A SUPPLEMENT TO
the HORSE
MARCH 2013
YOUR GUIDE TO EQUINE HEALTH CARE

YOUR GUIDE TO THE

2012 AAEP CONVENTION

TheHorse.com/AAEP2012

INSIDE:
Joint Injections, Managing Emergencies, and Much More

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Learning Opportunities in the Pages Ahead

STEPHANIE L. CHURCH, *Editor-in-Chief*

One thing our readers tell us on a regular basis is that they enjoy being on the cutting edge, always learning new tidbits that will help them care for their horses better. So, The Horse team makes it a priority to sift through the veterinary journals and keep our fingers on the proverbial pulse of what's happening in order to bring important take-home messages to you. We also attend several veterinary meetings a year to do more of the same.

By far, our biggest coverage event each year is the mother of all equine veterinary meetings: the annual convention of the American Association of Equine Practitioners (AAEP). Imagine more than 5,000 vets and industry members gathering and sharing state-of-the-art information in giant rooms with mammoth screens and fascinating Power Point imagery. (Yes, it's pretty intense.)

Before we guide you through the convention itself, here's a little about the organization behind it. This nonprofit is "dedicated to the health and welfare of the horse" and reaches more than 5 million horse owners through its nearly 10,000 members. It "is actively involved in ethics issues, practice management, research and continuing education in the equine veterinary profession and horse industry."

The Horse's mission is quite similar to the AAEP's, so it makes sense that we work closely with this organization and its members; we're a long-time media partner. We have an advisory board of AAEP veterinarians who read our content monthly (see their names at right) for relevance, timeliness, and accuracy. One of the reasons we love the convention is it gives us a chance to meet with our board in person. They are always very eager to suggest ideas that will keep our stories current and intriguing, and they speak from years of experience, both in clinical and research practice. (Watch a video interview with one of our board members, Dr. Debra Sellon, at TheHorse.com/31016, about this group's role.)

Our team of writers and editors have summed up and edited more than 100 presentations, breaking them down into take-home messages both for you and your veterinarian. This "Wrap-Up" that you're holding contains the latest messages pertaining to horse health. And there's more online. We thank Merck Animal Health for sponsoring our AAEP coverage and videos.

Yes, there's a lot of information here! Take in a little bit at a time, and be sure to save it for future reference. It's amazing how many of these topics might have application to your horse or a friend's horse over the coming months. Welcome to the AAEP Convention Wrap-Up. We hope you enjoy it!

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the HORSE

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STEPHANIE L. CHURCH

MORE FROM THE CONVENTION

COMPLETE COVERAGE AT THEHORSE.COM/AAEP2012

- Many more articles and blog posts on the latest news in equine veterinary medicine.
- Take-home messages from presentations described in video interviews with session moderators.
- Downloadable convention coverage reports.

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Find these videos and more at TheHorse.com/videos.aspx

VIDEOS

PREPURCHASE EXAMS

Dr. Sue Emerson shares what veterinarians learned about during the prepurchase exam table topic, including communicating with the buyer and components of the normal exam. TheHorse.com/31034. ***Videos sponsored by Merck Animal Health***

MORE VIDEOS:

The International Veterinarian ■ Feeding the Orphan Foal ■ Sarcoids and Tumors Advanced Integrative Therapies ■ BLM Wild Horse and Burro Program ■ Endocrine Disease ■ Lameness and the Western Horse ■ Medical Pain Management ■ Good Works Care of Therapeutic Horses ■ Dressage Horse Health ■ And many more...

By the Numbers

5,730

veterinary professionals, students, guests, and exhibitors attended the convention from Dec. 1-5.

Dr. Stephanie Valberg became the **First Woman** to deliver the Milne lecture

COURTESY AAEP

Planning for each convention begins **18 months** in advance.

STAFF

The Trade Show featured **571 booths**

More than 100

in-depth, how-to, table topic, dry lab, and subject-specific sessions were presented during the four-day Convention.

5 of the awards presented at the **President's Luncheon:**

Distinguished Life Member: Dr. Nat T. Messer IV
Distinguished Service Award: Dr. Midge Leitch
Distinguished Educator Award: Dr. Jill Johnson
Equine Welfare Award, The Lavin Cup: Christian Veterinary Mission
President's Award: Dr. Jay Merriam

$100,000

The annual silent auction held during the Foundation Celebration, along with a golf tournament, sporting clay tournament, and individual donations, raised more than $100,000 to benefit the Foundation's outreach programs.

The 59th Annual Convention will take place in **NASHVILLE, TENNESSEE**
DECEMBER 7-11, 2013

MILNE Lecture

Exertional Rhabdomyolysis

Not Just Tying-Up Anymore

COURTESY AAEP

ERICA LARSON

Few things are scarier than watching a horse sweating, trembling, and twisting in pain during a tying-up episode. Stephanie Valberg, DVM, PhD, Dipl. ACVIM, ACVSMR, professor at and director of the University of Minnesota (UM) Equine Center, in St. Paul, and other scientists have worked tirelessly to understand the disorder and its cause, and they continue to uncover ways to manage it. She chronicled her work in unraveling the causes of tying-up, or exertional rhabdomyolysis (ER), during the Frank J. Milne State-of-the-Art Lecture.

To help the audience understand the various manifestations of ER, Valberg gave an in-depth review on muscle function. Then she described research (Read more at TheHorse.com/31322) and reviewed the latest on assessing and treating ER types.

Evaluating ER Horses

Different ER types require distinct treatment approaches, so it's important to seek a clear diagnosis. To evaluate horses veterinarians should:

- Obtain a detailed history;
- Perform a full physical exam;
- Take blood samples for laboratory tests;
- Perform an exercise response test; and
- Collect and evaluate a muscle biopsy.

After determining specific diagnoses, they can make treatment recommendations. Here we'll focus on Valberg's suggestions for managing specific types of ER.

> "A detailed history is the foundation for evaluating ER because the disorder can be intermittent in nature and not evident on physical examination."
>
> DR. STEPHANIE VALBERG

Sporadic ER

Veterinarians typically see sporadic ER in horses with "adequate" performance histories. Causes include muscle trauma, overexertion, exhaustion, and dietary and electrolyte imbalances.

Practitioners should manage cases similar to how they would initially manage acute ER: rest, paddock access, and weekly serum creatine kinase (CK, an enzyme that indicates muscle damage) checks. If horses can't be turned out, hand walk them a few minutes at a time, gradually increasing to longer spans.

She also recommended balancing vitamins and minerals in the diet and providing a salt block or supplementing feed rations with salt to ensure the horse maintains proper sodium levels. And although it hasn't been proven scientifically, anecdotal reports indicate selenium and vitamin E supplementation can help prevent ER episodes.

Chronic ER

Several chronic ER types impact horses:

Recurrent exertional rhabdomyolysis (RER) is caused by an abnormality in muscle contraction and relaxation regulation, and excitement can trigger it. It shows up most commonly after low-intensity work. There is no genetic test for RER, so veterinarians diagnose it based on clinical signs and presence of risk factors, and they often look at serum CK and aspartate aminotransferase (AST, another enzyme indicator of muscle damage) levels to confirm muscle degeneration. To manage RER:

- Keep at-risk horses in a quiet environment and in a routine to reduce stress;
- Exercise affected or at-risk horses daily, and choose relaxing/quiet workouts;
- Consider placing affected horses on a high-fat, low-starch diet, which provides them with adequate calories for their work but reduces the amount of muscle damage sustained during exercise; and
- Ensure horses consume 30 to 50 grams of salt daily and consider electrolyte supplementation when it's hot/humid.
- Practitioners can consider administering dantrolene, a drug that slows calcium release from muscle storage sites, 60-90 minutes before exercise.

Suppressing estrus could help mares prone to RER during heat cycles, and some complementary therapies, such as massage, done by experienced professionals could help promote muscle relaxation.

Malignant Hyperthermia (MH) Anesthesia drugs can trigger MH-associated rhabdomyolysis (characterized by a high fever, metabolic failure, and death under general anesthesia), she said, and MH is difficult to control via diet/exercise. Consider genetic testing if horses' family members have/are suspected of having the disease.

She recommended treating affected horses with dantrolene 30-60 minutes prior to inducing anesthesia, but remember that cardiac arrest is difficult to prevent once rhabdomyolysis begins.

Convention Tweet

Christy Corp-Minamiji, DVM
@cminamiji

Fascinating! PSSM mutation may have been selected for in Middle Ages w/development of the great horse.

PSSM Types 1 and 2 Since PSSM1 involves a genetic mutation, the gold standard diagnostic test is a genetic test, Valberg said. Veterinarians can also use clinical signs, consistently elevated serum CK and AST levels, and muscle biopsies as adjunct diagnostics. They must diagnose PSSM2 with a biopsy because researchers haven't yet identified a genetic mutation in affected horses.

Management recommendations for PSSM are based on strict diet and exercise. When planning a diet for a PSSM horse:

- Select hay comprised of 12% nonstructural carbohydrates (NSC) or less to help keep plasma insulin concentrations stable; insulin encourages additional glycogen production, which leads to problems;
- Ensure PSSM horses consume additional fat to aid oxidation in skeletal muscles. Common fat sources include vegetable oils, rice bran, and animal-based fat (such as lard and fish oil); and
- Consider feeding a commercially available low-starch, high-fat concentrate feed if you find managing fat supplements cumbersome.

Dealing with overweight PSSM horses can be particularly challenging, so:

- Rather than supply additional fat to the diet, fast overweight horses for six hours pre-exercise. This elevates free fatty acid levels in the blood plasma, which has a similar effect to feeding extra fat; or
- Find forage with a very low (around 4%) NSC concentration and provide additional calories via fat and concentrates.

Valberg recommended working with your veterinarian on choosing feed for an overweight PSSM horse.

The other key aspect of managing PSSM is providing exercise, Valberg said, noting that neither management approach alone will effectively control the disorder. After a horse suffers an ER episode, limit total stall rest time to 48 hours or less, then turn the horse out. Excitable horses might need mild sedation before turnout to prevent excessive galloping. Limit hand walking to five to 10 minutes immediately after an ER episode, as even this amount of exercise could trigger another episode.

Prior to beginning an exercise regimen, give the horse two weeks to adjust to turnout and diet changes. Then begin quiet, relaxed ground work that includes lots of stretching in a long and low frame. Begin with about four minutes of walking and trotting and add two minutes daily.

Valberg said it usually takes about three weeks to build up to under saddle work, and she encouraged adding two minutes of collection or canter after the relaxed warm-up period. Build the horse back up slowly if no additional ER episodes occur.

Learn more about acute and chronic signs of PSSM1 and PSSM2 by visiting TheHorse.com/31322.

Seasonal Pasture Myopathy

This fatal rhabdomyolysis type is most common in pasture-kept horses in the fall. Until recently veterinarians did not know the cause. But Valberg identified the box elder tree as a common denominator in pastures affected horses inhabited. Box elder seeds contain the amino acid hypoglycin A, which is also found in a related fruit known to cause severe illness in humans.

Scientists found conjugated hypoglycin A metabolite methylenecyclopropylacetic acid, known to be toxic in other species, in affected horses' serum and urine.

A similar disease in Europe—equine atypical myopathy—is likely caused by the compound found in the European sycamore tree seed. Valberg and Swiss and Belgian researchers identified these in pastures housing affected horses.

This disease is preventable by removing horses from pastures containing box elder or European sycamore trees.

Take-Home Message

"It's not just tying-up anymore," Valberg said. ER now encompasses myopathies including metabolic disorders, calcium regulation deficits, and more.

"It's been a remarkable and wonderful journey being able to piece these things together," she concluded.

COURTESY AAEP

Top Equine Studies of 2012

ERICA LARSON AND NANCY S. LOVING, DVM

Equine practitioners are undeniably busy individuals, making farm calls, caring for patients, and evaluating test results on a daily basis. To help veterinarians keep up-to-date on the most recent and relevant research, three veterinarians reviewed the top studies in the fields of surgery, medicine, and reproduction at the ever-popular Kester News Hour, which kicked off the 2012 convention.

Lisa A. Fortier, DVM, PhD, Dipl. ACVS, associate professor of Large Animal Surgery at Cornell University's College of Veterinary Medicine, in Ithaca, N.Y., highlighted the year's top equine surgery-related studies; Pat McCue, DVM, PhD, Dipl. ACT, associate professor of equine science at Colorado State University, described important reproduction studies; and Stephen Reed, DVM, Dipl. ACVIM, of Rood & Riddle Equine Hospital, in Lexington, Ky., presented a summary of many recent practical and applicable equine medicine studies. Here we will talk surgery and medicine. Be sure to read the reproduction study write-ups at TheHorse.com/31328.

Colic

Fortier described several studies on colic. In the first, researchers evaluated how visualizing colonic mesenteric vasculature (the ability to see blood vessels supplying the large colon) on ***abdominal ultrasound*** might indicate right dorsal colon displacement, a 180° volvulus (twist), or both. The team performed abdominal ultrasound on 82 horses before confirming their diagnoses via surgery. Researchers concluded the test has a 68% sensitivity (these are true positives, meaning that when clinicians see vessels on ultrasound there is a 68% chance that horse will have a displacement or volvulus) and 98% specificity (true negatives, meaning that 98% of horses whose vessels are not apparent on ultrasound do not have a displacement). On that basis, she recommended practitioners implement abdominal ultrasound in their colic examinations.

Next, Fortier described a study in which scientists evaluated the success rates of treating horses medically for suspected right or left ***dorsal colon displacement***. The retrospective study included 116 cases of suspected large colon volvulus and showed that clinicians were 64% successful in managing presumed right colon displacement medically and 76% successful in treating suspected left colon displacement with medical approaches. If surgery was needed, Fortier said, roughly 94% survived to discharge. The researchers showed that most affected horses respond favorably to medical therapy.

Fortier also touched on a study in which researchers assessed the long-term survival rates of horses with ***large colon volvulus***. The team evaluated the two-year survival rates of 116 horses, and they found that 20% did not recover from surgical anesthesia and 71% survived to discharge. Of the latter, 48% survived one year past discharge and only 34% survived two years past discharge. Fortier stressed that veterinarians should refer such cases early to expedite treatment and/or surgery because

View "Day 2 Recap" at TheHorse.com/30990

increased preoperative packed cell volume was strongly associated with decreased survival.

Endocrinology, Metabolic Syndrome, and Laminitis

Reed reported on a retrospective study in which researchers examined the medical records of 217 horses diagnosed with ***pituitary pars intermedia dysfunction*** (PPID, or Cushing's disease) from three veterinary teaching hospitals from 1993 to 2004. Notably, there was an increase in PPID diagnoses from 2.5 per 1,000 horses in 1993 to 3.72 horses per 1,000 in 2002.

The most common findings veterinarians noted in these horses were hirsutism (excessive hairiness, 84%) and laminitis (50%). The time from onset of clinical signs to diagnosis was on average 180 days. Reed noted that about half of the horses diagnosed with PPID survived 4 ½ years following diagnosis. Treatment success varied with medication: a combination of cyproheptadine and compounded pergolide yielded 60% success; pergolide alone resulted in 40% success; and cyproheptadine alone in 29% success. These medications were all that were available prior to the FDA approval of pergolide.

Veterinarians can use a variety of ***diagnostic tests for PPID***, each of which poses a unique challenge. Historically, veterinarians considered the overnight dexamethasone suppression test the gold standard, but currently, more veterinarians are sampling for plasma ACTH (adrenocorticotrophic hormone). Reed mentioned another evaluation test for PPID: α-MSH (α-melanocyte-stimulating hormone). Of 126 horses with a mean age of 21.5 years slated for euthanasia, researchers identified 109 as normal, based on testing for ACTH, α-MSH, and cortisol; 17 had clinical hirsutism. Following euthanasia, researchers measured each horse's pituitary gland and evaluated it for pathology.

In summary, Reed noted, "All the currently available tests were good at correctly identifying the problem in end-stage cases of PPID." He advised of another test that might prove useful in future: the TRH (thyroid-releasing hormone) stimulation test that allows blood sampling at five and 20 minutes following administration.

Reed then addressed the use of ***digital cryotherapy (ice therapy) for laminitis*** treatment in nine horses with induced laminitis. At the first sign of lameness at a walk, investigators placed one forelimb in ice and kept the other at ambient temperature. Then researchers scored the severity of laminitis based on pathology following euthanasia. The iced legs showed much less evidence of pathologic injury. Reed was excited about the researchers' findings that demonstrated support for limb icing following the onset of clinical signs of acute laminitis.

COURTESY DR. STEPHANIE VALBERG

Researchers have discovered that horses consuming a toxin found in box elder tree seeds develop seasonal pasture myopathy.

Foals

Reed described a study in which researchers examined the use of histamine-type 2 receptor antagonists (such as the anti-ulcer drug omeprazole) and ***neonatal foals' risk of developing diarrhea***.

> **"All the currently available tests were good at correctly identifying the problem in end-stage cases of PPID."**
>
> DR. STEPHEN REED

Reed stressed, "In foals treated with anti-gastric ulcer medications, the study showed that hospital-associated diarrhea increased twofold while at the same time there was no reduction in foal ulcers." Clinicians should evaluate each neonate case very carefully to confirm ulcers before initiating anti-ulcer medication treatment.

Reed then described the **Lawsonia *organism's effects in weanlings***. The proliferative inflammation of the small intestine and colon leads to classic signs of increased thickening of the small intestinal mucosa and subsequent poor body condition. In addition, practitioners should be aware of the potential for necrotizing enteritis associated with *Lawsonia*; this can cause acute, severe gastrointestinal signs such as endotoxemia and death.

Moving on, Reed described a study in which scientists reviewed records of 5,251 weanling horses from three referral practices—all were treated with antibiotics for non-gastrointestinal-related problems. Although the incidence of ***antimicrobial-associated diarrhea*** (AAD) was very low (0.6%) among these horses, nearly 19% of the diarrhea cases had a fatal outcome. Reed stressed that drugs from any antimicrobial class can cause AAD due to the tendency for usual intestinal organisms to become opportunistic intestinal pathogens.

Neurologic and Muscle Diseases

Reed next described MADD (multiple acycl-CoA dehydrogenase deficiency), which veterinarians also refer to as ***seasonal pasture myopathy***. This is a highly fatal form of nonexertional rhabdomyolysis seen in autumn and spring, and it resembles an atypical myopathy veterinarians have observed in Europe.

Based on case histories, veterinarians diagnosed six North American horses with seasonal pasture myopathy. They tested urine and muscle samples, looking for organic acids that might suggest abnormal lipid metabolism. In affected muscles they noted degeneration as well as lipid accumulation in the myofibrils. In atypical myopathy cases in Europe, researchers believe an enzyme deficiency causes the biochemical deficit; in a similar disease that affects humans, there appears to be a genetic predisposition. But, with the variety of horse breeds affected, Reed suggested that MADD is less likely to have a genetic basis. Instead, researchers have identified that horses consuming a particular toxin, hypoglycin A—present in box elder tree seeds—develop the myopathy. (See page 9 for more information.)

Reed discussed a study in which the researchers sought to determine the period of time that horses infected with

equine herpesvirus shed the virus. Of 104 horses in an outbreak, 20 exhibited neurologic signs, and veterinarians took daily nasal swab samples from these cases. Two-thirds of the horses tested positive for virus on swabs from Day 0 to 3. Most importantly, Reed said, "The last day of detected shedding for all horses was disease Day 9." Whether a horse developed signs of herpesvirus depended on if he had a fever and/or was introduced to susceptible horses. "The take-home message is that biosecurity measures should be observed for 14 days beyond the last onset of clinical signs of the last horse in the outbreak," Reed said.

Orthopedic Therapies

Fortier discussed several orthopedic studies, the first of which involved distal (lower) hock arthritis. She said this was the first prospective study in which researchers evaluated the safety and efficacy of ***alcohol-facilitated ankylosis (joint fusion) in arthritic lower hock joints***. The team performed ankylosis (with 70% alcohol) on 21 horses with confirmed hock arthritis. The study revealed that 85% of the horses were not lame after three months, and 90% were sound one year post-procedure. Fortier cautioned that about 30% of the time, researchers could not enter the distal intertarsal joint (DIT, one of the four joints in the hock) to perform the injection, and that 45% of injected DIT joints "communicated" with the proximal intertarsal joint (another joint in the hock) and tibiotarsal joint (the major motion joint of the hock). Thus, veterinarians should use caution when considering alcohol injections because leakage into the tibiotarsal joint could cause ankylosis there, as well, which would be detrimental to the horse.

Fortier discussed another study in which researchers investigated alcohol for fusion of the lower hock joints, showing that 52% of osteoarthritic horses that had not responded to corticosteroid treatment improved in the short term after injection. However, the condition of 19% of those animals deteriorated significantly six to nine months post-ankylosis. The researchers believe this occurred because the horses were more clinically challenged (i.e., bilateral cases of arthritis or cases of more advanced disease) than in other studies.

Fortier cautioned that while alcohol-facilitated ankylosis is effective in fusing joints, it also poses drawbacks and should not be used as a first-line treatment option. In addition, veterinarians should perform contrast arthrography (joint evaluation) before each injection and, perhaps, they should only inject the tarsometatarsal joint to minimize alcohol leaking into the main hock joint.

Fortier then discussed a study in which practitioners evaluated ***alternative routes for administering mesenchymal stem cells (MSCs)***. When clinicians desire greater stem cell distribution—for example, where there isn't a core lesion (single obvious injury) or where there is a diffuse lesion (injury that is spread out over an area)—they need to establish a regional delivery route of MSCs. The researchers administered stem cells labeled for tracking purposes via intravenous (IV) and intra-arterial injection in six horses, using regional limb perfusion. They found that both IV and intra-arterial injections had good distribution in the carpus (knee) and metacarpus (cannon bone), and that the intra-arterial approach was more effective for distributing MSCs to the pastern and hoof than the IV. She cautioned that intra-arterial injections resulted in "severe thrombosis" (blood clotting in the veins) in one horse.

"This suggests that IV delivery of stem cells is the safer route of administration and that, perhaps, if delivery of stem cells to the pastern or foot is desired, then the cells should be delivered more closely to the target via IV injection below the carpus," she concluded.

COURTESY DR. MATHIEU SPRIET

Intravenous delivery of stem cells proved safer than intra-arterial.

Convention Tweet

Twin Pines Equine
@twinpinesequine

Do not use enrofloxacin for uterine infusion. Bad things happen. Got it.

Christy Corp-Minamiji, DVM
@cminamiji

Australian study looking at effect of age of race start on risk of retirement. Surprising results.

Racehorse Health

Fortier discussed several studies surrounding racehorse health. Researchers on the first paper evaluated the ***incidence of racehorse injury among different trainers***. They found that 25% of the 647 horses under the care of 13 trainers at six different racetracks sustained a carpal, metacarpophalangeal, and/or metatarsophalangeal (knee and/or fetlock) injury during training; further, there were significant differences in injury rates, location, and severity among trainers.

"Understanding the differences in training protocols between trainers might lead to methods to decrease injury," she said. "This might include not only exercise, but training surface, shoeing, medication, and rider."

In the next study Fortier discussed, scientists had evaluated if there was an association between ***career length and age of first start*** among a population of racehorses. A research team evaluated the race records of more than 117,000 Australian Thoroughbreds and found that horses' risk of retirement was actually lower if horses began racing at 2, had more starts at 2, and ran at longer distances. This suggests that there are no apparent detrimental effects of racing as a 2-year old, she said.

The final study Fortier presented involved ***subclinical (nonapparent) defects in non-lame Thoroughbred racehorses' suspensory ligaments*** seen with ultrasonography. Two reviewers evaluated ultrasound images from 60 racehorses at the end of a full race season, and they found

mild defects (Grade 1) in 26% of horses and moderate defects (Grade 2) in 7% of horses. The reviewers did not find any defects classified as severe (Grade 3), she said. On follow-up exam, Fortier noted that only one Grade 2 horse's defects had progressed to a clinical problem.

"This suggests that ultrasound findings are not always correlated with disease and a false diagnosis of suspensory ligament desmitis could negatively affect sales," she concluded. "If suspensory branch lesions are identified on ultrasound examination, further methods of evaluation such as a full lameness examination should be performed to understand the clinical significance of the ultrasound findings."

Respiratory Disease

In one study Reed described, researchers reported that **Streptococcus equi-*related guttural pouch empyema*** (a collection of pus within the guttural pouch) is most likely caused by failure to clear the organism from the pouch rather than a retropharyngeal (behind the pharynx) abscess breaking into the guttural pouch. Also, several clones of the organism might reside in the guttural pouches of horses that are strangles carriers.

Another paper Reed relayed centered on ***purpura hemorraghica*** (a condition of hemorrhage and edema that is triggered by an allergic immune reaction to the M protein from *S. equi* bacteria) following vaccination for strangles. He noted that SeM protein blood titers are very high following natural exposure and that antibodies might be detectable in the blood for more than a year. The take-home message is that veterinarians should consider vaccinating for strangles only if the horse's titer has been checked; in fact, it might be necessary to wait two years following infection to avoid vaccine-related complications such as purpura.

A third report Reed presented dealt with the association of clinical signs seen with ***nasopharyngeal cicatrix*** (scar formation) using endoscopic exam. From 2003 to 2008, researchers compared 118 cases to 121 controls. Clinical signs were fairly benign; horses exhibited clear nasal discharge, respiratory noise, or exercise intolerance if a circumferential lesion (one that is fully encircling) was present. The horse might experience respiratory distress if he had greater than 50% obstruction. Reed emphasized that veterinarians should include nasopharyngeal cicatrix in a differential diagnosis if a horse demonstrates any or several of these signs. The underlying cause is unknown but might be associated with an irritant, infection, or allergen.

ANNE M. EBERHARDT

Dynamic videoendoscopy can detect upper airway disorders without disrupting performance.

> **"Understanding the differences in training protocols between trainers might lead to methods to decrease injury."**
>
> DR. LISA FORTIER

Upper Airway Issues

Fortier discussed some of the first published studies in which researchers examined the use of ***dynamic videoendoscopy*** (in which the horse undergoes the exam while exercising on a high-speed treadmill or under saddle) to evaluate equine upper respiratory issues. In one study researchers used the relatively new technology to evaluate 129 performance horses presented for evaluation of exercise noise or decreased performance; researchers fitted the horses with a videoendscope before exercise riders put the animals' through their normal routines. Study results showed that 91% of horses presenting with exercise noise and 71% of those presenting with poor performance had some type of dynamic airway obstruction. Fortier said the obstructions—with the exception of dorsal displacement of the soft palate—worsened during times of "increased rider intervention," such as head flexion, spurring, circling, or jumping. Additionally, Fortier said, all of the dynamic airway obstructions identified via videoendoscopy were associated with both upper and lower airway inflammation. Fortier stressed that veterinarians should treat underlying airway inflammation in these cases.

Dynamic videoendoscopy might provide a new way for veterinarians to evaluate the respiratory tract, but does the instrument itself impact horses' performance? One research team examined Standardbred horses in sanctioned harness races using videoendoscopy and confirmed they could detect the presence of upper airway disorders without disrupting performance.

"This study further supports the use of dynamic endoscopy to understand what is happening in the upper respiratory tract during exercise with the horse in its natural environment as opposed to during a treadmill exam," Fortier said.

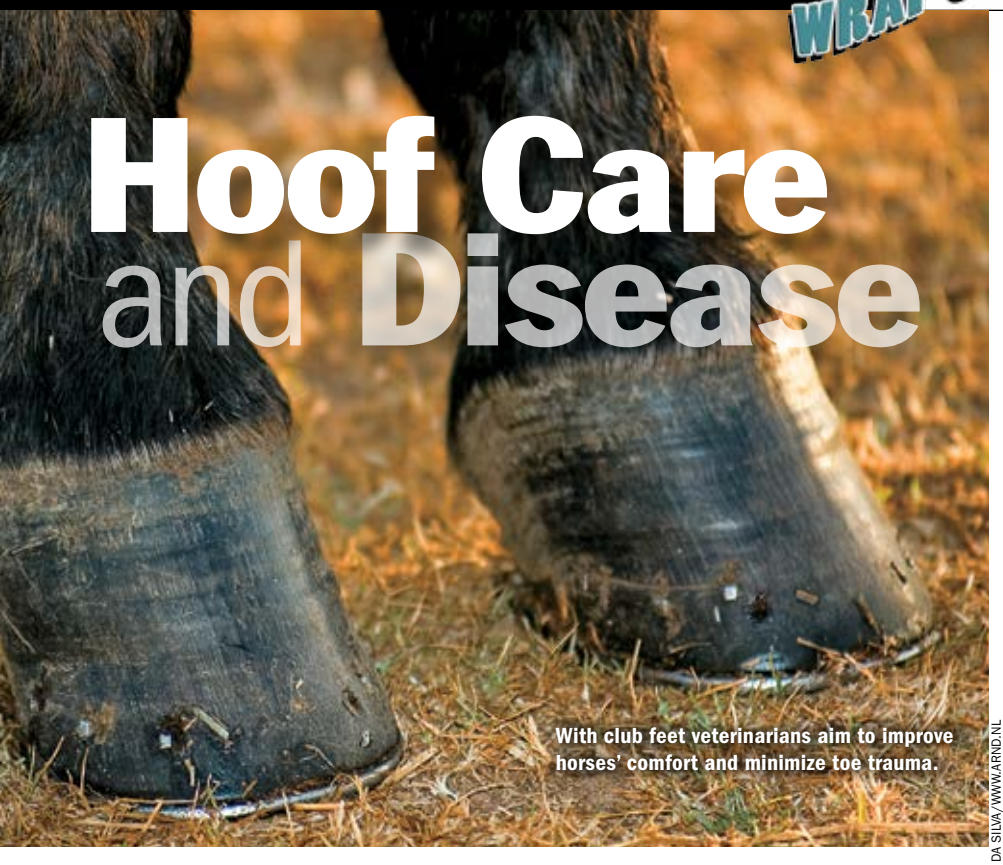
Finally, Fortier discussed a study in which researchers evaluated how mild, moderate, and severe degrees of ***soft palate dysfunction*** affected respiratory parameters. The team evaluated 40 Thoroughbred racehorses in training presented for recurrent palate instability (movement of the soft palate without displacement of its caudal border) and found that even abnormalities considered mild or moderate yielded negative effects on respiratory parameters. Specifically, Fortier said, affected horses had "decreased end tidal carbon dioxide and oxygen levels," indicating these obstructions impeded breathing.

"These results indicate that respiratory parameters should be considered along with subjective endoscopic observations to fully understand the clinical ramifications of observations that are subjectively judged as mild or moderate," she concluded.

MORE ONLINE
See TheHorse.com/AAEP2012

- 2012's Top Equine Reproduction Studies, TheHorse.com/31328

Hoof Care and Disease



With club feet veterinarians aim to improve horses' comfort and minimize toe trauma.

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NANCY LOVING, DVM

Recognizing Club Foot Cases

Not all horses have symmetrical feet, and one of the more common problems they develop is a "club foot" appearance. This problem might appear at birth or develop later in life and can be identified based on classic signs and grades of severity.

Robert Hunt, DVM, MS, Dipl. ACVS, of Hagyard Equine Medical Institute, in Lexington, Ky., defined a club foot as having an angle greater than 60° (the angle the dorsal hoof wall makes with the ground). Usually there is at least a five-degree discrepancy between the affected foot and its opposite.

"Initially, an owner may recognize a space between the heel and the ground that develops slowly over two to three hoof trims," Hunt explained. "The second sign is that the coronary band appears square and full. Then, the foot appears boxy with a dish in the front of the hoof wall. And eventually, the frog becomes quite recessed, the hoof contracts, and the horse appears 'back at the knee.' "

With this change in biomechanics, Hunt said, "The foot is prone to injury since loading on the foot moves forward, altered from its normal, heel-first landing."

A more accurate description of a club foot is a flexural limb deformity of the coffin joint. In most cases, shortening of the musculotendinous unit (which runs down the back of the leg) that shifts the load dorsally (forward) in the foot causes it.

Veterinarians have used multiple club foot classification systems: Type 1 refers to a club foot with a hoof axis less than 90°; Type 2 is greater than 90°. Or, they can use a grading system of the hoof axis relative to the opposite limb to define severity: Grade 1 is 3-5°; Grade 2 is 5-8°; Grade 3 has a broken-forward hoof-pastern axis (HPA)—in which the hoof wall angle is steeper than that of the pastern, hoof wall dishing, and irregular growth rings; Grade 4 has a hoof angle greater than 80°, a severely broken-forward HPA, marked concavity to the dorsal hoof wall, and the coronary band height at the heel is the same as at the toe.

> **"(Congenital cases) are self-correcting with minimal treatment other than toe protection."**
>
> DR. ROBERT HUNT

Usually, congenital cases (present at birth) "are self-correcting with minimal treatment other than toe protection," Hunt said. Veterinarians can also administer systemic oxytetracycline, but he says too much oxytetracycline treatment can cause excessive joint laxity.

An acquired flexural deformity usually appears when a foal is 4-6 months old. "It may result as a primary problem possibly due to a genetic predisposition," he said. But "it is often secondary to other lameness … such as pain elsewhere in the limb that alters weight-bearing on that leg.

"Treatment varies depending on age of horse, severity, and client expectations," he stressed. "The guiding principle is to improve comfort and minimize toe trauma while trying to reestablish load bearing on the heels."

He cautioned against using external shoe devices that improve the 'look' but don't achieve a long-term solution. In assessing an adult horse with a club foot, Hunt urged veterinarians to carefully consider the horse's intended use and to pay close attention to current management, including farrier care and nutrition.

Localizing Pain in the Feet

Practitioners must hone skills and strategies for pinpointing equine foot pain so they can detect the slightest aberration with sharp eyes and deft hands. Debra Taylor, DVM, MS, Dipl. ACVIM, and John Schumacher, DVM, MS, of Auburn University's College of Veterinary Medicine, described methods for pain localization.

Veterinarians should examine all aspects of a lame foot, noting any abnormal biomechanics that could contribute to pain. Taylor said, "The coronary band normally is straight or slightly arched, running at an angle about 20-25° from the ground plane. Hairs should lie flat against the coronary band, and the coronary band should feel full and spongy without a ledge."

Hoof wall "tubules … should be straight without flares or bends," she added. "The white line should be tight and about ¼ inch wide (not stretched/separated). Normal frog width is 50-60% of its length. Its depth should reach the bearing surface with no relative space under the rear of the foot. The central sulcus should be wide enough to fit an index finger." Contraction indicates possible pain. Collateral grooves at the frog sulci apex should be about 11

mm deep; depth might indicate sole depth and coffin bone orientation.

The heel should feel like a tennis ball on palpation, added Taylor, and there should be at least three- to four-fingers' width between the bulbs. Collateral cartilages should feel flexible with finger pressure, and the digital cushion should fill to the top of the cartilages. Always compare each foot to its opposite, and use hoof testers to assess for specific pain areas.

Changing gears, Schumacher described using digital anesthesia (nerve blocks) to localize lameness, suggesting that mepivacaine is the least irritating drug to use for regional or joint anesthesia. Historically, clinicians thought palmar digital nerve (PDN or heel) blocks numbed the back ⅓ to ½ of the foot. However, researchers have shown this block can also anesthetize the coffin joint, entire foot, and even the pastern joint, potentially interfering with lameness assessment.

"Blocking of the coffin joint is known to also numb the sole and even the heel if sufficient volume is placed into the joint," he reported. "Blocking the coffin joint also blocks the navicular apparatus with incidental anesthesia of the palmar digital nerves (which feed the navicular region). However, anesthesia of the navicular bursa only has an effect on sole pain at the toe but does not desensitize the heel."

In summary, practitioners must conduct a thorough physical exam and use hoof testers and flexion tests to reach an accurate foot pain diagnosis. He or she can use digital anesthesia to rule out problems in higher limb structures, but this method has limited value in localizing an area of distal limb pain. "Consequently," stressed Schumacher, "Results from digital anesthesia must be interpreted with caution."

Biomechanics and Hoof Problems/ Treatment

Lameness caused by foot problems is common in the horse, and it can significantly impact performance. Hoof bruising, heel soreness, and hoof cracks all create discomfort that alters a horse's gait and prevents him from giving his utmost to an athletic task. Nearly all equine foot diseases have their root in biomechanics, noted Andrew Parks, MA, VetMB, MRCVS, Dipl. ACVS, professor of Large Animal Medicine at the University of Georgia School of Veterinary Medicine, and veterinarians and farriers must take a biomechanical approach to treating these problems.

Parks reviewed important elements of equine foot anatomy during his session.

He started with a bit of biomechanical anatomy review: While the long bones of the skeletal system, such as the radius (forearm) or the cannon bone, effectively transmit force from one end to the other, the distal phalanx (coffin bone, a short bone), acts as a shock absorber, transferring weight-bearing forces from the hoof to the skeletal system. This bone is also well-adapted for attachment to soft tissues (tendons and ligaments) that aid or resist movement.

"The principle forces acting on the foot are the weight of the horse, the ground reaction force (GRF), and the tension in the deep digital flexor tendon (DDFT, which runs from the underside of the coffin bone to the flexor muscles higher in the leg)," Parks explained.

The GRF matches the weight the limb bears, but it is exerted in the opposite direction. When a horse's foot stands on a flat, firm surface, the GRF distributes around the perimeter of the hoof capsule. But when standing on a conformable surface such as sand, the GRF distributes broadly across the bottom of the horse's foot. In both cases GRF pressure is greatest approximately in the center of the foot, just in front of the coffin joint.

The hoof is unique in that it is comprised of many different types of integument that

RADIOGRAPHS' ROLE IN FARRIERY

Radiographs are an often overlooked but indispensible tool for assessing a horse's feet and developing a hoof care plan that will maximize his soundness. Randy Eggleston, DVM, of the University of Georgia's School of Veterinary Medicine, explained that radiography allows the veterinarian to measure sole depth, solar angles, and foot balance, as well as evaluate the health of the coffin bone and then formulate advice for the farrier.

Because the hoof can conform to the stresses it incurs on impact with each footfall, a visual exam helps the practitioner evaluate it for distortions and abnormalities that might develop over time due to hoof imbalances. Eggleston recommended using radiography if the veterinarian observes abnormal hoof and/or distal limb conformation, abnormal growth patterns, or hoof distortions; and/or when distal (lower) limb anesthesia blocks out lameness.

ERICA LARSON

To achieve good-quality images, place positioning blocks of similar height beneath each foot.

To achieve good-quality images, the handler should square the horse up as best as possible on a firm surface, with his head and neck aligned straight; any twisting will distribute weight unequally between the feet. Eggleston recommended placing positioning blocks of similar height beneath each hoof.

Hoof hygiene is another key element to getting quality films, and Eggleston noted that the hoof wall and frog sulci (the grooves next to and in the middle of the frog), in particular, should be cleaned well. Applying radio-opaque markers to the dorsal hoof wall and the bottom of the hoof allows the veterinarian to see these surfaces and angles on the radiographs and make accurate measurements and assessments. For images that require the frog sulci to be packed, he highly recommended placing the horse's foot in a water bath since this technique helps remove artifacts that can make X rays difficult to read.

Eggleston suggested that in addition to radiographing the hoof using a lateral-medial (side to side) view, the veterinarian should also obtain a horizontal dorsal-palmar (front to back) view aiming the X ray beam parallel to the bottom of the foot. With these multiple radiographic views, the veterinarian can obtain quantitative measurements to best plan trimming and shoeing strategies for the individual horse and facilitate good communication with the farrier to execute these recommendations.

> **"A proper diagnosis of abnormal forces on the foot must be achieved in order to apply appropriate therapeutic shoeing strategies."**
>
> DR. ANDREW PARKS

continually grow, yet it functions as an extension of the musculoskeletal system. Parks said the hoof wall responds differently to forces depending on the rate at which they're applied.

"For example," he says, "a force applied rapidly and immediately removed, such as the foot landing on the ground at speed, causes elastic change of foot shape that then immediately returns to its prior shape. In contrast, a prolonged and slow force applied to the foot deforms the tissue but when this force is removed, it takes much longer to return to its normal shape."

When biomechanics go wrong Prolonged abnormal loading or force on the foot, as occurs with improper hoof growth, trimming, or shoeing, has consequences—it might deform the hoof wall, causing flaring and the coronary band to move proximally (upward). Hoof growth slows as the body attempts to restore the hoof to a normal shape, resulting in growth ring spacing irregularities.

Parks commented, "The coffin bone is suspended in the hoof by the lamellae on three sides with the deep digital flexor tendon taking up tension on the fourth side. Interestingly, if the horse is lacking a functional hoof wall, he can't walk because of painful pressure between the sole and coffin bone. However, if lacking a functional sole, he walks tolerably well if sensitive tissues are protected from pressure because the lamellae and DDFT support the coffin bone off the ground."

Biomechanics and treatment As the horse begins each stride, associated shock waves can cause foot injuries. "Normally," Parks reports, "there is natural damping of concussion by many structures such as the inner lamellae of the hoof wall, the digital cushion, collateral cartilages, the vascular plexus, and thick articular cartilage."

Convention Tweets

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Treatment of club foot has to revolve around comfort.

Hagyard
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As the equine industry always evolves, core values of equine veterinary medicine remain the same. "Place welfare of horse first"

Applying a plain steel shoe to the hoof increases frequency of impact vibrations and maximum acceleration of the foot. In addition, he said, a steel shoe increases pressure on the navicular bone (which acts as a fulcrum around which the DDFT passes), restricts hoof expansion, and causes the heels to wear more rapidly than the toes.

To reduce impact shock waves, Parks recommended that veterinarians and farriers, "change the concussion of impact via a plastic shoe or a viscoelastic pad." He suggested other biomechanical modifications for improving foot function: Use a pad to distribute the force evenly, move the GRF's center of pressure, and move the point of breakover back. In the latter case, rolling the toe shortens the moment arm around which the coffin joint rotates and eases breakover.

In all cases, Parks urged, "A proper diagnosis of abnormal forces on the foot must be achieved in order to apply appropriate therapeutic shoeing strategies. This doesn't mean that horses shouldn't be shod, just that clinicians should be aware that adverse effects occur (with certain shoeing practices) and there may be a need to mitigate these effects."

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Lameness

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Researchers found that horses working on dirt surfaces placed greater forces and strain on their legs than those working on synthetic.

ERICA LARSON
NANCY LOVING, DVM
STACEY OKE, DVM, MSC

Racetrack Surface and Hind Limb Fetlock, Hoof Kinematics

Just as in the performance horse realm, racetrack surface can have a major impact on horse health. For instance, some anecdotal reports suggest synthetic track surfaces could be more associated with some musculoskeletal injuries when compared to dirt and turf tracks. However, exactly how racing surfaces affect horses' legs—specifically the lower portions of the limb—remains unclear. To better understand this interaction, a research team recently evaluated Thoroughbreds' hind limb motion on dirt and synthetic surfaces.

Jennifer E. Symons, MS, a PhD student in Biomedical Engineering, at the University of California, Davis, J.D. Wheat Veterinary Orthopedic Research Laboratory, and colleagues applied kinematic markers to specific points on five Thoroughbred racehorses' lower limbs before sending the animals out to gallop on a dirt surface and a synthetic surface. The team used high-speed video analysis to evaluate joint angles during workouts.

Their key findings included:

- When horses galloped on the dirt track, their hind fetlocks flexed 15° more than the when the animals worked on the synthetic track (maximum hyperextension was greater on the dirt track).
- When working on the dirt track, the horses experienced greater horizontal hoof slide—approximately 4 inches—than when breezing on the synthetic track, where hooves slid approximately 1.5 inches (i.e., hooves slid more readily on a dirt track than on a synthetic track).

Symons and colleagues found that horses working on dirt surfaces similar

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to the study track appear to place greater forces on their proximal sesamoid bones and greater strain on their suspensory ligaments than horses working on the synthetic surfaces similar to that studied. Horses would be more likely to injure their hind fetlock on the dirt surface than on the synthetic.

"Anecdotal reports suggest that the incidence of musculoskeletal injuries in the hind limbs has increased on synthetic surfaces," Symons said. "Trainers hypothesize that these injuries are due to decreased hoof slide. The results of this study did confirm lesser hoof slide seen on synthetic surfaces. However, we currently have no data that supports a causal relationship between less hoof slide and increased injury."

Symons noted that further studies are needed to help achieve the ultimate goal of reducing injury incidence with different surfaces: "Ultimately, we wish to design consistent race surfaces that reduce the incidence of racehorse musculoskeletal injury," Symons concluded. "In the interim, altering horseshoe design by removing or adding traction devices like caulks or stickers may allow trainers to increase or decrease hoof slide for horses training or competing on different race surfaces."

Handling Non-Weight-Bearing Lamenesses

One of the most common calls an ambulatory equine practitioner receives is that from a panicked owner whose horse becomes three-legged lame seemingly overnight, said Ryan Penno, DVM, a practitioner at The Equine Clinic at Oakencroft, in Ravana, N.Y. Whether the cause is a simple abscess or a complex fracture, Penno described how to manage acute-onset, non-weight-bearing lameness cases.

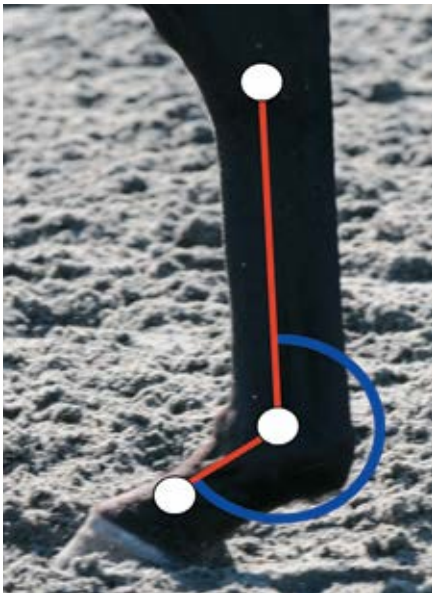
Veterinarians regularly encounter common causes of such lameness—penetrating hoof injuries, subsolar hoof abscesses, cellulitis, laminitis, fractures, and soft tissue injuries—so they must feel comfortable diagnosing and treating them, said Penno.

Penno said obtaining a complete history on a horse is crucial when dealing with acute lameness; details such as prior lamenesses or recent farrier care can help narrow down differential diagnoses (conditions causing similar clinical signs). He also recommended observing the horse from a short distance away to gauge his attitude, distress level, and respiratory status.

Next, Penno suggested completing a "brief but thorough" physical exam. To do this, he said, the horse should be fairly clean and not wearing a blanket, as mud, dirt, and blankets can potentially hide important signs. He suggested looking for any swelling, hemorrhage, or trauma before beginning the hands-on exam. He also recommended taking the horse's vital signs, which can alert the veterinarian to systemic disease.

> **"Ultimately, we wish to design consistent race surfaces that reduce the incidence of racehorse musculoskeletal injury."**
>
> DR. JENNIFER E. SYMONS

After the physical exam, the veterinarian can begin examining the affected limb closely. While there are certain aspects that should always be included in a lameness exam, Penno said each veterinarian will arrive at a diagnosis in his or her own preferred manner. During lameness exams veterinarians should ensure they:



COURTESY DR. SUSAN STOVER/UC DAVIS

Researchers applied kinematic markers on racehorses' lower limbs to evaluate joint angles.

- Carefully examine and palpate the affected leg and note any swelling and/or wound trauma, including punctures;
- Carefully elevate, flex, and examine each joint for effusion and heat;
- Check for an increased pulse and heat from the hoof capsule;
- Carefully lift the hoof and examine it for embedded foreign bodies; and
- If no foreign objects are present, use hoof testers to identify areas of sensitivity.

Once the exam is complete, the veterinarian can put his or her findings together, develop a list of differential diagnoses, and formulate a treatment plan. If the injury warrants more intensive care, veterinarians should consider referring the patient to an equine hospital or clinic.

Penno then touched on handling the most common causes of acute-onset, non-weight-bearing-lameness in the field:

Penetrating solar injuries generally present as severe lameness, Penno said, in horses with no other history of lameness. In most cases, a foreign body in the hoof sole is evident. He recommended veterinarians tell owners not to remove the object or move the horse. If necessary, suggest they provide wood blocks for the horse to stand on to prevent the object from traveling any deeper into the hoof.

These horses generally have little to no swelling, but they often have increased digital pulses. Penno recommended veterinarians use radiographs to determine the course of the object's penetration and what internal structures have been impacted. Additionally, he said, ultrasound might be useful for determining if the horse's digital flexor tendon sheath has been affected.

Penno said typical treatment protocol includes removing the penetrating object, paring out the object's tract through the sole, and flushing the hole with saline and disinfectant. In most cases veterinarians prescribe 10-14 days of antibiotics, in addition to non-steroidal anti-inflammatory drugs (NSAIDs) and a tetanus shot. Owners should wrap the foot to keep the tract clean, and in most cases they should have their veterinarian check healing progress.

In more severe cases, veterinarians might use regional limb perfusion, which involves applying a tourniquet to isolate a vein that supplies blood to the lower limb, then injecting antibiotics into the vein. They might refer the horse to a hospital for treatment and/or surgery, if necessary.

Subsolar hoof abscesses are generally straightforward to treat once the veterinarian locates the abscess using hoof testers. The veterinarian then pares the sole to allow the abscess to drain. The ultimate therapy goal is to drain the abscess while allowing the affected hoof structures to heal. Some common abscess treatment recommendations, he said, include:

- Soaking the hoof in Epsom salts and warm water for a span of time;
- Poulticing the hoof; and
- Flushing the tract with water and iodine.

Regardless of the treatment, the owner must continue wrapping the horse's hoof to keep it clean until the wound heals.

Cellulitis—a diffuse bacterial infection of the skin and associated tissues—can be difficult to diagnose and treat. Horses often have a small wound present, along with limb swelling, heat in the affected limb, significant pain on palpation, and variable lameness, Penno said.

Veterinarians often diagnose cellulitis using a combination of lab work, radiographs, ultrasound, and clinical signs, he said. Treatment often includes NSAIDs and antibiotics, along with corticosteroids. Owners should exercise affected horses; Penno recommended walking the horse for 20-30 minutes, two to three times daily.

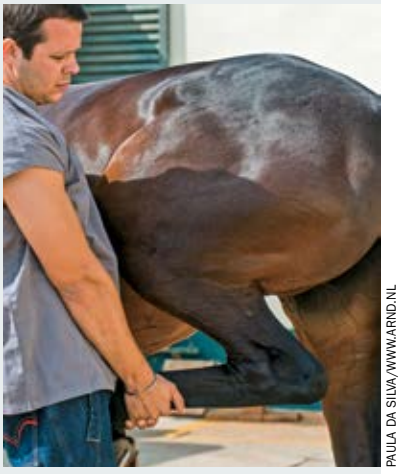
Horses also might benefit from the owner cold hosing the affected leg and/or applying clay poultices. Compression wraps can also help control swelling.

HIND-LIMB FLEXION TEST TIMES COMPARED

"A thorough lameness exam usually includes limb flexion tests to evaluate for gait changes when joints are stressed in a flexed position," said Amy Armentrout, DVM, MS, Dipl. ACVS, of Burleson Equine Hospital, in Texas. Holding a hind limb for a protracted time can be tough on practitioners, and horses aren't always compliant, she noted, so she and colleagues sought to determine if veterinarians could use shorter hind-limb flexion times.

Veterinarians generally believe it necessary to hold a hind leg in upper-limb flexion (ULF) for 60-90 seconds before trotting the horse off to watch for increased lameness, said Armentrout. The research team compared a shorter-duration ULF of 5 seconds to the longer 60-second duration.

In the study, practitioners flexed 34 client-owned lame horses as maximally as possible, such that the cannon bones were parallel to the ground. The researchers placed a camera 3 meters (9.84 feet) behind the horses for recording, and they repeated 10 of the flexion tests to identify if practitioners would make the same assessment on the same horses. Fifteen blinded practitioners, each with an average of 20 years of lameness diagnostic experience, reviewed the videos. Armentrout asked them to interpret the flexion as positive or negative as compared to the baseline lameness.



PAULA DA SILVA/WWW.ARND.NL

Researchers compared 5-second and 60-second hind-limb flexion times.

"About 74% of the time, the results of 5 vs. 60 seconds were interpreted the same," Armentrout noted. "The initial flexion was more likely to be called positive than the second flexion." She said the reviewers were more likely to judge the 60-second flexion as positive 54% of the time as compared to the 5-second flexion being positive 36% of the time. As for the 10 horses that had repeat flexion testing, the reviewers interpreted 5- and 60-second flexion test results the same way 75% of the time.

Armentrout advised practitioners to perform their own trials since clinical assessment is very subjective. In this study, the short and longer flexions did not yield the same results.

MRI for Evaluating Suspensory Ligament and Sesamoid Injuries

Equine practitioners use MRI extensively to help diagnose even the most subtle lameness causes. "One region of the horse's body that is a common site for injury is the lower (distal) aspect of the suspensory ligament near the fetlock joint," explained Alexander Daniel, MRCVS, of Colorado State University's Veterinary Teaching Hospital.

The suspensory ligament originates near the top of the cannon bone at the back of the knee and hock, travels down the back of the leg, and splits into two branches that insert onto a sesamoid bone.

"It is known that injury to the suspensory ligament near the fetlock can occur either in isolation or combination with injury to the one or both sesamoid bones," Daniel said. What wasn't known was whether the suspensory ligament's size or position changed following injury to the sesamoid bone(s). So Daniel and colleagues from the Alamo Pintado Equine Medical Center, in Los Olivos, Calif., reviewed the MRI scans of 26 horses diagnosed with injury to one branch of the suspensory ligament near the fetlock joint (either fore- or hind limb).

"We found that the dimensions of the suspensory ligament injury measured on MRI were different between horses that did or did not have concurrent sesamoid bone issues," relayed Daniel.

This means the cross area of the suspensory ligament was significantly larger in horses that had injury/damage to the sesamoid bone compared to horses without sesamoid bone injuries. The researchers suggested that MRI was an invaluable diagnostic tool for identifying suspensory ligament lesions in the fetlock as well as sesamoid bone damage.

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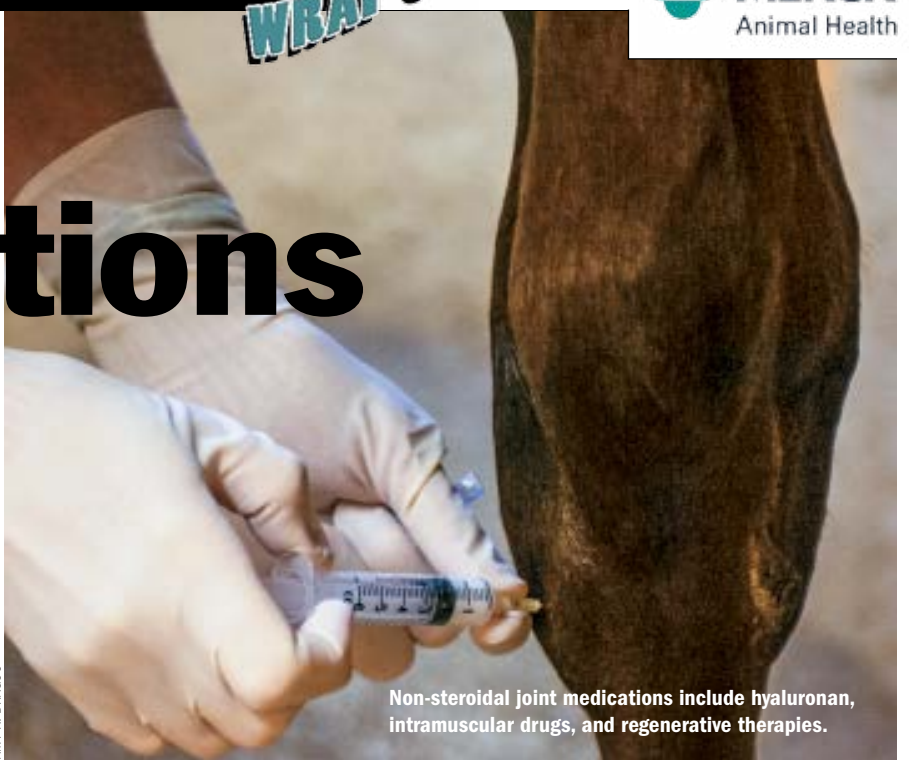
- MRI, Nerve Blocks to Diagnose Fetlock Lameness

Joint Injections

NANCY LOVING, DVM
STACEY OKE, DVM, MSC



AMY K. DRAGOO

Non-steroidal joint medications include hyaluronan, intramuscular drugs, and regenerative therapies.

Selecting the Best Joint Therapy Approach

A puffy fetlock. A knee that's warm to the touch. A hock that feels just a bit sticky in the trot. All are common performance problems pointing to the possible onset of osteoarthritis (OA). Equine joint therapy is often used to treat these types of OA-inflammation-related issues while potentially modulating disease.

Practitioners commonly use corticosteroid joint injections for this purpose, but sometimes they employ other medications to be used alone or in combination with corticosteroids. Peter Clegg, MA, VetMB, PhD, Dipl. ECVS, CertEO, MRCVS, of the University of Liverpool Veterinary Teaching Hospital, in Cheshire, U.K., reviewed the value of different non-steroidal joint medications.

Hyaluronan (HA) Clegg reported that this commonly used intra-articular drug has reasonably good anti-inflammatory effects and can potentially improve cartilage matrix synthesis (the cartilage, which absorbs shock during weight bearing, continually produces more matrix; if arthritis or injury inhibits this ability, the underlying cartilage degrades). With joint inflammation, normal synovial fluid loses some of its lubricating ability. Adding exogenous (from outside the body) HA through a joint injection might rescue the lubricating properties within an injured joint, he noted.

Clegg said he likes to use HA in a joint that is inflamed but has little to no radiographic changes indicative of OA. The best candidates are high-motion joints with capsulitis (joint capsule inflammation) or synovitis (inflammation of the synovial membrane lining the joint); inflammation in one or both of these structures is often a prelude to OA. Of veterinarians surveyed through AAEP, 62% reported using intra-articular HA to treat acute disease of high-motion joints. He said an affected horse's clinical lameness score often does not decrease with HA administration alone; usually veterinarians must combine HA with the corticosteroid triamcinolone to improve lameness. While no scientific data supports the idea that using higher molecular weight HA (which has greater viscosity) offers superior results, he noted that higher molecular weight proteins seem to better address synovial fluid viscosity.

Intramuscular drugs as IA options Veterinarians commonly administer polysulfated glycosaminoglycans intramuscularly (IM), but they can also use these drugs effectively via the intra-articular (IA) route. There's no safety or efficacy data on using pentosan polysulphate, another IM drug, intra-articularly. "However," he said, "No detrimental effects have been seen in pentosan-treated joints compared to those injected with saline."

Regenerative medicine Practitioners have found the use of stem cells in joints promising for producing cartilage matrix molecules, repair and growth factors, and trophic (nutritional) effects on cartilage. However, Clegg said, "There is no evidence of joint efficacy in the live horse although stem cells may be useful for soft tissue injuries within a joint." He said stem cells currently have no use in end-stage OA cases.

Clegg also described using autologous conditioned serum (also known as the product IRAP for the interleukin-1 receptor antagonist protein it contains). "The best indications for its use," reported Clegg, "are with early OA with minimal inflammatory changes in the joint, or in joints with minimal response to corticosteroids."

Clegg said another regenerative therapy, platelet-rich plasma, is best reserved for tendon and ligament injury. He does not recommend using bisphosphonates (Tildren) for OA therapy, either, as they might be toxic to cartilage cells.

In summary, Clegg noted, "There is a lack of evidence for many of these non-steroidal products to achieve profound clinical efficacy. Still, some medications may have a useful, ancillary role in the management of joint diseases."

Using Intra-Articular Corticosteroids

Corticosteroids can be an equine joint's best friend or its worst enemy, depending on the veterinarian's approach: Has he or she made a clear diagnosis of osteoarthritis? How many times has the horse's joint been injected already, and is the horse a high-performance athlete? Which joint is the vet targeting, and what's going on with the rest of the horse's body? Because there are many considerations for applying corticosteroid joint injections safely and effectively, Clegg addressed their use.

"The use of corticosteroids in joints involves risk, especially where there is no

definitive diagnosis," Clegg remarked. But with appropriate care and use, veterinarians might be able to mitigate these risks. He urged practitioners to first resolve a primary problem as thoroughly as possible before resorting to corticosteroid joint injections. That said, this stepwise approach can be a more expensive route. Clegg acknowledged the pressure veterinarians face from trainers and owners demanding joint treatment without a clear diagnosis.

Clegg said there seems to be a "maintenance injection" culture in the United States unlike anything he has seen in Europe. "Corticosteroids have a profound effect on chondrocyte (cartilage cell) metabolism and are not at all advisable in the absence of joint inflammation," he warned.

"If a horse requires repeat corticosteroid administration (to improve his soundness and athletic ability), then rethink other options to maintain athletic longevity," he said. "A recent paper relating to corticosteroid use in racehorses revealed some interesting data in which horses received from one to 74 IA corticosteroid injections over a lifetime—such frequent use of a powerful anti-inflammatory drug may not always be in the best welfare of the horse."

Once the veterinarian defines a joint as truly needing treatment, the drug he or she selects depends on the joint involved. "Is it a high-motion or low-motion joint?" he asked. "Is the joint afflicted with capsulitis or synovitis? Or is the horse experiencing end-stage osteoarthritis?"

Based on an AAEP member survey, responding practitioners who routinely treat joints preferred injecting the steroid triamcinolone (77%) in high-motion joints and methylprednisolone (73%) in low-motion joints.

Corticosteroids pose a variety of risks to the patient. Infrequently, they can cause articular sepsis (bacterial infection of the joint), which might be difficult to diagnose early because the steroids themselves can mask clinical signs for up to 10 days.

Many veterinarians worry about the risk of horses developing laminitis in the wake of this treatment, although scientists have made no definitive link between the devastating hoof disease and corticosteroid joint treatment. However, if a joint treatment candidate is obese, Clegg recommended using a low dose of corticosteroids or avoiding treatment altogether; an obese horse suffers from hormonal aberrations that increase his risk of developing laminitis under the best of circumstances.

Another concern regarding corticosteroid use in joints is the potential for catastrophic breakdowns, such as what is seen in racehorses. He stressed that because corticosteroids can mask pain from an injury, racing a medicated horse with an undiagnosed subtle prodromal (early stage) fracture could cause a breakdown.

In summary, Clegg recommended practitioners first establish a thorough diagnosis and only use corticosteroids in joints that will truly benefit from this therapy.

Preparing Joint Injection Sites

When administering joint injections, veterinarians must take steps to minimize the risk of septic arthritis developing in the treated joint. Particularly in equine athletes, septic arthritis can be a devastating and debilitating complication, though aggressive treatment returns a large range (27-92%) of affected horses back to work.

Stephen Adams, DVM, MS, Dipl. ACVS, of Purdue University's School of Veterinary Medicine, described appropriate site preparation and needle selection for septic arthritis prevention.

A NEW TOOL FOR MONITORING JOINT INFECTION TREATMENT IN HORSES

Joint infections are a serious occurrence in horses with the potential to end an athletic career or even a life. Although survival rates are as high as 62% in foals and 85% in adults, only 48-66% of horses return to previous athletic activity after a joint infection.

"A successful outcome requires early and aggressive treatment, including the intra-articular injection of a suitable antibiotic such as amikacin," said Andres Sanchez Teran, Vet MSc, of the University of Pretoria's Department of Companion Animal Clinical Studies, in South Africa (though he's currently at the Western College of Veterinary Medicine, University of Saskatchewan, Canada). Since there's no reliable way to determine if treatment is working, Sanchez Teran and his colleagues in Pretoria set out to find one.

Levels of a certain protein increase with joint infection, but not simply injection.

Scientists know that cells lining the inside of the joint produce a protein called serum amyloid A (SAA), and SAA levels increase in cases of infection. More importantly, SAA levels in synovial (joint) fluid do not increase following routine joint injections the way total protein and total nucleated cell counts (NCCs) do.

"This means that SAA could be a better marker of joint infection (than total protein and other cell counts that are currently used)," explained Sanchez Teran.

To test this hypothesis, Sanchez Teran and colleagues collected synovial fluid by inserting a needle into the middle knee joints of five horses every two days for a total of five times. In the control group the team simply collected a fluid sample, and in the treatment group they injected the antibiotic amikacin after collecting the fluid. They measured SAA, total protein, and NCC in all samples and found:

- As expected, total protein and NCC increased significantly after the first joint injection;
- In some cases the protein and NCC levels were so elevated they reached the point that would be expected in infected joints; and
- Synovial fluid SAA levels did not increase in either group of horses.

"Because SAA levels in synovial fluid are not affected by the process of inserting a needle or administering amikacin into a joint, SAA could potentially be used to monitor response to treatment following administration of amikacin into the joint," concluded Sanchez Teran.

He added, "For example, this means that if SAA levels are elevated in infected joints, the SAA levels would be expected to drop as the infection resolves."

Convention Tweet

Jenevieve
@thejenevieve

The payoff in discussing these talks with other practitioners is immense.

"Up to 80% of septic arthritis cases subsequent to joint injections are due to staph species that, in fact, live on the horse's skin, as well as the veterinarian's skin," Adams said. "One can never completely disinfect all layers of all portions of the skin."

Still, preparing the injection site helps minimize the risk of joint contamination. In previous studies veterinarians have demonstrated that the presence of hair at the injection site does not inhibit antiseptics' ability to effectively reduce the skin surface bacterial flora to an acceptable level. In other recent studies investigators proved that scrubbing with chlorhexidine was superior to using tamed iodine (Betadine solution).

Adams recommended that veterinarians perform a two-stage prep using sterile gauze sponges, chlorhexidine/saline, and isopropyl alcohol applied with gloves. He discouraged using prefabricated solutions, such as jars of gauze presoaked in Betadine or chlorhexidine solution, as they are susceptible to airborne contamination.

MATHEA KELLEY

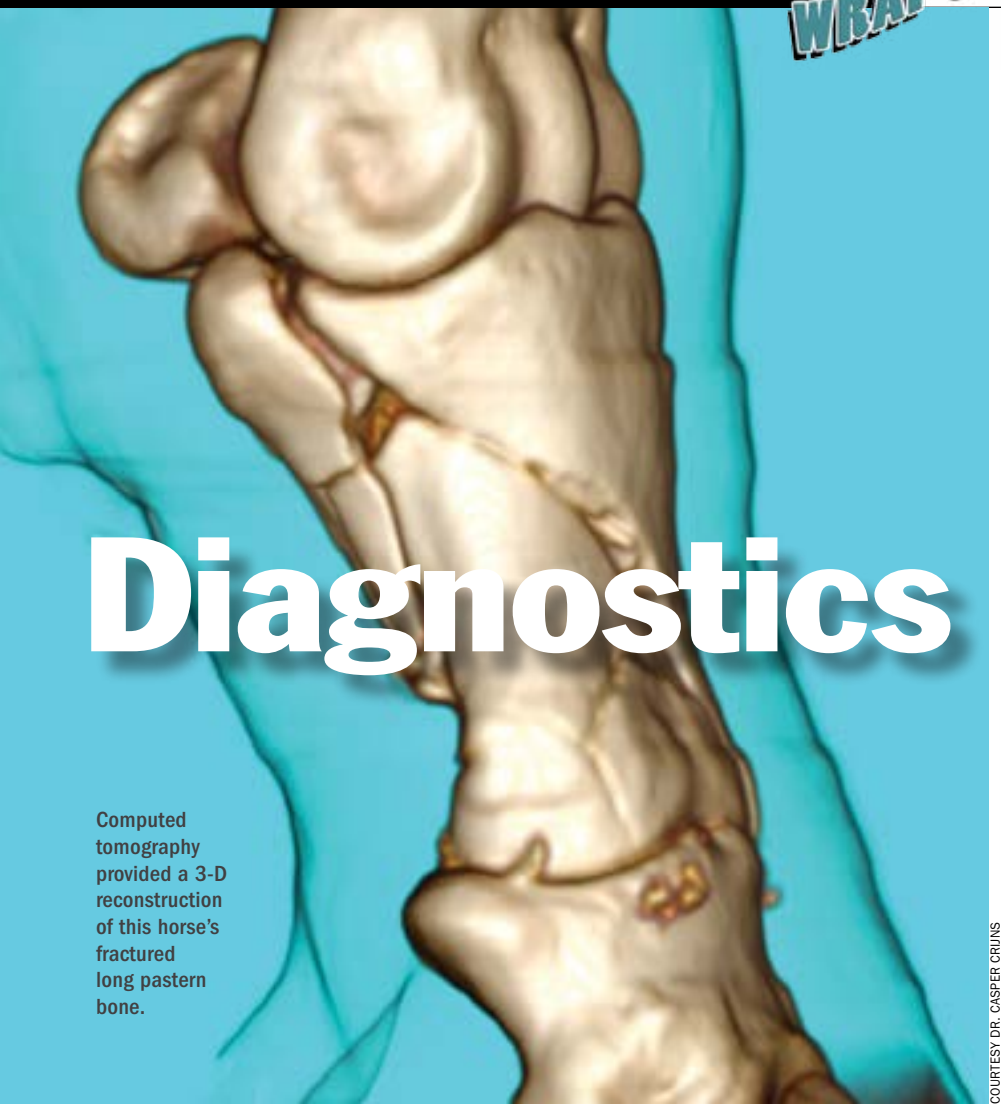
Hair at the injection site does not inhibit antiseptics' ability to reduce bacterial flora.

Needle size and direction of insertion can also impact the veterinarian's chances of introducing tissue fragments and hair into a joint. Adams reported that using 18-gauge spinal needles in humans during arthroscopy produced identifiable tissue fragments in the joint 100% of the time. In two studies in which he sought to find methods to minimize the joint contamination risk, Adams came to the following conclusions:

- Clipped or razored hair increases the risk of hair contamination into the joint by 2.4 times and 1.69 times, respectively.
- Reusing a needle increases contamination risk by 1.7 times.
- It is best to use the smallest needle possible; 22-gauge is better than 20- or 18-gauge.
- After placing a needle in the joint, allow the needle to clear with dripping joint fluid when possible.
- Insert a needle at an angle to the joint surface rather than straight in.
- Use 22-gauge spinal needles (rather than larger needles) to decrease the risk of introducing hair fragments.
- Removing the stylet (the fine wire that runs through the needle) from a spinal needle increases contamination risk fivefold.
- Deep layers of the skin cannot be disinfected.
- There is no need to remove hair prior to joint injection unless using 20-gauge or larger spinal needles.

In conclusion, Adams stressed that veterinarians should take considerable care when preparing a site for joint injection, along with selecting optimal needle size and placement to minimize joint contamination and risk of developing infection.

Diagnostics



Computed tomography provided a 3-D reconstruction of this horse's fractured long pastern bone.

COURTESY DR. CASPER CRIJNS

CHRISTY CORP-MINAMIJI, DVM
ERICA LARSON
NANCY LOVING, DVM
STACEY OKE, DVM, MSC

CT for Limb Fracture Diagnosis?

A fracture can put a horse's athletic future—sometimes even his life—on the line, and basing treatment on a complete and accurate diagnosis can make a major difference in the horse's recovery. Casper Crijns, DVM, a researcher at the Ghent University Faculty of Veterinary Medicine, in Belgium, believes computed tomography (CT) offers a better option for imaging some lower limb fractures than radiography.

Crijns and colleagues compared radiographs and CT—which can provide a detailed 3-D look at bone and damage within—for diagnosing distal limb fractures. He said veterinarians often use radiography as a first-line diagnostic modality when they suspect limb fractures, but they must assess several different views to make a diagnosis. Superimposition (anatomical structures overlapping each other in a two-dimensional image) and fracture complexity can complicate diagnosis.

On the other hand, he said, CT creates cross-sectional images of the limbs (allowing a 3-D evaluation), which eliminates the superimposition problem and allows the veterinarian to see the fracture better. In most cases, practitioners must place horses under general anesthesia for CT, and they can only evaluate the head and limbs with this modality because of unit size.

The team conducted a retrospective study of 27 horses with suspected lower limb fractures and three control horses. All animals underwent radiographic and CT exams. Four observers evaluated a variety of fracture characteristics with each modality, and they assessed intermodality (IM, consistent among modality) and interobserver (IO, consistent among the group of veterinarians) agreement levels.

Veterinarians could:

- Detect and localize fractures (determine exact location) consistently with "very good" IO agreement levels on radiographs and CT, but they were able to find fractures with CT that they missed on X rays (showing "moderate" IM agreement);
- Detect fracture displacement consistently using both modalities ("good" IM and IO agreement);
- Detect joint involvement and fracture comminution (breaking into multiple smaller fragments) and identify the number of fragments consistently, but all "bordered on the lower levels of good agreement" with CT showing a slightly better IO agreement; and
- Determine fracture orientation and width and identify coalescing cracks (numerous smaller cracks that form before a single dominant crack is evident) with "poor to fair IM agreement levels," meaning results were inconsistent between X ray and CT results, while veterinarians' evaluations were more consistent with CT than radiography ("IO agreement levels were clearly higher").

"Being able to visualize a presumed fracture or fissure is important, and accurately describing the fracture characteristics is necessary for a proper diagnosis and treatment," Crijns said.

"The extent and severity of a fracture is often underestimated on the radiographs," he continued. "If a surgeon encounters additional lesions during surgery, he or she will need to adapt or completely change his or her surgery plan, and this will prolong the surgical intervention and general anesthesia time.

He said the time and expense required for CT scan "will be recovered by a shorter surgery time and less complications afterwards. And due to the accurate diagnosis, better treatment is possible, which leads to a better prognosis for the horse."

Diagnosing Arytenoid Chondritis with Ultrasound

Veterinarians often choose upper airway endoscopy to diagnose arytenoid chondritis—an uncommon but problematic respiratory condition—but in some cases a definitive diagnosis lies out of reach. Ultrasonography could offer a valuable adjunct tool for diagnosing this condition, especially in cases lacking a definitive diagnosis.

View "Endocrine Disease" at TheHorse.com/30991

Katherine Garrett, DVM, Dipl. ACVS, of Rood & Riddle Equine Hospital, in Lexington, Ky., presented results of a study in which she and colleagues evaluated ultrasonographic features of horses with arytenoid chondritis—inflammation of one or both arytenoid cartilages, which close over the trachea when a horse swallows.

The team compared ultrasonographic findings of horses with confirmed arytenoid chondritis (diagnosed via endoscopy) to horses with normal arytenoids.

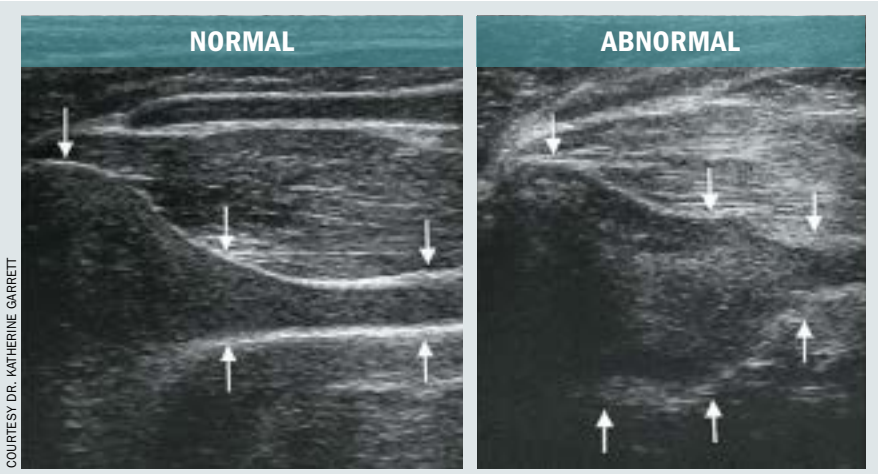
"We hypothesized that arytenoid cartilages with arytenoid chondritis would have a larger cross-sectional area, an irregular margin (i.e., edge), and abnormal echogenicity (how the ultrasound's waves reflect off, are absorbed by, or are transmitted through an object) as compared with normal arytenoid cartilages," she said.

The team reviewed the medical records of 33 Thoroughbreds diagnosed with arytenoid chondritis and 79 Thoroughbred controls. Veterinarians had taken ultrasound images of the larynges at the level of the arytenoid cartilages.

They found that 98% of affected horses had abnormally shaped arytenoid cartilages, and affected cartilages were approximately twice the size of unaffected ones. They noticed abnormal echogenicity in the ultrasound images of affected arytenoid cartilages, as compared with normal cartilages. Garrett noted these findings showed that ultrasound produced accurate, consistent, and reproducible results.

Seventeen case horses were available for follow-up exams. No difference in arytenoid cartilage size was observed when horses underwent multiple exams, suggesting that, once enlarged, arytenoid cartilages affected with arytenoid chondritis do not return to a normal size.

Garrett concluded that when used in combination with upper airway endoscopy, "ultrasonography is a valuable diagnostic modality when investigating cases of possible arytenoid chondritis or abnormal arytenoid cartilage movement."



COURTESY DR. KATHERINE GARRETT

Ultrasound of horses with arytenoid chondritis revealed abnormally shaped and sized cartilages, as well as abnormal echogenecity (how ultrasound waves reflect off, are absorbed by, or are transmitted through an object).

Using Ultrasonography to Diagnose Diseased Equine Lungs

Practitioners perform thoracic (chest) ultrasound exams in clinics routinely, but they can also conduct these efficiently and effectively on the farm, explained Virginia B. Reef, DVM, of the Department of Clinical Studies at the University of Pennsylvania's New Bolton Center.

Reef described the steps involved in conducting a complete ultrasound exam of the lungs, the ultrasonographic appearance of normal structures, and abnormalities that can affect the equine chest.

"An ultrasound examination of the horse's chest can yield a great deal of information, such as the precise location of the diseased lung, the type of fluid in the chest cavity if it is present, whether the diaphragm … is intact or not, and even the area between the two sides of the lung, which houses the heart and important lymph nodes," said Reef. She described:

- Pleural effusion: Fluid that accumulates between the lung and the body wall, diaphragm, and heart;
- Pneumothorax: Air that accumulates between the lung and the body wall. Can occur either uni- or bilaterally and can occur in concert with pleural effusion;
- Atelectasis: Partial or complete lung collapse;
- Pulmonary thromboembolism: Debris in the bloodstream lodges in lungs' small-diameter blood vessels, causing respiratory distress and an elevated heart rate;
- Lung and/or chest cavity abscesses;
- Neoplasias (tumors), granulomas (chronic inflammatory lesions), or fungal disease; and
- Diaphragmatic hernias.

> "In my experience and opinion, the extent and severity of a fracture is often underestimated on the radiographs."
>
> DR. CASPER CRIJNS

Reef said, "The sonographic pattern of pleural effusions includes anechoic complex nonseptated and complex septated fluid," referring to how some fluids appear "dark," either with or without debris floating within them. Reef went on to describe how veterinarians can distinguish between those types of effusions, and how the ultrasonographic appearance of certain types of fluid can help veterinarians determine the fluid's cause/source.

Reef said veterinarians can use ultrasound to help form a more accurate prognosis for survival, select appropriate diagnostics and treatments, and help determine when treatment can be discontinued.

Further, it is a robust and portable tool that allows horses to be examined without a stressful trailer ride to a clinic.

Lawsonia intracellularis Tests: How Do They Measure Up?

The bacterium *Lawsonia intracellularis* causes an economically important emerging disease of weanlings called equine proliferative enteropathy (EPE). Thoroughbred foals that recover from EPE sell for an average of 68% less than nonaffected foals by the same sire, so veterinarians consider

catching *L. intracellularis* early a priority. Connie Gebhart, PhD, associate professor in the University of Minnesota's Department of Veterinary and Biomedical Sciences, and colleagues examined four types of blood serum tests to determine their usefulness in detecting *L. intracellularis*.

The team collected blood serum samples from 96 weanlings in which they suspected EPE, 117 clinically normal weanlings, and 116 normal horses aged 1-27 years. They tested samples using an immunoperoxidase monolayer assay (IPMA, used to test swine), a slide-based immunoperoxidase assay (SIPA), and an enzyme-linked immunosorbent assay (ELISA).

They also considered a blocking ELISA (b-ELISA), which reports the inverse of the antibody titer. They examined serum total protein, a blood component lost in severe diarrhea, as a screening assay.

The IPMA, SIPA, and ELISA were both sensitive and specific (produced few false negative and false positive results, respectively) in weanlings. Results of all three tests were also consistent for weanlings. But results were less consistent for adults, suggesting these tests would require further optimization for use on adults.

Only four horses tested negative on the b-ELISA, so researchers concluded that it would need to be modified considerably. Serum total protein, however, showed promise, picking up 85% of positives.

Gebhart suggested monitoring outbreak herds by conducting physical exams and recording temperatures and body weights daily, along with measuring weekly serology and/or total protein levels. She suggested running monthly serology/total protein analyses post-weaning in endemic herds.

New Hyperinsulinemia Screening Test Promising

Screening for insulin issues is typically cumbersome, because tests are time-consuming and involved. A University of Tennessee team led by Nicholas Frank, DVM, PhD, Dipl. ACVIM, now at Tufts Cummings School of Veterinary Medicine, tested the feasibility and effectiveness of an oral sugar test (OST) for application on the farm (to decrease stress on the animal).

If horses with insulin resistance (IR) consume an increased amount of sugar or starch, high insulin concentrations build and increase their risk of developing laminitis, explained Frank, who is a professor of large animal internal medicine and chair of the department of clinical sciences at Tufts. Most IR horses are diagnosed after developing laminitis. The goal of screening for IR, then, is to recognize at-risk horses and prevent hoof damage.

Corn syrup is used as the sugar source in the new test and is well-tolerated by horses, so a horse owner can administer the 15 mL/100kg dose to a fasted horse. The veterinarian draws blood samples 60 and 90 minutes after sugar administration. Frank said the test is considered positive if glucose levels are higher than 125 mg/mL and insulin levels are greater than 60 microUnits/mL.

If a veterinarian is concerned a horse might develop laminitis after high sugar intake, he or she can measure fasting insulin levels prior to running the OST. If levels are sky high, there is no need to perform an OST. However, the OST "gets us as close as we can to what might be happening with that horse out on pasture."

The OST compared favorably with the intravenous insulin tolerance test, and it might provide a more convenient means of screening horses for hyperinsulinemia.

NEW LYME DISEASE TEST

COURTESY JAMES GATHANY/CDC

Horses contract the causative bacterium from infected ticks.

Diagnosing Lyme disease in horses is tricky business; not all horses that contract the causative bacterium, *Borrellia burgdorferi*, from infected ticks develop the debilitating condition, and those that do might not show signs until several months after infection. Cornell researchers have been searching for reliable ways to detect *B. burgdorferi* sooner. Bettina Wagner, DVM, PhD, associate professor of immunology at the university's vet school, described a new test she and her colleagues developed.

"Because clinical signs are rather nonspecific," said Wagner, meaning they could be attributable to a number of diseases, "Lyme disease can be difficult to diagnose in horses." Possible clinical signs range from chronic weight loss, low-grade fever, sporadic or shifting leg lameness, muscle tenderness, and arthritis to behavioral changes, neurologic signs, poor performance, and skin hypersensitivity.

It's important for veterinarians to consider a horse's potential for infection, such as if the animal lives in or has visited an endemic area. Another indicator to help the practitioner diagnose Lyme disease is serologic testing for antibodies against *B. burgdorferi*.

Wagner presented the results of the equine Lyme multiplex assay, a new antibody test available at Cornell's diagnostic lab. This test can detect antibodies as early as two to four weeks following infection, and it can distinguish early infection stages from late.

Previously, many equine practitioners have used the Snap 4Dx test (IDEXX Labs), one of the only commercially available tests for this purpose until recently. At Cornell, researchers compared Lyme multiplex assay results and Snap 4Dx testing. Overall, both tests detected antibodies against *B. burgdorferi*. However, Snap 4Dx testing yielded some false positive and false negative results. Wagner recommended confirming positive results on a Snap 4Dx test by also running the equine Lyme multiplex test. "A negative Snap 4Dx test with clinical signs suggestive of Lyme disease should also be confirmed with the Multiplex test," she said. Wagner and her colleagues have applied for a patent for the Lyme multiplex test.

Convention Tweet

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I want to scoop all these folks up and make the World's Best Vet School.

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- MRI, Nerve Blocks to Diagnose Fetlock Lameness


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ANNE M. EBERHARDT

NANCY LOVING, DVM
STACEY OKE, DVM, MSC

Flunixin Meglumine: More or Less?

Foot pain can be difficult to control, so Jonathan Foreman, DVM, MS, Dipl. ACVIM, of the University of Illinois at Urbana-Champaign, and his colleagues recently examined the possibility that higher-than-standard doses of non-steroidal anti-inflammatory drugs (NSAIDs) might better alleviate foot pain.

They used a reversible model of equine foot lameness to test this idea—a reversible heart bar shoe can make sound horses lame temporarily, and when researchers loosen the screw in the shoe to relieve foot pressure, the pain abates. This allowed them to study the same horses weekly for four weeks so each served as its own control. The tighter the screw, the higher the pain level as reflected by rising heart rates. They confirmed the tightened shoe's effects in each horse with palmar digital (heel) nerve blocks. Heart rates dropped from 60 to 40 beats per minute (bpm) following this regional anesthesia application.

Foreman also wanted to see if the half-strength dose of flunixin commonly used as an anti-endotoxin dose in colic treatment could provide sufficient foot pain relief. In a previous study he compared varying doses of phenylbutazone (Bute) and found no difference between the effects of a normal, single dose (1x), and those of twice the normal dose (2x), but the effects of one-half dose were not as long-lived as those seen with a 1x dose.

> **"More is not better, and less is less effective."**
>
> DR. JONATHAN FOREMAN

In this study the scientists compared the effects of varying intravenous (IV) doses (half-dose, 1x, 2x) of flunixin meglumine; they used saline as a control. Ten sound horses wore a reversible heart bar shoe on the left front foot. Following treatment, the 1x and 2x doses improved heart rates for the 12-hour duration, whereas heart rates remained elevated in the control horses. Heart rates in the horses given half-doses of flunixin did not decrease as much as those in the 1x and 2x horses, and they didn't remain low for as long. "They responded intermittently and not as obviously," Foreman said. There was no difference in heart rate results between the horses receiving 1x or 2x flunixin meglumine.

Plasma concentrations of flunixin meglumine increased in a dose-dependent manner, but by Hour 8, there was no difference among concentrations at half-dose, 1x, and 2x doses. This indicates that horses rapidly metabolize and excrete the drug.

In conclusion, Foreman noted that the double dose was no more effective than the single dose and presents a higher toxicity risk.The half-dose was less effective than the single dose; so one can't rely on an anti-endotoxic half-dose to provide complete pain control for painful hoof conditions such as laminitis. This is significant when treating colicking horses with flunixin meglumine to alleviate intestinal pain and combat endotoxemia. Since

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laminitis can be a sequel to colic, never rely on smaller-than-usual doses of flunixin meglumine to alleviate musculoskeletal pain. He summed up by saying, "More is not better, and less is less effective."

Oral vs. IV Bute and Drug Testing

The FEI (Fédération Internationale Equestre) has a drug-free policy for all equine disciplines. Recently, there was talk of allowing veterinarian-administered half-doses of flunixin meglumine or of Bute. After examining the legal implications and the ethics of fairness, FEI officials abandoned this modification, but the discussion caused Foreman to question whether alternate dosing approaches would help ensure testing compliance.

He wondered if half-doses of an NSAID could result in different blood plasma concentrations than full doses. He and colleagues studied this approach using Bute in nine healthy horses. They administered five consecutive once-daily half-doses of IV or oral Bute, taking blood samples 12 and 24 hours post-administration. After a week off, in the third week the administration methods were swapped.

The team compared oral vs. IV dosing and noticed Bute plasma concentrations accumulated, with concentrations higher on Day 5 than Day 1. They didn't note this with IV dosing. Foreman suggested that even at half-doses, oral Bute is not 100% bioavailable and accumulates in plasma. After stopping oral dosing, concentrations decreased to levels a test will not detect within 12 hours of dosing; horses on an IV dose tested close to a positive level but levels declined quickly after dosing stopped.

The potential for a positive test is a function of dose, administration route, time administered relative to testing, individual horse variability, and the regulatory threshold. Foreman said, "Even at lower doses than the single dose of Bute, oral phenylbutazone can accumulate in plasma over time and therefore may trigger a positive drug test particularly if given within 12 hours of the test. But at 24 hours, or even better would be 48 hours, the horse will likely be safe from testing positive."

GI Drug for Equine Eye Exams?

Sometimes veterinarians stumble across a drug side effect that's more useful than detrimental. As it turns out, the antispasmodic N-butylscopolammonium bromide (NBB), marketed as Buscopan (Boehringer Ingelheim) to treat colic, could help practitioners examine horses' eyes.

"One side effect of NBB is mydriasis—dilation of the pupil of the eye," explained Joanie Palmero, DVM, Dipl. ACVIM, formerly of the University of California, Davis (UC Davis), Veterinary Medical Teaching Hospital. She and UC Davis colleagues examined NBB's potential for eye exam use.

They administered the following treatments (interspersed by a two-week washout period) to six healthy adult horses: topical tropicamide (positive control; the gold standard for ocular exams), topical NBB, intravenous NBB, and topical or IV saline (negative controls). They measured pupil diameter, pupillary light reflex, and other parameters from time of administration and at least 60 minutes after administration. They observed:

- No changes in horses treated with either topical or IV saline, as expected;
- Topical tropicamide resulted in dilation, allowing a complete exam in all horses (mean time to dilation was 36.7 minutes; dilation lasted an average of 360 minutes);
- Topical NBB caused the pupillary dilation of one blue iris in one horse;
- IV NBB allowed for dilation and complete exam in two horses (mean time to dilation was 25 minutes; dilation lasted an average of 30 minutes);
- NBB also caused partial dilation and incomplete exams in two horses, and caused no effect in two horses; and
- A transient heart rate increase was evident in all horses after IV NBB.

Palmero, now at Alamo Pintado Equine Medical Center, in Los Olivos, Calif., also noted that eye color can influence how the eye responds to mydriatics—a phenomenon well-documented in human medicine.

"Interestingly, the mydriatic effect of NBB seemed to be more profound in the horses with blue or heterochromatic irises than in horses with uniformly brown irises," Palmero noted.

She added, "These findings suggest that NBB can result in ocular dilation in some horses; however, further studies are warranted to account for breed, gender, and color differences and to determine a safe, yet reliable, NBB dose that results in dilation in a majority of horses."

Convention Tweet

Mike Pownall, DVM
@McKeePownall

Don't keep too many controlled drugs in your vehicle. Supposed to have only enough for what you might use on 1 day.

CLIX PHOTOGRAPHY/SHAWN HAMILTON

An antispasmodic drug called N-butylscopolammonium bromide can be used to dilate the pupil, but more research on this application is needed.

Stem Cell Therapy

STACEY OKE, DVM, MSC

Not All Equine Stem Cells Equal: Choose your "Weapon" Wisely

Practitioners have identified stem cell therapies as potentially powerful weapons in the war on wounds and injuries. But the exact cell types most beneficial for certain "battles" remain unclear.

"Stem cells, particularly a specific cohort of stem cells called mesenchymal stromal cells that have the ability to become any one of a variety of cell types such as bone or cartilage, are a promising tool for treating various orthopedic conditions," explained Janina Burk, DVM, of the Large Animal Clinic for Surgery at the University of Leipzig, in Germany. She and her colleagues recently compared five different mesenchymal stromal cell sources.

Mesenchymal stromal cells can be derived from bone marrow, fat (adipose) tissue, other body tissues (such as tendons, the body tissue used in this study), and umbilical cord blood and tissue. Currently, the "best" source of stem cells for treating tendon, ligament, and other orthopedic injuries remains a topic of great debate due to a lack of comparative studies. And while many researchers are running from bench to stall with stem cell technology, others are recalling their troops and holding out for the "hero" stem cell source.

In their study the team determined:

- The highest cell yield was from adipose and tendon tissues;
- Those two populations of cells grew quickly in culture as compared to the other cell populations;
- Normal tendon tissues' production of cell "markers" varied depending on the cell source (meaning not all mesenchymal stromal cells behaved like true tendon cells); and
- Cells' ability to differentiate into bone or cartilage cells differed. Bone marrow-derived cells were best at becoming bone cells, and cells from umbilical cord blood were best at becoming cartilage cells.

"The five different populations of stromal cells used … showed significantly distinct properties in this study, suggesting that cell source could play a major role in the behavior of stem cells used in the clinical setting," Burk concluded. "It is possible that exploiting these properties could improve the outcome of stem cell therapy."

In other words, either choosing a specific cell source or altering the way mesenchymal stromal cells are treated in the laboratory before injecting them into an injured tendon could maximize this therapy's efficacy, improving injured horses' chances of recovering and returning to work.

Mesenchymal stromal cells have the ability to become a variety of cell types, such as bone or cartilage.

THE HORSE STAFF

Tweaking Stem Cell Therapy Use

"To derive the greatest benefit from stem cell therapy, we need to optimize and describe (stem cells') behavior in the laboratory," said Mandi J. Lopez, DVM, MS, PhD, Dip. ACVS, director of the Laboratory for Equine and Comparative Orthopedic Research, in Louisiana State University's Department of Veterinary Clinical Sciences. "Ultimately, this is necessary for the preclinical studies to confirm safety and efficacy prior to controlled clinical trials."

In their study, Lopez and colleagues isolated "multipotent stromal cells" from bone marrow and adipose tissue. Multipotent stromal cells are immature cells found in adult tissues that are thought to maintain normal tissue and respond to injury by maturing into adult cells as needed. In this sense they are a form of stem cells; however, unlike "totipotent" stem cells (that can become any tissue type), multipotent stem cells are generally limited to becoming the type of tissues from which they're derived. For example, a mesenchymal stromal cell can become muscle or bone cell but not a brain cell. In the study by Lopez et al., veterinarians harvested cells from adipose tissue and bone, so these cells were able able to become tissues such as bone, adipose tissue, and cartilage.

"The ability to isolate, grow, and selectively increase the number of these cells in the laboratory, as well as their ability to become different cell types, has been confirmed many times," Lopez said. "The focus (of research) has now begun to shift toward determining the best ways to use the cells to meet the needs of clinical patients."

One way to do this is to use patient cells to grow new or "neo" tissues in the laboratory. In theory, the new tissue can then be applied to either treat or replace damaged tissue, similar to a graft.

The team looked at the ability of multipotent stromal cells from bone and adipose tissue to become bone, adipose, and cartilage cells, and their ability to produce "neotissue" after the scientists loaded these cells onto pieces of collagen, called a scaffold (they did this using a perfusion bioreactor, which Lopez said "moves the cells suspended in fluid through the scaffold … to equally distribute the cells and maximize the number of cells on the collagen"). The scaffold provides the framework to which the cells adhere and begin producing tissue.

After loading, the researchers maintained the cells on the scaffolds in growth conditions for seven, 14, and 21 days. Then they evaluated the number of live cells, distribution in the scaffold, gene expression, and neotissue formation.

> **"Cell source could play a major role in the behavior of stem cells used in the clinical setting."**
>
> DR. JANINA BURK

"The key finding of this study was that adult equine multipotent stem cells, when loaded onto collagen scaffolds, turned into distinct cell types and produced adipose, bone, and cartilage neotissue," said Lopez.

Further, when cells were grown under conditions designed to produce a certain tissue type, the bone marrow cells tended to have earlier expression of bone and cartilage genes, while adipose tissue cells had earlier expression of adipose genes.

"This may mean that multipotent stromal cells from both types of tissue may be used for tissue regeneration under similar laboratory conditions," noted Lopez.

Additionally, the researchers determined that the perfusion bioreactor provided an efficient and effective way to load the cells onto the scaffold, potentially minimizing the total number of cells scientists need to generate specific neotissue.

She concluded, "These findings support our ongoing efforts to develop equine stem cell tissue regeneration to provide new and improve upon existing treatment options, especially in the area of fracture repair."

Tendon Injury Approach Ineffective

In the spirit of evidence-based meditice, one group of researchers put mesenchymal stem cells head-to-head with a simple "bone marrow supernatant" (a type of bone marrow extract that contains a

STEM CELLS FOR UTERINE INFLAMMATION

Researchers recently revealed that stem cells and other biologic therapies might be useful for treating subfertile mares.

Ryan Ferris, DVM, MS, Dipl. ACT, of Colorado State University's Equine Reproduction Laboratory, said that approximately 20% of mares are unable to clear a normal inflammatory response to spermatozoa by 24-48 hours post-mating, adversely impacting their fertility.

THE HORSE STAFF

Study results suggest stem cell therapy can alter the immune response in mares following mating.

Together with David Frisbie, DVM, PhD, Dipl. ACVS, ACVSMR (sports medicine), who is renowned in the industry for his work with IRAP (a type of biologic therapy used extensively for joint disease), Ferris evaluated how well stem cells (MSCs) and autologous conditioned serum (ACS) controlled uterine inflammation. To do this, they used 800 million dead spermatozoa to induce an inflammatory response in six mares. The team monitored the resulting inflammation using a variety of clinical and biochemical endpoints. Their key findings were:

- Both ACS and MSCs decreased evidence of inflammation by a reducing the number of neutrophils (a class of white blood cells) as compared to a placebo treatment; and
- Increased concentrations of the anti-inflammatory mediator interleukin-1Ra were identified after MSC treatment, but no difference in interleukin-1Ra was noted after ACS treatment.

"These preliminary results suggest that biologic therapies can alter the immune response in mares following mating," summarized Ferris. "Because a variety of bioactive substances could be involved in this response, more research is needed."

In other words, researchers aren't certain what exactly aspects of MSC and ACS treatment could be modifying these mares' uterine environments, but the preliminary results support future work in this field. They also need to more closely examine the impact of ACS and MSCs on pregnancy rates in subfertile mares to prove its benefits.

SDFT INJURIES: WHAT'S THE BIG DEAL?

Injury to the superficial digital flexor tendon (SDFT) is common in athletic horses and often refractory to treatment. Strains of the SDFT account for up to 46% of limb injuries in racing Thoroughbreds and were reported to be the most important reason for retirement of racehorses from racing in Hong Kong. These SDFT strains are often career-threatening events because recovery is slow and recurrence is high. In spite of treatment with long-term rest with or without supportive medical or surgical therapy, return to exercise is associated with a re-injury rate of more than 50%, which veterinarians believe is because the replacement of damaged tendon tissue with scar tissue compromises tendon biomechanical function.

number of cell types, not just stem cells) to treat superficial digital flexor tendon (SDFT) injuries.

"Implantation of mesenchymal stem cells has become a very popular treatment for tendon and ligament injuries in horses in recent years," explained Michael Schramme, DrMedVet, CertEO, PhD, Dipl. ECVS/ACVS, from the National Veterinary School Of Lyon, in Marcy L'Etoile, France. "One of the most commonly used stem cell products in both the U.S. and Europe uses the supernatant of the bone marrow aspirate from which the stem cells are cultured to re-suspend the cells prior to injection.

"In order to determine the benefit the cells might bring to the healing process in an injured tendon, we decided to compare the effect of implantation of stem cells suspended in bone marrow supernatant with the effect of injection of the supernatant alone," he added. "In particular we were looking for evidence of regeneration of new tendon tissue in both treatment groups, as opposed to scar tissue that is known to replace the damaged tendon tissue in horses treated with rest alone."

The team hypothesized that SDFT lesions would heal better if treated with the mesenchymal stem cells than simply with the bone marrow supernatant.

They created SDFT lesions in the front limbs of six horses. Four weeks later, the researchers treated one of each horse's limbs with mesenchymal stem cells and the other with only bone marrow extract. They assessed healing 12 weeks later using ultrasonography, MRI, and histopathology (looking at tissue under a microscope).

"We analyzed a variety of features of healing and not only did we not find any significant differences between the two treatments, we also saw no evidence for regeneration of new tendon tissue but only found scar tissue formation in the tendons of both treatment groups," he noted.

Schramme added, "There are a number of possible reasons that no differences … were observed, including the possibility of insufficient follow-up time, as the study was terminated after three months, which is a relatively early time-point in tendon healing; … that the stem cells did not survive or spread adequately in the damaged tendon, as we did not test this particular aspect of the treatment; or even … that the beneficial aspects of stem cells do not arise from promoting new tissue regeneration, but from a different mechanism.

"A lot of work still needs to be done before it can be established that stem cell therapy is the best current treatment for tendon injuries in horses or whether this is just a passing fashion," he added. "Future studies will need to look at the optimal number of stem cells used for implantation, the optimal time of stem cell implantation after injury, the optimal source of stem cells, and whether or not stem cells from a different donor can be used."

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Christy Corp-Minamiji, DVM
@cminamiji

34% of (non-vet) people performing complementary and alternative medicine services are untrained.

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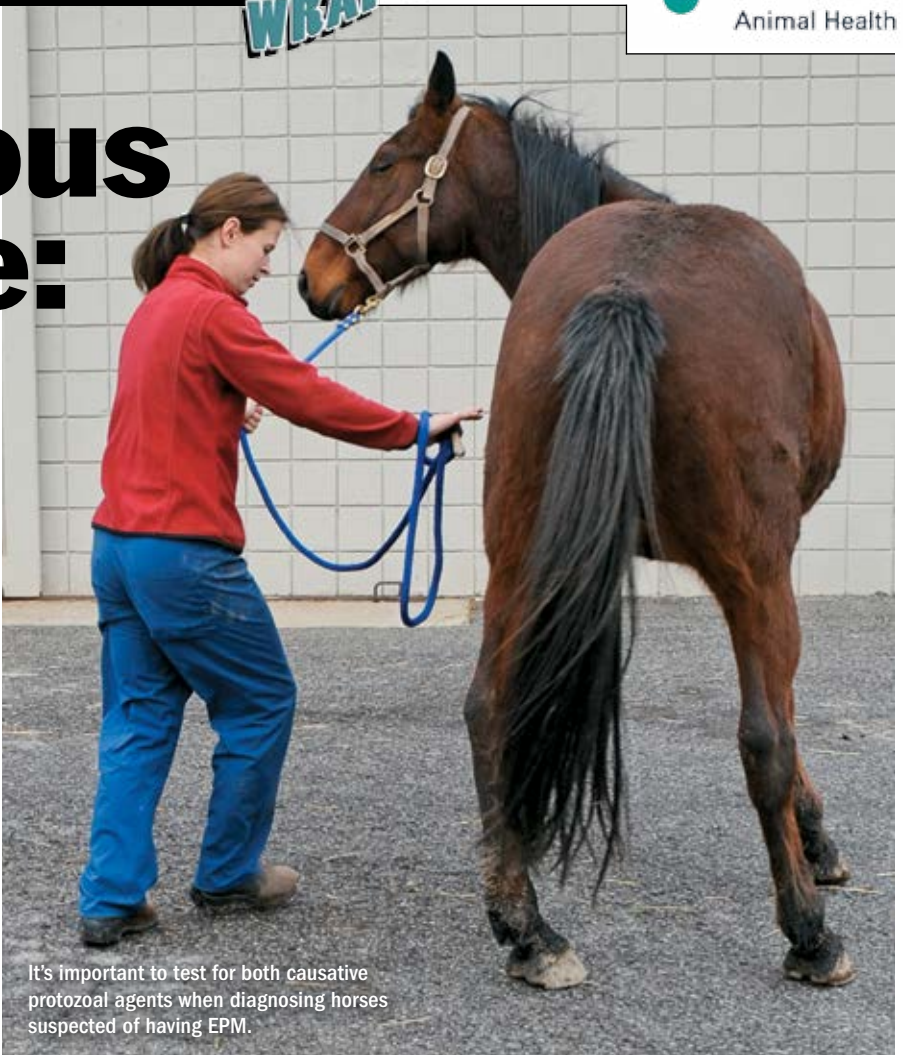
Infectious Disease: EPM

CHRISTY CORP-MINAMIJI, DVM



MATHEA KELLEY

It's important to test for both causative protozoal agents when diagnosing horses suspected of having EPM.

EPM-Causing Organisms Widespread Among U.S. Horses

The neurologic disease equine protozoal myeloencephtalitis (EPM) is caused by two protozoal agents, *Sarcocystis neurona* and, less commonly, *Neospora hughesi*. While researchers have long understood *S. neurona*'s life cycle and transmission, their understanding of *N. hughesi* is less concrete. To compare the two, a research team analyzed prevalence factors associated with suspected EPM in horses that tested seropositive or negative for *N. hughesi* and/or *S. neurona*.

Nicola Pusterla, DVM, PhD, Dipl. ACVIM, professor in the Department of Medicine and Epidemiology at the University of California, Davis (UC Davis), and colleagues evaluated the history of horses with serum samples submitted to UC Davis' Immunology Laboratory from Dec. 1, 2010, to Nov. 30, 2011. The samples were analyzed for *N. hughesi* and *S. neurona* antibodies using an indirect immunofluorescent antibody test. They evaluated 3,123 submissions, with horses ranging in age from 1-37. Horses from 25 states tested seropositive for *N. hughesi* while horses from 41 states tested seropositive for *S. neurona*.

The team then divided horses into four groups according to serological results: *N. hughesi*-positive; *S. neurona*-positive; *N. hughesi*- and *S. neurona*-positive; and *N. hughesi*- and *S. neurona*-negative. They found no statistical correlation between gender and group. They did note correlations between breeds and groups: There were more *N. hughesi*-positive, *S. neurona*-positive, and dual positive EPM suspected horses among Quarter Horses than other horse breeds; there were fewer *N. hughesi*-positive results in Thoroughbreds; and Warmbloods showed the fewest positive results for each type of protozoon and had the highest representation in the negative group.

The researchers noted that horses with a head tilt were more likely to be in the dually positive group, and ataxia correlated with a positive *S. neurona* titer.

Both organisms have a wider geographic distribution than commonly thought. It is therefore important to test for both pathogens when evaluating a horse suspected of having EPM, Pusterla concluded.

New EPM Treatment Dose Examined

Veterinarians have been treating EPM with ponazuril (Marquis) since the FDA approved the antiprotozoal in 2001, but fine-tuning an effective treatment protocol is always a work in progress. In lab studies scientists have shown ponazuril must reach a particular concentration in the cerebrospinal fluid (CSF) to kill *S. neurona*, so clinicians wondered if they could minimize *S. neurona*-caused damage by starting with a stronger loading dose.

Stephen Reed, DVM, Dipl. ACVIM, of Rood & Riddle Equine Hospital, in Lexington, Ky., and colleagues re-examined how horses' bodies process and maintain ponazuril. The team administered ponazuril in eight adult horses, giving each a single oral dose at the labeled 5 mg/kg rate. They obtained serum and CSF samples from the horses over the next eight days.

The researchers then calculated that with this dose, it would take approximately one week to reach a steady-state concentration of the ponazuril level that's lethal to *S. neurona*. They extrapolated from this model to conclude that a 15 mg/kg loading dose would produce steady-state concentrations immediately.

Reed said ponazuril is very safe; veterinarians conducting safety trials used up to six times the label dose without ill effect.

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Gastrointestinal Tract

Using a stent bandage significantly reduced the likelihood of incisional infection post-colic surgery.

COURTESY DR. AZIZ TNIBAR

CHRISTY CORP-MINAMIJI, DVM
NANCY LOVING, DVM

Stent Bandage Prevents Infection

Applying a stent bandage—a thick, nonadhesive bandage attached by sutures over the incision line—following colic surgery can dramatically decrease the risk of incisional infection, said Aziz Tnibar, DVM, PhD, Dipl. ECVS, of the Department of Large Animal Sciences of the University of Copenhagen.

In a comparative retrospective study evaluating the effects of stent bandage placement following colic surgery, Tnibar and his colleagues found that horses with stent bandages placed prior to anesthetic recovery were more than eight times less likely to develop incisional infections than horses without stent bandages.

The study involved 135 horses that had undergone abdominal surgery via a ventral midline approach and had survived more than 10 days post-surgery. Horses were assigned to one of two groups based on whether a stent bandage had been placed following surgery. Bandages were left in place for as many as five days with daily disinfection of the stent sutures, followed by use of a flat belly band.

Surgeons were randomly distributed across the two groups, so the effect of the surgeon on postoperative infection was thought to be negligible. Outcomes were assessed on the basis of whether they were infected or not. Tnibar reported a 2.7% infection rate in the stent group vs. a 21.8% infection rate in the nonstent group.

Tnibar said the stent bandage appears to create an ideal environment for healing by decreasing the tension on the suture line, reducing swelling, and protecting the incision from external contamination.

Because this was a retrospective study, Tnibar suggested that researchers would need to conduct a randomized, controlled study to accurately assess the specific effect of a post-surgical stent bandage. "This study showed that the use of a stent bandage significantly reduced the likelihood of incisional infections in horses undergoing colic surgery," he summarized.

Decoding Small Intestine Problems with Ultrasound

The sooner a veterinarian can determine whether a colicking horse requires surgery, the better the horse's chances of survival. Colic of the small intestine can be particularly tricky since it is not always easily felt on rectal palpation. Ultrasound examination can be used to gain visual clues into some causes of small intestinal colic.

Michelle Henry Barton, DVM, PhD, Dipl. ACVIM, Fuller E. Callaway Endowed Chair and professor of Large Animal Medicine at the University of Georgia's College of Veterinary Medicine, reviewed transabdominal ultrasound techniques for diagnosing colic caused by problems in the small intestine. Veterinarians can use a low-frequency, curvilinear ultrasound probe placed on the horse's flank to assess key features of the small intestine, including motility, degree of distension, intestinal wall thickness, and intestinal contents.

Barton said veterinarians can identify a normal small intestine on transabdominal ultrasound in only 10-30% of healthy, fed horses. In the healthy horse, waves of contraction called peristalsis move ingested food along the intestine. When this motility gets interrupted, it's called ileus. Veterinarians can identify the distinct pattern of ileus using ultrasonography. As gas builds up in the intestine, it creates an increasing series of hairpin turns that make the intestine resemble a series of switchback trails rather than a long, winding road.

In mild ileus cases resulting from paralysis secondary to a medical condition such as enteritis (small intestine inflammation) the intestinal wall might appear normal, whereas in more severe cases it might look thicker and possess irregular "lasagna noodle" mucosa. In either case, this ileus should resolve gradually with fluid therapy and time, said Barton, and veterinarians should see some motility on ultrasound.

In contrast, mechanical ileus continues to worsen, despite therapy, resulting in a larger number of hairpin turns. In some cases the intestine becomes so distended that the loops of bowel look like nearly perfect circles when the probe is turned so as to view a cross-section of the intestine.

Vets can also use ultrasound to distinguish between strangulating and nonstrangulating obstructive lesions. In the case of nonstrangulating, ultrasound might help the veterinarian determine if the obstruction is severe enough to warrant surgery.

In summary, Barton said ultrasound can be a valuable aid to practitioners when assessing the cause and severity of colic secondary to small intestine disease.

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GAYLE STRICKROOT

Muscular activity generates a great deal of heat that the body must eliminate. Watch exercising horses closely and help them cool and rehydrate as needed so they don't reach exhaustion.

Managing Emergencies

ERICA LARSON

Managing Dehydration, Exhaustion

Horses can lose up to 15 liters of sweat per hour during strenuous exercise, leaving them in a precarious metabolic balance that cold water hosing alone can't touch. Emma Adam, BVetMed, Dipl. ACVIM, ACVS, a practitioner performing research at the University of Kentucky Maxwell H. Gluck Equine Research Center, described ways veterinarians can manage severe dehydration and exhaustion.

Signs that a horse is approaching or has reached severe dehydration include:

- Excessive sweating (and associated electrolyte and isotonic fluid loss);
- A lack of perspiration (the horse has stopped sweating in spite of continued exercise and hot ambient conditions);
- Gastrointestinal (GI) tract dysfunction, including minimal gut sounds, no manure being passed, or loose stool;
- Anxiety and muscle twitching or, in severe cases, a lack of responsiveness;
- Synchronous diaphragmatic flutters (commonly called "thumps,");
- Rhabdomyolysis (tying-up); and
- Kidney dysfunction.

She noted that in severe cases, laminitis can be a possible consequence.

Adam said if she sees horses exhibiting a combination of severe dehydration and any of the aforementioned signs, typically she considers them exhausted.

If the horse is mid-workout when a rider notes signs of problems, he or she should stop exercise immediately and turn attention to cooling and rehydrating the horse.

Remove all tack, blankets, wraps, etc., and apply "copious volumes" of cold water all over the horse; if necessary, use ice water or add isopropyl alcohol (rubbing alcohol) to the icy water, which helps to cool it more efficiently. Adam stressed that the handler should scrape water off immediately, reapply, then scrape it off again to prevent it from becoming an insulator as it warms. Use fans to help cool the horse or bring the horse into a shady area.

Adam said one of the first things a veterinarian should do is place an intravenous (IV) catheter in one or both jugular veins to facilitate IV fluid therapy. Bear in mind that some severely dehydrated horses might require up to 60 to 80 liters of fluid over a six- to 12-hour period to effectively rehydrate. Her first choice for IV fluid is 0.9% normal saline with added potassium and possibly calcium, but any polyionic isotonic fluid will work. Permit the horse to drink if he desires, but monitor the GI tract closely to ensure gastric reflux does

COURTESY REBECCA GIMENEZ

Horses that survive barn fires can suffer burns to their skin, eyes, and respiratory tract.

not occur due to related exertional ileus (lack of gut motility). Exertional ileus is a common side effect of dehydration and exhaustion that typically resolves when fluid and electrolyte balances return to normal.

A dehydrated horse could have other internal problems (e.g., renal damage) that influence prognosis. Adam advised veterinarians to refer horses to a hospital when:

- They do not urinate after receiving roughly 40 liters of IV fluid;
- They develop respiratory distress, cardiac arrhythmias, or signs of colic; and/or
- They do not respond to therapy after several hours.

Most horses recover well from dehydration and exhaustion, Adam concluded. Complications typically do not hinder recovery, although life-threatening conditions such as multi-organ failure and laminitis can occur in serious cases.

Barn Fires: The Veterinarian's Role

A barn engulfed in flames, terrified whinnies coming from inside. Few scenarios are more frightening to owners of stable-kept horses. Practitioners, with their regular trips to the barn, are in a unique position to advise owners on fire prevention. It's impossible to eliminate any possibility of a barn fire, but Adam said "fireproofing" barns can decrease the likelihood of a devastating fire igniting and can reduce insurance premiums by 5 to 10%.

If owners are planning/building a barn:

- Consider having stall doors that open to both the aisle and exterior of the barn;
- Ensure there are enough electrical outlets to service the number of stalls; and
- Reduce the amount of wood used in barn and stall construction.

In existing barns:

- Ensure barn and stall doors are in good repair and open easily;
- Conduct regular checks and maintenance on electrical outlets and wiring.
- Pile manure away from the barn;
- Remove dust, debris, and cobwebs, especially around electrical equipment;

> **"When called to a barn fire, take instruction from the fire department's on-site leader."**
>
> DR. EMMA ADAM

- Remove accumulating flammable material, such as hay waste or bailing twine;
- Install heat and/or smoke alarms and a sprinkler system, if possible;
- Install lightning rods;
- Keep a functional fire extinguisher handy and know how to use it;
- Make sure everyone who frequents the barn understands fire safety and fire extinguisher use; this might mean translating guidelines into other languages;
- Avoid storing hay/straw in the barn; and
- Avoid storing fuel-filled vehicles near livestock.

Even with the strictest safety precautions, fires still occur. Affected horses can suffer burns to their skin, eyes, and respiratory tract, along with more severe consequences such as shock and internal organ failure. Immediate veterinary care is crucial to improve horses' chances of survival.

Practitioners treating victims at a fire scene must stay calm, focused, and safe.

"When called to a barn fire, take instruction from the fire department's on-site leader," she said. "Treat the horses that have already been removed from the fire, and do not enter the barn fire area."

Take a moment to assess the situation:

- Where are horses located relative to the fire? Will burns be the major concern? Will smoke inhalation or carbon monoxide poisoning be significant issues?
- What materials burned? Could horses have inhaled toxic fumes or substances?
- How stable is the barn structure? Have horses been struck with falling debris?

These factors could help veterinarians provide the most appropriate triage care before referring patients to a hospital for further evaluation and treatment, she said.

The key to dealing with barn fire victims is to treat each horse immediately and aggressively, Adam said, as if you're addressing serious shock. There's often latent damage, both inside and outside of the horse's body that's not evident initially.

"The mainstay of initial therapy is cardiovascular stabilization," Adam said. Veterinarians should place a long-term IV catheter in the patient's jugular vein and start fluid replacement therapy quickly, before tissue edema (fluid swelling) hampers vein access. In addition to isotonic fluids, she suggested administering hypertonic saline solution but noted that—if available—frozen plasma can be used as well.

Note that many horses might require a temporary tracheostomy immediately due to facial burns or laryngeal swelling.

Next, Adam said, consider administering the diuretic furosemide; many practitioners believe diuretics offset the risk of potentially fatal pulmonary edema (fluid buildup in the lungs), she said. Using furosemide in this scenario is controversial in human medicine, she said, but "I use it because I've seen what happens without it." The only way to diagnose equine pulmonary edema in the field is to watch for

a pink froth at the nostrils, she explained. Unfortunately, there is little that can be done to help the horse once this happens.

Adam said she also would administer a low dose of short-acting, rapid-onset corticosteroids to help stabilize horses' cell membranes. Some veterinarians use antimicrobials—both topically on burns and systemically—to help protect horses from environmental bacteria, she explained. It's also typically beneficial to administer anti-inflammatory and/or analgesic drugs—such as flunixin meglumine or phenylbutazone (Bute)—after starting fluids, she said.

After care at the scene of the fire, the veterinarian should refer horses to a hospital for further treatment. It's difficult to provide a prognosis—or an estimate on treatment cost—after initial care, since it can be tough to know the extent of cutaneous, ocular, and systemic organ damage.

Veterinarians responding to barn fires must often decide if euthanasia is the most humane course of action for severe cases.

Overall, treat each case individually and, most importantly, she said, "Stay safe."

Medication Mishaps in Horses

Try as they might to avoid them, veterinarians will manage medication mishaps, whether they or a tech inadvertently reached for the wrong drug or an owner administered an inappropriate medication. Adam explained how practitioners should handle such scenarios and listed precautionary measures to take.

Adverse drug reactions (ADRs) generally fall into one of two categories: idiosyncratic (reaction is unpredictable, might or might not recur in a given individual, and/or might become worse with repeated exposure, such as allergic reactions or hypersensitivity) and dose-related.

Adam said most drugs used in equine veterinary medicine can produce an ADR if not used carefully. Many can be toxic even if given at doses, frequencies, and durations necessary to effect a cure in the horse. And possible side effects aren't limited to systemic reactions; for instance: horses can develop skin irritation at administration sites, whether they're oral, intramuscular (IM), or IV. Giving even seemingly common and innocuous medications such as Bute and flunixin meglumine can have serious consequences. Both can damage the stomach and kidneys if not monitored properly; Bute is not licensed for IM injection and causes "massive tissue sloughs" if given IM; and flunixin meglumine—if given via an IM injection—can cause extensive tissue damage, infection, and even clostridial myonecrosis ("gas gangrene").

Clinical signs of an ADR vary, but they commonly include hives, diarrhea, swelling in all four limbs, or petechiation (small purple spots on mucous membranes). In the event of an ADR, the first step is to stop administering the drug believed to have caused the reaction. Then, she said, "it is essential to communicate about the situation calmly with the owner. Be transparent, be honest, and carry on formulating a plan to treat the horse."

Veterinarians should report any ADRs to the drug manufacturer. "Drug companies go to great trouble and expense to get products safely on the market," she said. "However, testing the product is obviously not possible on a limitless number of animals and, as such, it is our responsibility to help with this process."

She also touched on accidental overdoses, noting that inappropriate dosing is not uncommon in veterinary medicine, "but a lot less common than in human medicine."

Accidental administration of the wrong drug Veterinarians must remain calm and focused and inform the owner about what is transpiring or what has occurred in these cases. They should gather as much information as possible about a situation in which they, their tech or assistant, or the owner gives the wrong drug before proceeding. In some cases veterinarians should seek help from other sources if they're unsure how to best proceed.

Follow-up care depends on the drug administered and subsequent health risks posed, if any. Some cases require support such as fluid therapy, drug reversal agent administration, and/or additional drugs to return the horse to normal, she said. Each drug requires different protocol.

STEPS TO PREVENT MEDICATION MISHAPS

While we can't eliminate mistakes completely, Emma Adam, BVetMed, Dipl. ACVIM, ACVS, offered some suggestions for veterinarians that could help reduce the number of medication mishaps that arise:

- Be familiar with different drugs' physicochemical properties, and know when each should and should not be used;
- Arrange medications in cabinets or drawers thoughtfully and carefully;
- Add harmless dyes to certain clear liquids, such as mineral oil or rubbing alcohol, so you can quickly tell which one is which;
- Keep medications with similar appearances but different functions in separate areas;
- Consider labeling medication jars using tape and markers;
- When administering drugs to foals with intravenous catheters and nasogastric feeding tubes, differentiate the two ports, either with labels or different tube connections;
- Ensure anyone tasked with administering medications has written instructions (and in the case of caretakers who might speak a different language, Adam said, ensure they have access to instructions written in their native tongue); and
- Because fatigue has been shown to play a role in making mistakes—and many equine veterinarians find themselves overworked on a regular basis—Adam said to double-check your work (be it if you're administering drugs or leaving an owner with medication administration instructions), as well as your team's, for accuracy.

Convention Tweet

Ashley E. Craig, DVM
@ashleycraigdvm

"In emergencies, in the words of Churchill - keep calm and carry on" #AAEP2012 Great line!

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ERICA LARSON

Ethics

ERICA LARSON
NANCY LOVING, DVM

Veterinarian-Client-Patient Relationship Overview

Establishing and maintaining an active, functional veterinarian-client-patient relationship (VCPR) is the cornerstone to providing the best care for horses, said Richard Lesser, DVM, of Equine Clinic at OakenCroft, in Ravena, N.Y., during a recent veterinarian discussion on ethics. This VCPR is a legal "contract" between the veterinarian and the horse owner and/or trainer (client), and it implies that they will consult each other about the health of the horse (patient) following an examination.

Harry Werner, VMD, of Werner Equine, in North Granby, Conn., explained that the VCPR implies that the veterinarian has assumed responsibility for making clinical judgments, that the owner has consented, and that the veterinarian has sufficient information about the horse to make appropriate clinical decisions.

Broodmare, Pleasure, and Show Practice Each segment of equine practice can present different VCPR challenges. Lesser reported the many challenges broodmare practice can introduce. These horse owners are generally off-site, which can complicate veterinarian-owner communication. Lesser remarked, "It helps to have a discussion with owners as to their exact expectations, while at the same time providing them with information as to what the veterinarian can deliver."

Lesser also treats pleasure and show horses, noting that in his experience these animals' owners frequently communicate with their veterinarians and therefore pose fewer problems in the VCPR realm.

> **"Just because a vet may have briefly seen the horse or trainer doesn't mean there is an active, valid, and licit relationship."**
>
> DR. RICHARD LESSER

It's not just a matter of owner and veterinarian conversing, however. "The letter and spirit of the law should be followed, as for example when it comes to prescribing medication," Lesser added. "Just because a veterinarian may have briefly seen the horse or trainer doesn't mean there is an active, valid, and licit relationship."

He emphasized that a valid interaction means the veterinarian has seen the horse within the past year and dispensed medication after examining the horse for a specific problem.

Sport Horse and Ambulatory Practice Karen Nyrop, DVM, of Calgary, Canada, weighed in on VCPRs in sport horse and ambulatory practice. "A VCPR is established when the person calls and asks for services," she said. "Usually this entails face-to-face communications and exam of the horse."

However, she added, "There are situations when the trainer and/or owner are not present, and other challenges present when the horse has been seen by multiple other veterinarians with no accompanying medical records or documentation."

For example, "Emergencies may or may not be restricted to previously established relationships," she said. "This can be difficult in an emotionally charged case."

If veterinarians conduct long-distance prepurchase exams it further stretches the need for optimal VCPR: Practitioners must communicate clearly what veterinary services they offer, along with determining the buyers' expectations.

Another challenging situation arises at sales and sport horse auctions, Nyrop said: "There can be conflicts of interest at these venues when the seller's vet takes the required radiographs and reads the films for the sale, or the sales vet works for the sales company rather than for the buyer."

Racehorses Racetrack practitioner Jeff Blea, DVM, of Von Bluecher, Blea, Hunkin Inc., in Sierra Madre, Calif., described VCPRs in the Thoroughbred industry.

"The vet is responsible to both the trainer and the owner, and the owner should have access to all information," he said. "The trainer may tell the owner everything but may not always explain it well. Therefore, at times it may be best to have the vet directly explain information to the owner."

Misunderstandings can and will arise, for example, if an owner gets a bill for unexpected procedures, he noted.

To sum up a proper VCPR, Werner quoted Abraham Verghese, MD, a Stanford University physician and author: "A proper examination earns the patient's trust … and serves as a ritual that transitions two strangers into a doctor and patient."

In closing, Werner recommended that veterinarians "listen well, speak well, empathize, maintain clinical skills, record findings, respond, and follow through."

Functional Veterinarian-Farrier Relationships

The collaborative dynamic between veterinarian and farrier is important to

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ensuring a horse remains sound and receives the best possible hoof care, said William Moyer, DVM, of Texas A&M University's School of Veterinary Medicine, and Werner.

"A partnership with a farrier is important to the health and welfare of the horse, particularly if a veterinarian doesn't possess the necessary skill set to deliver competent hoof care," Werner said. He also remarked that the high incidence of human orthopedic injuries associated with farrier work underscores the importance of hiring a well-versed, experienced farrier.

Moyer noted that farriers can work on horses in the United States without certification, whereas in the U.K. they must complete a four-year apprenticeship. Also, American shoeing schools are not regulated, and many farriers are self-taught. "One organization, the American Association of Professional Farriers, has made a positive contribution by requiring continuing education credits of its members," he said.

Both practitioners urged veterinarians to share complete case information and comprehensive instructions with the farrier in clear, nontechnical language; some farriers have more of a medical background than others. They also recommended including the client in this discussion, actively encouraging him or her to participate as an integral part of the decision-making process. If the farrier isn't available during the farm visit, the veterinarian should leave written instructions for the farrier and follow up with a phone call.

Both presenters urged farriers to appreciate veterinarians' expertise and scientific knowledge, along with practitioners' ability to pursue diagnostic techniques and imaging. Similarly, veterinarians should recognize that many farriers have valuable knowledge and practical experience. No matter a farrier's breadth of experience, always keep in mind what the law permits: As Moyer stated, "It is illegal to operate technology that produces radiation without a license or licensed supervision because of public health hazards. With this in mind, farriers should not be taking radiographic images or making diagnoses."

Above all, clear communication is key, and "problems with a horse's care are best conveyed to all parties so there are no surprises for the owner, trainer, vet, or farrier," said Werner. This approach ensures all parties are seeking the best welfare outcome for the horse. Moyer advised veterinarians to clearly articulate instructions for how aggressive the farrier should be in his or her approach. It's also important to make sure the farrier is comfortable with executing these treatment plans.

Finally, Moyer instructed the veterinarians on outcomes: "Don't blame an adverse result on a farrier, but instead … look critically at the disease process as a significant reason for treatment failure."

Bottom line, both Moyer and Werner prescribed communication and cooperative planning when approaching a horse's feet as a veterinarian-farrier team. In short, Moyer said, "Conflict prevention is far better than conflict resolution."

ETHICAL ISSUES FOR RACETRACK VETS

Extra scrutiny has been placed recently on the responsibilities and ethical standards expected from veterinarians who dispense medications to racehorses.

No decisions on the backside of tracks are black and white, and many of the most difficult decisions practitioners encounter are out of their control, said Jeff A. Blea, DVM, a private racetrack practitioner in Sierra Madre, Calif. Still, he said these situations don't absolve racetrack veterinarians who must "explore and employ the highest ethics in practice."

ANNE M. EBERHARDT

Dr. Blea called on racetrack practitioners to use and distribute meds responsibly.

One way vets can facilitate change and promote ethical behavior is by charging for services, rather than only for dispensing medication—a common practice among racetrack veterinarians. This eliminates the perception that a veterinarian is simply out to sell a medication without regard for its necessity. He called on racetrack practitioners to use and distribute medications responsibly and to review the AAEP's "Clinical Guidelines for Veterinarians Practicing in a Pari-Mutuel Environment."

The public perception of medication use in racing is another big challenge practitioners face, Blea said, noting a Thoroughbred trainer once said that a good veterinarian with ethics is not going to do very well in racetrack practice. Blea said he takes exception to this trainer's opinion but also recognizes that ethical questions remain among the toughest to address.

"We're still discussing ethics and we're still discussing medications," he said. "Do we still have an image problem? Yes."

Blea stressed the point of his presentation was not to point fingers or place blame but to "stimulate awareness and discussion among (AAEP's) membership" and to prompt "self-examination of ethics in racetrack practice."

"At the end of the day, we need to do the right thing for the right reason," he concluded. "We have an obligation to the horse, industry, profession, and ourselves to take responsibility for our actions."

Convention Tweet

Stephanie L. Church
@TH_Stephanie L. Church

Vets discussing compounded meds. Still a touchy issue, & still some debate over what's legal/ what isn't.

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Reproduction

Breeders might overlook examining an apparently healthy mare in the face of a seemingly thriving foal.

PHOTOS.COM

STACEY OKE, DVM, MSC

Keeping Mares in Foal

Timely intervention can mean the difference between a live foal and a lost one. "In some cases, by the time a breeder or equine veterinarian recognizes the mare is showing signs of premature birth, any assistance is likely insufficient, resulting in a weak foal unlikely to survive," said Kristina Lu, VMD, Dipl. ACT, of Hagyard Equine Medical Institute, in Lexington, Ky.

One-third of all stillbirths and deaths within 24 hours of birth are due to infections of the fetoplacental unit, she noted. Other causes include bacterial infections, complications during birth, congenital anomalies (e.g., contracted foals—those that are very upright or buckled forward at the pasterns, fetlocks, and/or knees), premature placental separation, and twins.

"If we can manage infection and inflammation … we are targeting approximately one-third of the problem," Lu noted.

If Lu suspects or diagnoses infection, she treats the mare with pentoxifylline (to reduce inflammation), administers antibiotics, and gives the synthetic hormone altrenogest to help maintain pregnancy.

Other options to consider on a case-by-case basis for maintaining pregnancy include using tocolytic drugs to suppress uterine contractility, nasal oxygen delivered to the mare to increase oxygen delivery to the foal, and a technique called cervical cerclage, which involves tying a suture around the cervix to prevent bacteria from reaching the uterus through the vagina and cervix. Veterinarians use the latter technique only sparingly, and they must remove the suture prior to foaling.

> **"In some cases, by the time a breeder or veterinarian recognizes the mare is showing signs of premature birth, any assistance is likely insufficient."**
>
> DR. KRISTINA LU

Health During the Final Countdown

Even in seemingly healthy mares, pregnancy in the final month can quickly change from heavenly to horrific.

"In the past five years, substantial progress has been made identifying high-risk mares and devising appropriate management plans," relayed Tibary.

Such mares include old maiden mares, those with cervical defects, and mares with a history of either recurrent pregnancy loss or of medical/surgical problems that pregnancy can exacerbate (e.g., equine metabolic syndrome). Five major problems to consider in the final pregnancy month:

1. ***Colic*** Whether due to genital (e.g., uterine rupture) or nongenital (e.g., intestinal) causes, colic is relatively common in the late-pregnant mare. Veterinarians might need to take steps to avoid premature foaling in the colicking mare.
2. ***Abnormal vaginal discharge*** This can be challenging to recognize; look for clumped hair under the tail. Bloody discharge or a combination of mucus and pus should warrant veterinary examination; the latter indicates infection and requires immediate treatment.

3. ***Abnormal mammary gland development*** This includes premature udder development or lack of development altogether. The former along with a mucopurulent vaginal discharge suggests placentitis (placental infection). A mare with premature udder development might be carrying twins, or the condition might warn of impending abortion. Fescue toxicity can prevent udder development, or an udder might develop unexpectedly simply because someone recorded the incorrect breeding date.
4. ***Abnormal abdominal development or shape*** The most common causes include prepubic tendon rupture (which supports the mare's abdomen—rupture is painful, makes foaling difficult, and is life-threatening) or mammary suspensory ligament, development of a body wall hernia, or production of too much amniotic fluid. A rectal exam and transabdominal ultrasound can help diagnose the cause and guide management.
5. ***Other*** Accidents, prolonged pregnancy, and musculoskeletal problems (e.g., osteoarthritis) can negatively impact a broodmare's health.

If any one of these problems develops, it is imperative to stabilize the patient with intravenous fluids, anti-inflammatory drugs, and antimicrobials.

"Owners need to carefully monitor their pregnant mares to quickly recognize if a problem is developing, and veterinarians must devise suitable treatment plans," Tibary concluded. "Referral should be considered in all cases … particularly if close and continual observation is not possible."

Metabolic Syndrome and Pregnancy

Equine metabolic syndrome (EMS)—defined as obesity, insulin resistance, and high blood insulin levels—is dangerous for any horse, but it puts pregnant mares in especially precarious situations. It's crucial to address EMS and related conditions (i.e., laminitis) in mares to minimize risk of fetal compromise and abortion.

"During pregnancy, metabolic syndrome is a normal occurrence because it helps redirect nutrients from the mare to the developing foal," explained Peter Morresey, BVSc, MACVs, Dipl. ACT, ACVIM, of Rood & Riddle Equine Hospital, in Lexington, Ky. But problems can arise if the mare already has EMS before she's in foal.

"In mares that have metabolic syndrome before they become pregnant, the condition can become exacerbated," he said. For example, EMS mares have alterations in insulin and lipid (good and bad fats) circulating in their bloodstream, can develop laminitis, and potentially abort.

These mares are generally less sensitive to the hormone insulin than their healthy counterparts, resulting in higher-than-normal blood glucose levels. To help normalize insulin dynamics during gestation, Morresey suggested owners take the following steps:

- Feed these mares only hay/hay substitute, remove grain and sweet feeds from their diets, and restrict pasture access;
- Consider exercise if laminitis isn't a concern, to help control obesity; and
- Discuss using metformin (an oral antidiabetic drug), L-thyroxine (a thyroid supplement), and/or pergolide (for equine Cushing's disease) with your veterinarian; these could benefit some horses.

"Laminitis in horses with metabolic syndrome is a major concern," Morresey advised. Consult a farrier or podiatrist immediately in such cases. "Aggressive and early management of this condition (such as cryotherapy—intensely cooling the horse's feet) is paramount to a successful case outcome," saving the mare.

Top 3 Reasons for Embryonic Death

Pregnancy loss in early gestation can be perpetually perplexing; after taking measures to protect embryos visible at Day 15 after ovulation, mares can come up empty.

ACUPUNCTURE STUDY: NO OVULATION IMPACT

Canadian researchers recently showed that you can lead a mare to a stallion, but you can't necessarily make her ovulate … even using acupuncture.

Acupuncture is a popular traditional therapy in China, but physicians and veterinarians in Western countries have not yet fully adopted this adjunct medical technique. This is partly due to lack of scientific evidence supporting its efficacy, noted Nora Huaman Chavarria, DVM, MVetSc, of the University of Saskatoon's Western College of Veterinary Medicine. Veterinarians already use acupuncture for a wide variety of mare conditions, such as sub- or infertility, so she set out to study its usefulness.

"We hypothesized that acupuncture might help induce ovulation in mares based on some convincing evidence in human studies that found acupuncture treatments have a positive effect on irregular cyclicity and, therefore, infertility in women," said Chavarria.

The researchers randomly split 30 healthy, cycling mares into three groups. They treated the first group with the hormone human chorionic gonadotropin (hCG), which is known to induce ovulation. They administered saline and performed acupuncture in the second and third groups, respectively.

"This study did not find any impact of acupuncture on ovulation," she noted. "Further, no changes in hormone profiles were noted between any of the three treatment groups."

Some equine reproductive specialists have embraced acupuncture, and anecdotal reports of success abound. As such, Chavarria believes further research into equine acupuncture is warranted. "Well-designed clinical trials will help clinicians and owners make the right decision in the choice of treatment for a specific condition," she concluded.

ANNE M. EBERHARDT

Acupuncture did not impact ovulation when performed on a group of healthy, cycling mares.

Convention Tweet

Ernie Martinez, DVM
@emartinezdvm

Dr Samper - Dystocia in otherwise healthy mare, suspect compromised foal. Foal plays active role in normal delivery.

If laminitis is not a concern, exercise pregnant mares with metabolic syndrome to control obesity.

JENNAY HITESMAN/MANEPHOTO.COM

Tom Stout, VetMB, PhD, of the Department of Equine Sciences at Utrecht University, in The Netherlands, said that the majority of pregnancies, more than 60% in fact, are lost by Day 42 after ovulation.

Scientists know few reasons for early embryonic death (EED) and how to prevent it. They generally believe a "progesterone insufficiency" is the underlying cause, but Stout said that's not often (or always) the cause of EED. Causes include:

1. Embryonic abnormalities (e.g., a chromosomally abnormal embryo or a conceptus that is smaller than expected);
2. Inadequate maternal environment (e.g., an aged/degenerate uterus provides inadequate nutrient provision, or unresolved uterine infections resurge); and
3. External factors (e.g., severe stress).

"Currently, the best ways to prevent EED are nonspecific, but still very important," Stout relayed, and they include:

- Managing the mare carefully to minimize persistence of post-breeding endometritis—the normal inflammation of the lining of the uterus after mating. This clears in normal mares but can prevent conceptus establishment if it lingers.
- Addressing anatomical defects that permit air/urine to accumulate in the vagina, which can contribute to endometritis;
- Reducing twin pregnancies;
- Maintaining a closed herd to prevent disease transmission that could compromise pregnancy; and
- In some cases, your veterinarian might prescribe pharmacological treatment.

Stout noted, "Many cases of EED are probably not preventable and, although some methods aimed at preventing EED are in common use they may be successful in only a small proportion of cases."

Mating your Mare Postpartum

In most performance horse circles successful broodmares are expected to have one foal per year for six out of seven years. This stirs up the perennial question, should you breed on foal heat?

"There is only a period of approximately one month after foaling to establish pregnancy if the mare is to foal at the same time the following year, which is often desired," explained Stout. Although mares come into heat within five to 12 days of foaling, and many can conceive, they might not be ready to maintain pregnancy. The uterus might not be fully finished undergoing normal involution (returning to its regular size and shape), making it uninhabitable by a fetus, or the mare could develop post-breeding endometritis.

"The major dilemma for breeders is whether to breed on the foal heat or to wait until the second heat, when there is a better chance of pregnancy maintenance," noted Stout. "The catch is … not all mares cycle normally following the foal heat."

Factors to consider when making this decision include:

- ***Time of year the mare foals*** Mares foaling early in the year might be more at risk of not resuming normal cycles after the foal heat (due to decreased daylight when mares' cycles are normally

quiescent; keeping such mares under lights starting two to three months before foaling can help avoid this). Late foaling leaves fewer breeding chances, making breeding on foal heat appealing.

- ***Complications related to foaling*** If the mare had placentitis, a dystocia, retained fetal membranes, etc., you should avoid breeding on the foal heat.
- ***History of endometritis*** Mares with a history of endometritis might be more likely to develop it if bred on foal heat.
- ***Results of a pre-breeding clinical exam*** Performed six to eight days post-foaling, and not to be confused with the post-foaling exam that all mares and foals should have within 24 hours of foaling, a rectal exam and ultrasound can help the veterinarian determine whether the uterus is involuting well and whether ovulation will soon occur (usually around 10-15 days post-foaling).

There are ways to manipulate the mare pharmacologically to either optimize uterine involution or delay foal heat; but Stout recommended skipping the drugs and opting instead to perform an exam eight to nine days after foaling to assess involution and estimate the next ovulation date.

"If the first ovulation date is known then a mare can be treated pharmacologically to shorten the time between heats, which can save a few valuable days," he advised.

In other words, if the uterus is involuting well at eight to nine days after foaling and there is no evidence of any other issues, then breed on. Otherwise, try to get her to cycle normally to ensure there is no delay between foal heat and the next regular heat. This will also allow the uterus to recover, while not pushing the mare too far off the breeding calendar for the year.

Optimize lighting, nutrition, and exercise to minimize these "days lost" and maximize involution.

Beware of Problems up to Two Weeks after Foaling

Even though a mare and foal might seem fine initially after birth, complications in the mare can arise anytime during the immediate postpartum period, which lasts up to two weeks after foaling, said Ahmed Tibary, DVM, PhD, Dipl. ACT, from Washington State University's College of Veterinary Medicine.

"All mares should be examined by a veterinarian within 12-18 hours of foaling, even when everything seems to be normal," he advised. "Examination … should begin by simply observing the foal. Many postpartum conditions will result in poor foal-mare bonding."

> **"The major dilemma for breeders is whether to breed on the foal heat … (but) not all mares cycle normally following the foal heat."**
>
> DR. TOM STOUT

He also recommended owners keep the placenta in a cooler until a practitioner can examine it and hold off on giving oxytocin (to help the uterus expel fetal membranes) until he or she directs.

Some issues in the immediate postpartum period can be mild, such as behavior issues and foal rejection. Others are much more serious. In cases of known retained placenta, if the mare is colicky, or if she had a difficult labor (dystocia), Tibary recommended conducting advanced clinical evaluation, including transabdominal ultrasound or even hospitalization.

Other specific life-threatening conditions in the postpartum period include:

- Septic metritis, an infection of the uterus that can lead to laminitis;
- Hemorrhage from the urinary and/or genital tract (may or may not be visible);
- Uterine tears, rupture, or prolapse;
- Colic from twists/displacements;
- Vagina, rectal, or perineal tears; and
- Lack of milk production or infection of the mammary gland (mastitis).

Knowing risk factors for the conditions, such as age, breed, and previous injury/trauma (especially to the reproductive tract), together with postpartum exam findings, can expedite diagnosis, testing, and treatment of affected mares.

TREATING FUNGAL INFECTIONS IN MARES

Untreated uterine fungal infections, due to yeast or mold, can lead to fertility problems. Familiarity with the most common fungi infecting the mare and their respective drug susceptibilities is particularly important when practitioners must start treatment before culture results are complete, said Marco Coutinho da Silva, DVM, PhD, Dipl. ACT, of The Ohio State University's College of Veterinary Medicine.

Yeast were 100% susceptible to broad-spectrum antifungal agents.

From 1999 to 2011, researchers isolated 102 fungi, most commonly yeast, from 92 mares. Almost 100% of tested fungi were susceptible to broad-spectrum antifungal agents called "polyenes." In addition, the study authors found:

- Most fungi (47-81%) also responded to treatment with azole medications (e.g., ketakonazole, itraconazole, miconazole);
- Yeast were 100% susceptible to polyenes and least susceptible to miconazole; and
- Susceptibility patterns of particular types of molds (septate molds, the second most common type of fungi isolated from mares' uteri) were quite variable, and none of the mold organisms were susceptible to fluconazole.

Before initiating therapy the practitioner should also consider the safety of each drug and route of administration. Coutinho da Silva concluded, "For example, fluconazole is a very safe drug that can be administered orally, intravenously, or locally and has a good efficacy against yeast. That's my drug of choice for yeast infections."

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Feeding Orphan Foals

Newborns must consume colostrum immediately, after which they will nurse six to eight times per hour until their metabolism starts to slow.

ERICA LARSON

Whether a foal was orphaned because the dam did not survive parturition or because she rejected him, he requires special care from the very beginning. One aspect of his care that requires the most attention is his diet.

Mary Rose Paradis, DVM, MS, Dipl. ACVIM, an associate professor in the Department of Clinical Sciences at Tufts University's Cummings School of Veterinary Medicine, first reminded her audience that colostrum is essential for a foal's immunologic protection and key to a good nutritional start. She recommended providing approximately 2 to 3 liters to orphans as soon as possible after birth. Paradis prefers to tube-feed colostrum to ensure foals get as much as possible.

In the event colostrum isn't available, she said, veterinarians should administer an intravenous (IV) transfusion of plasma with high immunoglobin G (IgG) levels. Additionally, she said, owners can use colostrum supplements or colostrum from other species as an adjunct treatment.

Paradis also recommended breeders and veterinarians prepare for orphan foal arrivals ahead of time by storing 200-250 mL of good-quality colostrum from other broodmares in a freezer. This banked colostrum is good for one to two years.

There are several options for obtaining milk for orphan foals, Paradis said, and she discussed four in detail.

Mare's milk While this is the best option, Paradis said, it can be challenging to obtain. "Rare mares will adopt (orphan) foals in a herd and allow them to suckle" alongside their own foal, she said, but she emphasized that this is uncommon.

> **"Some foals actually prefer milk pellets over milk replacers."**
>
> DR. MARY ROSE PARADIS

Another option is to lease a nurse mare with the understanding that she will accept the orphan and raise him until weaning, she relayed. Advantages to procuring a nurse mare, said Paradis, are that she provides a foal with the social education he would lack if raised solely by humans, and it makes raising an orphan less labor-intensive for the people involved.

Possible downsides to consider include:

- The financial costs involved with the mare's lease;
- Some nurse mare farms require mares to be bred back before being returned;
- Nurse mares aren't always easy to find, and you might need to pay to ship one to your area;
- Bringing any outside horse onto a farm puts the rest of the equine residents at risk for contracting disease, so breeders must consider biosecurity methods before bringing a nurse mare home;
- If the nurse mare becomes sick or injured while in your possession, you must know ahead of time who's financially responsible for her vet bills; and
- Nurse mare use creates a second orphan: the mare's own foal (see sidebar on following page).

If an owner decides to use a nurse mare, Paradis suggested seeking the following qualities: The mare should have a good mothering instinct, be successfully raising a foal (who is removed just before the new foal is introduced, or "grafted"), and have good milk production.

View "Feeding the Orphan Foal" at TheHorse.com/31014

Inducing lactation To induce lactation in barren mares, Paradis said veterinarians typically use hormone treatments consisting of altrenogest and estradiol in combination with oxytocin and sulpiride or domperidone. She noted that it can take up to 14 days for lactation to begin, so supplemental foal feeding will be required.

Grafting foals to hormone-induced lactating mares can be challenging due to bonding issues, so she offered two suggestions that can help ease the process. First, she said, stimulating the mare's vagina and cervix during foal introduction can alter her hormone levels and make her more willing to accept a foal. Additionally, housing the mare and foal next to each other during hormone treatments can increase the odds of the mare accepting the foal.

Mare's milk substitutes In many cases inducing lactation in a barren mare or obtaining a nurse mare isn't a feasible option. Owners typically hand-rear these orphans, feeding them a powdered or pelleted mare's milk replacer. Powdered products, which must be reconstituted with water, can be fed to younger orphans, while pelleted products are often fed to older foals, she said.

Paradis noted that substitutes are designed to have similar nutrient and micronutrient levels as mare's milk, but some variations exist. For instance, she explained, mare's milk contains roughly 10.7% total solids, 25% crude protein, 17% crude fat, and 0% crude fiber, along with 580 kilocalories (energy) per liter of milk. Studies have shown that three replacers, prepared to manufacturers' specifications, consisted of 11-16% total solids, 19.5-25% crude protein, 14-16% crude fat, and 0.1-0.15% crude fiber, along with roughly 438 kilocalories per liter. Additionally, researchers have shown that most milk replacers' micronutrient concentrations exceed those of mare's milk.

"The healthy foal does not have difficulty in handling this excess," she said. "However, if you are feeding a foal that may have renal compromise (of the kidneys, as evidenced by elevated potassium levels), it can become a problem … dilution of the formulas to half-strength may be helpful."

Additionally, Paradis cautioned that some foals develop diarrhea when introduced to a milk replacer. To combat this, she recommends starting the foal slowly, feeding 10% of his body weight in milk replacer per day and increasing that amount by 3-5% daily until he is consuming 25-35% of his body weight per day (a rate at which most normal foals consume milk).

Milk from other species Paradis cautioned that consuming milk from other species could pose problems for the foal, simply because the foal's GI tract is designed to process nutrients in mare's milk; other milks possess different nutrients. For example, both cow's and goat's milk are higher in fat than mare's milk, and cow's milk is lower in sugar. She noted that of the two, foals typically digest goat's milk better than cow's milk, but goat's milk can still occasionally cause complications including constipation and metabolic acidosis.

Feeding methods If an owner does not acquire a surrogate mare, there are several ways to feed an orphan. Bottle feeding is a common choice, Paradis said, but it has its drawbacks, including an increased risk of causing aspiration pneumonia. She recommended bucket feeding as a more practical alternative. She said this method is less time-consuming and causes fewer human/foal bond issues than bottle feeding, and most foals learn quickly how to drink from the bucket.

Paradis also reminded veterinarians that foals must eat frequently. She relayed that very young foals typically need to be fed every 90 minutes (about 16 times per day), with the frequency decreasing to five times daily by the time they reach 15 days of age. As feeding frequency decreases, she noted, the foal's meal size should increase appropriately.

It's also important to offer orphans water, hay, and pellets early in life—options they would encounter alongside dams. Some foals actually prefer milk pellets over milk replacers, Paradis said, and these can be made into a mash if necessary.

Owners can wean orphans from milk as early as two months of age, Paradis noted, but she recommended delaying weaning until the three- to four-month mark, when dams and foals are typically separated. She also recommended slowly mixing normal grain and forage with milk replacer and pellets until the foal is weaned off the latter two completely.

Raising an orphan foal is a tremendous amount of work, Paradis said, and it requires a committed owner or handler who is able to provide a proper diet. But if it's done right, foals can thrive and prosper.

NURSE MARE FOALS

Choosing a nurse mare to feed and care for an orphan foal raises a common question among owners and managers: What happens to her own foal? Paradis said each nurse mare farm has its own strategy for handling foals when their dams are needed elsewhere.

Most farms, she said, place foals in a "kindergarten" situation, where multiple orphan foals are raised and fed together. "This helps to socialize the foals and prevent excessive human bonding that can occur with raising the single orphan," she said.

Some farms, Paradis said, choose to breed foals with good bloodlines in hopes they'll be easier to sell when the time is right. Others keep fillies to expand their broodmare herd.

Unfortunately, she said, because care protocol varies from farm to farm, not all nurse mare farms can boast good practices.

"I would recommend investigating potential farms for their practices and also for the health of the nurse mare," Paradis said. "Probably this is best done by the veterinarian so they can make recommendations to an owner. Usually things are fairly intense when a foal is suddenly orphaned, and it is best to know your options before you need them."

Convention Tweet

Jenevieve
@thejenevieve

"The dumbest kidney is smarter than the smartest internist." Dr. Adam

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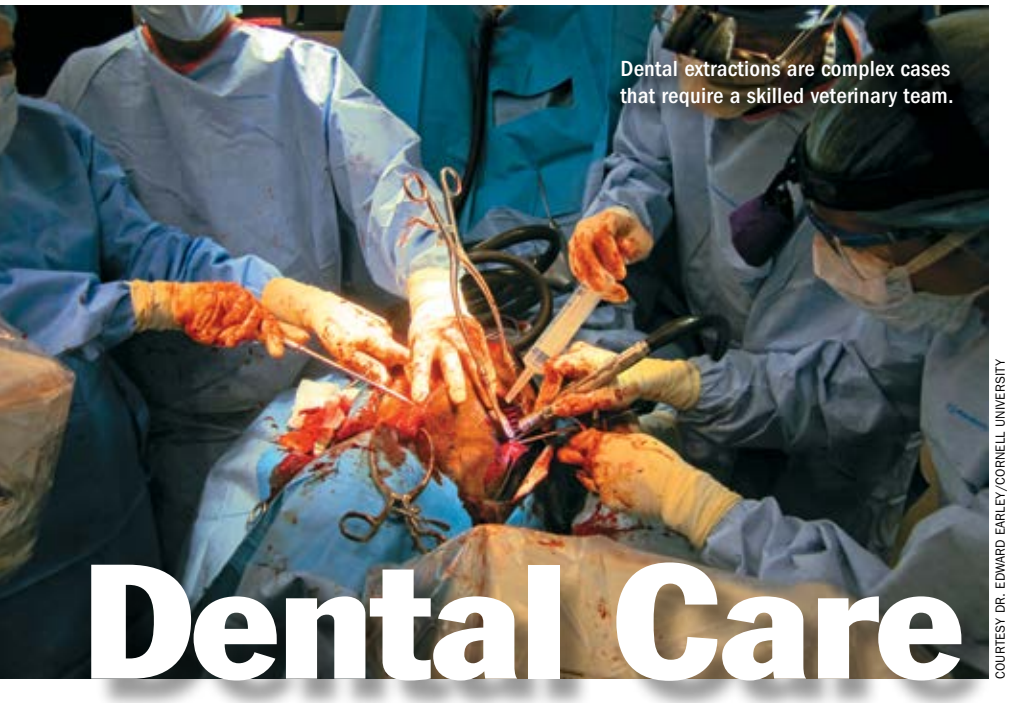


Dental extractions are complex cases that require a skilled veterinary team.

COURTESY DR. EDWARD EARLEY/CORNELL UNIVERSITY

Dental Care

CHRISTY CORP-MINAMIJI, DVM

Cheek Tooth Extraction Complications

As far as major dental surgeries go in horses, cheek tooth (premolar and molar) extraction is the most common; unfortunately, more than half these procedures pose risk of complication, noted Edward Earley, DVM, FAVD/Eq, of Laurel Highland Veterinary Clinic, in Williamsport, Penn. He addressed some of these potential complications, ways to minimize their occurrence, and methods of treating them.

Complications from tooth extraction might arise as a result of the extraction process itself or pre-existing issues. Earley listed a number of examples including:

- Palatine artery laceration;
- Iatrogenic (caused by veterinary care) dental and lower jaw fractures;
- Dilacerated (abnormally angled or curved) reserve crown (the portion of the tooth within the jawbone that has not yet erupted) and root;
- Alveolar bone sequestration (death of damaged bone in the alveolus, or tooth socket, resulting in a draining tract or a nonhealing alveolus)
- Paranasal sinus involvement and alveolar plug failure, resulting in a fistula;
- Iatrogenic upper jaw fracture from a horse chewing on the speculum;
- Tongue chewing if the veterinarian anesthetizes the lingual nerve during regional or local blocks;
- Nonhealing lower jaw fractures due to a tooth with severe periodontal disease at the fracture site; and
- Extension of dental pathology to either side of the obvious bad tooth.

Earley said pre- and post-procedural radiographs can minimize complications because they allow the veterinarian to view potentially complicating pathologies (damage to bone and soft tissue) ahead of time and to verify successful tooth extraction. The veterinarian should develop a comprehensive plan to minimize the complication risks and manage these scenarios when they occur. This plan should include:

1. A thorough presurgical evaluation, including a complete intraoral examination and radiographs. Earley even recommended referral for a head CT if the diagnosis is still unclear.
2. Treatment planning: preprocedural treatment (e.g., antibiotics) if indicated, an anesthesia/analgesia plan, and a postoperative treatment and follow-up plan.
3. Contingency treatment planning (e.g., what will the veterinarian do if a specific complication occurs?)
4. A plan for the extraction itself.
5. Post-procedural evaluation.

Earley summarized that planning for and being aware of potential dental extraction complications are essential to a successful procedure and outcome for horse and owner.

Handling Tooth Extraction Failures

Earley described typical reasons why oral extractions fail, alternative approaches when these problems occur, and the equipment, facilities, assistance, and skill a veterinarian should have on-hand to cope with the unexpected.

Usually practitioners extract a tooth orally by gradually breaking down the periodontal ligament that holds the tooth within the alveolus, noted Earley. If everything goes well, the clinician achieves this through slow, constant force using molar spreaders and molar forceps.

Earley listed some of the circumstances that can cause intraoral extraction failure:

- Fracture of the clinical crown (the visible portion of the tooth);
- Decay of the crown;
- Retained root tips;
- Excessive layers of cementum around the reserve crown and root tip as a result of root disease;
- Clinical and reserve crown fracture;
- Dilacerated root tips;
- Maleruption;
- Tooth resorption; and
- Alveolar ankylosis (fusion of the tooth to the surrounding socket).

Earley addressed alternate techniques for removing teeth or tooth fragments; he reviewed some of the dental units and tools necessary for completing these techniques; and he stressed the importance of having a trained team for equine dental procedures, saying that complex cases often require a surgeon, dental specialist, and a skilled assistant.

Convention Tweet

Elizabeth Schilling, DVM
@efsdvm

Consider the condition of teeth adjacent to the Xtraction candidate! Collateral damage.

ResearchSHORTS

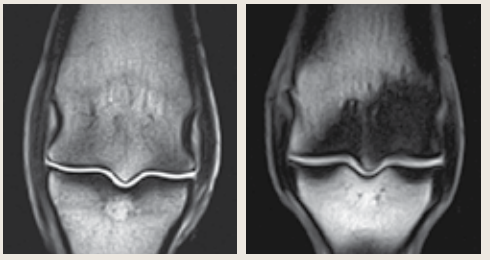
Diet's Effect on Broodmare Lactation

Peter R. Morresey, BVSc, MACVSc, Dipl. ACT, ACVIM (Rood & Riddle Equine Hospital), stressed the importance of providing mares with appropriate nutrition to ensure they can provide adequate milk for rapidly growing foals. "Successful lactation depends on normal hormonal activity and a lack of any inhibitory influences on the mare, such as underlying disease, pathology (damage/disease) to the mammary gland, malnutrition, and factors affecting the foal that can reduce normal suckling activity," he said. Find out more at TheHorse.com/31334.

Cheap n' Easy Method for Evaluating Stallion Sperm

Evaluating sperm morphology—to ensure the head, midpiece, and tail are shaped appropriately—on the farm or in the average veterinary clinic can be challenging. Malgorzata Pozor, DVM, PhD, Dipl. ACT (University of Florida), and colleagues evaluated whether staining semen with Dip (Diff) Quick could allow for quick, easy, and inexpensive semen morphology analysis and found that all spermatozoa defects they identified using traditional methods were also identifiable in samples stained with Dip Quick. Read more at TheHorse.com/31267.

MRI to Identify Bone Changes in Racehorses



COURTESY DR. JOHN G. PELOSO

MRI scans of control vs. case horses' fetlocks.

John G. Peloso, DVM, MS, Dipl. ACVS (Equine Medical Center of Ocala), and a research team have been using MRI to detect bone changes that could indicate a horse is at risk for catastrophic fetlock fractures, allowing career- or even life-saving intervention. Identifying trouble spots early allows vets and trainers to implement proper therapeutics—from stall rest to eliminating high-intensity exercise—that would lessen the horse's chances of experiencing a catastrophic breakdown. Find out more at The Horse.com/31335.

Stallion Fertility Fine Following Removal of One Testicle

If your stallion needs to have a testicle removed due to disease, neoplasia (tumor), or severe trauma, don't worry: Stallions can still lead productive lives as studs with only one testis. After performing unilateral castrations on nine stallions, Justin McCormick MS, DVM (Texas A&M University), and colleagues found that sperm quality was not negatively impacted in the immediate postoperative period. Learn more at TheHorse.com/31312.

Using MRI and Scintigraphy to Diagnose Suspensory Injuries

Natalie Zdimal, DVM (Bayhill Equine Sports Medicine & General Practice), and colleagues recently found success in using a combination of nuclear scintigraphy (bone scans) and MRI to diagnose suspensory ligament injuries. They found that with a bone scan veterinarians can identify the region of the limb that is causing the lameness/pain, and with MRI, they are better able to determine the specific cause. Read more at TheHorse.com/31336.

Progenitor Cells in Healthy and Laminitic Hooves

A Louisiana State University research team recently compared adult progenitor cell (immature cells that can divide and are capable of becoming different tissues) characteristics from healthy and laminitic hooves. "This new model provides a very precise method to look at ways to protect the stem cells in the hoof from the effects of laminitis and also treatments to direct them to return to their normal function in affected hooves," explained lead researcher Mandi J. Lopez, DVM, MS, PhD, Dipl. ACVS. "Progenitor cells in the hoof are a promising target for treatment and prevention of laminitis." Find out more at TheHorse.com/31327.

Rare Vertebral Disease of Foals

Michelle C. Coleman, DVM, Dipl. ACVIM (Texas A&M University), and colleagues conducted a retrospective study of foals affected with vertebral osteomyelitis/diskospondylitis (VOD), a rare and potentially fatal degenerative spinal disease. They determined that early diagnosis is critical to treatment, but it might be confounded by the highly variable and nonspecific signs of the disease. Learn more at TheHorse.com/31337.

Two Supplements' Effects on Ulcers

Louisiana State University researchers recently tested two commercially available feed supplements labeled to treat or prevent equine gastric ulcer syndrome (EGUS). By Day 28 of the study, researchers noted no significant differences between the treated horses and the controls. "But, after Day 28," presenter Michelle Woodward, BS, DVM, remarked, "the treated horses had increased ulcer scores indicating that the feed deprivation induction model worked to produce ulcers. At Week 5, based on gastroscopic exam, both treated groups improved over the control horses." Find out more at TheHorse.com/31269.

Optimizing Equine Piroplasmosis Treatment Protocols

Veterinarians' drug of choice for eliminating the causative parasites of equine piroplasmosis is imidocarb dipropionate, which is effective but commonly causes untoward side effects such as severe diarrhea and colic and, in rare cases, liver and kidney toxicity. A Scottish research team led by Janina Kutscha, DrMedVet, BVSc (Hons), MRCVS (Ardene House Veterinary Practice), found that medicating horses with intravenous glycopyrrolate before imidocarb use prevented gastrointestinal side effects. Read more at TheHorse.com/31323.

Looking FORWARD

New President Dr. Ann Dwyer's View for 2013

The American Association of Equine Practitioners (AAEP) swore in Ann Dwyer, DVM, as president during its 58th annual convention, held Dec. 5, 2012, in Anaheim, Calif. Dwyer co-owns Genesee Valley Equine Clinic, in Scottsville, N.Y., and is recognized internationally as a leader in equine ophthalmology.

Dwyer joined AAEP in 1984 after graduating from veterinary school and has remained active in the organization's leadership over the years. She has served on the AAEP's problems analysis, nominating, and executive director review committees. She's also participated in the governance review, the Bureau of Land Management wild horse and burro, and educational summit task forces. She represented her district on the board of directors from 2006-2008 and joined the executive committee in 2010.

We sat down with Dwyer at the convention to ask a few questions about what's ahead for the organization.

The Horse: What are AAEP's plans for 2013?

Dwyer: AAEP has ambitious plans for the coming year, and our blueprint for that has been outlined in the three-year strategic plan that was developed by the board of directors in summer of 2011.

Our strategic plan has three points that we're working on. The first is continuing education. We have governance changes that were voted on (at the 2012 AAEP convention) with leadership structure changes and how the work of the association has been organized.

The last place we'll be really focusing our attention is what we call "stakeholder partnership." That means making sure that we as the veterinarians can provide the most value to our partners, the horse owners. This is going to involve a variety of strategies ranging from promoting the image of the veterinarian in every sector in which we practice; using the most modern communication tools; and making sure that our members are well trained to show the compassion we all feel in our hearts.

The Horse: What benefit does veterinarians gathering at the annual AAEP convention offer the average horse owner?

Dwyer: If you're a horse owner you should be very proud, because this convention allows attendees to have access to all of the latest, not only through attending the sessions but also by reading the proceedings, visiting the trade show, and seeing the new pieces of equipment and developments in technology. This convention allows everyone to be brought right up to speed and then go home and immediately broadcast that information to their clients through newsletters, social media, and other ways that they communicate with their clients, plus their associates who are back "tending the store" while we're all here enjoying our education.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