; do not feed grass clippings
- Avoid feeding fermented forages to horses
- Avoid feeding improperly harvested or improperly stored large bales of hay, particularly those that have gotten wet or have visible areas of spoilage
- Discard hay and feed visibly contaminated with animal carcasses

Toxins degrade in sunlight within 1 to 3 hours.

Bleach (1:10 dilution) is an effective disinfectant (after thorough removal of organic material) for toxins and/or vegetative cells.

Clostridial spores are resistant to most environmental conditions and disinfectants.

Vaccination: See AAEP Vaccination Guidelines
Understanding of regional variation in the prevailing antigenic type helps determine the utility of vaccination. The vaccine is for prevention of neurotoxin type B botulism only, and only one toxoid vaccine is commercially available (https://www.neogen.com/categories/animal-health/clostridium-botulinum-type-b-toxoid-neogenvet-botvax-b/).

- Vaccination is recommended in endemic areas or if horses will travel to endemic area and be stabled in those areas.
- Adults (broodmares [including during pregnancy] and other adult horses): 3 dose initial series (at 4-week intervals) and annually.
- Foals from vaccinated mares: Vaccinate 3 dose initial series (at 4-week intervals) starting at 1 month.
- Foals from unvaccinated mares: Vaccinate 3 dose initial series (at 4-week intervals) as early as 2 weeks of age. Administer commercial plasma containing anti-botulism antibodies.

Release of Animals from Isolation
There are no isolation requirements for horses with this disease.

Biosecurity Issues for Receiving Animals
There are no biosecurity issues over housing and/or handling of these animals.

Zoonotic Potential
While botulism itself does not pose any zoonotic risk, horses with neurologic disease of unknown origin should be handled as rabies suspects with standard PPE until a definitive diagnosis is established.

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