



## AAEP TETANUS (*Clostridium tetani*) GUIDELINES

### Summary

Tetanus is a neurological disease caused by a potent neurotoxin produced by the anaerobic, spore-forming bacterium *Clostridium tetani*. While tetanus can affect humans and other domestic animals, the horse is considered particularly sensitive to tetanus neurotoxins.

### Clinical Signs

Clinical signs of tetanus arise from the *C. tetani* neurotoxin's ability to block inhibitory signals in the spinal cord, leading to painful muscle spasms and rigidity. Clinical signs vary from mild to severe, are exacerbated by sound or other sensory stimulus, and can rapidly progress to death.

Clinical signs noted in >50% of affected horses include:

- Stiffness and difficulty ambulating
- Wide-based “saw horse” stance
- Agitation
- Third eyelid protrusion
- Trismus (lock jaw)
- Extended neck
- Elevated tail
- Dysphagia
- Anorexia
- Abnormal (decreased or absent) gut sounds
- Abnormal (decreased or absent) defecation

While most affected horses will have normal mucous membranes, normal rectal temperature, tachycardia, and tachypnea, some may present with congested mucous membranes, low or normal heart rates, normal respiratory rates, hypothermia, and hyperthermia. Cardiac arrhythmias may also occur. Autonomic nervous system disturbances observed in humans with tetanus have also been described in horses and foals, and may include severe tachycardia and excessive sweating, bradycardia in the face of painful muscle cramps, gastrointestinal impaction, diarrhea, and bladder dysfunction.

In severe cases, generalized muscle spasms progress to dyspnea, recumbency, seizures, and death. Mortality is generally high and literature reports non-survival in 25–75% of cases, with most reports describing mortality rates over 50%.

Affected foals (<6 months) often present recumbent and may display seizures. Foals presenting with signs of tetanus should be examined for umbilical infection, as this is a common site of entry. Foals have similar survival rates to adult horses.



### Incubation Period

Incubation period can range from 1–43 days, and the initial site of inoculation may have healed by the time clinical signs of tetanus develop. The duration of the incubation period is believed to depend on the inoculation dose, the extent of necrotic tissue (or anaerobic environment), and the distance of the site of inoculation to the central nervous system.

### Risk Factors

- Absent or inadequate tetanus vaccination history
- Young horses (<4 years of age)
- Foals born to unvaccinated mares or with a history of untreated failure of passive transfer
- Physical sites that allow for anaerobic bacterial entry and growth: wounds, hoof abscesses, castration sites, retained fetal membranes, and umbilical infections

### Transmission

*C. tetani* is ubiquitous in soil and is present in the gastrointestinal tract and feces of horses, resulting in an ever-present risk of exposure for horses. It survives in aerobic environments as spores, and the spores can germinate into a vegetative and toxin-producing bacterium when anaerobic conditions develop. Inoculation into deep penetrating wounds or other physical entry sites (e.g., umbilicus, postpartum uterus, etc.) allows for development of such an anaerobic environment as a result of compromised vascular supply or local tissue necrosis. Tetanus is not considered contagious and does not spread between individuals.

### Diagnostic Sampling, Testing and Handling

Diagnosis of tetanus is based on exclusion, and efforts should be made to rule out similarly presenting differentials (e.g., laminitis, pleuropneumonia, protrusion of the third eyelid due to chronic uveitis, rhabdomyolysis, hypocalcemia, viral encephalitis, hepatic encephalopathy, etc.)

A presumptive diagnosis is usually made based on the presence of the classical clinical signs of stiffness, trismus, and protrusion of the third eyelid, often in combination with a negative vaccination status and the identification of a wound or other physical entry point. Definitive diagnosis is difficult due to the challenges of demonstrating the presence of neurotoxins and the bacterium. However, laboratory techniques such as culture of *C. tetani*, gram stain smears from infected wounds, or PCR to detect the *C. tetani* neurotoxin gene can be performed. It should be noted that false negatives are common, although positive results strongly support the diagnosis in horses with accompanying clinical signs. False positives can also occur, as the organism is widespread in the environment and can be present without causing tetanus.

*C. tetani* bacteremia has been described in humans, and foals with tetanus commonly suffer from sepsis. Thus, blood culture is recommended for affected foals as an aid to diagnosis.



## Postmortem Findings

Tetanus does not cause specific gross or histopathological lesions. Necropsy may identify lesions that are a consequence of tetanus, such as trauma following violent spasms and seizures. A postmortem examination can aid to rule-out differentials.

## Treatment

Treatment goals for tetanus include:

### Elimination of *C. tetani* as the source of toxin production

- Cleaning and debridement of the wound or inoculation site (if identified).
- Antimicrobial treatment: penicillin or metronidazole are the preferred antimicrobials. There are no clear differences in the outcomes of people affected by tetanus treated with penicillin or metronidazole.

### Neutralization of the circulating, unbound neurotoxin by tetanus antitoxin (TAT)

- Optimal administration route, dose, and length of duration of TAT therapy are currently unknown. Information regarding TAT in the literature includes:
  - Typically administered IV or IM at a dose of 100–200 U/kg
  - Daily administration for 1–9 days
- Intrathecal administration of TAT has been reported with variable success. To administer TAT intrathecally, remove 30–50 mL of CSF from the anesthetized patient and replace with equal volume TAT.
- If tetanus toxoid is given at the same time as TAT (for tetanus treatment or prevention), they should be administered in separate sites.
- *Note: There are currently no tetanus antitoxin (TAT) products labeled for horses. If practitioners administer TAT to horses for the prevention or treatment of tetanus, they should be aware that this represents an off-label use. Furthermore, TAT products not labeled for horses are unlikely to have been tested for Equine Parvovirus, the causative agent of viral hepatitis (Theiler's Disease) in horses. Clinicians are advised to consider this risk when administering TAT, particularly if for preventative purposes.*

### Muscle relaxation and analgesia

- Tetanus is a very painful disease due to the widespread muscle spasms. Measures should be taken to limit auditory, tactile, and visual stimulation as they can initiate painful muscle spasms.
- Additional measures may include padded stalls, dim lights, cotton ear plugs, and IV catheter placement to avoid direct injections and oral medications.
- First-choice muscle relaxants: benzodiazepines (diazepam or midazolam) or phenothiazine (acepromazine or chlorpromazine).
- Additional drugs that can aid in muscle relaxation: alpha2-agonists, guaifenesin in recumbent animals, dantrolene, magnesium, methocarbamol, and barbiturates.
- Additional analgesics: NSAIDs and/or opioids.



### Supportive care

- Avoid secondary trauma: soft bedding, padded head and limb protection, artificial tears, and sedation.
- Wound care: including the initial wound and of the wounds that develop as a disease complication.
- Cardiovascular support: IV fluids if the horse cannot drink.
- Respiratory support: intranasal oxygen therapy can be needed if dyspnea develops.
- Digestive support: some horses can develop stasis, colic, or diarrhea, and treatment might be required for this.
- Nutrition: soft foods that are easy to swallow, tube feeding, IV glucose, and/or parenteral nutrition.
- Urinary support: some horses develop abnormal bladder function or can't posture to urinate. Catheterization may be needed in these cases.
- The use of slings is controversial and depends on the type of sling, how much the horse can still support itself in the sling, how much the hanging of the horse in the sling compromises breathing, and how much the use of the sling triggers muscle spasms.
- Physiotherapy can be beneficial for recovery after a couple of days when touch and passive movements of the limbs do not trigger spasms anymore.

### Establishment of active immunity against neurotoxins

- Tetanus infection does not stimulate a durable immunity, and horses can get tetanus again after recovery.
- Tetanus toxoid should be administered to boost immunity.

### **Shedding of Organism Following Resolution of Clinical Signs**

There is no shedding of the bacterium or toxin.

### **Environmental Persistence**

The *C. tetani* spores can survive in aerobic conditions and are resistant to intense heat and most disinfectants. The spores survive boiling but are eliminated after autoclaving (115°C or 239°F) for 20 minutes.

### **Biosecurity Considerations**

Tetanus is not contagious. However, biosecurity guidelines for animals affected by tetanus are related to the contagious nature and zoonotic potential of several differential diagnoses of acute onset of neurologic disease (e.g., rabies, Hendra, EHV myeloencephalopathy, and other viral equine encephalitis diseases). The geographical area will dictate how high the risk is for some of these potentially dangerous viral encephalites. Until these differentials are ruled out, or tetanus is confirmed through presence of the classical clinical signs in the face of a negative vaccination status and presence of inoculation site, it is strongly advised to act on the side of caution by wearing personal protective equipment (PPE) and isolating the horse.



### Specific Control Measures

- Detailed tetanus vaccination recommendations may be found in the [AAEP Tetanus Vaccination Guidelines](#) and in the [AAEP Adult Horse Vaccination Chart](#) and [AAEP Foal Vaccination Chart](#).
- The vaccine against tetanus (tetanus toxoid) is a very successful and highly protective vaccine. Only rarely does tetanus occur in vaccinated horses, and generally indicates incomplete or ineffective vaccination has occurred. Due to the ever-present risk of exposure, the severity of the disease, and the almost 100% protection following vaccination, tetanus toxoid is considered a core equine vaccine and should be included in equine immunization programs for every horse.
- It is generally accepted that tetanus toxoid administered per manufacturer recommendations is both safe and efficacious. All tetanus toxoid vaccines are labeled for annual (12 month) revaccination.
- Protective responses from vaccination are usually attained within 2 weeks of the second dose.
- If tetanus toxoid is given at the same time as TAT (for tetanus treatment or prevention), they should be administered in separate sites.

### Zoonotic Potential

None known.

**Author:** Gaby van Galen, DVM, PhD, DECEIM, DECVECC

**Supported and reviewed by:** AAEP Infectious Disease Committee