STRANGLES

Strangles is one of the oldest infectious diseases described in horses. It is an upper respiratory infection of lymph nodes with the bacteria *Streptococcus equi* subspecies *equi*. *Streptococcus equi* subspecies *zooepidemicus* and *Streptococcus dysgalactiae* subspecies *equisimilis* are two other types of Streptococcus found in horses. Strep zoo is commonly found in all horses including those that are healthy and those that are ill. It is considered part of the normal bacterial flora. This article will focus exclusively on *Streptococcus equi* subspecies *equi*, the causative agent of Strangles.

IMPORTANT POINTS
(click to jump to topics in text or keep reading)

Etiology and Pathogenesis

As a member of group C streptococcus, Strep equi is a gram-positive cocci that can be differentiated from other

Streptococcus in the microbiology lab**. The organism is transmitted directly and indirectly from horse to horse**. Once ingested or inhaled, Strep equi attaches to cells in pharyngeal tonsils and quickly moves intracellular. Translocation occurs to the lymph nodes draining the head where abscesses develop. Most abscesses occur in the pharyngeal region but metastasis to other lymph nodes can occur via blood and lymphatic spread. Development of abscess outside of the pharyngeal tissue is a condition known as "bastard strangles".

The first clinical sign of infection is a fever on day 3 to 14 after exposure. Lymph node abscess develop rapidly which is frequently accompanied by edema. Nasal shedding begins 4 to 14 days after exposure **and can persist for years**, although most cease after resolution of the clinical disease in 3 to 7 weeks. Fevers usually develop before nasal shedding developes. 75% of horses will develop immunity after a Strep equi infection, leaving **25% susceptible to reinfection within months of resolution**. Use of antibiotics may reduce the level of immunity that develops from an infection. Local immunity develops against M protein although the development of local and systemic responses are independent of each other. Foals are protected when colostral antibodies recirculate to the nasal mucosa.

Epidemiology

Purulent discharge is an easily recognizable source of contamination and transmission. Indirect transmission occurs through sharing of contaminated husbandry equipment, especially water. There are limited studies on environmental persistence of Strep equi, with some studies showing up to 60 days in some laboratory conditions, although recent reports (CVJ 2009) **show a limited survival (< 3 days) in outdoor** environments. As such the **most important source of Strep equi exposure is other horses**. Transmission of Strep equi can occur from asymptomatic carrier horses. These cases are occasionally early in the course of a clinical disease, but more commonly are horses harboring the organism in the upper respiratory tract after resolution of the clinical disease. Some horses may harbor Strep equi for years in the sinus and guttural pouch. These horses continue to shed low levels of bacteria in the normal nasal secretions. Identification of these animals is challenging, and can be accomplished with guttural pouch endoscopy, guttural pouch lavage, and/or nasopharyngeal lavage with PCR testing. Surface bacteria in the pharynx turnover rapidly and identification of DNA in this location is indication of an active infection or colonization. A carrier state has been proposed to occur in 10% of horse who develop guttural pouch infections as a consequence of a Strep equi infection.

Most but not all cases are diagnosed in later Winter and early Spring. A recent surveillance report from the Merck bio surveillance program showed that Strep equi is not a young horse disease. In fact of the horses that tested positive for Strangles in this study (Vet Rec 2011), 50% were between 6 and 15 years of age. Thirty-three percent were under 6 years of age and the remaining 15% were 16+. In horses 6 years of age and older, Strep equi was the most common identified cause of upper respiratory disease.

Clinical Signs

The severity of clinical signs is dependent on the horse's immunity, challenge load, use of antibiotics and duration of exposure. The classic clinical signs include abrupt pyrexia, lethargy, and lymph node swelling. The fever may present prior to any other noticeable change. As lymphadenopathy develops horses may develop significant pharyngitis with inability to swallow.

Other clinical signs affecting local neurologic function may develop depending on where in the pharynx the abscess develops, External squeezing of the larynx will often cause marked pain, retching, and elicit a cough.

The abscesses will then mature and rupture. The observation of large quantities of purulent exudate from the nostrils when the horse has its head down, when the horse is eating, or when the horse is coughing is a strong indicator of guttural pouch empyema.

20% of horses with strangles experience some type of complication which can increase mortality. Complications include:

1. pupura hemorrhagica,
2. immune mediated myositis,
3. ulcerative lymphangitis,
4. glomerulitis,
5. mydocarditis,
6. metastasis,
7. airway obstruction,
8. dysphagia.

While not impacting mortality, development of a carrier state is a frustrating and expensive complication.

Diagnosis

Definitive diagnosis of "typical" Strangles case is straightforward and is based on culture of nasal swabs, nasopharyngeal lavages, guttural pouch lavages, and samples aspirated from abscesses. Occasionally other beta hemolytic streptococcus or the live attenuated vaccine strain may complicate identification of Strep equi. Additionally, cultures from lavages early in the clinical course of the disease may be falsely negative. Nasal lavages are preferred over nasal swabs as it will sample a larger area. Guttural pouch endoscopy and guttural pouch lavage is preferred over nasal lavage.

Serologic tests for multiple antigens is possible, and the major serologic test is for SeM. Serology will identify horses with previous exposure to Strep equi, but not necessarily a current infection.

Testing of samples by PCR can detect very small levels of Strep equi DNA. PCR will identify both living and dead DNA and should be confirmed with culture. In a single individual case, culture is most likely adequate for diagnosis. In a herd situation, identification of animals shedding Strep equi is important to limit the outbreak. In such cases **PCR is critical to identifying the asymptomatic carrier**, determining Strep equi status prior to transport or comingling, and to evaluate the effectiveness of clearing Step equi from the guttural pouches.

Culture of the pharynx can be done with long swabs (15 cm rayon tipped) or with saline lavage. Short cotton swabs of the nasal passage is not adequate for testing.

Treatment

Treatment depends on the stage of disease and use of antibiotics remains controversial. Most typical cases require no treatment other than anti-inflammatories and supportive care. During an outbreak treatment of a horse with an acute fever (<24 hours) with appropriate antibiotics may be curative and prevent focal abscessation. Horses successfully treated in this manner will not develop an anamnestic immune response and will remain susceptible to subsequent infection. **No experimental or clinical data exists to support the belief that use of antibiotics will increase the risk of bacteremia or "bastard strangles"** Treatment of horses showing the earliest signs is an effective way to limit an outbreak in stables and barns.

Once lymphadenopathy is identified there is no value in the use for antibiotic therapy in "typical" caces. Treatment may improve the initial symptoms, but delays the ultimate maturation and rupture of the abscess. Therapy in horses with lymphadenopathy is directed at maturing the abscess and improving comfort.

In cases where life threatening complications have developed (severe pyrexia, dyspnea, ect) antibiotics are indicated to reduce abscess size and inflammation. Horses that have resolved all clinical signs, but continue to test positive on nasal lavage culture or PCR may benefit from a course of systemic antibiotics and local lavage and treatment of the guttural pouch.

Prevention

Measurable immunity develops in 75% of cases recovered from Strangles for 5+ years. Multiple vaccines for Strep equi exist including adjuvant extracts of Strep equi containing SeM and attenuated live strains of Strep equi. Occasional contamination of an injection site occurs when live vaccine is given at the same time as other IM vaccines. Vaccinating in the face of an outbreak with the attenuated live strain has not been shown to increase complications. However protective immunity takes up to 2 weeks to develop and DNA from the vaccine will lead to a false positive on subsequent PCR testing for 4 to 6 weeks. Prevention of additional cases is an important aspect of treatment in a herd. Shedding does not typically begin for 1 to 2 days after a fever is identified allowing for quarantine of pending cases. One method of handling a herd outbreak is to isolate clinical cases and segregate additional horses into test positive, pending, and test negative groups. It is important to not contaminate twitches or other equipment when doing nasal lavages and use of sedation and lip chains enhances this process. This method will identify carrier horses allowing for treatment and potentially eliminating Strep equi from an endemic herd.

Farm Biosecurity

Strangles is one of the more contagious diseases seen in equine medicine, but once recognized is not that difficult to control. Good routine farm management goes a long way to limiting the risk on a farm. As the organism does not live outside of the host for very long except in wet environments, control measures should be targeted at eliminating wet areas. This includes shared water buckets, water troughs, brushed to clean water buckets and troughs, tack and grooming equipment that involves the head and mouth, shared treats, twitches and other tools for restraint, and people's hands. Taking care to wash hands, wash equipment, and not to cross contaminate the hose or hose handle when filling water buckets is very powerful at reducing the risk of spreading disease.

Use of vaccines against infectious diseases is a critical part of preventing disease. The strangles vaccine has some controversy, but it can protect horses from disease. There are muscle vaccines and a modified live bacterium that are used to

reduce the degree of shedding if a horse is infected and to also hopefully prevent infection in cases with low levels of exposure. No vaccine is protective against any disease if the horse is exposed to a large or constant load of infectious agents. No vaccine is without risk. You should involve your veterinarian to help design a vaccine program for your farm. In most instances, Brazos Valley Equine Hospitals encourages the use of the modified live bacterium twice a year to reduce the risk of farm outbreaks in show horse barns.

Documenting daily rectal temperatures as part of a routine can identify cases early and prior to spreading. This is a good practice for all diseases and on farms where there is a transient population.

Especially during an outbreak, taking daily rectal temperatures is critically important. Recognize that affected and sick horses should be handled and fed last to avoid the risk of contamination. Moving horses away from the general population reduces the chance of spreading the disease. Setting up hand disinfectant around the facility increases the chances of everyone disinfecting their hands, but also serves as a visual reminder to everyone to practice biosecurity.

On a farm with an index case, the use of disposable gloves between horses and disinfecting equipment can help stop the spread. Everyone should have their rectal temp taken daily. Horses that were exposed to the index case should have their rectal temp taken twice daily. Any new fever should be isolated and a veterinary opinion on early treatment sought for each case. It is possible to stop the spread of an outbreak with appropriate use of vaccines and antibiotics. It is also possible to completely confuse which horses are infected and to create several severe problems with antibiotics.

When possible cases should be isolated in a separate facility. When a horse has a fever, it may or may not be shedding. Testing with nasal pharyngeal lavage can help to identify some of the early cases, but a negative PCR early in the course does not eliminate that horse from being infected.

In a large outbreak separating horses into groups of infected, suspected, and cleared can help to contain the disease while allowing some horses to continue to travel and show. The only way to eliminate a horse from the possible silent carrier pool is to scope the guttural pouches and test with PCR and culture.

Certificates of Veterinary Inspection are issued by licensed veterinarians after examining all the horses. It requires taking rectal temperatures. It is the veterinarians and farms responsibility to protect the industry and show by not shipping any sick or suspect horses to the facility. When the farm has had recent cases, the veterinarian has the responsibility that any horse going to the show is not infected. In some cases, this can be done by inspection. In other cases, this requires more invasive examination and microbial testing. It takes an average of 7 days from the time a culture is submitted for the results to be finalized. Prior to a show any farm that have diagnosed cases should discuss with their veterinarian how best to certify the horses free of disease, especially if any additional testing is needed.

Show Biosecurity

At the farm you have more control of the environment. At a show it is more challenging. Extra caution should be taken to reduce the exposure to possible sources of infection in water, grooming equipment, and people. Every facility has a set of biosecurity measures that should be observed at a minimum. Daily rectal temps can help to catch problems early and before the whole barn is exposed.

Every facility has a check in process to document that incoming horses are healthy. These can be very time consuming but are critically important to all the horses in the facility to reduce the risk of disease. A facility will also be transparent and honest about infectious disease cases and what steps are being taken. Conversely it is the responsibility of the horse owners, trainers, and veterinarians to communicate with the facility when any infectious disease is suspected. Because no disease shows clinical signs immediately, observation and documentation or rectal temps should also be done for 7 to 10 days after returning home. If possible, isolating horses that are new to the farm, or returning from a show will help to reduce risk to the rest of the facility.

Disinfectants

Only after a thorough cleaning, should a disinfectant be applied to the area. In general gram+, gram-, enveloped viruses are susceptible to most disinfectants. Spore forming bacteria, non-enveloped virus, and oocyst are more difficult to kill. The stability of an organism outside the horse will also impact the effectiveness of a disinfectant.

Cleaning is the process where all visible debris is removed. This is a critical component of disinfection as even the best products are rendered in-effective in the presence of much organic material. Dirt, feces, and bedding not only inactivate some products, they also act as a barrier between the target bacteria and the disinfectant. Removal of as much organic material as possible is important and effective cleaning can remove much as 90% of the bacterial load in the environment. **Cleaning is manual labor.** Scrubbing with anionic detergents loosen organic debris, emulsify fats, and loosen bacterial biofilms. The choice of the cleaning agent should be considered when choosing a disinfectant to avoid any adverse chemical reactions. Use of high pressure systems should also be avoided when the surface contains much organic material. High

pressure washers will effectively clean a surface but will also aerosolize and spread infectious agents to areas more difficult to adequately clean.

Even with an excellent cleaning and choice of a appropriate disinfectant, errors can lead to lack of efficacy. Most disinfectants require at least 10 minutes of wet contact time. If they are applied and then immediately rinsed away, they will not be effective. Disinfectant concentrations vary and most need to be diluted. Excessive dilution has little effect, while excessively strong may be more irritating and toxic. Label instructions should always be followed. The disinfection process can be divided into three levels based on the potential transmission of disease.

High level disinfection should eliminate all virus and vegetative bacteria. Examples of items requiring this level of disinfection include endotrachael tubes and some surgical equipment.

An intermediate level should eliminate all vegetative bacteria and most viruses. Examples of items needing intermediate level of disinfection include dental equipment, endoscopes, some nasogastric tubes and community thermometers.

Low level disinfection should eliminate most bacteria. Examples of items needing a low level of disinfection include individual thermometers, twitches, feed and water buckets, muzzles, most nasogastric tubes, and stethoscopes.

The choice of a disinfectant should be based partially on the surface with nonporous surfaces (stainless steel) being easier to disinfect than non-porous surfaces (wood flooring in stall). Painting or sealing porous surfaces will make disinfection less challenging. The organism targeted will also help determine the choice of disinfectant. A perfect disinfectant should have the following characteristics: germicidal against all pathogens, nontoxic to animals and humans, environmentally safe and biodegradable, economic and easy to use, unaffected by organic matter, non destructive to stall and trailer surfaces, and stable on a variety of surfaces at a variety of temperatures. The following is a summary of different disinfectants.

Alcohols have a rapid germicidal activity against bacteria, fungi, and some virus. They are relatively non-toxic although highly flammable. **They do not work in the presence of organic material.** In the veterinary environment they are typically only useful as a component of a hand sanitizer. Most hand sanitizers are 60-70% alcohol although recent suggestions have been to use a concentration of 80% or higher.

Aldehydes are very effective, stable disinfectants and work in the presence of organic material. Unfortunately, they are also toxic to patients and personnel. Formaldehyde and glutaraldehyde are two examples of aldehydes, of which glutaraldehyde (Cidex) is the most frequently used. Glutaraldehyde can be used to disinfect surgical instruments and equipment.

Biguanidines are cationic compounds that are incompatible with anionic detergents. Chlorhexadine is the most frequently used example. **It is inactivated in the presence of organic material.** It works best a concentrations ranging from 0.01% to 0.1%. and at a pH of 7.0. Chlorhexadine may have some residual activity. It is not frequently used as an environmental disinfectant.

Chlorine compounds are effective disinfectants killing a wide range of bacteria and virus. **They are rapidly inactivated in the presence of organic material.** They lack stability and should be used soon after mixing. The most commonly used example is hypochlorite (bleach). It is cheap, readily available, **but lacks usefulness in most equine environments**. Caution should be taken when using this product in combination with other disinfectants or in the presence of ammonia (ureine) due to the potential for toxic gas formation (chloroform, chlorine gas, etc). Chlorine compounds are also corrosive to metals and concrete. Despite these limitations, bleach is one of the limited disinfectants available that will kill spores and non-enveloped virus. It is commonly diluted 1:64.

Iodine compounds are commonly used in veterinary medicine. They are highly dependent on pH and concentration. The amount of free iodine in the solution determines its effectiveness. They are germicidal and may be effective in the presence of organic debris. Povidone-iodine is the more frequently used example. It is not routinely used as an environmental disinfectant.

Peroxygen compounds are a relatively new class of disinfectants, although hydrogen peroxide has been used since the late 19th century. Hydrogen peroxide vaporizes to gas which is irritating and is toxic to tissue. However the germicidal effect of hydrogen peroxide can be enhanced by combining with surfactants and organic acids, while reducing is toxicity. Accel is a stabilized hydrogen peroxide product. It appears to be non-toxic, sporocidal, effective against non-enveloped virus, stable across a wide range of temperatures and in the presence of organic material and has limited corrosiveness to metal surfaces. It has some detergent effects and can be used in the cleaning step.

Potassium peroxymonosulfate is another product that is currently available in the US (Trifectant or Virkon). It is effective as a foot bath despite gross contamination with organic debris. It has activity against spores and non-enveloped virus. It has limited effectiveness against fungi. It is non-toxic, biodegradable, and has limited corrosiveness to metal surfaces. Like Accel it has some detergent properties and can be used in the cleaning process.

Phenols have broad germicidal activity against bacteria, fungi, and enveloped virus. They are active in the presence of organic debris and have some residual activity if left to dry on surfaces. In higher concentrations they produce irritating fumes and can cause some skin irritation. They are relatively non-corrosive. While they do have some detergent properties, they do not mix with cationic and nonionic detergents. They are also toxic to cats.

Quarternary Ammonium compounds are cationic chemicals and incompatible with anionic detergents. Commonly known as quats, **they are inactive in the presence of organic debris**, but kill bacteria and virus on clean surfaces. When combined with nonionic detergents they can be effective cleaners of environmental surfaces. They are generally stable, nonirritating and have low toxicity. They can be very effective in combination with phenols and have some residual activity after drying.

Stall Cleaning/Disinfection Protocol at Brazos Valley Equine Hospitals-Navasota

1. Remove equipment (buckets, balls, etc)
2. Remove all bedding, hay and feed material
3. Rinse surface with water hose to loosen debris
4. Apply detergent (Trifectant) and scrub surface to remove all organic debris
5. Apply detergent (Accell) to buckets and scrub
6. Rinse surface and inspect for dirty areas
7. Clean, repair, replace or seal surface as necessary
8. Rinse buckets
9. Allow surface to dry thoroughly (fan dry)
10. Apply disinfectant to all surfaces including buckets
11. Allow disinfectant to dry to maximize contact time
12. Rinse buckets thoroughly
13. Culture stall surfaces with moist gauze sponges or Swiffer pad are indicated

Protective Barriers

No barrier is useful without compliance. Too strict or cumbersome of guidelines will lead to a breakdown in protection. Gloves are one of the most important and abused tools in preventing the spread of disease, as hand contamination is the most important vector in iatrogenic disease spread. Rubbing one's face, nose, eyes, or touching other patients eliminates the value of using gloves to protect the patient and to prevent colonization of the operator. When used properly, they are a single use disposable item. Multiple boxes can be dispensed around the facility or dedicated to one stall. Gloves are not a substitute for appropriate hand washing.

Other Resources

AAEP STRANGLES GUIDELINES

https://aaep.org/sites/default/files/Documents/Strangles_Final2.pdf

AAEP BIOSECURITY

https://aaep.org/sites/default/files/Documents/BiosecurityGuidelines_Sept2018.pdf

AAEP Infectious Disease Control

https://aaep.org/guidelines/infectious-disease-control

ACVIM consensus Statement – Update

https://onlinelibrary.wiley.com/doi/full/10.1111/jvim.15043

ACVIM consensus Statement

https://onlinelibrary.wiley.com/doi/pdf/10.1111/j.1939-1676.2005.tb02671.x

Other References

1. **Waller A. New Perspectives for the Diagnosis, Control, Treatment, and Prevention of Strangles in Horses. Veterinary Clinics of North America – Equine. 2014**
2. **Weese J, Jarlot C, Morley P. Survival of *Streptococcus equi* on surfaces in an outdoor environment. Can Vet J 2009.**
3. **Pusterla N, et al. Surveillance programme for important equine infectious respiratory pathogens in the USA. Veterinary Record 2011.**

Frequently Asked Questions

1. Should I test my horse before going to a horse show?
   ANSWER – A good inspection by your veterinarian is usually all that is required. However, to protect the farm and the facility it may be wise to test individual horses. Specifically, any horse that has had clinical signs, or fevers should be tested prior to the CVI/Health Certificate. Keep in mind it takes 7 days for the test to come back.

2. Best testing method?
   ANSWER – The best test is scoping the guttural pouches and visualizing the lymph nodes, as well as, testing fluid lavaged out of the guttural pouch by PCR and culture. Special swabs are recommended for culture.

3. Should I vaccinate my horse before the show?
   ANSWER – It takes a minimum of 14 days for the vaccines to generate good immunity. Vaccinating at 2 weeks or further out can help reduce risk to the farm and to individual horses. Vaccinating less than 2 weeks out is unlikely to help much for that horse show.

4. My horse was at a farm or facility that had strangles. Is he now contagious?
   ANSWER – Not necessarily. Take his temp daily. If he has a rectal temp >101.5 that is a fever and you should consider him contagious until he can be tested.

5. Is 2 weeks long enough for a horse to not be contagious after having Strangles?
   ANSWER – No. It is impossible to know when a horse is no longer contagious unless you test her. A minimum of 2 weeks is recommended after recovery before testing. Only with adequate testing can you determine if a horse is contagious.

   You can send more questions to bveh.navasota@bveh.com or to our Facebook page and we will continue to update this sheet.