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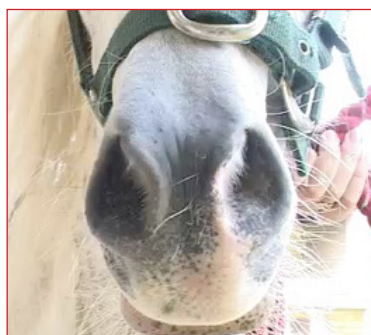
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New Technique for Injecting the Navicular Bursa Developed

A lateral approach to injecting the navicular bursa under ultrasonographic guidance is successful in most limbs with minimal attempts, according to a recent study.

This approach avoids the need for radiographs, according to **Knut Nottrott**, DVM, of Marcy L Etoile, France.

Dr. Nottrott and his colleagues wanted to develop a novel technique for injecting the navicular bursa that avoided penetrating the deep digital flexor tendon. They used four cadaver limbs to develop the technique, before a study was conducted using a 62 additional cadaver limbs sectioned at the fetlock joint.

These were positioned on a 60° incline radiographic block (Hickmann block) before injecting the navicular bursa with 1.5 mL of the contrast agent, meglumine ioxitalamate, under ultrasonographic guidance. Then 0.2 mL of methylene blue was injected into the bursa and an additional 0.3 mL injected as the needle was withdrawn to show its pathway through the tissues.

Successful injection of the navicular bursa was achieved in 58 out of 62 limbs. Of these, 49 showed contrast agent in the bursa alone. In the remaining nine, contrast agent was also observed in the distal interphalangeal joint. Contrast agent was not detected in the digital flexor tendon sheath, either radiographically or by methylene blue staining in tissue sections. In approximately one-quarter of limbs, extravasation of contrast agent into adjacent soft tissues was observed, although this was faint in the majority of cases.

In an in vivo study, 26 Standardbred horses without lameness were assigned to one of two clinicians who performed ultrasound-guided navicular bursa injection on both forelimbs under sedation and local anesthesia, with the limb held or positioned in a block in a flexed position. Contrast radiographs confirmed injection of the navicular bursa in 88% of limbs, with agent being present in the bursa alone in 77%. Where agent was also present in other locations, it tended to be faint compared with marked opacity visible in the navicular bursa. Between one and two injection attempts were needed in most cases. There was no significant difference in outcome or number of needle redirections between cadaver and

live limbs. Successful injection depended significantly dependent on the quality of the ultrasound image.

The study has limitations, the researchers said, because the limbs were healthy. "It is unknown whether injection results obtained in the limbs of horses without disease can be extrapolated to horses with clinical disease of the podotrochlear apparatus," they wrote. "The localization of contrast medium on radiographs may not accurately reflect the behavior of local anesthetic solution or therapeutic medications injected in the navicular bursa."

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Injecting the navicular bursa.

Courtesy of the Equine Veterinary Journal

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For more information:

Nottrott K, De Guio C, Kharoun A, Schramme M. An ultrasound-guided, tendon-sparing, lateral approach to injection of the navicular bursa. *Equine Vet J*. 2017 Feb. 28 [Epub ahead of print] DOI: 10.1111/evj.12673.

<http://onlinelibrary.wiley.com/doi/10.1111/evj.12673/epdf>

FEEDING the portly horse and pony

B y P a u l B a s i l i o

Managing an obese horse or pony can be a stubborn issue for owners and veterinarians. Insulin resistance, laminitis, impaired reproduction and general inflammation are associated with excessive adiposity, and when coupled with an estimated 30% of owners who do not believe their obese horse or pony is actually obese, the treatment becomes even harder.

At the 62nd Annual AAEP Convention in Orlando, **Ingrid Vervuert**, DMV, of the Institute of Animal Nutrition, Nutrition Dis-

eases, and Dietetics at the University of Leipzig in Germany, offered feeding recommendations for a proper weight loss reduction program.

Feeding Recommendations

For starters, Dr. Vervuert recommended reducing energy intake by reducing the hay intake to between 1 and 1.5 kg/100 kg of body weight. Hay levels in this range have been shown to induce a decrease in body weight. In Europe, it is common practice to include some straw into the diet to reduce

the amount of hay a bit more.

For obese horses without muscle problems, concentrated feeds are not recommended for weight loss, even if the concentrates have a reduced starch and sugar content.

“These complementary feeds often have a high fat content,” she explained. “They are not intended to feed obese horses. They are intended for horses with muscle problems.”

The choice of feed can also play a large part in weight loss in obese horses and ponies. Dr. Vervuert recommended late-cut mature grass hay (see Practical Feeding Recommendation). Analysis of this type of hay shows an energy content of 5.5 megajoules of digestible energy (MJ DE)/kg, compared with 11.5 MJ DE/kg in oats and complementary feeds that have reduced starch and sugar content.

Soaking the hay for 30 minutes can also reduce carbohydrate content by up to 50%. However, if it soaked for longer than 30 minutes, the microbial populations increase without an additional decrease in carbohydrates.

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¹Data on file at Merial, Safety Study, PR&D 0144901.

²Doucet MY, Bertone AL, et al. Comparison of efficacy and safety of paste formulations of firocoxib and phenylbutazone in horses with naturally occurring osteoarthritis. *J Am Vet Med Assoc.* 2008;232(1):91-97.

³EQUIOXX product labels and FOI summaries and supplements.

⁴Data on file at Merial, Clinical Experience Report PHN 471, PR&D 0030701.

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Treatment with EQUIOXX should be terminated if signs such as inappetence, colic, abnormal feces, or lethargy are observed. As a class, cyclooxygenase inhibitory NSAIDs may be associated with gastrointestinal, renal, and hepatic toxicity. Sensitivity to drug-associated adverse events varies with the individual patient. Horses that have experienced adverse reactions from one NSAID may experience adverse reactions from another NSAID. Patients at greatest risk for adverse events are those that are dehydrated, on diuretic therapy, or those with existing renal, cardiovascular, and/or hepatic dysfunction. The majority of patients with drug-related adverse reactions recover when the signs are recognized, drug administration is stopped, and veterinary care is initiated.

Concurrent administration of potentially nephrotoxic drugs should be carefully approached or avoided. Since many NSAIDs possess the potential to produce gastrointestinal ulcerations and/or gastrointestinal perforation, concomitant use of EQUIOXX with other anti-inflammatory drugs, such as NSAIDs or corticosteroids, should be avoided. The concomitant use of protein bound drugs with EQUIOXX has not been studied in horses. The influence of concomitant drugs that may inhibit the metabolism of EQUIOXX has not been evaluated. Drug compatibility should be monitored in patients requiring adjunctive therapy.

The safe use of EQUIOXX in horses less than one year of age, horses used for breeding, or in pregnant or lactating mares has not been evaluated. Consider appropriate washout times when switching from one NSAID to another NSAID or corticosteroid.

The Safety Data Sheet (SDS) contains more detailed occupational safety information. For technical assistance, to request an SDS, or to report suspected adverse events call 1-877-217-3543. For additional information about adverse event reporting for animal drugs, contact FDA at 1-888-FDA-VETS, or <http://www.fda.gov/AnimalVeterinary>.

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“You can also soak it for a shorter time,” she said. “This can reduce the sugar content of the hay. This can be useful in horses that are markedly obese and those who have laminitis.”

However, some horses don’t react well to reducing their calories. A reduction in hay intake can lead to an increase in behavioral problems. Some horses have been known to begin eating their bedding material when feeding is decreased. To combat this, Dr. Vervuert will sometimes turn to a hay net, which can increase the feed intake time and decrease the behavioral consequences.

“A recent study in the UK showed that when the mesh size of the hay net is less than 3 cm, then you can adequately increase the intake time to about 35 minutes per kilogram of hay,” she said. “However, with a hay net with a mesh size of 7.5 cm, the hay intake was about 25 minutes per 1 kg of hay.”

Horses with a history of metabolic laminitis should not have access to a pasture. Currently, there is no known minimum grass intake for inducing laminitis, so it is typically best to keep these horses off pasture, she suggested.

Monitoring

A reasonable goal for a weight reduction program is approximately 1% of the horse’s body weight per week. A little less is ok, but losses of 2% or 3% can increase the horse’s risk for hyperlipemia, as the negative energy balance triggers excessive mobilization of fatty acids from adipose tissue.

The best way to monitor is with a scale, although that can be difficult in some situations where access to certain equip-

Horses with a history of metabolic laminitis should not have access to a pasture. There is no minimum grass intake for inducing laminitis, so it’s best just to keep them off the pasture.

ment is difficult. An alternative is a body weight tape.

“The tape is not as easy as a scale, so you have to teach the owner how to use them,” Dr. Vervuert said. “The best way to teach them is to use the body weight tapes in comparison with the scale. They tend to learn better that way.”

Body condition and crusty neck scores tend to be less useful in these horses and ponies, as both scores tend to respond late in relation to loss of body weight.

“A reasonable alternative is to measure resting insulin during the weight reduction program,” she explained. “It can be good for the owner to see the values decrease as the horse loses weight. It can be a good motivator.”

MeV

Practical Feeding Recommendation

RECOMMENDATION 1

- 1.2 kg/100 kg of body weight (BW) late-cut, mature grass hay
- 0.1 kg/100 kg BW of grass meal pellets
- Vitamin and mineral supplementation

RECOMMENDATION 2

- 1 kg/100 kg BW of late-cut, mature grass hay
- 0.4 kg/100 kg BW of straw
- 0.1 kg/100 kg BW of alfalfa pellets
- Vitamin and mineral supplementation

Provide several small portions throughout the course of the day for each recommendation.

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Toxic Weeds

T O H O R S E S

There are numerous poisonous plants in horse pastures all over the United States—the good news is that most are unpalatable and horses tend to selectively graze around them and never consume them.

However, in pastures that are overgrazed, horses may start to nibble at some of these toxic plants. If they are in hay fields and get mixed into hay bales, it becomes more dif-

ficult for horses to eat around them.

The adverse effects to the horse range widely with the amount of ingestion and often the environmental conditions the plant was grown under (drought typically increases the poison concentration in some plants). Other factors that can affect toxin level include stage of growth, season and fertilization, part of the plant eaten,

as well as boredom, age and general health of the horse. While the effect on the horse will depend on the amount ingested and the amount of toxin accumulated in the plant, most toxins primarily attack the major systems in the horse such as the respiratory, cardiac and digestive systems.

Weeds can be classified as annuals or perennials. Annual plants are plants with a life cycle that lasts only one year. They grow from seed, bloom, produce seeds and die in one growing season. Perennials are plants that persist for many growing seasons. Generally, the top portion of the plant dies back each winter and regrows the following spring from the same root system. **MeV**

B y T a n i a C u b i t t , P h D

A FEW COMMON TOXIC PLANTS FOUND IN OR NEAR HORSE PASTURES

BUTTERCUPS:



Buttercup causes oral irritation when chewed, and horses rarely consume the plant because it is unpalatable. The toxic component is in the fresh leaves and flowers, but they lose toxicity when dried for hay. Symptoms of buttercup poisoning include increased salivation, decreased appetite, colic and diarrhea.

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JIMSONWEED:



Jimsonweed can be recognized by its distinctive tree-like shape, white or purple trumpet-like flowers and prickly seed capsules. All parts of the jimsonweed plant are poisonous to horses and humans. Symptoms of poisoning in horses include a weak, rapid pulse, dilated pupils, dry mouth, incoordination, diarrhea, convulsions, coma and sometimes death. Jimsonweed has a foul odor and taste, and horses rarely consume it if they have other quality forage.

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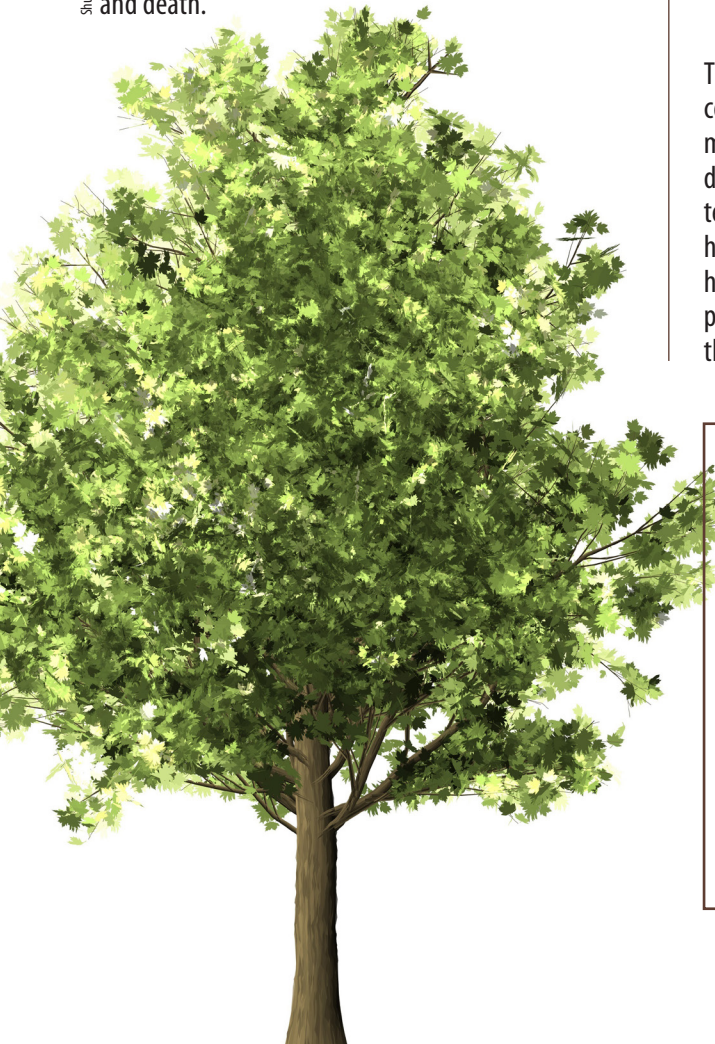
NIGHTSHADE FAMILY:

The nightshade family contains many toxic plants, including horse nettle, black nightshade, bittersweet nightshade, some species of groundcherry, and even tomatoes and potatoes. The plant affects the central nervous system and the gastrointestinal tract. It is estimated that one to 10 lbs of ingested plant material is fatal for horses. Some symptoms of poisoning include dilation of pupils, diarrhea, loss of appetite and loss of muscular coordination.



MAPLE TREES:

Maple leaves are highly toxic. Particularly when they are in a stressed state prior to dying (e.g. leaves on a fallen tree limb lying in a pasture or during the fall). Fallen and dead leaves remain toxic for about a month and cause severe kidney damage if ingested in large quantities. It is estimated that an adult horse needs to consume 1.5 pounds of leaves or more to become poisoned. Symptoms of toxicity include depression, lethargy, increased rate and depth of breathing, increased heart rate, jaundice, dark brown urine, coma and death.



BLACK WALNUT:



The bark, woods, nuts and roots of the black walnut tree contain a toxic compound. Horses are primarily exposed through black walnut shavings mixed in with other shavings as bedding. Symptoms of exposure include depression, lethargy, laminitis, swelling of the lower limbs, and increased temperature, pulse, respiration rate, abdominal sounds, digital pulse and hoof temperature. Symptoms usually disappear within hours after the horse is removed from the shavings; however, laminitis can present further problems. Since the bark and nut hulls from the black walnut are toxic, these trees should be removed from horse pastures as a precaution.

About the author:

Tania Cubitt, PhD, is a nutrition consultant with Performance Horse Nutrition. She consults with Standlee Premium Western Forage, as well as other companies. Her interests are focused on developing feeding strategies for horses with special needs horses including metabolic syndrome, developmental orthopedic disease, gastric ulcers, and senior horses as well as feeding the broodmare.

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A Profile in Sesamoid Fractures: *Who's at Risk?*

Missing training sessions might be a signal that a Thoroughbred racehorse is at increased risk for a catastrophic fracture, according to a recent study.

Fatal musculoskeletal injuries are a major problem in Thoroughbred racing in North America. While there may be no way to completely avoid these fractures, equine medical research is making strides toward that goal.

"It begins with reaching an understanding about the many factors that contribute to injury," said **Scott E. Palmer, VMD, DABVP**, the equine medical director for the New York State Gaming Commission and adjunct professor at Cornell University, here at the 62nd Annual AAEP Convention in Orlando. "Initial epidemiologic studies using broad-case definitions were the first step in this process, and they were helpful. But I believe case-specific studies are the next step to develop an enhanced multimodal screening

protocol for horses at risk of catastrophic musculoskeletal injury."

With the aim of getting a clearer picture of which horses are at an increased risk for biaxial proximal sesamoid bone fractures, Dr. Palmer and his colleagues crafted a preliminary study to identify Thoroughbreds that might be predisposed to injury and quantify their associated risk. The target population for the study was all Thoroughbred racehorses at New York state racetracks between 2013 and 2015.

Any Thoroughbred racehorse that sustained a BPSB fracture during a race was included. Two randomly selected control horses from the same race were assigned to the study—the horse listed immediately prior to and immediately after the case horse in the racing program. In all, 20 horses with BPSB fractures and 40 control horses were included.

The study examined 82 putative risk factors for an association with

BPSB fractures. Variables included age, gender, speed, the number of high-speed furlongs, whether the horse had a recent decrease in performance, and the number of career starts, just to name a few.

Tallying the results

"Nothing ruins a good scientific hypothesis like a research project," Dr. Palmer joked. "I had a strong bias that these fractures were over-use injuries because I had seen a lot of them in older horses. In addition, I had seen extensive subchondral bone remodeling, sclerosis, cartilage erosions, cartilage fragmentation, and osteochondral defects. I felt pretty confident that these horses were literally wearing out their joints."

The results were a little less black-and-white. It turns out that horses can sustain these fractures at any time in their career. Dr. Palmer noted that some horses sustained a BPSB fracture in their

Courtesy of Dr. Scott Palmer, taken at Belmont

B y P a u l B a s i l i o

first race, and some that were fine until the fracture occurred at 8 years of age. This indicated that BPSB fractures were not simply an overuse injury that could be anticipated by counting the number of high speed furlongs.

"There was a lot of information in the literature that looked at exercise intensity," Dr. Palmer said. "Those studies found a positive correlation between exercise intensity and fatal musculoskeletal injuries that I thought would apply here, but they didn't fit quite as easily as I thought they would."

A strong correlation between accumulated high-speed furlongs and weeks in training was found, but there was no difference between horses with BPSB fractures and controls. This suggested that simple accumulation of distance and training time is not a discriminator.

Dr. Palmer explained that while earlier studies that used broad-case definitions found associations with any kind of musculoskeletal fracture, this study was focused on a single type of fracture. "I think it is reasonable to consider the possibility that risk factors may apply specifically to one type of fracture but not another," he said.

After diving deeper into the data, Dr. Palmer and his team found that instead of more high-speed furlongs or accumulation of stress during the weeks leading up to the injury, they found less. Horses that sustained BPSB fractures had fewer starts in their peak earning years (2 to 3 years of age), fewer high-speed workouts during the 12 weeks leading up to the fracture, and more time off in the 8 weeks leading up to the fracture when compared with controls. Horses that sustained a BPSB fracture were also found to be more likely to drop by two classes between the penultimate start and the incident race.

"Currently, exercise modeling alone can predict fatal musculoskeletal injury with a 65% accuracy."

Dr. Scott E. Palmer

"Why would these horses not be training regularly?" he asked. "For the horses that dropped in class, it's easy to leap to the conclusion that the horse was lame and the owner wanted to get rid of them. We know that happens, but we need to be careful in making assumptions. These horses were racing at a declining level of competition at the time of the incident race, but why?"

One obvious reason is that unsound horses miss training, but there are other reasons. One possibility is that the horses were not visibly lame, but not sound enough to participate in regular exercise.

"I think the term 'healthy horse profile' is something that we can use to get a handle on this," Dr. Palmer said. "A healthy horse is one that has regular training and racing exercise. Cohorts that don't keep up with them because they are hard to get to the races or it's difficult for them to keep up with their cohorts, is a tipoff. This is perhaps more important than the number of high-speed furlongs."

Dr. Palmer warned against interpreting this findings to mean that rest has anything to do with sustaining a BPSB fracture. The more appropriate conclusion to draw is that rest can be a proxy

measure for unsoundness.

"This study is a first step to help trainers and veterinarians identify horses that should undergo examination to rule out orthopedic conditions that can lead to catastrophic BPSB fractures," he said. "The complexity of multiple contributing factors can limit the predictive value of any single value when trying to make a prediction, but horses identified as at an increased risk of BPSB fracture warrant increased levels of scrutiny, implementation of protective factors, and modification of the training schedule if necessary."

The information in this study can be useful to identify variables to eliminate false-positive or false-negative results in the screening for BPSB fractures. False positives can lead to unnecessary scratches and a negative economic impact, and false negatives can lead to potentially fatal injuries to the horse and injuries to the jockey.

"Currently, exercise modeling alone can predict fatal musculoskeletal injury with a 65% accuracy," Dr. Palmer said. "That's not too shabby, but it's not good enough. By measuring serum biomarkers that can identify proteins released or synthesized due to osteochondral injury, horses can be identified as injured or not injured 74% of the time. If we combine these two methods with some advanced imaging, I believe we can greatly enhance the sensitivity and specificity of the screening process."

An optimal screening program to identify horses at increased risk for injury should include tests that are inexpensive, accurate and readily available. Our ultimate goal is to combine exercise history with clinical exam findings, blood tests and commonly available diagnostic imaging to increase the accuracy of our risk assessment.

MeV

Premature Foal Gets a Leg Up



Brave, a newborn male foal, was born five weeks premature and immediately brought to the University of California at Davis veterinary hospital with his dam, Ally, who was also experiencing a life-threatening condition with uterine artery bleeding. Upon arrival, the colt was lethargic with diarrhea and mild colic.

They were received by the Equine Internal Medicine and Equine Medical Emergency, Critical Care and Neonatology Services. The team, led by faculty member **Gary Magdesian, DVM,** focused on the foal, while **Krista Estell, DVM** and her team focused on the mare.

The initial physical exam in the Lucy Whittier Neonatal Intensive Care Unit (NICU) found pneumonia and sepsis, signs consistent with prematurity. Bloodwork showed that the colt had decreased protein and globulin counts, specifically a low immunoglobulin G, indicating he didn't receive enough colostrum, which left him vulnerable to infection.

Brave remained in the NICU for further monitoring, diagnostics and intensive treatment. An IV catheter was placed to help facilitate fluid therapy along with antibiotics and gastroprotectants. He was provided parenteral nutrition (PN) along with other medications to stabilize him.

Brave was also administered a plasma transfusion to give him the necessary immunoglobulins he didn't receive from his dam's colostrum.

Ultrasound examinations revealed a pulmonary infection with small areas of aspiration pneumonia being visualized, as well as a large bladder that required placement of a urinary catheter to prevent rupture.

Radiographs confirmed the premature status of the colt by showing that the cuboidal bones within the carpus and tarsus were not fully ossified. Because of this, Brave had his own personal foal sitters and technicians to prevent him from standing excessively and crushing these soft, cartilaginous bones.

Physiotherapy program developed

Dr. Magdesian developed a physiotherapy program that included assisted standing to keep the bones from being crushed while still allowing the limbs and muscles to strengthen. This condition required Brave to remain hospitalized for many weeks until his bones could support his weight. In addition, to prevent limb contracture, the team performed passive range-of-motion exercises several times per day.

During Brave's extensive hospitalization, the equine care team dealt with many health issues, according to Dr. Magdesian, chief

of the Equine Internal Medicine Service and the Roberta A. and Carla Henry Endowed Chair in emergency medicine and critical care, which are common to such premature foals, including recurrent diarrhea, hypothermia, hypoproteinemia, and poor tolerance of milk feeding.

The trouble with being premature

Premature foals have difficulty transitioning to extrauterine life. Their immune system is immature, and they often don't ingest enough colostrum, he explained. This puts them at high risk of developing sepsis, or bloodstream infection. They often require plasma transfusions to ensure adequate immune function, as well as antibiotics to prevent sepsis.

The foals can have reduced breathing efficiency, and may require oxygen supplementation or respiratory stimulation. They may be intolerant of milk feeding and require PN while their gastrointestinal tract adjusts to milk, as well as require enzymes to help with digestion. They may be unable to urinate, and require bladder catheterization. Their eyes can develop corneal ulcers and require close monitoring, sutures or staples if they have entropion,

along with eye lubricant. As in in Brave's case, they can have leg issues as well. In short, they often require intensive care, with patience while their bodies adjust to life outside of the mare's uterus.

Radiographs were performed weekly to track Brave's bone ossification. After five weeks in the NICU, Brave's bones completed ossification. Following a few more days of increasingly good health, he was ready to be discharged. After being hospitalized for 43 days, Brave was finally able to go home. In addition, his dam Ally resolved her uterine artery bleeding and also went home healthy.

Very few hospitals are equipped and staffed like UC Davis, with the ability to care for all of the issues that arose during Brave's hospitalization. The hospital's board-certified specialists are at the forefront of neonatal care. Being able to facilitate all of Brave's care under one roof is a unique quality of the UC Davis NICU, and a distinct benefit for horse owners in California. **MeV**

For more information about the William R. Pritchard Veterinary Medical Teaching Hospital, visit www.vetmed.ucdavis.edu/vmth.

Treating Equine Arthritis

Merial has released a new video that explains how LEGEND treats joint dysfunction due to synovitis associated with equine osteoarthritis.



[Click here to watch video](#)



Equine Asthma Results in Cardiac Changes

Equine asthma results in pulmonary hypertension and secondary changes to the right side of the heart, related to pressure overload, according to a recent study.

Researchers from The University of Ghent, in Belgium, wanted to identify changes to the

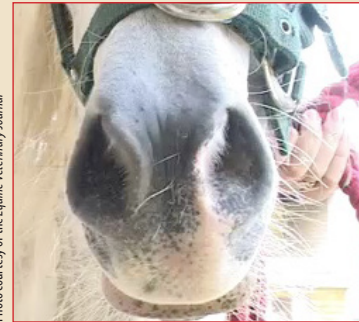
structure and function of the right heart associated with an acute exacerbation of equine asthma. They performed a prospective study on six horses with a history of severe equine asthma, which were in remission at the beginning of the study. An acute episode of equine asthma was experimentally induced via exposure to straw and moldy hay for seven days. The horses were then returned to a dust-free environment and treated with daily IV dexamethasone until resolution of clinical signs.

All horses developed clinical signs within two days. Clinical and endoscopy scores were higher in horses following allergen exposure compared with pre-exposure, and PaO_2 and pH were lower. Cardiac biomarkers did not change.

Following exposure, significant increases in right atrial, right ventricular and mean pulmonary artery pressure measurements were demonstrated. The highest pressures were found in horses with the highest clinical and endoscopic scores, likely reflecting increased severity of disease.

When echocardiographic measurements in the experimental group were compared with healthy controls, significant differences in several measurements were found including greater right ventricular wall thickness in the disease group, suggesting hypertrophy due to right ventricular pressure overload. Neutrophil infiltration and interstitial fibrosis were noted in myocardial biopsies from three of six horses, providing evidence of myocardial inflammation and remodeling in response to pressure overload. **MeV**

Photo courtesy of the Equine Veterinary Journal



For more information:

Declodt A, Borowicz H, Slowikowska M, et al. Right ventricular function during acute exacerbation of severe equine asthma. *Equine Vet J*. 2017 Mar 2 (Epub ahead of print) doi:10.1111/evj.12675.

<http://onlinelibrary.wiley.com/doi/10.1111/evj.12675/full>

Long-term Prognosis Good After Colic Surgery in Horses

A recent study shows that the odds of a successful outcome after colic surgery are better than some veterinarians and owners think, according to a recent study in the journal *Acta Veterinaria Scandinavica*.

Colic, defined as abdominal pain, affects between 4% to 10% of horses during their lifetime. It is a serious and sometimes life-threatening condition.

Colic surgery is a difficult decision for many owners because of the expense and the expectation of a poor outcome.

“Many horses encounter colic at some point of their life and, fortunately, many of the episodes can be treated conservatively with medication and fluids,” said **Isa Anna Maria Immonen**, DVM, of University of Helsinki, Finland, one of the researchers. “Sometimes, however, the horse requires surgical treatment, which is expensive and a major operation for the horse. This may be a difficult life-and-death decision for the owner.”

Researchers looked at the long-term outcomes of 236 horses undergoing surgery for colic between

2006 and 2012, focusing on owner satisfaction and patient performance after surgery. The team found that, of the horses that survived to hospital discharge, 83.7% returned to their previous or intended activity, and 78.5% regained their pre-surgical or higher level of performance.

The team also found a high level (96.3%) of owners were satisfied with their veterinary care and that “nearly all (98.5%) evaluated the recovery after the colic surgery as satisfactory or above.”

The researchers thought that “defining the factors affecting the prognosis and postoperative performance could give answers that would help both the owners and the veterinarians in the decision-making process—whether to operate or not—especially when focusing on the meaningful long-term life and use of the horse after colic surgery,” Dr. Immonen said.

Dr. Immonen received funding for the retrospective colic study through Morris Animal Foundation’s Veterinary Student Scholar program.

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For more information:

Immonen IAM, Rikoski N, Mykkänen A, et al. Long-term follow-up on recovery, return to use and sporting activity: a retrospective study of 236 operated colic horses in Finland (2006–2012). *Acta Veterinaria Scandinavica*, 2017 [Epublished Jan. 27] DOI: 10.1186/s13028-016-0273-9

Cutting-edge Imaging Improving Head and Spine Diagnoses

Major progress in imaging the horse’s head and spine is helping veterinarians better diagnose their patients.

The Equine Veterinary Journal has joined forces with Equine Veterinary Education and Veterinary Radiology and Ultrasound to showcase an online collection of the latest articles on imaging these intricate and less accessible parts of the equine anatomy. They cover the advantages of cutting-edge modalities and draw useful comparisons with more readily available tools such as radiography.

The large size and shape of horses has made it difficult to use diagnostic imaging efficiently and accurately. Radiographs were the only feasible option until the availability of Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) over the past decade. MRI and CT take detailed, three-dimensional images of organs, soft tissues and bone. Now with the development and



availability of bigger, wider and more adaptable scanners, horses can be examined in a standing position. This has significantly improved diagnostic and treatment strategies and also avoids the need for a general anesthetic. Advanced diagnostic techniques are helping with clinical and surgical approaches to problems with the equine head.

Despite the significant advances in imaging, the horse’s back is still defying conventional systems, primarily because of its size, concludes a spinal evaluation article. New technologies such as robotic fluoroscopy and cone-beam CT, may provide a cross-sectional method to evaluate the equine spine, but for now radiographs are still better to evaluate findings of spinous process impingement seen on scintigraphy. The imaging of the Equine Head and Spine Online Collection can be downloaded here

<http://bit.ly/2gUxtN8>

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Case Study Cystotomy



By Tammy Treitline, LVT

On Feb. 21, 2012 an 18-year-old Quarter horse gelding was presented to our clinic showing signs of lying down, straining to urinate and acting more

comfortable after urinating. The difficulty urinating had been occurring over the last several weeks. The client would notice the gelding stretching out, standing on his rear toes and passing small, intermittent streams of urine. On some occasions the urine would be dark or bloody.

The client noted that the difficulty in urinating would often occur after exercise. The gelding did not present with any typical signs of muscle issues or damage after exercise, when the difficulty in urinating would occur—suggesting that exertional rhabdomyolysis (azoturia) was not a primary concern.

Physical findings

The physical examination upon presentation was within normal limits. Rectal temperature was 99.5° F, respiration rate was 12 breaths/min, capillary refill time was less than 2 seconds, and mucous membranes were pink and moist. The gastrointestinal auscultations revealed borborygmi in all four quadrants. The heart rate was tachycardic at a rate of 54 beats/min, which could be a result of pain or discomfort, excitement or trailering.

After the physical examination, the recommenda-

tion was to proceed with further diagnostics consisting of a rectal examination, ultrasonography of the bladder and kidneys, complete blood count, serum chemistry and urinalysis. The gelding was sedated with xylazine hydrochloride and butorphanol tartrate for rectal examination. The rectal examination revealed normal feces and a small bladder that was palpated. No uroliths or masses were palpated at this time and the bladder was expressed easily.

The rectal ultrasonography showed a small intact bladder with an increased hyperechogenicity at the dorsal bladder wall, with sediments suspended in the urine. External examination of the penis and prepuce were normal. A stallion urinary catheter was passed through the urethra to obtain a urine sample for a urinalysis. The stallion urinary catheter passed easily up the urethra with no urethral obstructions present. The urine sample obtained appeared cloudy, with no visual blood present. The automated urinalysis results revealed a pH of 8, leukocytes of 500 leukocytes/pL, protein of 30 mg/dL and erythrocytes of 250 erythrocytes/prL. Manual microscopic evaluation of the urine was also performed. Reported results of the manual microscopic evaluation were leukocytes of 2 to 5 per high powered field (hpf), erythrocytes of 2 to 5/hpf, transitional epithelial cells of 0 to 1/hpf, calcium carbonate crystals of 50/hpf and cocci bacteria of 5 to 10/hpf. The automated urinalysis reported the leukocytes and erythrocytes higher than manual microscopic evaluation, which could be a result of the presence of calcium carbonate crystals and possibly interfering with the mechanical reading. The calcium carbonate crystals are commonly found in horse urine, and calcium oxalate crystals can also appear in horse urine but are not as common.

Serum chemistry results

The serum chemistry results showed the blood urea nitrogen (BUN) at 30 mg/dL and creatinine at 2.4 m/dL which are elevated levels. These results would indicate a mild azotemia. Calcium (CA), albumin (ALB), aspartate aminotransferase (AST), alkaline phosphatase (ALP), creatine kinase (CK), lactate dehydrogenase (LDH), gamma glutamyl transferase (GGT), total bilirubin (TBIL), and globulin (GLOB) were all within normal limits. The electrolytes results were as follows: sodium (Na) at 143 mmol and potassium (K) at 3.9 mmol/L, which were within normal limits. The chloride (CL) was 109 mmol/L, which was elevated. The packed cell volume was 38%, which

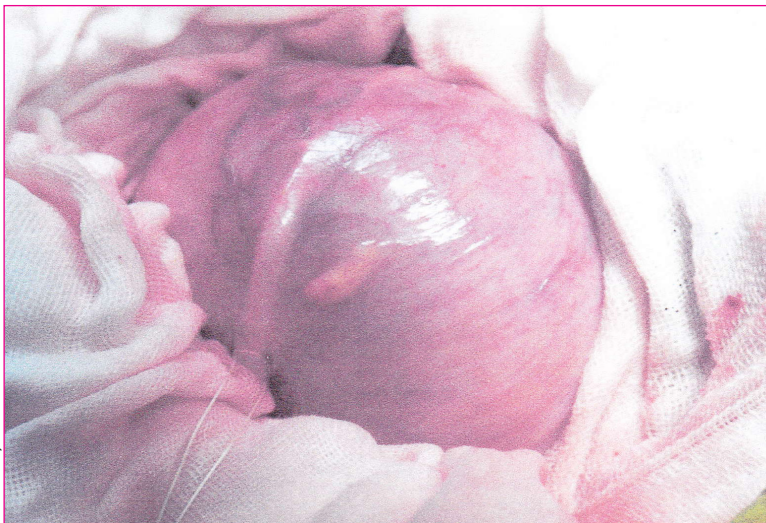


Figure 1: Bladder exteriorized with stay sutures.

Photos courtesy of xxxxx

was within normal limits. The transabdominal ultrasound of the kidneys was within normal limits, with no abnormalities found.

The results of the rectal examination, ultrasound, serum chemistry and urinalysis were discussed with the client. Other possibilities addressed for the gelding's signs were GI colic, nephroliths, azoturia and neoplasia. The recommendation was to hospitalize the gelding for 24 hours for observation and then proceed with endoscopic evaluation of the mucosa of the bladder. The owner consented and the gelding was hospitalized.

The gelding was reevaluated the following day. His physical examination was within normal limits. He was sedated with detomidine hydrochloride and butorphanol tartrate for rectal palpation and endoscopic evaluation of the bladder mucosa. The bladder was very empty and a repeat rectal examination revealed a firm object that was suspected to be a urolith. The veterinary team proceeded with the endoscopic evaluation to confirm that the firm object was a urolith, along with ruling out any masses or abnormalities with the bladder mucosa. The endoscopic evaluation revealed inflammation of the bladder mucosal lining and visualization of the urolith. Both ureters were seen to be emptying urine into the bladder normally.

Hospitalization and surgery

The veterinarian discussed with the client and recommended hospitalizing the gelding over the weekend, and cystotomy surgery was scheduled for that following Monday. On Monday morning blood was collected for a CBC, and serum chemistries of total protein (TP), BUN, and creatinine for evaluation prior to surgery. The BUN was still high at 25 mg/dL, creatinine was still high at 2.5mg/dL. Total protein was 6.4 g/dL. The automated CBC revealed a hematocrit, which was within normal limits. The white and red cells were low, but the platelets were normal. The platelets were normal. The elevations of the serum chemistries BUN and creatinine could be azoturia, inflammatory response to urinary system from the pressure of the urolith, or stress on the kidneys from the urolith preventing the bladder from completely emptying. The low WBCs could be a result of a previous or chronic infection or chronic inflammatory response of the urinary system, or automated hematology error. The low RBCs could be a result of rouleaux, chronic disease or automated hematology error. A manual CBC could be performed to verify the automated hematology results. The gelding was administered IM procaine penicillin G, IV gentamicin sulfate and IV flunixin meglumine one hour prior

to surgery. A catheter was placed in the right jugular vein and sutured in place. A six-inch, high-flow extension set and male port were attached to the IV catheter. The gelding was premedicated with IV xylazine hydrochloride. Then the gelding was induced with diazepam and ketamine.

He was intubated with a 26 mm endotracheal tube and placed in dorsal recumbency. The gelding was maintained under anesthesia on a ventilator with inhalant isoflurane. A stallion urinary catheter was placed in the urethra to the bladder and the left caudal abdomen was prepared in standard sterile surgical fashion. An iodine impregnated drape was placed over the surgical site and the horse draped in standard sterile surgical fashion.

The surgical incision was on the left caudal quadrant of the ventral abdomen. Dissection through the subcutaneous tissue, fat and muscle tissue was per-

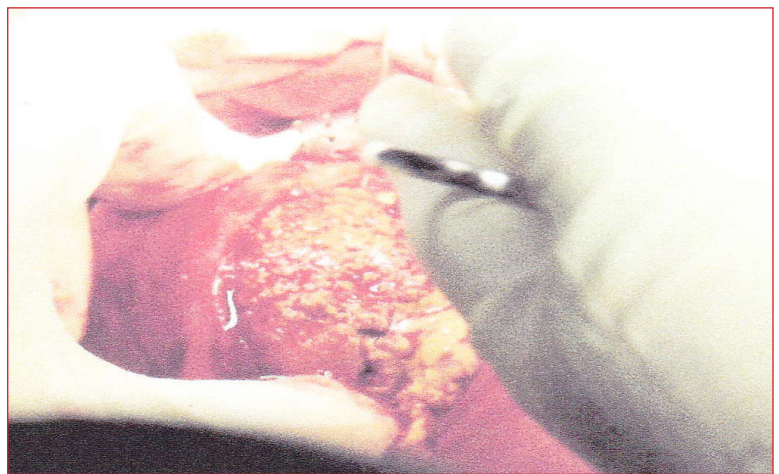


Figure 2: Urolith exteriorized.



Figure 3: Urolith

Uroliths are most often seen in adult horses and more frequently in males than females. This tendency toward males might be attributed to the anatomic differences in the urethra between the two genders.

formed until the peritoneum was visualized. Blunt perforation was used to enter into the abdominal cavity, with manual palpation used to locate and express the bladder. The bladder was then exteriorized through the incision. Two stay sutures were placed in the bladder and were used, along with manual traction underneath, to maintain the bladder position through the incision (Figure 1). An incision 4 cm long was made through the bladder layers so the urolith could be exteriorized and removed from the mucosal layer of the bladder (Figure 2 and 3). After removal of the urolith from the bladder, it was lavaged with sterile saline. Suction was then used to remove the remaining fragments and the bladder was lavaged with sterile saline. The bladder was sutured close, lavaged with sterile saline, and placed back into the abdomen. The remaining muscle, fat, subcutaneous and skin tissues were closed, then a huck towel stent was sutured in place over the incision site.

The gelding was anesthetized for the procedure, which took 1 hour and 30 minutes. His vitals were monitored throughout the procedure.

The gelding was administered IV fluid therapy of lactated Ringer's solution during surgery, which was removed during the recovering phase, then continued when he was taken back to his stall. The lactated Ringer's solution was used to diurese the bladder and kidneys. The gelding was moved to the recovery stall and extubated within 10 minutes. He was administered xylazine hydrochloride via IV catheter to assist in a smooth recovery.

The gelding was standing in 35 minutes and moved back to his stall after an additional 20 minutes of standing. The recovery phase from surgery and anesthesia was uneventful. The gelding was hospitalized for three days after surgery for observation and retesting of the serum chemistry creatinine. His urination resumed to a normal steady stream following surgery. The color of the urine was tinged with red following surgery, then resumed a normal yellow over the next three days.

The gelding consumed 15 to 20 liters of water dai-

ly. On the daily physical examinations his rectal temperature ranged from 99.5° F to 100.5° F. Heart rate ranged from 36 to 44 to bpm, respiration rate ranged from 8 to 20 breaths/min, and the mucous membranes were pink and moist. The incision site did develop pitting edema that extended to the sheath. The pitting edema did show improvement and reduced over the three days of hospitalization.

Heading home

For two days following surgery, the gelding was administered IM procaine penicillin G 12 hours, IV gentamicin sulfate every 24 hours and IV flunixin meglumine every 12 hours. On the third day, the gelding was then placed on oral sulfadiazine trimethoprim every 24 hours for 10 days and oral phenylbutazone powder every 24 hours for seven days.

The serum chemistry of creatinine was elevated the day after surgery, but decreased to high normal the day the gelding was released from the hospital. The decrease in the creatinine values could be a result of the diuresis of the kidneys with the IV fluid therapy of lactated Ringer's solution, or removal of the urolith, which allowed the urinary system to function properly, or reducing the inflammatory process in the urinary system that was a result of the urolith.

The gelding was released from the hospital and was doing very well. The incision looked clean and dry. Pitting edema was present cranial to the sheath, but was decreasing. The owner was instructed to keep the gelding in stall confinement for four weeks, with hand walking 10 minutes two to three times a day. No free exercise was permitted during this time, allowing the incision to heal. After the four weeks he could graduate to a small paddock, where he could walk and trot, but no hard exercise or play is allowed for eight weeks.

After the eight weeks if there were no complications, he could be turned out to pasture for an additional four weeks, then resume his normal exercise program.

The gelding was placed back on his normal diet of grass and alfalfa mixed hay, and access to clean fresh water. It is important for horses that have had uroliths to increase the water consumption to aid in flushing the bladder. Promoting water consumption can be accomplished by adding salt blocks, or adding salt to the grain portion of the diet.

Uroliths are most often seen in adult horses and more frequently in males than females. The increase in frequency in males may be attributed to the anatomic differences in the urethra. Males have a longer, more narrow urethra, where females have a shorter, broader urethra, allowing larger crystals to pass thereby preventing accumulation and urolith formation. There are two forms of calcium carbonate uroliths that occur in the bladder. The most common form is a rough, speculated, yellow, oval shape that is soft and friable which is comprised of salts and mucoproteins. This form is the type seen in this particular case. It was very important during surgery to remove the fragments during surgery to prevent further urolith formation.

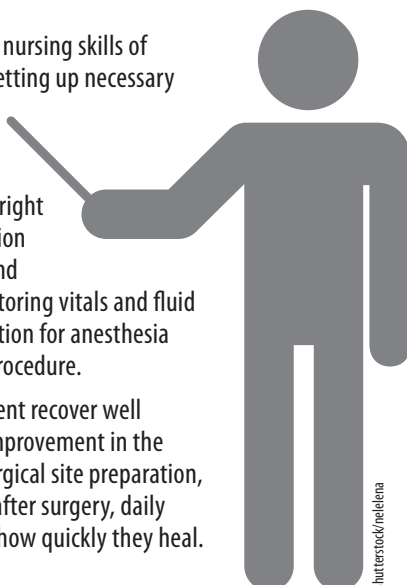
The second form of calcium carbonate is smooth, white, very hard and resistant to fragmenting. Calcium carbonate urolith formation in equines may be attributed to the alkaline and high mineral content and large amounts of mucoproteins. The mucoproteins allow crystals to adhere to each other accumulating and forming uroliths.

Other attributing factors are high calcium concentration in feeds such as alfalfa, high mineral content in water and genetics. The diagnosis of uroliths is based on history, clinical signs and confirmation by endoscopic examination of the bladder. The treat-

Teaching Points

Through performing the advanced nursing skills of preparation of the surgical suite, setting up necessary equipment such as suction and endoscopy, blood collection for pre-surgical screening, intravenous catheterization of the right jugular vein, endotracheal intubation and placement on the ventilator and maintaining with isoflurane, monitoring vitals and fluid therapy, I have gained an appreciation for anesthesia and close monitoring during the procedure.

It is very rewarding to see the patient recover well and the client's feedback on the improvement in the patient's health. I assisted with surgical site preparation, recovery phase, monitoring urine after surgery, daily physical examinations and seeing how quickly they heal.



ment for uroliths is surgical extraction and formation of uroliths can reoccur.

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About the author

Tammy Treitline, LVT, VTS-EVN, has been a veterinary technician for more than 15 years and currently works at Casselton Veterinary Services in Casselton, N.D. She enjoys spending time with family, friends and horses.



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