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**College of Veterinary Medicine**

# ***EQUINE HEALTH UPDATE***

**FOR HORSE OWNERS AND VETERINARIANS**

## **Regenerative Medicine in the Equine Athlete**

By Megan Bolger, DVM Class of 2023

Edited by Dr. Camilla Jamieson

Injuries to tendons, ligaments, bones, and muscles are a few of the most common reasons for loss-of-use in equine athletes. While the location and degree of injury varies for each individual patient, the healing processes are typically similar and involve a long recovery period. Because of this, regenerative medicine has become increasingly popular as treatment options have become more available and less invasive. The goal of regenerative medicine is to modulate the healing process in a localized area by stimulating and recruiting the body's own cells. Three main therapies, platelet-rich plasma (PRP), interleukin-1 receptor antagonist protein (IRAP) and stem cell therapy, have proven to aid in the healing process of equine musculoskeletal injuries and athletic return-to-work.

Platelet-rich-plasma or PRP is defined as a volume of plasma that contains a platelet count that largely exceeds that of whole blood. The therapeutic effect of this treatment is focused on the platelets and the growth factors they contain. When platelets respond to a site of injury, they break apart or degranulate, and release  $\alpha$ -granules which contain important growth factors. These growth factors “promote healing by enhancing cell migration, proliferation and differentiation, improving matrix synthesis, and stimulating the formation of new blood vessels.”<sup>1</sup> The process of PRP can be done stall-side which makes it easy and accessible for clients. A blood sample is taken from the patient, spun down and the red blood cells are removed leaving only the plasma. This plasma is then injected into the site of injury, typically tendons and ligaments, or can also be applied as a topical medication for wound healing. In addition to PRP, a recent study showed that administering extracorporeal shockwave therapy (ECSWT) in conjunction with PRP stimulated additional growth factor release after PRP was injected.<sup>2</sup> As research continues in the field of regenerative medicine, the suggested synergism between PRP and ECSWT could mean these two modalities are administered together to promote healing.

Interleukin-1 receptor antagonist protein or IRAP is another popular form of regenerative medicine. However, in contrast to PRP, IRAP works mainly by inhibiting the inflammatory cascade by blocking interleukin-1 (IL-1) from binding to its receptors.<sup>3</sup> IL-1 is a key player in the inflammatory cascade and IRAP helps to modify that inflammatory process and reduce joint degradation.<sup>1</sup> This makes IRAP an ideal

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# News & Notes *SUMMER BIOSECURITY*

By Drs. Carla Olave and Emily Hess

## **Intro:**

Summer is a fun and exciting time for many horse owners and riders. Everyone looks forward to warmer weather, sunshine, and long evenings with many horse shows. However, all of these events carry their own risks! Horse shows expose horses (and their bugs) to new horses (and new bugs)! The warmer temperatures mean that mosquitos and other insects are much more active, leading to the spread of vector-borne disease. Long summer days bring more sun exposure, leading to an increased risk of skin cancers.

## **Vaccines + vector borne diseases:**

The American Veterinary Medical Association (AVMA) has defined the term “core vaccinations” to refer to vaccines “that protect from diseases that are endemic to a region, those with potential public health significance, required by law, virulent/highly infectious, and/or those posing a risk of severe disease. Core vaccines have clearly demonstrated efficacy and safety, and thus exhibit a high enough level of patient benefit and low enough level of risk to justify their use in the majority of patients.”. The following vaccines are considered core for equine patients by the AVMA and the American Association of Equine Practitioners (AAEP): Eastern & Western Equine Encephalomyelitis (EEE/WEE), Rabies, Tetanus, and West Nile Virus (WNV). We will briefly touch on each of these diseases, as well as introduce a few other vaccines that should be top on your list when entering horseshow season.

**Eastern & Western Equine Encephalomyelitis:** Eastern Equine Encephalomyelitis has been reported most in North/South America, while WEE has been more commonly reported in the Western states of the United States (US). Venezuelan Equine Encephalomyelitis has been reported in Central America, South America, Mexico, and less commonly in the southern US. The most common method of transmission of these 3 diseases is via mosquitoes. Immunization against EEE and WEE is core for all horses in North America, while immunization against VEE is optional. Clinical signs include a decrease in appetite, as well as the presence of a fever and neurologic signs (tremors, ataxia, and recumbency). Diagnosis of the disease is made via bloodwork, and treatment involves supportive care. The prognosis for horses diagnosed with EEE is poor, but is slightly better for WEE/VEE. Adult horses should be revaccinated in the spring. While EEE cannot be passed from horses to humans, it can be transmitted from mosquitoes to humans. Therefore, the presence of EEE in the population of horses means that humans are at an increased risk for contracting a similar condition from infected mosquitoes.

**Rabies:** Although infrequently diagnosed, if contracted this virus is almost always fatal. Exposure to this virus involves the bite of a rabid animal (most commonly bats in our area, as well as raccoons, foxes, and/or skunks). This virus migrates up the nerves and causes inflammation of the brain, leading to various neurologic deficits and eventually, death. There are several vaccines listed for use in horses, but these vaccines must be administered by a licensed veterinarian. Adult horses should

be vaccinated annually. This disease is zoonotic, meaning that it can be transmitted from horses (and other animals) to humans.

**Tetanus:** This condition is caused by a toxin producing bacteria (*Clostridium tetani*). This toxin leads to the development of, often-times fatal, neurologic signs. This bacteria is present in the intestinal tract/feces of healthy animals and is commonly found in the soil, leading to constant exposure of the bacteria and its toxins to horses. Although tetanus is not spread between animals, it can easily infect horses via entrance into wounds, surgical incisions, and other exposed tissues. A common clinical sign associated with tetanus includes stiffness of muscles, leading to difficulty moving and eating. Once clinical signs are noted, treatment may or may not be successful. However, vaccination against this disease is highly effective. Adult horses should be revaccinated annually.

**West Nile Virus (WNV):** West Nile Virus has been identified in all parts of the continental US, most parts of Canada, and Mexico. The virus remains present in birds and is passed to animals (including humans) via mosquito vectors. Both horses and humans cannot transmit WNV to other individuals (not contagious or zoonotic), but instead the virus relies on mosquito vectors to pass between hosts. Clinical signs of WNV include fever, stumbling, weakness, muscle twitching, abnormal sensitivity to touch/sound, and recumbency. Bloodwork is used to diagnose this condition and treatment involves supportive care. Approximately 33% of horses that contract WNV will die or be euthanized, and surviving horses are at risk for residual neurologic deficits. Adult horses should be revaccinated annually. Horses living in high risk areas, may be vaccinated more frequently.

**Equine Influenza and Equine Herpesvirus (Rhinopneumonitis):** While they are not considered core vaccines, the Equine Influenza and Equine Herpes Virus vaccinations should be included in the vaccination protocol for any horse that is traveling to a show during the upcoming spring/summer.

Equine Influenza is highly contagious and spreads via aerosolized droplets or on inanimate objects (fomites). Clinical signs typically involve the respiratory tract, as well as fever and lymph node enlargement. Diagnosis can be made based on testing from a nasal swab and treatment is typically supportive in nature. Adult horses should be revaccinated annually. However, horses at increased risk of exposure (e.g. traveling to shows) can be revaccinated every 6 months.

Equine Herpesvirus type 1 (EHV-1) and Equine Herpesvirus type 4 (EHV-4) cause respiratory disease in horses. Clinical signs include fever, decreased appetite, nasal discharge, and cough. Equine herpesvirus type 1 can also cause abortion in mares, birth of weak foals, and/or neurologic disease (equine herpesvirus myeloencephalopathy-EHM). Both EHV-1 and EHV-4 spread mostly via respiratory secretions, but can also spread via contact with aborted fetuses, placental/fetal fluids, and placenta. The virus is able to infect a horse and remain dormant for a long period of time, making it difficult to control

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# Tying Up for Equine Owners

By Jenny Oberhelman, DVM Class of 2023

Exertional rhabdomyolysis, or also known as Tying Up, is a muscular abnormality syndrome in equine. There are two classifications of tying up that includes sporadic and chronic. Sporadic may be a single episode or occur infrequently. Any equine can undergo sporadic exertional rhabdomyolysis if exercised too drastically, too quickly. Chronic is repeated episodes and can occur with minimal exercise. Additionally, chronic can be hereditary with polysaccharide storage myopathy Type 1 and 2, abbreviated PSSM, recurrent exertional rhabdomyolysis, and malignant hyperthermia. Recurrent can be seen most in Thoroughbreds and seen less in Standardbreds. PSSM Type 1 can be observed in several breeds of horses with draft breeds being the most effected.

PSSM Type 2 most effects Warmblood horses and young Quarter Horses. Malignant Hyperthermia is a genetic mutation in Quarter Horses and American Paint Horses of the RYR-1 gene that can cause a fatal hyper-metabolic state (Tinkler, 2021). As an owner, being aware of owning any of these breeds that your horse can be at risk of tying up.

One theory according to Aldrich (2021), the cause of exertional rhabdomyolysis is abnormal intracellular calcium regulation that causes muscle to continue to contract. The College of Veterinary Medicine at Michigan State University explained the signs of exertional rhabdomyolysis include muscle pain and cramping

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## Regenerative Medicine

(continued from cover)

treatment for degenerative joint disease, osteoarthritis, and other orthopedic diseases. IRAP is prepared differently from PRP and cannot be done stall-side. Instead, a whole blood sample is taken from the patient and cultured before the serum can be harvested.<sup>4</sup> Culturing the blood allows for stimulation of white blood cells and subsequent cytokine release. The serum is then collected and can be injected directly into the affected joint or stored for a period of time. Studies have shown that IRAP has decreased the clinical signs of joint pain by decreasing the degree of lameness and articular cartilage erosions in horses with osteoarthritis.<sup>5</sup>

The final type of regenerative therapy is the use of stem cells. Stem cell therapy involves the use of undifferentiated cells that can develop into a diverse set of lineages with the goal of healing and regenerating damaged tissue. Similar to PRP, mesenchymal stem cells “function to decrease inflammation, inhibit scar formation and cellular death, and increase the formation of new blood vessels”.<sup>6</sup> Stem cells can be harvested from various sources in the equine body including bone, fat, peripheral blood, amnion and umbilical structures (Figure 1).<sup>7</sup> Bone marrow collected from the sternum or tuber coxae of the horse are common collection sites along with fat (adipose-derived) stem cells. The harvested cells are typically sent to specialized labs for culture and expansion. Similar to PRP and IRAP, stem cells are administered as an injection directly to the site of injury. This treatment modality takes the longest of the three therapies however is still popular for use in tendon, ligament, bone, and cartilage injuries because of their great potential for tissue regeneration and repair. Studies have shown that stem cell therapy can reduce scar tissue and produce cells that are more closely related to the original composition and function of the damaged structure, making it another viable treatment option for tendon, ligament and joint injuries.<sup>8</sup>

Equine athletes of all kinds are susceptible to musculoskeletal injuries that can range from non-critical to life-threatening. As veterinary medicine continues to advance, more options for treatment of these injuries are becoming available. Regenerative

medicine has gained popularity in the equine world due to the relatively non-invasive procedures and ability to stimulate healing with the use of the patient's own cells. While still in the early stages of research, treatments such as PRP, IRAP and stem cell therapy have produced promising results regarding regeneration of tissues and return to athletic abilities in equids.

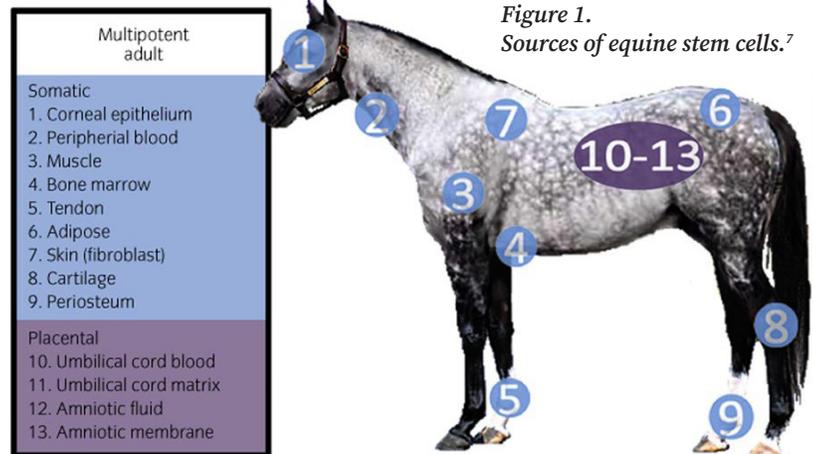


Figure 1. Sources of equine stem cells.<sup>7</sup>

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# EGUS Will Give Your Horse "A Pit in Its Stomach"

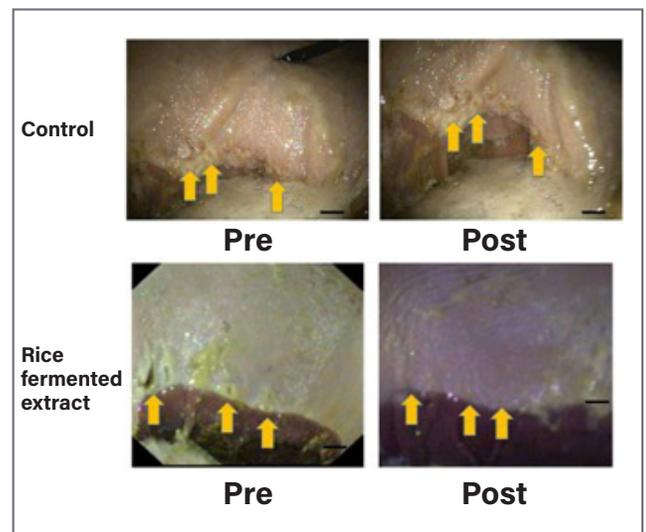
By Summer Burkeen, DVM Class of 2023

EGUS is equine gastric ulcer syndrome and is very common in adult horses with 60-90% prevalence and racehorses above 90% occurrence. Gastric ulcers are open sores that arise on the lining of the stomach. Gastric ulcers can occur at either the squamous/non-glandular region of the stomach (Equine Squamous Gastric Disease) or the glandular portion of the horse's stomach (Equine Glandular Gastric Disease).

The equine stomach is affected by many factors, but an important protective factor is blood flow, thus anything compromising blood flow increases the risk of ulcers such as the horse being ill having systemic inflammation or another common contributor to EGUS is the use of NSAIDs such as phenylbutazone "Bute". Another prominent cause for ulcer formation is increase of acid production. Fasting increases acid production and feeding decreases acid production due to saliva with sodium bicarbonate acting as a buffer and with high forage diets there is more saliva production versus a high grain diet. Hence, a horse on a high grain diet is more predisposed. Exercise is correlated with slowing motility and decreasing gastric emptying which exposes the stomach to acid for longer which is why high-performance horses, especially racehorses, have a very high prevalence of EGUS. Gastric ulcers have also been linked to horses under stress and is higher with cribbers.

Gastric ulcer symptoms vary from horse to horse, but some common signs are: the horse does not eat its food like normal, decrease in weight and/or in poor condition, if there are any behavioral changes such as not wanting to exercise or work as usual, or if they show signs of decreased performance. In more severe cases of gastric ulcers, the horse can demonstrate bruxism (grinding the teeth), be colicky, or found lying on their back. If the horse shows these signs and is predisposed with the risk factors discussed above, the veterinarian may be inclined to treat the horse and monitor the response to treatment. Sucrose permeability testing and fecal occult blood testing has been shown to be helpful screening tests, but not as sensitive in diagnosing ulcers in adult horses. The only way to definitively diagnose Equine Gastric Ulcer Syndrome is for a veterinarian to perform a gastroscopy with a 3m scope with a camera that looks for ulcers in both the non-glandular and glandular regions of the stomach.

It is important to adjust the diet and management of a horse with gastric ulcers. Some cases will resolve with just a reduction of stress/exercise and adjusting the diet by feeding forages or putting the horse on pasture instead of feeding a high concentrated diet. However, most cases will need medication to go along with management changes. The



first line drug to treat EGUS is Omeprazole. Omeprazole is a proton pump inhibitor that stops the production of acid and increases the gastric pH and a typical course of treatment is typically of 4 week duration. If gastroscopy findings show ulcers in the glandular region of the stomach, omeprazole should be combined with sucralfate treatment as it increases bicarbonate and mucus secretion. Misoprostol can be used instead of omeprazole with sucralfate and is argued to be more effective; however you cannot use Misoprostol in pregnant or nursing mares. Omeprazole (range 0.5-4mg/kg) can be used as a preventative measure for ulcers in horses that are more prone to ulcers or prior to a known stressful event. Though the use of Omeprazole concurrently with NSAIDs may prevent glandular gastric ulcers, the combination may lead to adverse intestinal complications. Other drugs such as ranitidine and cimetidine can be used as they reduce acid secretion because they are histamine antagonists. Non-pharmaceutical interventions

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# Summer Biosecurity

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spread of the disease. The vaccine protects against both EHV-1 and EHV-4. However, it does not protect against the neurologic form of EHV-1 (EHM). Timing/frequency of vaccination depends on your horse's age and other factors, including certain show regulations. Therefore, you should contact your horse's veterinarian to determine if this vaccination is appropriate for your horse.

## Strangles and Biosecurity:

Strangles is an upper respiratory tract disease caused by a bacteria (*Streptococcus equi subsp. equi*). It is transmitted via horse to horse contact and/or via contaminated objects (fomites). Horses may not show clinical signs of a strangles infection, but can still harbor the bacteria and infect other horses. Clinical signs include fever, cough, mucoid nasal discharge, and enlarged lymph nodes. Horses with a strangles infection are also at risk for metastatic infections (spread of the bacteria to other organs/body systemics). Gold standard diagnosis is made via lavage of the guttural pouches (within the upper respiratory tract) and testing of that fluid. While a vaccine is available, only certain horses are good candidates for the vaccine. It is recommended that you work with your horse's veterinarian to determine if your horse is an appropriate candidate for vaccination. Overall, prevention methods involve quarantining new arrivals for a 1-month period, as well as isolating any horses showing clinical signs of a strangles infection. During quarantine or isolation, rectal temperature should be checked once to twice daily and any temperatures over 101F should be considered a fever. At horseshows, stalls should be cleaned with bleach between horses, horses should be fed and watered from their own water buckets, grooming equipment/tack should not be shared between horses, and horses should not be allowed to engage in nose-to-nose contact. Any horses showing clinical signs of a strangles infection at a show should be immediately isolated and a veterinarian should be contacted. The bacteria

causing strangles can also be spread via clothing, which is an important factor to keep in mind when managing an outbreak at a farm.

## Sun protection for horses with white skin

While time in the sun can be enjoyable for both you and your horse, certain horses are at increased risk for developing conditions associated with sun-exposure. For example, grey horses are at an increased risk for developing melanomas, while white/paint horses are at an increased risk for developing squamous cell carcinoma when exposed to the sun. Just like humans, sunscreen can be applied to non-pigmented sections of the coat (e.g. nose, muzzle, and ears). Fly masks, fly boots, and fly sheets can also be used to protect against the UV rays. It is highly recommended that all horses, especially grey horses, white horses, and paint horses, be examined 1-2 times each year, in order to detect early onset cases of melanoma or squamous cell carcinoma. Grey horses, which are predisposed to developing melanoma, typically present with dark colored undulations underneath the tail head and/or overlying the parotid glands on the head. Squamous cell carcinoma is often first found on the third eyelid, sheath, and/or penis of white colored/paint horses. Early diagnosis and prompt treatment of these conditions is lifesaving for many horses.

## HAVE FUN AND STAY SAFE!

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# EGUS (continued from page 4)

may also be used to decrease and/or prevent ulcers in horses for example: Aloe-vera supplement may be considered an adjunct therapy to help improve ulcers, probiotics support gut health and can help prevent gastric ulcers, and rice fermented extracts protect the gastric mucosa to prevent EGUS as well as improves gastric ulcer lesions that are already present after oral administration for a month.

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## News & Notes

### NEW PEOPLE AND NEW POSITIONS



Dr. Camilla Jamieson



**Dr. Jamieson** was born in rural Vermont, but traveled and moved with her family, living in the UK and Portugal and then Oklahoma, Texas, and Qatar to pursue her career in equine medicine.

Dr. Jamieson graduated from the University of Nottingham School of Veterinary Medicine and Science in 2011 as one of the flagship graduating class. She began to specialize in equine practice from her first externships after her first year of vet school, and went on to complete her internship at Lingfield Equine Vets in Surrey, where she had spent much time as a student. She stayed at LEV as an associate before moving back stateside to complete her specialist training.

Dr. Jamieson's passion for medicine, especially high risk and critical care foals, drew her to specialize in internal medicine, completing a fellowship and residency in Large Animal Internal Medicine at Oklahoma State University. She obtained board certification with the American College of Veterinary Internal Medicine (ACVIM) in 2018. During this period, she worked with a number of infectious disease researchers in the region, and developed a passion for research, with a focus on critical care modalities that improve the outcomes of the equine patient.

Dr. Jamieson then spent a year in private practice in Houston Texas, working with various disciplines of horses including top rodeo and ranch horses, elite jumpers, and dressage horses, which increased her skills in sports medicine and lameness, however, her love for foals, and equine research drew her to the opportunities at the EVMC in Doha, where she spent 4 years establishing the internal medicine and anesthesia services. However, 4 years in the Middle East, missing home and missing the world of academia, as well as her growing passion for emergency medicine, brought Dr. Jamieson back to the states where she did a 4-month locum as an emergency clinician at Hagyard Equine Medical Institute before joining the faculty at Purdue as an Assistant Professor of Large Animal Emergency and Critical Care.

In her spare time, Dr. Jamieson enjoys training her KWPN gelding Architect and is looking forward to exploring the Indiana dressage circuit this summer. She also enjoys yoga, rock climbing, and she has recently discovered a love for SUP and SUP yoga. If she's not at the clinic, the barn, or the gym, you can find Dr. Jamieson out to dinner with friends!



Eleanor Nichols



**Hello!** I am Eleanor Nichols and I am a medicine technician. I just graduated from International Business College in April and will be sitting for my VTNE in July. For the last year I have worked in small animal emergency, so being in a hospital with large animals is a change of pace for me. I came to Purdue for my two-month externship to work in large animals because I knew it was something I was interested in and ended up loving it here so much that I wanted to stay. While I have grown up around horses, I am definitely very green to working on them in hospital and definitely new to farm animal work, but I am looking forward to getting to do more work with farm animals. I have a passion for learning and want to constantly learn the newest things and the newest ways of doing things. I know this is a field that is constantly changing and that excites me because I know there will always be more to learn and more things that I could get better at. Purdue was a great choice for me, and the people here are amazing. They are so willing to teach anyone who wants to learn and have always been receptive to all my questions. This is an amazing hospital full of amazing people and I am so happy that I made the choice to work in large animal and the Large Animal Medicine Service specifically.

### Large Animal Emergency and Critical Care — A New Service at Purdue!

Dr. Jamieson is a new faculty member and face in the Equine and Farm Animal Hospitals, and she is working with all of the other large animal clinicians to develop an emergency and critical care service to work alongside all of the internal medicine doctors and surgeons you know and love.

While no one wants to have an animal admitted to the emergency and critical care service, we have always felt that having doctors whose passion, specialization, and focus in the area that your horse needs at that moment, brings our clients the best possible treatment for each horse. To further this, we are developing a dedicated team to take in, triage, stabilize, and provide critical care to horses and foals when they are most urgently in need of care. This service helps to minimize disruption to scheduled appointments when emergencies do occur, while giving your urgent cases the dedicated team that they require!

We are hoping to build this service in the coming years into a full-time, third large animal service with dedicated critical care technicians and doctors, so look for new faces in our emergency and critical care service when you come in!

# Equine Strangles—The 5 W's

By Lindsey Takacs, DVM Class of 2023

## Who is the culprit and who does this affect?

The causative agent of strangles infecting equids worldwide is a **highly contagious bacteria** known as *Streptococcus equi* subspecies *equi* (*S. equi*). All ages of horses, donkeys, and ponies are susceptible, but mostly yearlings and weaned foals. Equids less than 4 months old are protected by maternal antibodies.

## What should I look for to identify an outbreak?

When *S. equi* enters the mouth or airway, it attaches to the tonsils and eventually reaches the lymph nodes. Clinical signs can include any combination of the following: fever (>100.5°F), lethargy, lack of appetite, upper respiratory tract infection, **profuse nasal discharge, and swollen or abscessed lymph nodes** in the head and neck region (submandibular and retropharyngeal). Abscessation in the lymph nodes can lead to fistulas in guttural pouches followed by empyema (collection of pus) and later on chondroids (hardened pus). The name strangles comes from the eventual airway obstruction that causes coughing, trouble breathing, and possible death if left untreated. The infection can spread elsewhere in the body through the blood stream or lymphatic system causing metastatic or “bastard” strangles.



*Draining submandibular lymph node abscess*



*Mucopurulent (mucus + pus) nasal drainage*



*Purpura hemorrhagica of the muzzle*

## Where is this bacteria coming from?

The source of this infection is from **nasal secretions** of a carrier animal that is shedding bacteria, but may or may not appear clinically ill (healthy or ill). This includes **direct or indirect contact** with any purulent discharge (pus) from the upper respiratory tract or ruptured lymph node abscess. Bacteria may be spread through nose to nose contact, snorting, coughing, contaminated objects such as clothing, hands, equipment, feed/water buckets. Biosecurity measures such as disinfection and appropriate stocking density is important to minimize the risk of a strangles outbreak when not all horses are showing obvious clinical signs.

## When should I isolate and release my horse(s)?

Any newly acquired horses or in-contact horses after an outbreak need to be quarantined for at least 30 days. Monitoring body temperature, providing soft, palatable feed, and keeping the horse dry and protected from extreme temperatures during this time is important. **3 negative cultures** at weekly intervals, 3 weeks after resolution of clinical signs are needed before release from isolation. Quantitative Polymerase Chain Reaction (qPCR) is more sensitive than culture, only 1 negative test is required for an animal to be cleared if there are no remaining clinical signs indicating an ongoing infection. Samples can be collected from the following locations: nasopharyngeal wash, guttural pouches, lymph node abscess aspiration. Most animals (>75%) recover spontaneously within 2-4 weeks and develop a strong immunity.

## Why should I be concerned about this disease?

Strangles is a **notifiable disease** in many states. Contact your veterinarian and halt all horse movement if an outbreak is suspected. Morbidity can be up to 100% (All or most animals get infected) although, mortality is less than 5% (few animals die if infected). **Guttural Pouch Empyema** is painful and causes difficulty breathing from accumulation of purulent exudate in guttural pouch secondary to upper respiratory infection. Treatment includes providing pain relief, applying a hot compress, draining mature abscesses, rinsing the guttural pouches with saline, and administering antibiotics. **Bastard strangles** is rare, but can consist of a disseminated infection causing abscessation in many organs, needing treatment with antibiotics. **Purpura hemorrhagica** is an immune-complex mediated vasculitis that may be triggered by a strangles infection or vaccination of a previously infected horse. **Asymptomatic carriers** must be identified and treated to significantly reduce chance of outbreaks or they will continue to serve as a sneaky source of infection to their equine neighbors.

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## Tying Up *(continued from page 3)*

after exercise, excessive sweating, and reluctance to move. The muscles may be trembling, and the horse may have tachycardia, rapid heart rate, and shallow breathing. The topline muscles are most effected, including the lumbar, or the midback region, sacral, or the hip region, and the gluteal muscles. These regions may be firm and painful. The horse may have hemoglobinuria, where the urine will be dark red color due to the breakdown of muscle hemoglobin.

If you are suspicious if your horse is suffering from tying up, a veterinarian should be called immediately because this is a true emergency to prevent acute kidney damage (Tinkler, 2021). The breakdown of myoglobin from the muscle overwhelms the kidneys and can damage them. Intravenous fluids will be given to rehydrate the horse, especially in situations to prevent acute kidney injury. The veterinarian will also perform diagnostics. A genetic test for chronic exertional rhabdomyolysis of PSSM Type 1 includes whole blood or mane and tail hair. PSSM Type 2 requires a muscle biopsy due to unknown specific causes (Valberg 2022). Additionally, blood samples would be taken to measure creatinine kinase, CK, a muscle enzyme, and aspartate transaminase, AST, to measure degenerations of muscles (Aldrich, 2021). These tests are done to evaluate how much damage has been done to the muscle to formulate a proper treatment plan.

The College of Veterinary Medicine at Michigan State University's recommended stall rest or small paddock confinement while the muscles heal. Gradual return to exercise and low starch diets helps prevent reoccurrence. Electrolytes and minerals are important

to prevent another episode so free access to a salt block or loose salt is essential. Vitamin E and selenium are natural antioxidant and help prevent more damage to the muscle. Additionally, pain management is important such as Banamine or phenylbutazone, also known as bute, to make the horse more comfortable during its recovery (Tinkler, 2021).

In conclusion, sporadic exertional rhabdomyolysis can be prevented by owners gradually returning to exercise and do not overwork the horse. Chronic exertional rhabdomyolysis can be prevented by genetic testing and preventing a positive horse producing off-spring. Finally, being a proactive owner and observing for signs of exertional rhabdomyolysis in your horse can allow quicker veterinary care to maintain the health and well-being of your horse.

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Published by the Donald J. McCrosky Equine Sports Medicine Center with generous support from the Purdue University Veterinary Hospital and the College of Veterinary Medicine Office of the Dean.

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