

# *the*HORSE

YOUR GUIDE TO EQUINE HEALTH CARE

## AAEP Convention

A supplement to *The Horse*

- 2 ► Contents
- 4 ► Highlights and Awards
- 7 ► Lessons from Barbaro
- 11 ► Kester News Hour
- 15 ► Reproduction
- 24 ► Diagnostics
- 30 ► Foot/Lameness
- 42 ► Arthritis
- 44 ► Digestive Health
- 47 ► Medicine/Surgery
- 51 ► Horse Management
- 55 ► Infectious Diseases
- 58 ► Nutrition
- 63 ► Ophthalmology

SPONSORED BY

*Steadfast*  
EQUINE™



( your way )



( our way )

Are you *still* using multiple supplements  
to keep your horse sound?



## Introducing STEADFAST™ EQUINE — the better way to build soundness from the inside out.

More than a joint health product, better than a typical hoof health product, and different than a vitamin/mineral product, STEADFAST™ EQUINE is the only product designed by veterinarians and nutritionists specifically to support your horse's entire structural system. With its exclusive ingredients NEM® and TélaFirm™, STEADFAST EQUINE is "the one and only one" supplement that provides noticeable results for all your structural health concerns, including relief from joint discomfort in as little as 7 days!

**Learn more at [arenusperformance.com](http://arenusperformance.com).**



Ask your veterinarian about STEADFAST™ EQUINE or order online  
at [www.smartpakequine.com](http://www.smartpakequine.com) and [www.arenusperformance.com](http://www.arenusperformance.com).

**Steadfast**  
EQUINE™

*The One and Only One.™*

STEADFAST™ EQUINE is a product of Arenus, a division of Novus Nutrition Brands, LLC., St. Louis, Missouri | [www.arenusperformance.com](http://www.arenusperformance.com)  
STEADFAST™ and TélaFirm™ are trademarks of Novus Nutrition Brands, LLC. | NEM® is a registered trademark of ESM Technologies, LLC.  
The SmartPak™ logo is a trademark of SmartPak Equine, LLC. | Patent pending | © Copyright Novus Nutrition Brands, LLC., 2008.



## AAEP 2007 CONVENTION FEATURES

**6 Awards & Officers**

The first woman took the helm of the AAEP while others were honored.

By Kimberly S. Brown

**10 Lessons from Barbaro**

Dean Richardson, DVM, Dipl. ACVS, of the University of Pennsylvania, told Barbaro's medical story.

By Kimberly S. Brown

**14 The Latest News**

Research and accomplishments in veterinary medicine that either were too new to make the regular AAEP presentations, or warranted additional commentary, were presented in the revamped Kester News Hour.

By Christy West

**20 Reproduction**

Among the many presentations was an in-depth discussion of sperm in the Milne State-of-the-Art Lecture.

By Les Sellnow

**26 Diagnostics**

Discussions ranged from MRI to pre-purchase exams and airway evaluations.

By Christy West

**32 Foot/Lameness**

Topics included therapeutic shoeing, stem cells, and tendonitis.

By Christy West and Nancy Loving, DVM

**38 Arthritis**

New studies on treatments for arthritis in horses, including doxycycline, Surpass, and Myristol.

By Christy West

**40 Digestive Health**

Research clues for vets and owners on management practices for problems with sand, ulcers, and acidosis.

By Christy West

**44 Medicine/Surgery**

Topics included traumatic brain injury, IV lidocaine for pain management, cisplatin beads for cancer treatment, and hernia surgery.

By Christy West

**48 Horse Management**

Topics included airlifting a horse, back sensitivity and treatment, poisoning, and Healthy Horses Workshop talks.

By Les Sellnow and Christy West

**54 Infectious Disease**

Researchers discussed strangles, *R. equi*, West Nile virus, *Leptospira* spp that causes moon blindness, and more.

By Les Sellnow

Many more articles from the 2007 AAEP convention will be available in a PDF on [TheHorse.com](http://TheHorse.com).

**55 Dentistry**

Discussions on the horse's mouth included biting and sinus problems.

By Les Sellnow

**56 Nutrition**

Research on feeding horses with equine metabolic syndrome, equine Cushing's disease, and colic.

By Nancy Loving, DVM

**61 Ophthalmology**

Information on a normal eye exam and moon blindness.

By Nancy Loving, DVM

**62 And More ...**

Other information included corneal ulcers, uveitis, and a list of topics that couldn't fit in the print version, but will be available online.

By Nancy Loving, DVM, et al.

**62 Advertising Index**

THE 2007 CONVENTION PROCEEDINGS WITH SYNOPTES FROM EACH SPEAKER CAN BE PURCHASED FROM THE AAEP BY CALLING CHELSEA AT 800/443-0177; 859/233-0147; OR WRITING TO AAEP, 4075 IRON WORKS PARKWAY, LEXINGTON, KY 40511.

**Partners in Equine Health**

**MEDIA PARTNER**

**AAEP**



**AAEP Media Partners** are an esteemed group of industry-leading corporations dedicated to providing resources and education, through the AAEP, to veterinarians and horse owners to improve the health and welfare of the horse.

PHOTO CREDITS: COVER AND ABOVE—COOKIE SERLETIC  
BARBARO—COURTESY DR. DEAN RICHARDSON

# Convention Highlights Research, Learning

The 53rd American Association of Equine Practitioners Convention offered the latest in research findings and honored leaders in the veterinary field

BY KIMBERLY S. BROWN

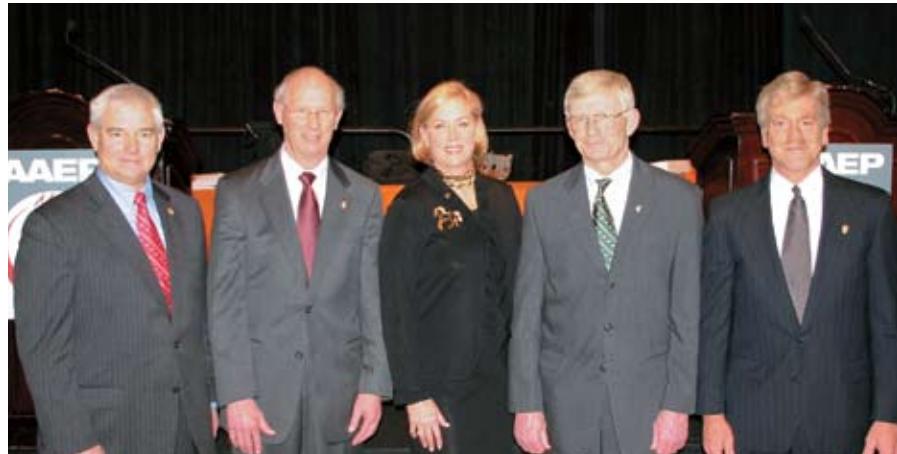
Veterinarians, veterinary technicians, and horse owners gathered in Orlando, Fla., Dec. 1-5 for the 2007 convention of the American Association of Equine Practitioners (AAEP), which is the largest educational event for horse veterinarians in the world. This convention was the second consecutive meeting that broke attendance records, with 7,238 veterinary professionals, guests, and exhibitors at the gathering. The previous attendance record of 6,842 was set at the 2006 convention in San Antonio, Texas.

Another first was the swearing in of the association's first woman president, Eleanor Green, DVM, Dipl. ACVIM, ACVP. Green was the program chair for the 2007 convention. Green is professor and chair of the Department of Large Animal Clinical Sciences at the University of Florida's College of Veterinary Medicine. She also is the college's chief of staff at the Large Animal Veterinary Medical Center.

"Dr. Eleanor Green and the Educational Programs Committee put together another great meeting program for our members," said David L. Foley, AAEP executive director. "I continue to be overwhelmed each and every year with the increasing attendance and the quality of the material."

## New Officers and Board Members

The 2008 Executive Committee and new members of the Board of Directors took office on Dec. 4. Executive Committee members are: Green, president; Harry W. Werner, VMD, a private practitioner in North Granby, Conn., president-elect; Nat White



The 2008 Executive Committee includes (left to right): Immediate Past President Doug Corey, DVM; Vice President Nat White II, DVM, MS, Dipl. ACVS; President Eleanor Green, DVM, Dipl. ACVIM, ACVP; Treasurer R. Reynolds Cowles Jr., DVM; and President-elect Harry W. Werner, VMD.

II, DVM, MS, Dipl. ACVS; Jean Ellen Shehan Professor and director of the Marion duPont Scott Equine Medical Center in Leesburg, Va., vice president; Doug Corey, DVM, a private practitioner in Adams, Ore., immediate past president; and R. Reynolds Cowles Jr., DVM, a private practitioner from Free Union, Va., treasurer.

New members of the board of directors are: Dickson D. Varner, DVM, MS, Dipl. ACT, Texas A&M University; W. David Wilson, BVMS, MS, University of California, Davis; Roxy J. Bell, DVM, MSc, Dipl. ACT, a private practitioner from Alberta, Canada; and Brian S. Carroll, DVM, a private practitioner from Edmond, Okla.

## Distinguished Educators

Several awards were presented during

the Dec. 4 President's Luncheon. The Distinguished Educator Award is given to those who "have significantly impacted the development and training of equine practitioners." The 2008 recipients were Howard "Gene" Gill, DVM, a retired practitioner and former faculty member at Michigan State University, and James Moore, DVM, PhD, Dipl. ACVS, of the University of Georgia.

Gill served on the faculty of Michigan State University beginning in 1966, and he led a four-veterinarian practice in Pine Bush, N.Y. Gill is now retired, although he occasionally assists with surgery at his old practice. He has been an AAEP member since 1957, has served on the Resident Veterinarian and Constitution/Bylaws Committees, and he now holds the distinction

of Honor Roll member within the association.

Moore is known for his research in endotoxemia, and he has worked within a group of investigators to develop innovative computer-aided teaching modules depicting some of the more complex aspects of endotoxemia, gastrointestinal abnormalities in horses, and intracellular signal transduction pathways (known as The Glass Horse; watch for clips from this animated educational video coming to TheHorse.com soon). Moore received the University of Georgia's Creative Research Medal in 1988 for his research on intestinal diseases and endotoxemia; the David Tyler Award for Innovation in Teaching at the University of Georgia in 1998; the World Equine Veterinary Association Research Award in 1999; and the Alumni Achievement Award from the School of Veterinary Medicine at the University of California, Davis in 2006. Moore was the 2001 Frank J. Milne Memorial Lecturer at AAEP, and he has been a Distinguished Research Professor at the University of Georgia since 2002.

#### Distinguished Service Award

The AAEP Distinguished Service Award

is given to an individual "who has provided exemplary service to the AAEP or a similar organization to the benefit of the horse, horse industry, or the profession of equine veterinary medicine." The 2007 recipient was Gary Norwood, DVM, a private practitioner formerly from Louisiana and now residing in Texas. Norwood, a former AAEP president, assumed the leadership role in the World Equine Veterinary Association for 2008. Norwood served in the U.S. Army Veterinary Corps during the Vietnam War, and he has lead and served on numerous AAEP and other industry committees. He also is a spokesperson in the AAEP On Call Program, offering veterinary insight during various televised elite equine competitions.

#### George Stubbs Award

The AAEP's George Stubbs Award recognizes contributions made to equine veterinary medicine by individuals other than veterinarians. The 2007 recipients were George Bagby, MD, and Barbaro's owners Roy and Gretchen Jackson, along with the horse's trainer, Michael Matz.

Bagby is an orthopedic surgeon still practicing medicine even now at 84 years of age. Bagby received a master's degree

in orthopedics for the development of the self-compressing bone plate. In 1975, Bagby created a visitation program between the Washington State University College of Veterinary Medicine and Sacred Heart Hospital in Spokane, Wash. This unique program introduced veterinary surgery residents at Washington State to surgical procedures in human medicine. The collaboration resulted in the development of the Cloward technique, which treats cervical (neck vertebrae) malformations in horses. This procedure has been utilized in more than 1,000 horses to date.

The spotlight was shone on the Jacksons and those associated with the Thoroughbred racehorse Barbaro during his fight against catastrophic injury and laminitis. "The Barbaro team has made significant contributions to equine veterinary medicine through the creation of multiple research funds, an endowed chair in equine disease research at the University of Pennsylvania School of Veterinary Medicine, and positive public outreach efforts that helped showcase the advances in equine medicine and surgery," noted the AAEP. "This all stemmed from their unwavering support and love for Barbaro."

# Jump higher.

Different than a vitamin/mineral product. More than a joint health product. Better than a typical hoof health product. STEADFAST™ EQUINE is "the one and only one" dietary supplement that's better at building soundness from the inside out, providing your horse with a long, healthy and active life.

**Learn more at [arenusperformance.com](http://arenusperformance.com).**

## Convention Highlights

### The Lavin Cup for Welfare

Named for AAEP Past President Gary Lavin, VMD, the Lavin Award is presented to a nonveterinary individual or organization that has demonstrated exceptional compassion or developed and enforced rules and guidelines for the welfare of the horse. The 2007 recipient was Finger Lakes Thoroughbred Adoption Program.

The Finger Lakes Thoroughbred Adoption Program is dedicated to finding homes for former racehorses. Racetrack veterinarian Margaret Ohlinger, DVM, trainer Phyllis Shetron, and horse owner Valerie Morrison, together with management from Finger Lakes Gaming and Racetrack, founded the program in 2005. It is the first Thoroughbred adoption facility in the country to be run as a collaborative effort between racetrack management and horsemen. They have found new homes for more than 100 former racehorses and are currently fundraising for the construction of a new barn to house retirees before adoption.

Previous recipients of the Lavin Cup include the Thoroughbred Retirement Foundation, American Quarter Horse Association, California Horse Racing Board, Professional Rodeo Cowboys Association, Thoroughbred Charities of America, and Days End Farm Horse Rescue.



CHAD MENDELL

George Bagby, MD, (left) received the George Stubbs Award for his contributions to equine veterinary medicine.

### Distinguished Life Member

AAEP Past President Robert D. Lewis, DVM, of Elgin, Texas, was recognized for his contributions to veterinary medicine with a Distinguished Life Member Award.

Lewis received his veterinary degree from the Louisiana State University School of Veterinary Medicine in 1977. He entered private practice upon graduation and began working at Cardwell and Graham Veterinary Hospital. He became a full partner in 1979, at which time the business entity was renamed Elgin Veterinary Hospital. He was also a partner in Elgin Breeding Service until 1985, and a partner in Southwest Stallion Station until 1993. Currently Lewis is president of Elgin

Veterinary Hospital, which is a private hospital and referral practice owned and operated by five veterinarians, with an additional seven associate veterinarians.

An AAEP member since 1976, Lewis has been very active within the association. In addition to serving as president in 1999, he served on the board of directors from 1987 to 1993. He is an On Call team member and he also has served on the AAEP Long-Range and Strategic Planning, Constitution and Bylaws, Problems Analysis, Research, Convention Planning, President's Advisory, Nominating, Public Policy, and Foundation Advisory Committees. Lewis also is the AAEP representative for the Racing Medication and Testing Consortium and the AAEP representative for the Legislative Advisory Council of the American Veterinary Medical Association.

### About AAEP

The AAEP, headquartered in Lexington, Ky., was founded in 1954 as a nonprofit organization dedicated to the health and welfare of the horse. Currently, the AAEP reaches more than 5 million horse owners through its nearly 9,000 members worldwide, and it is actively involved in ethics issues, practice management, research, and continuing education in the equine veterinary profession and horse industry.

The AAEP's 54th Annual Convention will be held in San Diego, Calif., Dec. 6-10. ♣

# Ride farther.

Your horse's joints, bones, hooves, and other connective tissues may be impacted over time due to athletic performance and aging. While many equine health products may address one component of your horse's framework, STEADFAST™ EQUINE supports your horse's entire structural system.

Learn more at [arenusperformance.com](http://arenusperformance.com).

# Lessons from Barbaro

BY KIMBERLY S. BROWN

**B**arbaro first captured America's imagination, then its heart. "People thought a superstar was on the horizon" after Barbaro's easy win in the Kentucky Derby, said Dean Richardson, DVM, Dipl. ACVS, the veterinary surgeon who headed the team that attempted to save Barbaro's life after a catastrophic injury in the 2006 Preakness Stakes.

Richardson's presentation, sponsored by Merial, was designed to walk the audience of several thousand equine practitioners through the ups and downs of medically attending a horse of this caliber with an injury one veterinarian had described to this editor as "a bag of ice" because of the multiple bone fragments involved.

He said his unique presentation was designed "for veterinarians and adults" as he dealt in-depth with the injuries and techniques used to try to save Barbaro.

Richardson is known for his ability to handle complicated surgery cases and became quite adept at fielding complicated press relations during Barbaro's stay at the University of Pennsylvania's New Bolton Center. He was just as adept and calm in handling a difficult speaking scenario while contending with a sound system problem during about a quarter of his presentation. The fire alarm went off in a section of the hotel attached to the conference center, which turned on the house sound system speakers, which caused feedback deafening squeals. Richardson only paused when the feedback became unbearable.

## The Story of Barbaro

He said the story of Barbaro became a phenomenon for several reasons, including trainer Michael Matz, the former Olympian who was a hero in his own right



BARBARA LIVINGSTON

Kentucky Derby winner and champion Thoroughbred Barbaro captured America's imagination and heart with a thrilling victory and his brave struggle to overcome catastrophic injury.

after saving three children during a plane crash. "He's a legitimately great human being," said Richardson.

"There's no such thing as a good horse without good owners," continued Richardson, "and you can't do better than the Jacksons (Roy and Gretchen, Barbaro's owners). They are private people who had to become public."

At that juncture he showed a video of the Preakness, Richardson said, "It's really hard still for me to watch that tape." He accentuated the athleticism of Barbaro to keep galloping on three legs, and the skill of jockey Edgar Prado in pulling up Barbaro and keeping him from running off.

Richardson and moderator Eleanor

## Barbaro

Green, DVM, Dipl. ACVIM, ACVP, head of the large animal hospital at the University of Florida veterinary school, both paid tribute to long lists of people who were involved in the Barbaro story. The group included those at the track who stabilized Barbaro and those who drove him to New Bolton, to the nurses and technicians at the hospital who cared for the horse on a daily basis.

Richardson singled out Larry Bramlage, DVM, Dipl. ACVS, an orthopedic surgeon at Rood & Riddle Equine Hospital in Lexington, Ky., who was the AAEP On Call veterinarian at the Preakness who spoke to media to try and explain what had happened to Barbaro.

### The Surgery

Barbaro was transported and stabilized the night of the Preakness, and Richardson flew back from Florida, where he had been performing surgery. He had seen X rays taken at the racetrack prior to leaving Florida, "so I knew what I was dealing with," he said.

The extent and type of injuries "precluded certain options, such as external fixation," explained Richardson. "He was placed under general anesthesia in a sling and the leg was unwrapped. There were no gross breaches in the skin, but there was serum coming through the skin."

He said there was no option but to do a fetlock arthrodesis (fusion). Richardson said there was no history of lameness for Barbaro, and no evidence of pre-existing injuries evident at surgery. A question from the audience at the end of the presentation asked whether Barbaro breaking from the gate prior to the start of the race had any predisposing effect on Barbaro's injury. Richardson said, "I didn't address his early breaking from the gate because I don't think it was part of the injury. The horse was examined by a veterinarian when he broke out of the gate. It doesn't take much effort to break through a starting gate."

"My gut feeling is I don't think it was related, but we'll never know," he said.

Richardson walked his veterinary audience through the entire surgical procedure, showing images of the various stages of the operation with comments on the type of equipment, plates, screws, bone



One rough recovery left the entire team sitting along the wall around the recovery pool exhausted while Barbaro stayed in the recovery raft with some hay in front of him.



COURTESY DR. DEAN RICHARDSON

Richardson credited the water recovery raft system of waking horses up from anesthesia for helping keep Barbaro alive through his numerous surgeries and cast changes.

grafts, etc., that were used, and why.

"Infection is the No. 1 concern with this type of surgery," he said. In his "Lessons Learned" section at the presentation's end, he said he wished there could have been better fixation of the pastern joint. "We got into trouble when the pastern joint didn't remain stable and we had to go back in and the horse developed an infection and foundered," reflected Richardson.

### The Long Road

Richardson credited the water recovery raft system of waking horses up from anesthesia for helping keep Barbaro alive through his numerous surgeries and cast changes. He showed several videos of Barbaro being lifted in the sling while anesthetized and while awake and heading to

his stall in the intensive care unit, which was about 100 yards away.

"He got used to it," said Richardson of the use of the pool, sling, and being hoisted. But he did cite one "difficult" recovery that in hindsight, he said, was probably when the horse was developing laminitis.

"Things were working really well the first six weeks," said Richardson. "He was comfortable with Bute. But I knew all the problems were not going to be addressed in the first two, six, or eight weeks. But I'm still human, and I got my hopes up."

When Barbaro's right hind pastern began to be unstable, he became sore. Richardson found on X rays that one of the screws was bent and coming out of the plate. That screw was replaced and more screws were added.

"If you put one moment that was the turning point of this case ... he ended up getting a local infection at the distal end of the plate" after that surgery, said Richardson.

That required going back into the pastern, removing the plate, cleaning it up, putting two plates back in, and two cast changes. It was at this point he had a "rough recovery" from anesthesia, said Richardson. "That was one of the low points in this eight-plus-month saga."

It took 16 hours to try and get him on his feet. "Every time we got him out he struggled," said Richardson. "It took three of four tries." One image Richardson showed was Barbaro in the recovery raft with some hay in front of him, and the team sitting along the wall around the pool, visibly exhausted (see top photo on page 8).

"I was sure we were in big trouble at that point," recalled Richardson. The pastern healed (fused), but that was about the time that Barbaro foundered badly in his left hind.

There was distal displacement of the coffin bone (it sank) within two days. "We had him on intense analgesia, including an epidural," noted Richardson. "He was remarkably comfortable."

A meeting was held in front of Barbaro's stall with Richardson, the Jacksons, and the Matzes to discuss his future.

"I told them this was catastrophic

**“ If you put one moment that was the turning point of this case ... he ended up getting a local infection at the distal end of the plate. ”**

#### DR. DEAN RICHARDSON

and suggested it might be time to quit," said Richardson. "None of us could do it because all of us were in front of his stall and Barbaro looked like he had barely a care in the world. Barbaro had the final vote, and we pressed on."

At that point the foot was completely unstable since most of the hoof capsule had been removed. "There was nothing but a blood clot (under the hoof wall)," said Richardson. The only stable part of the foot that was connected was the lateral quarter. "The medial side never recovered," said Richardson. A hoof cast was applied, and "a dozen different appliances" were used. "He still had to bear weight on the right hind, and that resulted in some collapse," he noted.

For two weeks Barbaro was in and out of his sling. "He was a smart horse, and as long as you gave him plenty of attention, he was good in the sling," said Richardson. Most of the leg cast and foot cast changes were done under general anesthesia.

Then Barbaro began having some healthy coronary tissue, and he improved

to just wearing a bandage and cast. At that point Richardson could lead him out a few feet to a grassy patch outside the hospital for the horse to graze.

"Just having him munch grass made me happy," said Richardson. "He was walking on both hind limbs very well."

That progress continued through the fall of 2006, with the horse going out to hand graze every day. He was out of his cast for several months before things took a final downturn. His fracture healed, but the excess weight bearing resulted in less-than-perfect alignment of the right hind pastern. Barbaro was still not growing enough hoof.

"The real thing that led to his demise is when he developed a horrific sole abscess in his right hind," said Richardson. "Because his left hind foot was still not growing adequately and not comfortable for him, it was impossible to manage the abscess in the right hind foot." Then Barbaro foundered in his front feet, and, as Richardson termed it, "the story faded to black." ♣

# Show stronger.

Two exclusive ingredients in STEADFAST™ EQUINE — **NEM** and **TelaFIRM** — work together to build soundness from the inside out in as little as seven days. STEADFAST EQUINE also provides ascorbic acid for healthy joints; calcium, phosphorous and vitamin D for healthy bones and biotin for healthy skin and hooves. **Learn more at [arenusperformance.com](http://arenusperformance.com).**



( your way )



( our way )

Are you *still* using multiple supplements  
to keep your horse sound?



## Introducing STEADFAST™ EQUINE — the better way to build soundness from the inside out.

More than a joint health product, better than a typical hoof health product, and different than a vitamin/mineral product, STEADFAST™ EQUINE is the only product designed by veterinarians and nutritionists specifically to support your horse's entire structural system. With its exclusive ingredients NEM® and TelaFirm™, STEADFAST EQUINE is "the one and only one" supplement that provides noticeable results for all your structural health concerns, including relief from joint discomfort in as little as 7 days! [Learn more at arenusperformance.com](http://Learn more at arenusperformance.com).



Ask your veterinarian about STEADFAST™ EQUINE or order online  
at [www.smartpakequine.com](http://www.smartpakequine.com) and [www.arenusperformance.com](http://www.arenusperformance.com).

**Steadfast**  
EQUINE

*The One and Only One.™*

STEADFAST™ EQUINE is a product of Arenaus, a division of Novus Nutrition Brands, LLC., St. Louis, Missouri | [www.arenusperformance.com](http://www.arenusperformance.com)  
STEADFAST™ and TelaFirm™ are trademarks of Novus Nutrition Brands, LLC. | NEM® is a registered trademark of ESM Technologies, LLC.  
The SmartPak™ logo is a trademark of SmartPak Equine, LLC. | Patent pending | © Copyright Novus Nutrition Brands, LLC., 2008.

# Kester News Hour

BY CHRISTY WEST

A variety of topics, including methicillin-resistant *Staphylococcus aureus*, influenza outbreaks, stem cell therapy, and reproductive research were highlighted during the reinvented Kester News Hour. The popular two-hour scientific program kickoff featured three new presenters discussing the latest advances in equine surgery, internal medicine, and reproduction.

Replacing outgoing presenters John Madigan, DVM, MS, Dipl. ACVIM, and Larry Bramlage, DVM, MS, Dipl. ACVS, were Scott Palmer, VMD, Dipl. ABVP; Bonnie Rush, DVM, MS, Dipl. ACVIM; and Margo Macpherson, DVM, MS, Dipl. ACT. The new panel presented the fast-paced news broadcast format under the call letters WKNH (W Kester News Hour), complete with equine-themed "commercials" for comic relief.

The work of Bramlage and Madigan as Kester News Hour hosts was not forgotten. As starting time approached, a video accompanied by the song "The Way We Were," was presented, highlighting both poignant and humorous moments during the Kester News Hour through the years.

The program is designed to give a quick overview of some of the research and accomplishments in veterinary medicine during the previous year that either were too new to make the regular presentations or warranted additional commentary.

## Lameness/Surgery

**Stem Cells** A study published in *Veterinary Surgery* (VS) in 2007 evaluated fat tissue (adipose)-derived stem cells (ASC) in an attempt to discover whether these stem cells are as effective as those harvested from bone marrow (MSC). "(ASC) are capable of adipogenic (fat-producing) and osteogenic (bone-producing) differentiation, and their expansion characteristics are similar to those of other species," Palmer reported. "But osteogenic induction of ASC is slower than that of MSC."



The Kester News Hour featured three new presenters discussing advances in equine surgery, internal medicine, and reproduction. (Left to right) Margo Macpherson, DVM, MS, Dipl. ACT; Scott Palmer, VMD, Dipl. ABVP; and Bonnie Rush, DVM, MS, Dipl. ACVIM, presented the fast-paced news broadcast format under the call letters WKNH.

A second study published in the *Journal of Orthopedic Research* found that arthroscopic scores for MSC-implanted cartilage defects were significantly better than controls at 30 days post-treatment, but no better in the long-term (at eight months).

"This field is relatively young, but holds promise," Palmer summarized. "It's important to balance our expectations with the scientific knowledge we have available. Our clinical expectations have outpaced our scientific knowledge at this point."

He also noted that stem cells derived from skin tissue might hold promise for equine use.

**Coffin joint medication success** An

*Equine Veterinary Journal* (EVJ) study found that polysulfated glycosaminoglycan (PSGAG, i.e., Adequan) injected into the coffin joint for treatment of arthritis had a 76% success rate one year after treatment based on owner surveys, compared to a 46% success rate for methylprednisolone acetate (MPA, i.e., Depo-Medrol).

"But in this study it's not possible to make a direct comparison between these two medications because if horses didn't resolve with MPA treatment, they were later treated with the Adequan," cautioned Palmer. The exercise recommendations for the two treatments were also different, introducing still another variable. Addi-

tional findings were that dressage horses enjoyed better results than jumpers, and in general horses did better if they were older than 10 years, had lameness of less than three months duration, or had unilateral lameness (in one front or hind foot only).

**Interleukin-1 receptor antagonist protein (IRAP)** This relatively new treatment did well in a study of arthritis published in the *American Journal of Veterinary Research* (AJVR). Treated horses showed a significant improvement in clinical lameness and a decrease in synovial membrane hyperplasia (thickening of the joint lining due to inflammation) compared with controls. They also experienced no adverse side effects and showed a trend toward decreased cartilage fibrillation (softening and grooving of joint surface cartilage).

**Interpreting joint fluids** When is a horse's joint infected? Usually a veterinarian looks for levels of total protein, neutrophil percentage, and total nucleated leukocyte count in the joint fluid to be increased with infection, but a VS study found that injection of plain saline or amikacin antibiotic resulted in temporary increases in all of these values, despite sepsis (infection) not actually being present.

"Reactive synovitis from injections can confuse interpretation of synovial values," explained Palmer. "Some horses had increases in synovial fluid values that might be interpreted as sepsis even though it wasn't present. But the potential for sepsis shouldn't be ignored; veterinarians must be careful to interpret synovial values in the context of culture and sensitivity test results, and the degree of lameness. Horses that have a mild reactive synovitis are generally sound, while horses with infection are usually quite lame."

**Nutraceuticals for lameness** Palmer reported on several nutraceutical studies, including an equine study of avocado and soybean extract (published in AJVR) that found that it didn't improve lameness caused by experimentally induced arthritis, but it did significantly reduce synovial hemorrhage (bleeding) and the severity of the articular cartilage erosion. "It doesn't provide a lot of analgesia, but it certainly can have a disease-modifying role in management of these diseases," he noted.

**Racing surfaces** Researchers, veterinarians, and others are always on the lookout

for ways to minimize catastrophic injuries (severe injuries necessitating humane euthanasia) on racetracks. Palmer discussed a study published in *Clinical Techniques in Equine Practice* regarding track factors that might influence injuries. Turf tracks had one-third the risk of breakdowns than dirt tracks with fast conditions had, and muddy dirt tracks had a significantly lower rate of breakdowns compared to fast tracks. The injury rate per 1,000 starters was found to be 3.5-7.3, and the rate of catastrophic injuries was found to be 0.99-1.85 (or approximately one in 1,000 starts). The metacarpophalangeal joint ( fetlock) was injured in 12.3% of catastrophic injuries.

"Transitions may be a factor; when a track is dry or under a lot of rain it's sta-

equine slaughter plant.

"Prior to that, about 80 horses per week were shipped from the United States to Mexico for slaughter, but during the week after the Illinois plant closure, that number jumped to 1,345," she reported. "It's estimated that 40,000 horses will be shipped to Mexico for slaughter by the end of this year; 31,086 horses have been transported as of Dec. 6, whereas only a total of 6,392 horses were transported last year.

"Doug Corey (DVM, then the chair of AAEP's Welfare Committee) and Tom Lenz (DVM, then the AAEP president), and David Foley (AAEP executive director) visited the Texas slaughter plants and found that horses were treated humanely and euthanized according to USDA/AVMA guidelines," she went on. "AAEP's concerns with

**“It’s estimated that 40,000 horses will be shipped to Mexico for slaughter by the end of this year.”**

DR. BONNIE RUSH

ble, but when the rain first soaks the track or as the track dries, inconsistencies can increase the risk of injury," commented Palmer.

## Horse Identification

"Right now we're in the midst of a voluntary program designed to facilitate traceback in the event of an outbreak," said Palmer. "The USDA has approved new 134.2 KHz microchips in addition to the older 125KHz chip, and they recommend the 134.2 KHz chip from this point forward." Vets implanting the new chips will have to report them to the USDA.

For more information, see [www.EquineSpeciesWorkingGroup.com](http://www.EquineSpeciesWorkingGroup.com).

## Slaughter

"When the Horse Slaughter Prevention Act was introduced in 2005, there were three slaughter plants processing about 80,000 horses per year (two in Texas and one in Illinois)," began Rush. After briefly discussing the progress of that legislation and closure of the Texas plants, she noted that in late September of 2007, the federal appellate court upheld the constitutionality of an Illinois law banning slaughter, effectively closing the last remaining U.S.

the current situation are long-term placement of the 80,000 unwanted U.S. horses per year and funding for them. The American Veterinary Medical Association will be including provisions to fund the care, maintenance, and disposal of unwanted horses. But we need to address the root—irresponsible horse ownership—not the symptom, which is unwanted horses going to slaughter. The Unwanted Horse Summit was held in April 2005 and the Unwanted Horse Coalition grew out of that summit as a broad allegiance of equine organizations committed to educating the horse industry about the unwanted horse issue. The goals are to reduce the numbers of unwanted horses; educate owners, breeders, and sellers; facilitate adoption and donation; and establish a rescue organization registry to facilitate adoptions."

"It's a very tough situation," Palmer concluded. "The demand for horse meat in Europe is still very high; in fact it's at an all-time high due to consumer concern regarding beef consumption in the wake of recent outbreaks of bovine spongiform encephalopathy (mad cow disease). At this point we're not changing anything (with regards to decreasing horse slaughter), we're just shifting it beyond U.S. borders."

## Medicine/Infectious Disease

### **Methicillin-Resistant *Staphylococcus aureus* (MRSA)**

"MRSA often manifests as flesh-eating disease or septicemia, and it caused 90,000 cases of invasive infection and 18,650 human deaths in the United States in 2007," reported Rush. "Its death rate exceeds that of HIV. In the past year it's become more community-associated than hospital-associated, with community-associated outbreaks causing 32 infections and 6.2 deaths per year. About 0.8-3% of the general population carries it in their nasal passages without showing disease. Based on one study, the disease has an 83% survival rate in horses, but the length of the hospital stay and costs are extensive."

Zoonotic MRSA infection—which jumps from humans to animals or vice versa—was first reported by the University of Guelph in 2004. Horse to human transmission occurs readily (dogs can carry it, too), and a study published in the *Canadian Veterinary Journal* found that 2% of horses admitted to veterinary hospitals carry the bug. Penicillin and sulfa antibiotic use are risk factors for horses, as is admission to a neonatal intensive care unit and previous colonization of the horse or the horse's farm. Undergoing surgery might reduce risk, possibly because most surgeries are elective and most cases get less antibiotics

beforehand than internal medicine cases.

Attendees got quite a shock from Rush's report of the results of a study conducted on veterinarians attending last year's AAEP convention. Nasal swabs were collected and cultured at an exhibit booth on 257 veterinarians from 12 countries. "Recall that the general population's carrier rate is 0.8-3%, but 10.1% of us are carrying MRSA and 62% of the carriers were ambulatory practice veterinarians," she stated. "The most common strain was USA500/CRSA5, which is normally uncommon in humans (but common in horses). Handwashing between cases and farms reduces the likelihood that someone will carry MRSA, so this is the recommendation for prevention at day cares, hospitals—everywhere."

**Do foals get *Rhodococcus* from their dams?** Rush discussed an AJVR study of 171 mare-foal pairs, 53 (31%) of which included a foal affected with *Rhodococcus equi* pneumonia, that attempted to answer the question of whether foals get *R. equi* from their dams. Researchers found virulent *R. equi* at least once in every mare during the study period, and fecal concentrations of the bacterium were not significantly different between dams of sick and healthy foals. Thus, foals might indeed get *R. equi* from their dams, but the ones that get sick don't appear to get any more of a challenge from

their dams than those that don't.

### **Treating *R. equi* infection with gallium maltolato**

One substance might help combat foal susceptibility to *R. equi*—gallium maltolato. Rush explained that it is an iron mimic that exploits the iron dependency of the *R. equi* bacterium to kill it. It's highly bioavailable and has minimal side effects in humans, and prophylactic (protective) administration reduces the severity of *R. equi* infection in mice. Side effects were minimal or nonexistent in an AJVR study.

Treatments for *R. equi* include immunostimulation to boost interferon (a protective protein) and prophylaxis with gallium maltolato to kill the bacteria, she explained. "It will be interesting to see which strategy is more effective," she commented.

**Equine herpesvirus outbreaks** "There have been 25 confirmed equine herpesvirus (EHV) outbreaks since 2000, which approximates the number of outbreaks in the previous 30-35 years," reported Rush. "In six well-documented outbreaks, there were 119 cases and 35 deaths—resulting in higher-than-normal morbidity (disease rate) of 26% and mortality (death rate among ill individuals) of 29%. The disease is evolving in terms of virulence and behavior, and the USDA has designated neurologic EHV as a potentially emerging disease. Outbreaks are caused by a specific strain of EHV-1; 30 of the outbreaks between 2000 and 2006

# Jump higher.

Different than a vitamin/mineral product. More than a joint health product. Better than a typical hoof health product. STEADFAST™ EQUINE is "the one and only one" dietary supplement that's better at building soundness from the inside out, providing your horse with a long, healthy and active life.

Learn more at [arenusperformance.com](http://arenusperformance.com).

were caused by a mutant strain and only two were caused by a wild type.

"The mutant strain causes tenfold higher viremia (level of virus in the bloodstream) than typical EHV," she said. "A single amino acid substitution in the virus' DNA is the mutation, and that viral genome is highly conserved across species. An article by George Allen (PhD, a former professor at the University of Kentucky's Gluck Equine Research Center) in the *Journal of Veterinary Diagnostic Investigation* on a real-time PCR test for EHV-1 with a 24-hour turnaround time showed perfect agreement with the four-day test, so diagnosis of the disease can be very quick now."

Regarding treatment, she noted valacyclovir has eight times the bioavailability of oral acyclovir, according to a study published in *Antimicrobial Agents and Chemotherapy*, and serum levels of the drug are within the range of sensitivity for EHV-1. "I think the hope is that it will serve as a preventive, but it's unclear if it will clear clinical signs once they're established," Rush noted.

"EHV outbreaks have had an enormous impact on the performance and racing industries," commented Palmer.

**Cisplatin for skin cancer** Skin tumors are often aggravating to veterinarians and owners due to their tendency to recur. But a study published in *Journal of the*

**“EHV outbreaks have had an enormous impact on the performance and racing industries.”**

DR. SCOTT PALMER

*American Veterinary Medical Association* found that when cisplatin (in sesame oil emulsion) is injected into a solid tumor, the cure rate at two years after treatment was 93%, which Rush described as "astounding." One factor contributing to failure of the first treatment included large tumor size and residual tumor cells left in the area after debulking the lesion.

Rush also noted that a later convention presentation would discuss the use of biodegradable cisplatin beads, which result in an 83% success rate at two years. "There's obviously at least two good ways of doing this, and I think it's really an exciting way to treat these lesions," Rush commented.

**General anesthesia risks** "Nobody likes to talk about it, but there are fatalities related to general anesthesia," said Palmer. A study published in *Veterinary Anaesthesia and Analgesia* found that 0.12% of 961 horses (21 horses) undergoing procedures under general anesthesia died due to factors directly related to anesthesia, including cardiac arrest, fractures during recovery, or neuropathy/myopathy. That rate went up

to 42 (0.24%) when horses euthanized or dying in within seven days after anesthesia were included. This rate is lower than previously reported rates, noted Palmer.

"Familiarity with an anesthetic protocol in combination with reduced anesthetic time, emergencies of shorter duration between diagnosis and surgery, and adequate preoperative examination appear to minimize the risks associated with general anesthesia in horses," noted the authors.

#### **Cervical vertebral myelopathy (CVM)**

"Most horses with CVM (narrowing of the spinal canal and compression of the spinal cord) are thought to be three years old or less, but a study published in *Journal of Veterinary Internal Medicine* on 22 horses found a mean (average) age of 8.4 years," said Rush. Males were most often affected, and Warmbloods, Quarter Horses, and Tennessee Walking Horses were overrepresented.

"In older horses with spinal ataxia (incoordination), the neck may be the problem due to bony restructuring or degenerative disease," she noted. ♣

# Ride farther.

Your horse's joints, bones, hooves, and other connective tissues may be impacted over time due to athletic performance and aging. While many equine health products may address one component of your horse's framework, STEADFAST™ EQUINE supports your horse's entire structural system.

Learn more at [arenusperformance.com](http://arenusperformance.com).

# Reproduction

BY LES SELLNOW

## Milne Lecture

Dickson Varner, DVM, MS, Dipl. ACT (a specialist in reproduction), is a self-described “renegade” when it comes to presenting papers at veterinary gatherings. He is known for his irreverent humor, poetry, and clever turn of phrase. That being said, Varner is also a leading researcher in equine reproduction and has helped propel Texas A&M University into a leadership role in that field.

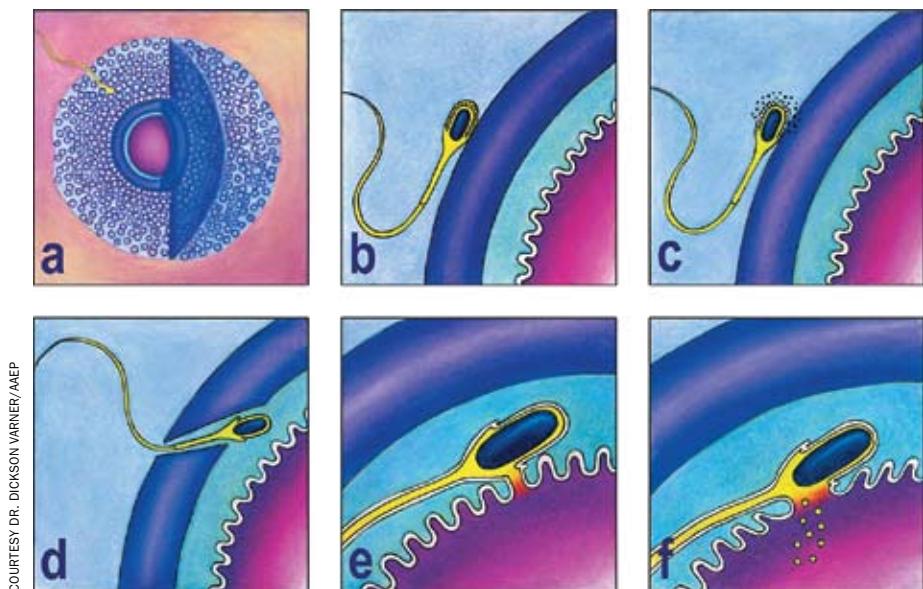
He was chosen to present the Milne State-of-the-Art Lecture at the convention. The lecture and award were named in honor of Frank Milne, the late and longtime editor of the annual AAEP Convention *Proceedings*. The lecture is designed to offer in-depth information on a particular subject.

Varner lectured on the topic: “From a Sperm’s Eye View—Revisiting our Perception of This Intriguing Cell.”

Varner said the lecture was not a compilation of his work, but a presentation of the work from a great many scientists through the years. As if to prove that point, his paper published in the *Proceedings* contained more than 1,000 references.

**Dickson's ditty** It was truly an in-depth description of the sperm cell, but it also contained Varner’s trademark brand of humor. He said that program chairman and 2008 AAEP President Eleanor Green, DVM, Dipl. ACVIM, ABVP, and 2007 AAEP President Doug Corey, DVM, had frequently expressed concern about what bent his humor might take and worried that he might get out of line. He jokingly offered to don a dog shock collar and said they could have the remote control button and activate it whenever he went over the edge in the humor department.

Among other things, Varner is a cowboy. He grew up working with his parents in a Wild West show, complete with rough stock and trick animal acts, and he went on from there to be a rodeo contestant before joining the academic path. Thus, it came as



COURTESY DR. DICKSON VARNER/AAEP  
Illustration of how a spermatozoon fertilizes an egg. a) The spermatozoon navigates through the egg's protective barrier and b) adheres to the inner layer. c) The sperm cell's protective covering begins to disintegrate. d) The sperm gains entry into the egg. e) The protective covering dissolves, allowing the sperm cell's DNA to merge with that of the egg (f).

no real surprise when he announced that an animated cowboy would help him with his message during the Milne Lecture. He introduced “Dr. Dick,” an out-of-work cowboy, who would ride a sperm through a series of slides depicting the cell’s travels from the time it is formed until it ends up entering the female oocyte and establishing a pregnancy.

Everyone who knows Varner also knew he would do something unique when he arrived at the halfway point of his lecture and it was time for a break. He didn’t let them down. He harked back to the 1998 Milne Lecture presented by O.J. Ginther, VMD, PhD, of the University of Wisconsin, and did him one better. During his break, Ginther, who was presenting a paper on equine pregnancy, picked up a guitar and sang a ditty titled “Mare is Four-Letter Word.” It was a hit.

Varner brought to the stage two professional musicians from Texas, Aaron Watson and Dan McBride, as backup, and he sang

a song titled “Stud is a Four-Letter Word.” He also whipped out his trademark harmonica to play along, and the large crowd responded with a standing ovation.

**Origin of the sperm** With the help of “Dr. Dick,” whose spermatozoal ride got rather hectic and scary at times—especially during ejaculation—Varner described the origin of the sperm within the testis “the sperm factory.”

The process is called spermatogenesis. “Spermatogenesis,” he wrote in the paper he presented, “is an extremely complex process that involves germ proliferation, germ cell differentiation, and, paradoxically, programmed germ cell death (termed apoptosis). This lengthy process, which is 57 days in the stallion, is controlled by a vast array of cell-signaling messengers acting through endocrine, paracrine (when target cell is close to signal-releasing cell), juxtacrine (cells must be in direct contact), and autocrine (via secretion of a substance) pathways.”

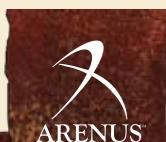


( your way )



( our way )

Are you *still* using multiple supplements  
to keep your horse sound?



## Introducing STEADFAST™ EQUINE — the better way to build soundness from the inside out.

More than a joint health product, better than a typical hoof health product, and different than a vitamin/mineral product, STEADFAST™ EQUINE is the only product designed by veterinarians and nutritionists specifically to support your horse's entire structural system. With its exclusive ingredients NEM® and TelaFirm™, STEADFAST EQUINE is "the one and only one" supplement that provides noticeable results for all your structural health concerns, including relief from joint discomfort in as little as 7 days!

[Learn more at arenusperformance.com.](http://arenusperformance.com)



Ask your veterinarian about STEADFAST™ EQUINE or order online  
at [www.smartpakequine.com](http://smartpakequine.com) and [www.arenusperformance.com](http://arenusperformance.com).

**Steadfast**  
EQUINE

*The One and Only One.™*

STEADFAST™ EQUINE is a product of Arenus, a division of Novus Nutrition Brands, LLC., St. Louis, Missouri | [www.arenusperformance.com](http://arenusperformance.com)  
STEADFAST™ and TelaFirm™ are trademarks of Novus Nutrition Brands, LLC. | NEM® is a registered trademark of ESM Technologies, LLC.  
The SmartPak™ logo is a trademark of SmartPak Equine, LLC. | Patent pending | © Copyright Novus Nutrition Brands, LLC., 2008.

The seminiferous tubules within the testis are where the spermatozoa are manufactured, Varner said. If the tubules from two stallion testes were stretched out end to end, he said, they would be 50 football fields in length. As such, these tubules are capable of producing 60,000 to 70,000 spermatozoa per second. If one were to line up the number of sperm produced by a stallion in a normal lifetime, Varner said, they would stretch to the moon and back more than three times.

The main storage area for the sperm within the testis is the epididymis, which if stretched out would be about three-fourths of a football field in length. Each epididymis is capable of storing 40 to 45 billion sperm. During their time in the epididymis, the spermatozoa undergo a maturation process that is required for interaction with the mare's reproductive tract and establishment of fertilizing potential.

Prolonged storage of the sperm within the epididymis is not necessarily a good thing and problems can arise, Varner said, in the form of bent tails, detached heads, distal droplets (abnormalities on the sperm flagella, or tails), and decreased motility. Normally, spermatozoa enter the epididymis at a constant rate in a reproductively normal stallion, with about 5 billion arriving each day.

The stay within the epididymis is from eight to 11 days. After their stay in the epididymis, sperm are either ejaculated or spontaneously ejected into the urethra and expelled. This latter mechanism ensures that viable sperm are available for fertilization at the time of mating or artificial insemination.

**A Sperm's Tale** Varner described an individual spermatozoa as being shaped like a tadpole, with a head and a flagellum. Stallion spermatozoa are about 70 to 80 microns in length. They are only about half as long as mouse spermatozoa.

Here is how Varner described the make-up of the spermatozoa: "The head contains the nucleus, overlying acrosome (a membrane-bound compartment at the tip of the sperm head that contains enzymes to digest the outer surface of the egg), and a reduced complement of cytosolic (fluid portion of cytoplasm) elements. The head can be subdivided into an acrosomal

region, equatorial segment, post-acrosomal region, and posterior ring, which demarcates the junctions between the head and flagellum. The posterior ring is the site of plasma membrane anchoring to the nuclear envelope and is thought to produce a tight seal that separates cytosolic components of the head and flagellum. The flagellum can be subdivided into a connecting piece, middle piece, principal piece, and end piece. These various parts of the spermatozoon are surrounded by a common plasma membrane."

### **Many of the sperm, Varner said, do not complete the journey and are lost along the way, with only about 0.0006% of spermatozoa gaining access to the oviducts following insemination.**

The spermatozoa are virtually immobile in the epididymis, Varner told the group, but develop motility when ejaculated. After ejaculation, the sperm make their way from the uterus into the oviduct on a journey that allows them to meet up with the descending egg. Many of the sperm, Varner said, do not complete the journey and are lost along the way, with only about 0.0006% of spermatozoa gaining access to the oviducts following insemination. The remainder are lost through the cervix. Approximately four hours are required for sufficient sperm to ascend from the uterus into the oviduct to establish pregnancy at a normal rate.

The ejaculated spermatozoa cannot fertilize an egg right away. Varner described it this way: "In mammals, freshly ejaculated spermatozoa are not immediately capable of fertilizing an oocyte. Early studies showed that spermatozoa require residence time in the female reproductive tract to gain this capability, later termed capacitation."

The principal location where capacitation occurs, Varner said, is the caudal (toward the rear) segment of the oviduct. "Interactions with an ovulated oocyte, however, require spermatozoal migration to the ampullar region of the oviduct, and only a small percentage of spermatozoa that gain

access into the oviduct will eventually arrive at this fertilization site. The precise mechanisms by which spermatozoa migrate to the ampullar region of the oviduct remain speculative, but contractile movements of the oviduct and hyperactivated spermatozoal motility are thought to play key roles in this migratory phase."

After capacitation, the spermatozoa must undergo an "acrosomal reaction" before they can penetrate the vestments of the egg required for fertilization. This is a rather complicated reaction that occurs

upon spermatozoal contact with the zona pellucida, a thick, transparent outer envelope that encases an egg. In this reaction, the outer membrane of the acrosome fuses at multiple points with the overlying plasma membrane of the sperm head. The process enables the release of enzymes from the acrosome that are necessary to enable the sperm to enter the egg.

Once that entry has been made, the sperm's journey has come to an end. And so it was for "Dr. Dick," who was able to head off into the sunset, looking for new adventures.

**Stallion Fertility** Varner directed the final two hours to a discussion of stallion fertility and told the group, for example, that morphologically abnormal sperm often do not have a negative impact on normal sperm. "Therefore," he said, "the total number of morphologically normal sperm in ejaculates may provide more information regarding the fertility of a stallion than the percentage or absolute number of morphologically abnormal sperm."

He also discussed ways to refine a stallion breeding soundness examination, and he described newly developed laboratory assays that might improve the predictive value of such an examination.

Varner concluded his talk by telling the group that, while scientists have achieved much concerning research on sperm, more study is needed.

"Goals might include devising methods for long-term cooled semen preservation, improving the preservation of cryopreserved (frozen) semen, and incorporation of *in vitro* fertilization (both conventional *in vitro* fertilization—using multiple sperm—and intracytoplasmic sperm injection, where only one sperm is injected in the egg) in commercial programs," he said.

"Although these might seem to be lofty goals, a more absolute understanding of the spermatozoal structure and function would certainly take a lot of the 'guesswork' out of current approaches to analysis and manipulation of equine spermatozoa."

## Perinatology

Traditionally, one of the stronger parts of each AAEP convention program is the time devoted to reproduction. The convention held in Orlando was no exception. It began with an in-depth session titled "Perinatology—End of Pregnancy Through Beginning of Life," during which experts in the field presented hour-long lectures on various reproductive problems, and it ended with two separate sessions of 20-minute lectures in which the presenters dealt with specific reproduction topics.

In-depth presenters were Wendy Vaala, VMD, Dipl. ACVIM, who is employed by Intervet Inc.; Margo Macpherson, DVM, MS, Dipl. ACT, of the University of Florida; Regina Turner, VMD, PhD, Dipl. ACT, of the University of Pennsylvania's New Bolton Center; and Robert Franklin, DVM, Dipl. ACVIM, a referral hospital veterinarian based in Ocala, Fla.

**Late-Term Mare, Newborn Foal** Leading off in the in-depth section and continuing on as moderator was Vaala. She offered "New Perspectives on the Late-Term Mare and Newborn Foal."

Under ideal conditions, Vaala told the group, the late-term mare would be managed before birth by a specialist in reproduction and after birth by a specialist in neonatology. However, she said, in most ambulatory practices, one person must be prepared to fill both roles, have proper equipment to assist in birth, and, if necessary, provide resuscitation and nursing care for the foal.

Many problems begin within the uterus, she told the group, and the practitioner must be able to monitor fetal development in order to determine early if something is going awry.

When a mare, especially one in the at-risk category, nears parturition it is important to monitor her progress so that help is at hand if needed. There are many monitoring aids available, she said, but no one aid should be considered infallible. "Nothing beats a human walking by and checking on the mare," said Vaala.

One of the problems that occur is



ANNE M. EBERHARDT

Observation and regular check-ups of the mare and foal are recommended post-parturition.

prolonged gestation. It is important that the practitioner has a complete history of the mare, including whether she has been kept on fescue. There are some 35 million acres of fescue in the United States, Vaala said, and fescue toxicosis from infected varieties can lead to prolonged gestation and myriad other problems that can compromise the foal's chances for survival.

The drug of choice in dealing with fescue toxicosis, she said, is domperidone.

Once the foal has been delivered and the fetal membranes passed (something that should occur within three hours of delivery), Vaala told the group, it is very important that you save and weigh the placenta. The weight of a placenta, which can be 10-11% of fetal weight, can be an indicator that problems might exist with the newborn. Heavy placentas, she said, might be associated with conditions such as edema (fluid swelling), congestion, and/or infections. A light placenta might relate to incomplete development of the foal, along with other conditions.

Inducing labor in a late-term mare, Vaala said, should only be used as a last resort. "Indications for induction should only be limited to conditions that would seriously threaten maternal or fetal health if the pregnancy were allowed to continue, or if unsupervised, spontaneous delivery would occur," she said. "Examples of such conditions include hydrops (excessive placental

fluids), prepubic tendon rupture (tearing of the ligament that supports the abdomen in the mare—loss of this structure makes it impossible for mares to contract muscles and deliver the foal normally), imminent death of the mare because of colic or other systemic illness, and maternal history of dystocia requiring mandatory assistance during foaling."

The quality of the mare's colostrum, which Vaala called "liquid gold," should be evaluated immediately after delivery, she said.

Vaala noted in her written paper: "Equine perinatology has evolved rapidly over the last two decades. However, most mares will continue to foal in locations other than in large clinics and university hospitals. Therefore, it will remain in the hands of clinicians in private practice to help improve our knowledge of the high-risk mare by using and reporting on the use of the antepartum (pre-foaling) monitoring techniques and interventional strategy discussed in this presentation."

**High-risk mare** Macpherson concentrated on "Identification and Management of the High-Risk Pregnant Mare" in her lecture. There are a number of conditions that can jeopardize the pregnant mare, she said, and the practitioner's challenge is to identify those problems, then find proper approaches to resolve them.

Three common conditions, she said, are

early udder development, acute pain, or an unusual increase in abdominal size. For each condition, she presented the case history of a mare that had suffered from the condition.

She first discussed premature mammary gland development. Normally, mares undergo udder development between two and four weeks before giving birth. Development of the udder prior to that might be an indication she is going to foal early, Macpherson said.

Two of the conditions that can cause early udder development are the presence of twins and bacterial placentitis (inflammation of the placenta), Macpherson told her listeners.

In the case of twins in late gestation, she said, the best approach has already been missed. That would involve early detection at 13 to 15 days gestation and the elimination of one embryo. Carrying twins to term puts the mare at risk for a number of complications, including dystocia (difficult birth). Once twins reach the late-term stage, she said, there are basically two options left for the practitioner: terminate the pregnancies, or allow the pregnancies to continue, monitor the mare, and provide assistance during delivery. Neither is particularly palatable to the practitioner, she said.

A promising approach for treatment

**“ Nothing beats a human walking by and checking on the mare. ”**

DR. WENDY VAALA

of bacterial placentitis, Macpherson said, involves administering trimethoprim sulfamethoxazole and pentoxyfylline in conjunction with altrenogest (Regu-Mate).

In a study at the University of Florida, she said, 10 of 12 mares with experimentally induced placentitis delivered live foals after treatment with this protocol.

The colicky late-pregnancy mare poses a serious challenge for the practitioner, Macpherson said, because it first has to be determined whether the manifestation of pain is from labor contractions or some other condition not connected with the birthing process.

Once the diagnosis had been made, a treatment protocol can begin. It is important to have a complete health history of the mare, Macpherson said. For example, if she has a history of colic when not pregnant, there could be greater likelihood of her having gastrointestinal disease than a type of colic related to pregnancy.

The case study mare Macpherson described underwent colic surgery and four days later delivered a live foal.

A mare in late pregnancy that develops unusual abdominal distension is frequently in great jeopardy, Macpherson said, and she is at risk of losing the pregnancy. There are several conditions that could cause the problem, including hydrops, rupture of the prepubic tendon, and abdominal wall herniation.

Treatment options, she said, could involve use of a supportive belly bandage, induction of labor, and delivery by Cesarean section.

**Three Problems** Turner told the group that when she began preparing her presentation, she had decided to discuss her top 10 list of postpartum problems in mares. Then she realized that there wouldn't be enough for that lengthy of a presentation and cut it back to five, then to three.

The three problems she chose were 1) hemorrhage from uterine or ovarian vessels, 2) uterine lacerations, and 3) retained fetal membranes.

Hemorrhage from uterine or ovarian vessels usually occurs during the birthing process, Turner said. Older mares that have had a number of foals appear to be at greater risk.

Treatment of the condition, she said, can be difficult and confusing. The practitioner must decide whether to place the mare in a tranquil setting to lower stress

# Show stronger.

Two exclusive ingredients in STEADFAST™ EQUINE — **NEM** and **TelaFIRM**™ — work together to build soundness from the inside out in as little as seven days. STEADFAST EQUINE also provides ascorbic acid for healthy joints; calcium, phosphorous and vitamin D for healthy bones and biotin for healthy skin and hooves. [Learn more at arenusperformance.com](http://arenusperformance.com).

and blood pressure, or whether he or she should institute aggressive treatment that might increase stress and blood pressure.

"In most instances, as a minimum," she said, "we will place an indwelling venous catheter and begin the mare on volume replacement fluid therapy." She discussed some of the drugs that have been used to treat the condition and others that are not recommended.

The prognosis for recovery is variable, depending on the severity of the hemorrhage, she said. "Mild hemorrhage into the broad ligament (a band of tissue that helps suspend the uterus within the abdominal cavity) typically is associated with a good prognosis for recovery," she said. "However, severe hemorrhage into the abdomen or uterus can be acutely fatal."

If the mare survives, she said, a future pregnancy might result in a recurrence. If the mare is a valuable producer, Turner said, embryo transfer should be considered.

She then turned her attention to retained fetal membranes. In the mare, she said, it is considered that fetal membranes have been retained if they have not been passed in their entirety in three hours.

The condition can occur in any breed but it is most common with draft mares. Friesian mares, she said, are at a significantly higher risk, even after an uncomplicated delivery. She described one study where 54% of Friesian mares retained their fetal membranes after normal delivery.

When membranes are retained, Turner said, the treatment of choice by many practitioners involves administering oxytocin. Forceful removal is not a wise approach, but gentle pressure can be helpful, along with uterine lavage.

Proper management of a mare that undergoes Caesarean section is important for the mare's survival and future reproductive success, she said.

One of the problems involved with Caesarean section, Turner told the group, is that it often is resorted to only after prolonged attempts for a vaginal delivery. Delivery of a live foal after Caesarean section, she said, results in foal survival rates of 11-42% and survival of the foal after leaving the hospital is lower still at 5-31%.

"The wide range in foal survival consistently depends on duration of second-stage

labor," she said. "Thus, whether or not a mare has a Caesarean section is not what determines the outcome for the foal. Rather, it is how long it takes for a foal to be delivered, regardless of delivery method—this is the critical factor."

She had this succinct advice for the practitioners in the room: "Refer early."

Mares that undergo Caesarean section and have good postoperative management often have pregnancy rates between 58-68% if bred back that year. If bred back the next year, the rate rises to about 72%.

## **“Preparations in terms of equipment for resuscitation, veterinary planning, and foaling attendance are critical to the successful delivery of a high-risk foal.”**

DR. ROBERT FRANKLIN

**High-risk foal** Franklin closed out the in-depth session with a discussion on "Identification and treatment of the High-Risk Foal."

Early identification of high-risk foals is imperative so that successful treatment can be initiated in a timely manner, he told the group. However, identification is only the beginning of the process. The ambulatory veterinarian should be equipped with appropriate equipment for resuscitation, assisting with breathing, and increasing heart rate.

A valuable tool, Franklin said, is an instrument that measures lactate levels (in the blood). High lactate level can be an indicator that the foal is in the at-risk category.

One of the new approaches described at this AAEP convention involved equipping attendees at some lectures with keypads for responding to specific multiple-choice questions, which then were immediately tallied by computer. The keypad response in one instance provided evidence that very few veterinarians attending the session utilize the lactate-measuring machine. Franklin made a strong pitch for its use and cited a number of examples where the device had first identified at-risk foals, then was helpful in monitoring their recoveries.

A later presentation would underline his

point that measuring lactate levels can be helpful at both the diagnostic and monitoring levels (see page 21).

Franklin said in conclusion: "It is obvious that early recognition of the high-risk or abnormal foal is the key to a successful outcome. Efforts and financial contributions should be made early in the course of the foal's life to document all problems so that an appropriate prognosis and treatment plan can be made. Mares with periparturient disease should be monitored closely for foaling trouble or for the delivery of a compromised foal. Preparations in terms of equipment for resuscitation, veterinary planning, and foaling attendance are critical to the successful delivery of a high-risk foal."

## **Reproduction**

**Fetal pulse** Stefania Bucca, DVM, of XY Equine Veterinary Services in Kildare, Ireland, reported on using the fetal pulse rate as an aid in determining fetal

health. Abnormal patterns in fetal heart rate, she said, are a clear indication of fetal compromise. The veterinarian can record the pulse rate with the use of transrectal ultrasound, she said.

**Periparturient hemorrhage** Carolyn Arnold, DVM, Dipl. ACVS, of Texas A&M, reported on a study of mares treated at Hagyard Equine Medical Institute near Lexington, Ky., for periparturient (occurring either shortly before, during, or shortly after parturition) hemorrhage. She said that 73 mares met criteria for inclusion in the study and that most of them had delivered a number of foals. Most of the mares, she told the group, were admitted to the hospital within 48 hours of giving birth and manifested signs of abdominal pain and hypovolemic shock (an affected horse has abnormally low levels of blood plasma in the body, such that the body can't properly maintain blood pressure, cardiac output, or normal amounts of fluid in tissues). The aim of treatment was to relieve pain, enhance coagulation (clotting), and restore perfusion (blood flow), she said. The survival rate of the treated mares was 84%. Mares that didn't survive in a number of instances were those that hemorrhaged before giving birth.

**Hemorrhage in the field** Charles F. Scoggins,

DVM, MS, of Pioneer Equine Hospital in Oakdale, Calif., continued the discussion on periparturient hemorrhage. He said in one study it was found that rupture of a uterine artery frequently was the cause of death in nonsurviving mares. Scoggin spent most of his lecture on various approaches the attending veterinarian might take when faced with a case of hemorrhage in the field. He emphasized that periparturient hemorrhage is a severe and life-threatening condition in mares and that immediate treatment is imperative. It is important, he said, to keep the mare as calm as possible.

**Foal adoption** Peter Daels, DVM, PhD, Dipl. ACT, ECAR, of Belgium, discussed approaches veterinarians can take to induce lactation in a mare and how to convince her to adopt an orphan foal. Work at the Keros Equine Insemination and Embryo Transfer Center in Passendale, Belgium, where he is headquartered, has been going on for five years. Lactation in a nonparturient mare, Daels said, can be induced during a two-week treatment period by administering progesterone, estrogen, and dopamine D2 antagonist (in this case, sulpiride) on a daily basis, along with milking the mare regularly. Two drugs that helped to arouse maternal instincts that would allow for foal adoption were dinoprost and oxytocin. Under the approach

used by Daels and his colleagues, adoption was expected to be completed in five days.

**Lactate levels and prognosis** Imogen S.F. Henderson, BVSc, of the Royal (Dick) School of Veterinary Medicine in Scotland, reported on the monitoring of lactate levels in newborn foals to help form a diagnosis, monitor response to treatment, and form an accurate prognosis. She and her colleagues reviewed the records of foals under 96 hours of age. It was found, she said, that nonsurvivors had significantly increased lactate levels at 12 to 36 hours of age as compared to survivors. A cutoff point of 4.85 mmol/L of lactate at admission correctly classified more than 80% of cases as either survivors or nonsurvivors, with the nonsurvivors being foals with lactate levels above the cutoff point. When lactate levels reached 11.3 mmol/L, she said, there were no survivors.

**Glucose and lactate monitoring** Pamela A. Wilkins, DVM, PhD, Dipl. ACVIM, ACVECC, of the University of Pennsylvania's New Bolton Center, concurred with Henderson's findings on using lactate levels in diagnosis and monitoring, but she added the measuring of glucose levels as another valuable tool. However, she also had a word of caution: "In both referral and practice situations, point-of-care (stall-side) glucose and lactate monitoring is inexpensive, easily performed, and potentially very

clinically useful. However, individual monitors should be regularly compared with a standard laboratory technique because of variation in agreement when using horse blood or plasma. Understanding the potential limitations of any individual monitor used will aid in interpretation of the results produced by the meter."

**Adrenal function** Kelsey A. Hart, DVM, of the University of Georgia, told the group that evaluation of adrenal function is of growing importance in equine medicine. Hart discussed a study where the drug cosyntropin, synthetic adrenocorticotrophic hormone (ACTH; natural ACTH is produced and secreted by the pituitary gland) was administered intravenously (IV) when low levels of cortisol were identified. "The results in this study," Hart said, "show that in 3- to 4-day-old foals, the cortisol response to IV administration of cosyntropin is dose-dependent, with higher cosyntropin doses resulting in a higher peak and longer duration of rise in cortisol."

**Mathematical model** Barton W. Rohrbach, VMD, MPH, Dipl. ACVPM (preventative medicine, epidemiology), of the University of Tennessee, presented a mathematical approach for predicting foal survival. He described the approach thusly: "By combining clinicians' experience based on the initial assessment of the foal with results of observations recorded for

# Feel better.

Rest assured, you're doing what's right for your horse with STEADFAST™ EQUINE from Arenus. There is no better, safer, faster and more convenient way to build soundness from the inside out. And by providing your horse with a long, healthy and active life, you'll feel better, too — about your performance and the animals for which you care. [Learn more at arenusperformance.com](http://arenusperformance.com).

a large number of hospitalized foals, the practitioner can provide a more precise estimate of the probability of foal survival."

### Ovariohysterectomy

The final speaker in the Reproduction-Perinatology session was David E. Freeman, MVB, PhD, of the University of Illinois. He discussed performing an ovariohysterectomy (OHE) on mares. The surgery can be complete—involved removal of the entire uterus and ovaries—or incomplete with partial removal. The surgery, Freeman said, should be considered when a mare is suffering from a condition that is life-threatening, such as uterine torsion, or if she has a problem with a poor prognosis for resolution. Success rates are high and he pointed to one study that revealed 16 of 17 mares undergoing the procedure had survived. He said OHE is a viable option in certain instances as an alternative to ineffective medical treatment or euthanasia.

### More Reproduction

One of the final sessions held at the AAEP convention involved further discussion on reproduction.

**Advanced approach** Silvia Colleoni, PhD, of the Laboratorio di Techologie della Reproduzione in Cremona, Italy, was the first speaker and discussed advances in ovum pick-up (OPU), intracytoplasmic sperm injection (ICSI), and embryo culture in equine practice. The process involves collecting immature oocytes from the ovaries, maturing them *in vitro*, injecting them with a single sperm (ICSI), and implanting the embryo—either in a fresh state or after having been frozen and thawed—into a recipient mare. The success rate has not been extremely high, but there has been success, she said.

She reported on a study that involved data collected from 47 commercial OPU sessions performed from 2004 to 2007 on 30 donor mares ranging in age from 3 to 24 years old. Here are the results: 808 follicles were aspirated and 474 oocytes recovered—a mean recovery rate of 58.19%. From this group, 66.05% reached a stage at which they were fertilized via ICSI, which resulted in 199 cleaved embryos and 40 blastocysts (the stage at which an embryo is ready for transfer). At the time of her report, 18 embryos had been

surgically implanted and 15 of the recipient mares had become pregnant.

**Making use of ICS** Elaine M. Carnevale, DVM, MS, PhD, of Colorado State University (CSU), which pioneered the ICSI concept, reported on the success rate of the procedure during the 2006 breeding season at CSU. From 91 normal oocytes, she said, 62 cleaved into at least two cells and were fertilized with one of the following: fresh, cooled, or frozen semen. After ICSI, the embryos were transferred, achieving a

number of treatments and seasonal factors. In the fall, fewer mares ovulate in the 24- to 48-hour window. Practitioners may consider altering monitoring schedules based on the season, number of hCG treatments, and changes in endometrial edema."

**Breeding and ovulation interval** Terry Blanchard, DVM, MS, Dipl. ACT, formerly of the Texas A&M University faculty and now a veterinarian at Hill 'n' Dale Farm in Kentucky, told the group that intervals between mating and ovulation of more than two days significantly lowered pregnancy rates in Thoroughbred mares. It would be wise, he said, to breed the mare again "double service" (mate again on the same estrus) if she has not ovulated within two days of being bred the first time.

### Interpreting endometrial edema

Juan Samper, DVM, MSc, PhD, Dipl. ACT, of Veterinary Reproductive Services in Langley, British Columbia, told the group that when a mare is under the influence of estrogen, there is increased blood flow to the uterus that results in an increase in endometrial edema. The edema can be viewed ultrasonographically, he said, describing a measuring system with values from 0 to 5 to assess the edema. The bottom end of the scale would normally exist in mares that were in a state of diestrus (not in heat), and the higher end is when mares are in estrus. During examination there are several instances in which the veterinarian should be alerted to possible problems, Samper said. He identified them as: 1) presence of obvious endometrial edema and a large follicle 14-15 days after ovulation; 2) presence of hyper-edema during the normal estrous period; 3) failure to reduce edema as the mare approaches ovulation and the presence of marked uterine edema 24 hours after ovulation; 4) significant increase in the degree of uterine edema 12 to 24 hours after breeding; and 5) lack of uterine edema during the estrous period. "Interpretation of endometrial edema," he said, "requires a good-quality ultrasound and evaluation of the mare on a regular basis during the late diestrous and early estrous period until ovulation is detected."

**Measuring progesterone** Edward L. Squires, MS, PhD, of CSU discussed the best approach to take when measuring progesterone (hormone that supports a

## Intervals between mating and ovulation of more than two days significantly lowered pregnancy rates in Thoroughbred mares.

DR. TERRY BLANCHARD

pregnancy rate of 44% at 16 days and 31% at 50 days. The type of sperm injected had no effect on the outcome, she said. Using ICSI, Carnevale told the group, 24 late-term pregnancies were produced for stallions with poor-quality semen or limited sperm numbers.

**FSH hormone** Kory D. Niswender, DVM, MS, Dipl. ACT, of Reata Equine Hospital in Weatherford, Texas, reported on the use of recombinant equine follicle stimulating hormone (reFSH) to promote follicular development in cycling mares. His conclusion was that reFSH "may be a useful tool to stimulate follicular development in the mare."

**Using hCG** Jodyne Green, DVM, of the Western College of Veterinary Medicine at the University of Saskatchewan, reported on the use of human chorionic gonadotropin (hCG) as a stimulant for ovulation. Green said results of a retrospective study showed: "In summary, hCG is effective in inducing ovulation in 73% of mares administered this drug. Follicular size and cervical tone at time of treatment with hCG are associated with ovulation within the next 48 hours. A decrease in endometrial edema (excess fluid swelling) score from the initial administration of hCG to 24 hours was associated with ovulation in the 24- to 48-hour window. As the breeding season progresses, there is a reduction in the ovulatory response rate to hCG administration related to increasing

new pregnancy) of the mare during early gestation after nonsurgical embryo transfer. An appropriate progesterone level, he pointed out, is highly important in maintaining pregnancy. Squires reported on a study that involved measuring progesterone levels in blood that was collected once a day, morning and night on a given day, and once a day for two days. Here is the conclusion: "Because the variance was quite small between the morning and evening samples on a given day, there did not seem to be any major advantage to collecting samples twice in a given day. In contrast, the variance was greater for samples collected two days in a row. This indicates that two daily samples provide a better estimate of the mare values than one sample. In other words, if the clinician bleeds (collects blood from) the mare two days in a row, the accuracy of the estimate can be increased considerably over obtaining just one individual sample.

**Anestrus** Claire Card, DVM, PhD, of the University of Saskatchewan, reported on a study to determine whether administering a vaccine against gonadotrophin-releasing factor (GnRF) would prevent mares from coming into estrus. Mares in the study received two injections of GnRF vaccine four weeks apart. In the study, it was found that four weeks after the second dose, 98% of the mares receiving GnRF were anestrous

or transitional. The treated mares ceased cycling for the rest of the breeding season. The next year, 88% percent of the treated mares were cycling, and the year after that, 98% were cycling. Pregnancy rates for the treated mares in the first year after vaccination were 75% and rose to 90% the following year.

**Oxytocin to block luteolysis** Dirk Vanderwall, DVM, PhD, Dipl. ACT, of the University of Idaho, reported on the use of oxytocin to successfully block luteolysis (destruction of the corpus luteum), thus, prolonging the lifespan of the corpus luteum. The importance of a functioning corpus luteum, he reminded the group, is the production of progesterone. Administering 60 units of oxytocin twice daily on Days 7 to 14 post-ovulation blocked luteolysis and induced prolonged corpus luteum function, he said. Mares with prolonged luteal function, he told the group, maintained progesterone levels of more than 1.0 ng/ml continuously through Day 30. This level of progesterone, he said, is sufficient to block estrous behavior; "therefore, disrupting luteolysis by administering exogenous oxytocin seems to be a plausible method of long-term suppression of estrus in mares."

**Paraphimosis in the stallion** Steven Brinsko, DVM, MS, PhD, Dipl. ACT, of Texas A&M University, discussed the condition

known a paraphimosis, where the stallion is unable to retract his penis. The condition most often surfaces in breeding stallions, Brinsko said, but it can also occur in geldings. It begins with penile prolapse (protrusion or displacement), and that results in excessive edema and swelling of the penis and prepuce. Early, aggressive therapy is important, he said, because it can minimize secondary complications. The primary goal, he told the group, is to reduce swelling and replace the prolapsed penis into the preputial cavity as soon as possible. The use of anti-inflammatory drugs and hydrotherapy are part of the treatment protocol, as is penile support to prevent further swelling.

**Post-mortem sperm collection** Adam C. Eichelberger, DVM, of the University of Florida, concluded the session by discussing how to collect, handle, and process semen from the epididymis of a stallion that has died or has been euthanatized. Being able to harvest sperm from a dead stallion can be important, he said, because reproductive science has produced ways in which to preserve the sperm for later use. He discussed the approaches a veterinarian should take in first obtaining the testicles, then harvesting the sperm residing there. He said he and his colleagues have "collected a range of sperm from 5 to 18 billion per testicle." ♦

# Jump higher.

Different than a vitamin/mineral product. More than a joint health product. Better than a typical hoof health product. STEADFAST™ EQUINE is "the one and only one" dietary supplement that's better at building soundness from the inside out, providing your horse with a long, healthy and active life.

Learn more at [arenusperformance.com](http://arenusperformance.com).

# Diagnostics

BY CHRISTY WEST

## Diagnosing Coxofemoral Subluxation with Ultrasound

Subluxation (partial dislocation) of the coxofemoral joint between the femur and pelvis in horses is rare; only two cases have been reported in the literature. However, six cases were seen at the University of California, Davis, in a three-year period, suggesting that perhaps this problem is somewhat more common than previously thought. Suzanne Brenner, DVM, an intern at UC Davis, discussed a technique for diagnosing these subluxations with ultrasound.

Radiographs have been considered the gold standard for diagnosing pelvic disorders, she noted. But the views needed to identify subluxation require the horse to be on its back under general anesthesia, while ultrasound in the standing horse is much quicker, carries less risk to the horse, and can provide a solid diagnosis. All six of the UC Davis cases were diagnosed with ultrasound.

Affected horses were quite lame (mostly Grades 4/5, with one exhibiting Grade 3 lameness), with an acute onset of lameness in five horses and insidious (slow) onset in one horse. Crepitus (a bone-grinding noise), muscle atrophy, and pelvic asymmetry were seen in some horses, but only one case had all three signs. No horses had external (outward) rotation of the distal (lower) limb, which has been noted in other reports of the condition. All six cases showed clear displacement of the head of the femur on ultrasound, and five horses had associated acetabular (coxofemoral joint rim) fractures and severe joint effusion (fluid swelling).

Four of the affected horses were euthanized, and only one of the remaining two horses is comfortable at the walk, leading investigators to conclude that the prognosis for this condition is not favorable.

"Coxofemoral subluxation should be considered when a hind limb lameness is suspected to originate from the pelvic region," Brenner concluded. "Diagnosis can



Veterinarians have a plethora of diagnostic imaging tools available to help them come to a conclusion about a horse's lameness.

be readily and safely obtained through the use of dynamic ultrasound in the standing horse if weight-bearing and resting views are performed."

## Computed Tomography for Imaging the Stifle

The stifle joint is often implicated in cases of lameness, but it can be a notoriously tough joint to image. Radiography, ultrasonography, nuclear scintigraphy (bone scan), and diagnostic arthrography (joint evaluation) all can be used, but they all have limitations. And no currently available MRI units are big enough to accept a horse's stifle for imaging.

Computed tomography (CT), however, might be able to image the stifle with detail approaching that of MRI, and with a shorter examination time. Erik Bergman, DVM, Dipl. ECAR, a veterinarian from Lingehoeve Diergeneeskunde, in Lienden, the Netherlands, presented a study of the technique and clinical application of stifle CT evaluation.

"Historically, CT has been infrequently

used to evaluate the anatomy of the upper limbs for a variety of reasons, such as the physical constraints of the horse, gantry (ring around the imaging tunnel) size, X ray tube output, and difficulties in linking a table strong enough to support a horse to the CT scanner," he said. "Advances in all of these areas—in addition to CT-scanner software and hardware improvements—have made the technique reported possible."

After development of CT arthrography (joint evaluation) technique via contrast media on cadaver specimens, Bergman described the findings and procedures used to evaluate stifles on 16 horses with CT (general anesthesia is required). Horses were Grade 2-4/5 lame on the AAEP lameness scale, and pain had been localized to the stifle joint by joint blocks and thorough lameness examinations.

Diagnostic images were achieved in all horses, and ultrasound-guided contrast media injection for arthrography was successful in all cases. Lesions were found on CT that correlated with the clinical exam in 14 of the 16 horses, and 12 horses had



( your way )



( our way )

Are you *still* using multiple supplements  
to keep your horse sound?



## Introducing STEADFAST™ EQUINE — the better way to build soundness from the inside out.

More than a joint health product, better than a typical hoof health product, and different than a vitamin/mineral product, STEADFAST™ EQUINE is the only product designed by veterinarians and nutritionists specifically to support your horse's entire structural system. With its exclusive ingredients NEM® and TelaFirm™, STEADFAST EQUINE is "the one and only one" supplement that provides noticeable results for all your structural health concerns, including relief from joint discomfort in as little as 7 days! [Learn more at arenusperformance.com.](http://arenusperformance.com)



Ask your veterinarian about STEADFAST™ EQUINE or order online  
at [www.smartpakequine.com](http://www.smartpakequine.com) and [www.arenusperformance.com](http://www.arenusperformance.com).

**Steadfast™**  
EQUINE

*The One and Only One.™*

STEADFAST™ EQUINE is a product of Arenus, a division of Novus Nutrition Brands, LLC., St. Louis, Missouri | [www.arenusperformance.com](http://www.arenusperformance.com)  
STEADFAST™ and TelaFirm™ are trademarks of Novus Nutrition Brands, LLC. | NEM® is a registered trademark of ESM Technologies, LLC.  
The SmartPak™ logo is a trademark of SmartPak Equine, LLC. | Patent pending | © Copyright Novus Nutrition Brands, LLC., 2008.

multiple lesions. The most common problem was a lesion of the meniscotibial ligament and/or its insertion onto the proximal tibia, which was found in six of 16 horses (37.5%).

"CT was vastly superior to radiography for evaluation of hard tissues, including bone and dystrophic soft tissue mineralization," he reported. "Ultrasound and radiography consistently underestimated the extent of bone remodeling in these cases."

Bergman noted that CT arthrography carries two major benefits over radiography and ultrasound—the ability to find lesions not previously seen with these two methods, and a more complete evaluation of the extent of lesions seen with these methods. "In several cases, ultrasound accurately identified the lesions, but the CT scan documented other lesions or more extensive pathology than was suspected."

"In conclusion, the techniques of equine stifle CT and CT arthrography are feasible and clinically useful," Bergman summarized. "CT should be considered complementary to a complete clinical examination and other diagnostic imaging modalities. In this group of clinical cases, CT was useful to define the extent of suspected or previously diagnosed injuries and to identify injuries that were elusive. This information allows clinicians to develop more directed therapeutic plans or provide a more accurate prognosis."

### Specificity of Digital Flexor Tendon Sheath Nerve Blocks

Diagnosing lameness in horses has often been termed an art and a science, in part because the use and interpretation of nerve blocks to isolate sources of pain is more art than exact science. In recent years, several blocks have been found to numb more structures than scientists previously thought based on research performed at Auburn University; this, in turn, impacts the interpretation of lameness that is attenuated by those blocks. To help sort out one particular block, Justin Harper, DVM, a resident in equine surgery at Auburn, presented the results of a study on analgesia of the digital flexor tendon sheath (DFTS).

He said the study was designed to answer one question: Is analgesia of the

DFTS specific, only desensitizing the digital flexor tendon sheath and its contents, or is it nonspecific, blocking more structures distal to (lower than) or outside the confines of the sheath itself?

Six horses with no pre-existing forelimb lameness were studied in three trials (using temporary lameness induction methods); the first used set screws to induce solar

**“ CT was vastly superior to radiography for evaluation of hard tissues, including bone and dystrophic soft tissue mineralization. ”**

DR. ERIK BERGMAN

pressure at the heel or toe, the second used endotoxin to create joint inflammation in the coffin joint, and the third used endotoxin to create inflammation in the navicular bursa. Each horse was videotaped walking and trotting toward and away from the camera before and after lameness induction, then the horses were blocked at the DFTS and videotaped again at 10 and 20 minutes after the block was applied.

Four investigators blinded to the video timing evaluated the videos on a 10-point lameness scale. Median lameness scores after trial 1 (sole pain) were not significantly improved at 10 minutes post-block, but they were significantly improved after 20 minutes. In trials 2 and 3 (coffin joint pain and navicular bursa pain), there were no significant improvements in lameness at 10 or 20 minutes after the blocks were applied.

"Analgesia of the DFTS using the palmar axial sesamoidean approach does not interfere with pain originating from the sole, coffin joint, or navicular bursa if evaluated within 20 minutes," Harper concluded. "So, if pain is attenuated with the DFTS block, chances are the pain is in the deep digital flexor tendon."

### Diagnosing Upper Cannon Area Injuries

Pain originating in the upper cannon bone area, just below the knee or hock, is common in all types of equine athletes. Determining exactly what structure is injured, though, can be difficult; some injuries can only be seen with high-field MRI. Matthew

Brokken, DVM, clinical assistant professor of veterinary clinical sciences at the University of Florida, described a Washington State University study of lameness originating in this area.

"Detection of abnormalities, specifically desmitis (ligament inflammation) of the inferior check ligament (ICL) and proximal suspensory ligament (PSL), has not been possible in some horses (via radiography or X rays, ultrasound, or nuclear scintigraphy)," he explained.

For the retrospective study, 45 horses with lameness localized to the proximal metacarpus/metatarsus (upper cannon bone area) were selected. Most were Warmbloods (20) and Thoroughbreds (12), and the horses ranged from 3 to 17 years of age. All were lame; 22 had been lame for less than four months, 22 for longer, and one had been lame for an unknown time. Forelimb lameness affected 29 horses. Thirty-one horses were Grade 3/5 lame, nine were Grade 2 lame, and one was Grade 4. All were imaged with a high-field (1.0-tesla) MRI system.

"The use of MRI in this area allowed an accurate diagnosis in 44 of 45 horses," Brokken reported. "The transverse proton density sequence was the most helpful in detecting subtle changes in signal and size within the ICL and PSL. Having an accurate diagnosis enabled appropriate treatment in these horses, which helped a high percentage of them to return to their intended use."

Researchers found that 23 horses had desmitis in the upper 4 cm of the PSL—13 had desmitis in hind limbs and 10 in forelimbs. Sixteen horses had ICL desmitis; 12 had lesions from 1-4 cm below the upper end of the cannon bone and four had them 5-10 cm down. Of the remaining six horses, one had ICL and PSL desmitis in the same limb, one had desmitis in both ligaments but on different limbs, one had an injury to the cannon bone, one had effusion (fluid swelling) of the distal tarsal sheath of the deep digital flexor tendon (DDFT), one had a DDFT injury, and one had no obvious abnormalities.

"It is interesting to note that 59% of horses that had lameness localized to the proximal metacarpal region (forelimb) had ICL damage," noted Brokken. "Previously it was thought that horses that block to the

proximal metacarpal region usually have a proximal suspensory injury," but these results prove that this isn't always the case.

Treatments ranged from a six-month rest and rehabilitation program (33 horses) to surgery, injections, and various combinations thereof. Forty-three of the horses were available for followup:

- Eight of 10 horses (80%) with forelimb PSL desmitis returned to full work.
- Nine of 13 horses (69%) with hind limb PSL desmitis returned to full work.
- Ten of 16 horses (63%) with ICL desmitis returned to full work. Five of eight horses that had ICL desmotomy (complete cutting of this ligament) returned to full work. "The success of ICL desmotomy in these horses further supports the importance of making an accurate diagnosis, because (in) horses with ICL desmitis you have a surgical option that is not appropriate for horses with PSL desmitis," Brokken noted.
- The two horses with both ICL and PSL desmitis returned to full work, as did the horses with distal tarsal sheath effusion and DDFT injury.
- Eight horses had ultrasound evaluations, but ultrasound findings were unremarkable or misinterpreted as PSL injury when ICL injury was detected instead by MRI. "Ultrasonographic examination of the PSL is technically challenging,

especially in the hind limbs," Brokken commented.

"In conclusion, lameness localized to the proximal metacarpal and metatarsal region has been a diagnostic challenge," Brokken concluded. "Traditional imaging modalities don't always yield an accurate diagnosis. High field strength MRI should be considered in performance horses with lameness localized in the proximal metacarpal and metatarsal areas."

*For more information, see "Magnetic Resonance Imaging Features of Proximal Metacarpal and Metatarsal Injuries in the Horse," Veterinary Radiology and Ultrasound, Vol. 48, No. 6, 2007, pp 507-517.*

### MRI for Diagnosing Sesamoidean Ligament Desmitis

The high degree of detail seen with MRI has made it possible for veterinarians to find equine injuries they've never seen before. One example of this—MRI evaluation of desmitis in the oblique and straight distal sesamoidean ligaments—was described. Sarah Sampson, DVM, doctoral graduate student in equine surgery and MRI at Washington State University (WSU), discussed the anatomy of these ligaments and a study of findings and treatment success in 27 horses.

"The distal sesamoidean ligaments include four ligaments (straight, paired

oblique, paired cruciate, and paired short distal sesamoidean ligaments) that comprise the distal suspensory apparatus," she explained. "That apparatus resists extension of the fetlock and holds the suspensory bones to the first and second phalanges. The distal sesamoidean ligaments are susceptible to overload injury from hyperextension.

"Initially, diagnosis of desmitis in these ligaments relied on observations of swelling over the palmaroproximal (upper rear) aspect of the digit or on ruling out other causes of lameness in the area with radiographs," she noted. Ultrasound has been helpful in some cases, but she said this area is hard to evaluate with ultrasound.

However, MRI was found to be a very good way to identify these injuries, much more so than ultrasound or swelling. After describing the anatomy and imaging of these ligaments in great detail, Sampson described a retrospective study of affected horses. Of the 27 horses, most (15, 55.6%) were jumpers or dressage horses, and the age range of the whole group was 2 to 13 years. All were lame—six for less than four months, 19 for longer, and two for an unknown length of time. Seventeen horses had hind limb lameness (left, right, or bilateral), while the rest had forelimb lameness.

MRI confirmed injuries of the oblique

# Ride farther.

Your horse's joints, bones, hooves, and other connective tissues may be impacted over time due to athletic performance and aging. While many equine health products may address one component of your horse's framework, STEADFAST™ EQUINE supports your horse's entire structural system.

Learn more at [arenusperformance.com](http://arenusperformance.com).

(ODSL) or straight distal sesamoidean ligament (SDSL) in all study horses, but only one horse had palpable swelling in the distal sesamoidean ligament region. Only two horses' injuries were detected with ultrasound by referring practitioners (four horses were reevaluated with ultrasound at WSU).

Most of the horses (24/27, 89%) had injuries of the ODSL, and these were more frequently in the hind limb (16/24, 67%). The total number of medial (inside) and lateral (outside) branch injuries was about the same overall, but forelimbs tended to have medial branch injuries (87% of forelimb injuries) and hind limbs tended to have lateral branch injuries (71%).

Sampson noted that blocking the digital flexor tendon sheath eliminated most lameness due to distal sesamoidean ligament injury after 30 minutes. Thus, this injury should be considered when this block alleviates lameness.

**Returning to Work** The primary treatment for all cases was six months of rest and a rehabilitation program. Twenty-two horses had initial hyaluronic acid and methylprednisolone acetate injections into the digital flexor tendon sheath to combat inflammation, swelling, and fibrous tissue formation. Two horses also underwent ligament splitting.

All six horses with short-term lameness (less than four months' duration) were sound at follow-up (one to three years after diagnosis). Eight of 12 horses (67%) with lameness for more than four months at the time of diagnosis were sound. Ten horses had mild lesions, and four of the five available for follow-up (80%) were sound. Thirteen of 14 horses with moderate lesions were available for follow-up, and of those 10 (77%) were sound. Two of three horses with severe lesions were sound (67%). Finally, 16 of 21 horses (76%) that were available for follow-up were competing at the same or a higher level of performance than before the injury. The remaining five were lame and had been retired.

"The ability of most of these horses to return to athletic performance indicates that the prognosis is not as poor as previously reported," Sampson noted. "High-field strength MRI is capable of early diagnosis of distal sesamoidean ligament injury, and appropriate treatment soon after injury may provide a better prognosis for returning to performance."

"Injury to the ODSL or SDSL can occur without palpable abnormalities in the region," she concluded. "These injuries do not need to be severe to cause performance-limiting lameness in athletic horses, and they should be considered in the differential diagnosis when examining horses with lameness that blocks out in the area of the pastern or metacarpophalangeal/metatarsophalangeal region. High-field strength MRI is a valuable way to evaluate ODSL and SDSL desmitis."

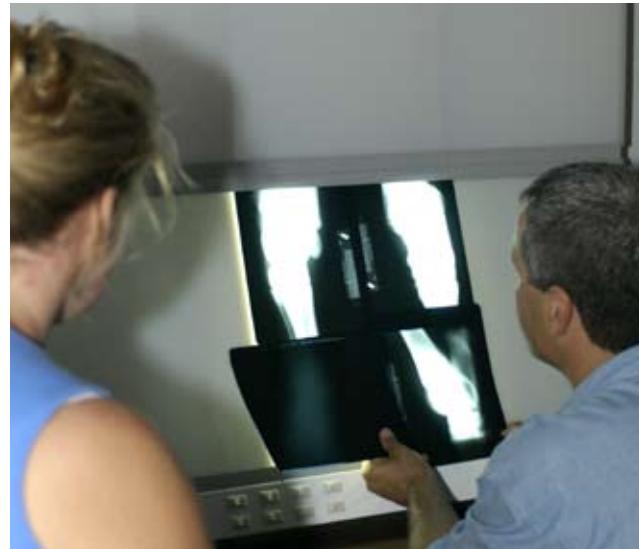
## Purchase Exam for Public Auction Forum

Sale description accuracy, radiograph (X ray) repositories, radiograph quality, radiograph reports, medications, and genetic diseases—what do they all have in common? All of these topics were discussed during the Purchase Exam at Public Auction Forum, an open discussion session.

The first item on the agenda was a report of what happened based on recommendations from the 2006 forum regarding statements made by announcers about a horse's condition while a horse was in the ring. Some felt that a veterinarian should be involved in writing or reviewing these statements to ensure accuracy, as these statements can impact buying decisions. Inaccuracies in sale ring announcements, some veterinarians feel, can often have the effect of glossing over or minimizing a problem.

There wasn't much of a result from those recommendations, said one attendee; the AAEP didn't get involved and sales companies didn't either, so any further action on this will have to happen on the local level.

**Radiograph quality and repositories** Radiograph repositories and quality were discussed extensively; different sales' procedures, handling of images, and technological concerns were mentioned as well. One concern shared by many attendees was that a significant number of radiographs in the repository are either of poor quality or



ANNE M. EBERHARD

Repository radiograph quality is one issue faced by veterinarians evaluating sale horses.

the wrong angle to see areas of interest.

"I have a tough time being critical of colleagues, but if you can't read the films you can't read them," said one veterinarian. "It happens enough that some attention needs to be paid to it."

Sale companies often allow only one study of each horse in the repository, which makes it impossible to get new views unless the veterinarian takes them himself. However, concerns about maintaining the integrity of the medical record complicate the issue.

There were a couple of suggestions to improve this situation. "One, we could improve our educational efforts for the veterinarians so they all know it's not just about the right views, but also the right angles, exposures, etc.," opined one attendee. "And if the sales companies would agree to have some sort of quality control in place, that would help, but they haven't wanted to take the responsibility."

Another veterinarian suggested reviewing radiographs post-sale to approach the issue without threatening veterinarians' relationships with their clients. The Kentucky Association of Equine Practitioners held just such an educational session after a Keeneland sale in Lexington in 2007, which was well-received.

**Radiograph Interpretation** Moving on to radiograph interpretation, moderator Scott Hay, DVM, president and managing partner of Teigland, Franklin, and Brokken in Ft. Lauderdale, Fla., commented, "We need to emphasize that it's our responsibility not

so much to find lesions as to assess their impact. When you start out, it's all about finding something wrong, and lots of good horses are penalized. The evolution is that you find a lesion, and maybe you emphasize it, but maybe you don't. It's important to have people assess the impact of lesions rather than just filling pages with lists of anomalies."

Attendees agreed that there is often pressure to minimize reports of lesions to help sell a horse, but the flip side of that is the trouble one can have if a lesion is not reported pre-sale and is found post-sale. Most said they draw a hard line between reports and opinions, listing all their findings in a report, but not offering an opinion on them unless requested. Others prefer to put their opinions on reports as long as the findings are not omitted.

**Medications and medical records** The availability of a horse's medical records was also a topic of discussion; Hay noted that legislation has been proposed in Florida to make a horse's entire medical history public at the horse's auction. "It's pretty far-reaching what they're proposing," he said. "It would include any history of any disease, EPM, all vaccination records, any lameness, anything. It's a little scary that some of the things written there could become legislation."

Disclosing a horse's entire health record is cumbersome and raises client confidentiality issues, opined one veterinarian.

Medication usage in sale horses is another issue, and it's one that's not exactly clear-cut. "The problem with medication issues is that they vary from state to state," said one attendee. Several studies are ongoing to determine typical baseline values for several compounds and hormones; these will provide the basis for additional research to develop withdrawal times and acceptable levels of various medications.

**Genetic diseases** The forum ended with a presentation by Stephanie Valberg, DVM, PhD, Dipl. ACVIM, director of the University of Minnesota's Louise and Doug Leatherdale Equine Center. She presented new information on the inheritance, testing, and clinical signs of five equine genetic diseases that affect Quarter Horses and related breeds. Test results for these diseases are playing an increasingly important role in many sale environments.

She noted that a DNA mutation has been identified in only eight equine diseases,

although with the genome research completed in 2007 that number will likely increase soon. She discussed hyperkalemic periodic paralysis (HYPP), glycogen-branching enzyme deficiency (GBED), hereditary regional dermal asthenia (HERDA), polysaccharide storage myopathy (PSSM), and malignant hyperthermia (MH). The three genetic mutations that don't affect Quarter Horses are severe combined immunodeficiency syndrome (SCID) in Arabians, overo lethal white syndrome (OLWS) in Paints, and junctional epidermolysis bullosa (JEB) in Belgians.

### How Important Is That Airway Exam Grade?

The airways of many breeds of horses, particularly Thoroughbreds, are evaluated via an endoscope and graded before sale. The intent is to identify horses whose airways might have problems that could limit the horses' performance at maximal exercise, so buyers can consider this in their purchasing decisions. Scott Pierce, DVM, of Rood & Riddle Equine Hospital in Lexington, Ky., presented a study investigating the exam results and later racing performance of 2,954 Thoroughbred yearlings in an effort to answer the question of just how significant airway grades are.

The exam takes only one to two minutes, and it evaluates arytenoid cartilage function (these cartilages should be able to abduct, or move completely out of the airway to allow maximum airflow) on a scale of 1-4. Epiglottises are also evaluated; a short or otherwise abnormal epiglottis can contribute to dorsal displacement of the soft palate, which can also obstruct airflow. Following are the grading scales Pierce used to evaluate all study horses between 1998 and 2001, and the results.

#### Arytenoid function (AF)

- Grade 1: Synchronous movement, symmetrical cartilages; maximal abduction easily achieved. 19% of horses (571) were in this category.
- Grade 2a: Mildly asynchronous, mildly asymmetrical, maximal abduction easily achieved (70%, 2,068 horses).
- Grade 2b: Asynchronous, asymmetrical, maximum abduction with difficulty (9%, 260 horses).
- Grade 3: Asynchronous, asymmetrical, limited arytenoid movement. Full abduction is usually not achieved and especially is not maintained (2%, 55 horses).

■ Grade 4: No arytenoid movement, no abduction. No horses were Grade 4, but Pierce noted that most of these horses would not be offered for sale, as they are usually withdrawn.

#### Epiglottis structure (ES)

- Grade 0: Normal epiglottis with good thickness, length, and definition with normally serrated edges. 81% of horses had normal epiglottises.
- Grade 1: Slightly flaccid, with adequate length and texture, but slightly thinner than normal and without serrated edges (14% of horses).
- Grade 2: Mildly flaccid, with adequate length, thinner than normal, curled edges, and no dorsal vasculature (4% of horses).
- Grade 3: More severe, moderately flaccid, very thin, and bent easily (1% of horses).
- Grade 4: Severely flaccid, extremely thin, markedly short, and bent easily (0 horses).

Race records for the 2-, 3-, and 4-year-old years were collected and analyzed in context of the throat exam findings. Pierce reported no difference in the number of starts, earnings per start, or total earnings of horses with Grade 1 vs. Grade 2a arytenoid function at 2, 3, or 4 years of age. Grade 2b horses had significantly lower total earnings per year at 2 and 4 years of age than Grades 1 or 2a, and they almost had significantly lower earnings at Grade 3, but a few big winners in this group kept the numbers at this age from being significant. Grade 3 horses had fewer starts and lower earnings than Grades 1, 2a, and 2b.

Forty-three percent of horses with Grade 3 arytenoid function went unraced, compared to 15% of Grade 2b, 16% of Grade 2s, and 13% of Grade 1.

Horses with epiglottis structure grades of 0-2 all performed about the same, while those with Grades 3 and 4 had significantly decreased earnings at ages 2 and 4.

"So what do I tell clients?" Pierce asked. "I tell them Grades 1 and 2a arytenoids function are no problem. For Grade 2b, there's something there. They don't perform as good as the 1s and 2as; however, if you think the horse is really special, I would buy him anyway. I can't condemn all of these horses. Grade 3s are bad."

"For epiglottis structure, Grades 0-2 are no problem, but I can't recommend horses with higher grades or a really flaccid or short epiglottis," he concluded. ♣

# Foot/Lameness

BY NANCY S. LOVING, DVM, AND CHRISTY WEST

## Therapeutic Shoeing

The AAEP table topic on Therapeutic Shoeing attracted a large group of veterinarians and farriers such as Steve O'Grady, DVM, MRCVS, of Northern Virginia Equine, and Bruce Lyle, DVM, a veterinarian who focuses on foot care in Aubrey, Texas, led a discussion sparked with controversy.

Questions began instantly, with the first topic focusing on treatment of hind limb suspensory desmitis (ligament inflammation). There was little debate that the feet and sore suspensory ligaments are related to one another. By managing the feet with a logical approach, O'Grady believes that suspensory ligament problems will improve. He feels the only way that shoeing directly affects a hind leg suspensory ligament is related to length of the foot and ease of breakover. He advocates shoes that are as wide as they are long, with no extended heels. He doesn't feel that raising the heels is helpful, particularly if the entire back of the foot is "crushed" and collapsed.

For suspensory ligament desmitis, Lyle advocates the use of rail shoes when the plantar angle (the angle the wings of the hind limb coffin bone make with a horizontal plane) is zero or negative. A rail shoe is a square-toed shoe with "rails" along the underside of the shoe. He feels many superficial digital flexor and suspensory ligament problems are a result of delayed or inadequate function of the deep digital flexor tendon during the stance and propulsion phase of stride. He commented that a negative palmar (referring to the hind limb coffin bone)/plantar angle of the coffin bone ends up stretching the deep digital flexor tendon to a less-than-optimal state for

support and contracture. His approach is to use the rail shoe to move the horse's weight back onto its heel since typically lameness moves weight toward the toe. His objective is to engage the deep digital flexor tendon to take tension off the suspensory ligament.

In practice, he has noted that improvement of the palmar/plantar angle can



PAULA DA SILVA

Veterinarians in attendance all agreed that it is not always in the horse's best interest to make his foot "look" better, especially if the horse has adapted to its unique situation.

transform a previously lame horse (or one that is reluctant to perform) into a sound horse.

An audience participant pointed out that most therapeutic approaches are an attempt to return weight-bearing back to normal; for example, a navicular horse lands on its toe so it is important to move weight loading toward the back of the foot.

To compute the center of force, Lyle uses a tool called a Mat\*Scan (Tekscan, Inc.) that records ground reaction forces at 40 frames per second from the time the

foot contacts the mat until final liftoff. His objective is to move the ground reaction forces back toward the center of the foot mass, to improve phalangeal alignment, and by doing so, to allow every structure in the foot and leg to bear its share of the load; this is especially useful to alleviate repetitive stress injuries.

Andrea Floyd, DVM, co-editor of the book, *Equine Podiatry*, discussed chronic heel pain in horses. She noted that radiographs often show a post-like position of the short and long pastern bones, then the coffin bone ends up sitting in a negative palmar angle, such that the horse appears to have two disparate feet. This alignment often leads to heel and quarter cracks. She stressed that trimming the hoof to the widest part of the frog does not take into account the palmar angle, and the best way to improve heel growth is to first find the center of the coffin bone on radiographs. Then draw a straight line down to the distal bearing surface and rasp the cranial-dorsal portion of the hoof into a zero palmar angle. This leaves an invisible heel area to be filled with a flat shoe applied by nailing only at the toe. Soft Equithane packing,

taped in place with duct tape, is applied between the heel and shoe and fills the "air gap," and that is left for 6-8 weeks. With this shoeing method, the heels still receive neurologic messages to remain stable and grow.

Lyle added that the position a horse stands for hoof radiographs will affect the phalangeal alignment, but the parameters within the hoof capsule relative to the coffin bone will remain consistent.

Gene Ovnicek, RMF, brought up the point that in dry climates (such as the western United States), horses grow a lot

of false sole (the sole of a hoof that does not exfoliate normally), the resulting trim could end up with a negative palmar angle. He recommends using radiographs, hoof testers, and veterinary guidance to assist the farrier in trimming the soles in feet that are difficult to read.

An audience member made several remarks, including the statement that dynamic movement can alter perception of the standing trim. He also said the impact of footfall is unique to each horse, and reminded the audience that a standing shoe is not always the same as a moving shoe, nor does a horse in rehab need the same support as an athletic horse.

O'Grady said that the soft tissues of the foot bear weight and serve to dissipate concussion. O'Grady cautions against trimming away frog as he feels that this would alter the base of support, and problems develop if the frog sits below the heels or is receded. Lyle pointed out that even 1 mm of trim can make a huge difference to a horse's comfort, especially when the foot is trimmed by 5-10 mm and there might only be 10-12 mm depth beneath the coffin bone.

He also said there is a misconception of trimming to the widest part of the frog: If there is not enough depth of foot, then there isn't a sufficient amount with which

to work. Additionally, trimming heels can move the center of force sufficiently forward to put the weight of the horse on the navicular bone and deep digital flexor tendon/bursal unit, resulting in problems ranging from bursitis to necrosis and rupture of the tendon. If there is only 3-5 mm thickness of sole based on radiographic measurements, the horse needs time to grow foot. A trim job should attempt to maintain at least 15 mm of sole depth; at sole depths of 6-7 mm or less, one should worry about bruising and lameness. If the sole is too thick with false sole, the resulting trim could end up with a negative palmar angle.

Lateral radiographs are helpful for the farrier and veterinarian. O'Grady stressed that lateral-medial hoof balance is also important and the length of heel from the ground to the hairline should be similar side-to-side. Radiographs taken of the dorsal-palmar view help evaluate balance, particularly when using a measurement taken across the heels over the wings of the coffin bone. If a balance abnormality is present, one must determine if it is related to a horse's conformation or is farrier-induced sheared heels. Usually a horse that lands laterally will rotate the foot to land on the inside, and this must be corrected.

The question was asked about how to

differentiate a laminitic horse from a thin-soled horse. The unequivocal answer from the moderators was: "Treat as if laminitis until proven otherwise." Sequential radiographs provide objective measurements for monitoring the bone to hoof capsule relationship. For a reference on each individual horse, compare the hoof capsule thickness just below the extensor process to thickness at the level of the tip of the coffin bone. Both should be equidistant and approximately 15 mm thick.

Another question was: What is normal foot landing? The speakers said ideally a horse lands flat or heel first, but it should be considered that we don't know if some horses are just fine hitting toe first. Lyle noted if the horse has 6 mm digital break-over and joint articulation lies in the center of the coffin bone, then this horse is likely to have a long, sound career. If the horse has a 2½ inch (65 mm) digital breakover and articulation is in the caudal one-third of the foot, he is not likely to stay sound landing toe first.

In summary, everyone agreed that it is not always in the best interest of the horse to make his foot "look" better, especially a horse that has adapted to its unique situation. Additionally, all parties were in favor of the idea that more critical biomechanical research with an eye to the details and

# Feel better.

Rest assured, you're doing what's right for your horse with STEADFAST™ EQUINE from Arenus. There is no better, safer, faster and more convenient way to build soundness from the inside out. And by providing your horse with a long, healthy and active life, you'll feel better, too — about your performance and the animals for which you care. [Learn more at arenusperformance.com](http://arenusperformance.com).

factors discussed would add benefit and greater consensus on therapy and prevention.

## Managing Acute and Chronic Laminitis

To a packed room of veterinarians at the 2007 American Association of Equine Practitioners Convention in Orlando, Fla., Jim Belknap, DVM, PhD, Dipl. ACVS, an associate professor of veterinary clinical sciences from The Ohio State University's Galbreath Equine Center, and Rob Boswell, DVM, a practitioner with Palm Beach Equine Clinic in Wellington, Fla., opened the table topic discussion about prevention and treatment of laminitis.

Belknap (who co-hosted TheHorse.com's Webinar on Understanding Laminitis) said the latest research points to laminitis as an intense inflammatory injury of the foot, and it is no longer believed to be solely a blood flow problem. It is known that even though a horse with imminent laminitis might look normal and show no lameness, inflammatory mediators are already elevated by up to 1,000-fold in the laminae.

With that in mind, Belknap is an advocate of very high levels of anti-inflammatory medications (500 mg three times per day of flunixin meglumine, or Banamine) within the first 72 hours of insult (a cause of laminitis) or onset. He said he realized this high dose is more likely to lead to some gastrointestinal (GI) ulceration and, thus, it should not be used on every horse. But he stressed that it is critical to get foot inflammation under control, so ulceration might be the lesser of two evils. Once the acute stage has settled down, it might be desirable to switch to phenylbutazone for better pain relief.

Ice might be beneficial for the same reason that hypothermia is used in some types of inflammatory injury in human medicine: hypothermia is anti-inflammatory and slows the metabolic rate (i.e., enzyme activity) of injured tissue. There could be great benefit to immediately ice the feet to decrease activity of deleterious enzymes such as matrix metalloproteinases and to decrease inflammation. Studies show the best means of cooling the feet is by using a bucket arrangement or wrapping the hoof in a 5-liter plastic bag or truck tire inner tube filled with ice and water. Refresh the ice continually as needed. The discussion facilitators stressed that no

harm can come of keeping feet in ice for 72 hours—as much ice therapy as possible is desirable in averting the inflammatory effects related to acute laminitis. After 72 hours, no ice is necessary and, in fact, it might be counterproductive by softening the foot too much. The horse should not be walked during the acute phase.

DMSO (dimethyl sulfoxide) is a commonly employed drug for laminitis treatment, but there is very little research supporting its use. In an already-laminitic horse, DMSO might have anti-inflammatory properties due to its being a superoxide radical scavenger (it binds to radicals and inactivates them), and it might work as a vasodilator. It can be given either orally or intravenously (IV) with good absorption.

Equioxx is a new non-steroidal anti-inflammatory drug (NSAID) that targets COX-2 inflammatory mediators. Belknap advised that this drug needs five to seven days to reach a steady state of effect, but if it's initially given at a triple dose, the steady state can be reached in 24 hours. Until scientists perform research on its effect in the early stages of laminitis, it might be best used on nonacute cases due to concerns about its potential to exacerbate vascular events (such as Vioxx did in humans at risk) in the at-risk horse or in the acute case of laminitis.

Equioxx should be advantageous in chronic cases, as there should be fewer side effects due to a lowered incidence of GI ulceration or kidney lesions when compared to other NSAIDs. However, it was also mentioned that COX-2 mediators are needed to heal gastric ulcers, so there is some concern on giving the drug to horses known to have GI ulcers.

Blood flow might not play as predominant a role as once thought, so vasodilator therapy is not necessarily as important as some other treatment choices. Acepromazine only opens vascular beds for about 40 minutes following intramuscular (IM) administration, so if given, it should be administered at least four times a day. Another possible vasodilator to use is IV lidocaine.

Belknap and Boswell said they felt a single dose of dexamethasone in a horse at risk of laminitis might help decrease inflammation in the feet, but the vets are resistant to use it due to potential litigation regarding steroid use and laminitis.

**Supporting the Hoof** The facilitators and

audience discussed foot support. Boswell prefers a two-part putty mixture material placed generously from the tip of the frog to the back of the frog and into the sulci (grooves in the sides of the frog). This recruits the frog and the sulci for support. There was mention that "Soft-Ride" pads give a horse with acute laminitis a good measure of relief, but these pads only contact the frog, so it helps to also use impression material within the sulci.

Lidocaine nerve blocking of the front feet on the initial visit allows assessment of any hind limb involvement, shoe removal, and radiographs. Belknap suggests that veterinarians use lidocaine for the nerve block due to its short duration of action. Shoes left in place could place too much pressure on the hoof wall and laminae. Removal of the shoes also allows the practitioner to obtain good X ray images to evaluate the internal components of each hoof. Prognosis of foot health and integrity is achieved by comparative views of radiographs (both lateral and D-P, or dorsopalmar, views) taken during the initial 35 days of a laminitis event. Measurements of the distance from the dorsal hoof wall to the dorsal border of the coffin bone assist in evaluating the integrity of the laminae within the hoof capsule and helping determine if there is any displacement or rotation of the coffin bone.

Boswell suggests serial weekly radiographs for four weeks. If there is a 25-30% decrease in sole depth during this time, this is not considered a good prognosis and the laminitis is likely terminal. If there is less than 6-7 mm of sole, treatment might fail to alleviate the crisis. If a horse is not progressing well despite aggressive therapy, a venogram might be helpful to determine the circulation in the front of the hoof. If circulation is absent, euthanasia might be indicated. However, not all veterinarians agree, and it was stated that some horses have been saved that appeared to have no chance on venogram results.

If the shoes are left on, the back of each foot should be filled with cushion support substance (such as two-part putty) from the tip of the frog to the back of the foot. The hoof should be placed on the ground so the material fills the spaces within the frog and any extra oozes out that would have caused excess pressure.

In the early stages, a horse undergoing rotation can be placed in a temporary raised-heel shoe, such as the Nanric

Ultimate (taped on), but both practitioners recommend unscrewing one wedge from this shoe to make it shorter in horses whose coffin bones have both rotated and undergone sinking. The objective is to stabilize and derotate the coffin bone as much as possible to relieve forces, while providing support to internal structures of the foot. Both clinicians emphasized that it is important to watch the horse's response to shoeing, and they should realize that there is not one type of foot support that works for every horse.

The discussion continued onto chronic laminitis, noting that an affected horse has a mechanical problem that can't be fixed chemically by this point in the disease. The best approach is using special shoes.

Audience discussion centered around the wooden clog shoe, using either a homemade shoe made of 1-1/8" plywood, beveled 45 degrees all the way around, or the commercially available EDSS (Equine Digit Support System) product. These are screwed in on the side of the hoof wall, and just enough cushion impression material is placed in the frog area to give relief without too much pressure. Such a shoe absorbs concussion and allows the horse to adjust how he wants to stand, possibly more so than with other shoeing options. Belknap and Boswell pointed out that they use many different types of shoes in the

chronic cases, and one shoe does not work on all cases.

Belknap has noticed that previously 10% of laminitis cases were in horses with pasture-associated obesity; now this has increased to 60-70% of cases. He cannot find an explanation for that trend, nor did anyone in the audience have any suggestions.

### Wooden Shoes for Chronic Laminitis

The chronically laminitic horse is often a very tough case to manage because displacement of the coffin bone within the foot leads to a lot of pain and damage, in addition to the damage that allowed the displacement in the first place. O'Grady, discussed how to build and fit wooden shoes (clogs) to improve healing in three forms of chronic laminitis.

He listed several benefits of these shoes, which are made out of stacked plywood or subfloor wood:

- Easy to build;
- Lightweight;
- Dissipate energy (absorb shock) better than harder metals;
- Inexpensive;
- Flat, solid construction allows weight bearing to be applied over specified sections of the foot;
- Easily altered according to the horse's needs;

- Applied nontraumatically (no impact from nailing, as they're attached with screws).

A thorough assessment of the foot with lateral and dorsopalmar radiographs (side and front views) is essential to design the shoe according to what that foot needs, he noted.

When the shoe is constructed from a wood block, the sides and toe are cut at about a 45° angle. This places weight bearing directly under the bones, allows the horse to easily choose the most comfortable hoof angle when standing, and decreases torque on the laminae (which attach the coffin bone to the hoof wall). The shoe can be further modified in several ways: Its foot surface can be "routed" out in specific areas to alleviate pressure on a dropped sole, wedge pads can be added to further elevate heels, and the overall thickness of the shoe can be modified by adding or removing layers of wood.

O'Grady went on to describe the use of this shoe for three manifestations of chronic laminitis: dorsal rotation (the most common rotation case), medial or lateral displacement of the coffin bone (sinking on the outside or inside of the foot), and dropping of the sole or prolapse of the coffin bone through the sole.

Dorsal rotation In these cases, the coffin bone has pulled away from the hoof wall at the toe and is rotating so its tip is closer

# Jump higher.

Different than a vitamin/mineral product. More than a joint health product. Better than a typical hoof health product. STEADFAST™ EQUINE is “*the one and only one*” dietary supplement that’s better at building soundness from the inside out, providing your horse with a long, healthy and active life.

**Learn more at [arenusperformance.com](http://arenusperformance.com).**

to the ground. O'Grady recommended realignment of these feet so the bottom surface of the coffin bone is parallel to the ground by removing some of the heels and using the increased solar surface for weight-bearing. Once the foot is prepared, impression material is applied to the foot to recruit the sole, bars, frog, and sulci (grooves alongside the frog) for weight bearing. Then the wooden shoe is applied with 1 1/2-inch drywall screws.

O'Grady said that in some cases of coffin bone rotation and prolapse (penetration through the sole), this treatment has provided a viable alternative to deep digital flexor tenotomy (cutting the deep digital flexor tendon). He reported a favorable response (increased sole depth and wall growth at the toe) in 17/21 cases (81%) with this method.

**Medial/lateral sinking** Medial sinking (to the inside of the foot) is more commonly seen, although sinking to the outside has been noted in supporting limb laminitis, O'Grady reported. The approach for these feet is similar to that for dorsal rotation, except the heels might not need to be taken down to realign the foot, and a one-quarter-inch extension on the high side is used to help lighten the load on the low side.

He found a favorable response (increased wall growth on the low side) in 8/11 cases (65%) with this method.

**Solar/coffin bone prolapse** In these tough cases, the coffin bone is realigned as with the dorsal rotation case, heel elevation is used to decrease the pull of the deep digital flexor tendon, and the shoe is routed out to prevent weight bearing by the prolapsed sole and/or bone. The rear half of the foot is packed with impression material to help support the horse's weight.

He reported a favorable response (cornification of the exposed soft tissues and hoof wall growth) in 7/9 cases (77%) with this method.

"The wooden shoe provides another very consistent farriery option when treating a horse with chronic laminitis," he concluded.

## Looking Inside the Lame Foot

Advances in diagnostic imaging such



DR. STEPHEN O'GRADY/AEPP PROCEEDINGS

Dr. O'Grady says, "The wooden shoe (two examples are shown above) provides another very consistent farriery option when treating a horse with chronic laminitis."

as digital radiography (X rays) and MRI have given researchers the tools they need to look inside and learn more about lame feet in horses. However, those tools require a good deal of knowledge about how to interpret the results, and those results have to be viewed in light of the horse's clinical signs.

At convention two world-renowned practitioners spent a half-day informing attendees about the proper use and interpretation of these imaging methods, reporting on recent research and a host of case studies to illustrate their findings. Sue Dyson, VetMB, PhD, FRCVS, head of clinical orthopedics at the Animal Health Trust in Newmarket, United Kingdom, and Kent Allen, DVM, owner of the imaging referral facility Virginia Equine Imaging in The Plains, Va., presented the popular session.

Dyson described the objectives of the presentation as follows: to present the results of recent studies, discuss the art and science of lameness diagnosis, provide practical tips, show some high-quality images, and demonstrate that sophisticated technology is not always required.

For example, she commented: "It is important to recognize that computerized or digital radiography does not necessarily equate with better. Excellent quality conventional radiographs can be vastly

superior to poor quality digital images. Attention to detail is crucial to achieve excellent quality images, whichever technique is used. However, excellent quality computerized or digital images can potentially yield more information than conventional images and enhance our diagnostic capabilities.

"I believe very strongly that there is both art and science in lameness diagnosis," she opined. "There are rules, but there are very fuzzy edges to them."

**Keep Asking the Question** Allen briefly discussed a tough lameness case that was still an enigma after extensive nerve blocks, scintigraphy (bone scan), and physical examination. When the horse's long winter coat on the leg was clipped for ultrasound, a small swelling was noted that turned out to be a large lesion in the superficial digital flexor tendon.

"That's the diagnostic clipping procedure," he said with a chuckle. "A detailed physical exam is critical to these cases. You have to keep asking the question, what's going on here? If there's no answer on scintigraphy or clinical examination and nerve blocks, either keep blocking or go back to your imaging and ask more questions."

Dyson and Allen agreed that horses with significant proximal (upper) superficial digital flexor tendon lesions like this don't tend to recover full soundness for competition-level exercise.

**Palmar Process Fractures of the Coffin Bone** This term describes a fracture of the rear "wings" of the coffin bone; the inside (medial) wing, outside (lateral) wing, or both can be fractured. An Animal Health Trust study of 22 horses (eventers, show jumpers, and general purpose horses with an average age of 8.4 years) found that the medial palmar process (back part of the wing) was more often affected, accounting for 81% of fractures. Owners of many of the horses had not observed a sudden onset of acute lameness, but horses were mildly or moderately lame upon examination at the Animal Health Trust—less severe than one usually associates with fractures, Dyson noted.

She reported that lameness was worse

when the horses were worked in a circle, especially on hard ground with the lame limb on the inside. Conventional radiograph views showed no abnormalities in half of the horses, but oblique (off-angle) views were able to show the fractures. "This highlights the need for routine use of oblique projections when evaluating horses with foot pain," she advised.

She also noted that nuclear scintigraphy or bone scanning identified bone remodeling at the fracture site in all 12 horses that were scanned. Scintigraphy is a metabolic imaging modality that uses blood flow and bone remodeling to produce an image. A radioactive compound is injected intravenously and circulates throughout the horse, localizing in areas of injury and active bone remodeling. The radioactivity is measured, producing an image. "Nuclear scintigraphy can be useful to highlight the potential presence of a fracture and prompt acquisition of different radiographic views to identify a fracture," she said. However, scintigraphy is not usually essential for diagnosis.

Thirteen of the 22 horses became sound, three improved but not to complete soundness at their previous level of work, and two healed but had lameness from other injuries, for an overall successful recovery rate of 81%. Alteration of bone architecture in some horses suggested that this can be a repetitive stress injury, Dyson commented.

The location of the palmar process fracture and whether it affects the joint surface (an articular fracture) doesn't appear to affect the prognosis in sport horses, she said. However, concurrent injury of the collateral ligament that stabilizes the coffin joint might lead to increased bone instability and delayed union of the fracture.

**More on the Palmar Processes** Dyson also described a study that compared radiography, nuclear scintigraphy, and MRI to evaluate the palmar processes of 258 horses with front foot pain, in part to determine if pedal osteitis (inflammation of the coffin bone) is a legitimate diagnosis. "I've always been somewhat reluctant to use (the pedal osteitis diagnosis) unless there's evidence of IRU (increased radiopharmaceutical uptake, indicative of bone remodeling, seen on a bone scan). I still ask, is it necessarily contributing to pain and lameness? I tend to say it's the diagnosis of the diagnostically destitute," she said with a grin.

Focal moderate to intense IRU was seen in 2.8% of medial processes and 1.2% of lateral ones. Radiographs noted multiple radiolucent areas (of less dense bone) in palmar processes in 21.1% of feet, new bone on the ventral (lower) aspect of palmar processes in 11.8% of feet, and palmar (rearward) elongation of the palmar processes in 4.6% of feet.

No correlation between sole depth and

IRU was found, nor was there correlation between the angle of the coffin bone with the ground (solar angle or palmar angle) and IRU. Veterinarians found more abnormalities in medial palmar processes with MRI than scintigraphy, and MRI grade was significantly correlated with scintigraphy grade.

"Focal increased radiopharmaceutical uptake in a palmar process of the distal phalanx is not common, but it occurs most frequently in the medial palmar process," Dyson summarized.

"There's a huge variation in radiographic, scintigraphic, and MRI appearance of palmar processes," she went on. "Focal IRU can be seen with MRI abnormalities associated with lameness or incidental MRI abnormalities (which are present, but not causing lameness). Abnormalities are more frequent in lame limbs, but are they contributing to the abnormal loading or a consequence of it? The clinical significance of these lesions has to be established. Most horses present with concurrent lesions that could also cause lameness."

"So is pedal osteitis a legitimate diagnosis? Can it contribute to pain and lameness?" she asked. "Yes, but in no horse was this the primary cause of lameness in this study."

"So pedal osteitis is still the trashcan diagnosis?" Allen asked with a smile.

"Yes, I think it is," answered Dyson.

# Ride farther.

Your horse's joints, bones, hooves, and other connective tissues may be impacted over time due to athletic performance and aging. While many equine health products may address one component of your horse's framework, STEADFAST™ EQUINE supports your horse's entire structural system.

Learn more at [arenusperformance.com](http://arenusperformance.com).

**Enostosislike Lesions** Allen described a 4-year-old Western pleasure gelding that presented with variable left front foot lameness and short striding behind. When the left front was blocked, the lameness switched to the right front. "We gave him a sound leg to limp on and he took the opportunity," Allen commented.

Imaging results were unusual in several respects, and the final diagnosis was enostosislike lesions (bone growths within the central bone cavity) in all four fetlocks. The horse was treated with shock wave therapy and tiludronate, became sound in 30 days, and he competed successfully at the Quarter Horse Congress and the World Championship Show.

"This horse had a lot of bone turnover, with osteoblastic (bone-producing) and osteoclastic (bone breakdown) processes happening at the same time," he said. "The medication tiludronate inhibits osteoclastic activity; if you can modify this process, the osteoblastic activity should also subside."

"Are these lesions always a cause of lameness? Not necessarily," Allen said. "We see these often in older horses and they're often incidental findings."

#### **Distal Border Navicular Bone Fragments**

What appears to be a fragment off the distal (lower) side of the navicular bone might not actually be a fragment, noted Dyson. It might be a mineralization in the adjacent distal sesamoidean impar ligament or an enthesophyte (bony growth where the ligament attaches to the bone). Regardless of the actual structure, these apparent fragments have been increasingly recognized with the advent of digital radiography.

Dyson noted that lameness associated with movement of the fragment relative to the navicular bone can occur, and the fragments might be associated with pathology (changes due to disease) and/or adhesions of the digital sesamoidean impar ligament and/or deep digital flexor tendon.

**Figuring Out Tough Cases** After presenting a case where the horse's response to nerve blocks didn't entirely match the imaging results, Allen made the following comments: "The longer I do this, the more nervous I get about where local anesthetic used for nerve blocks is going. They're still the gold standard, but the anesthetic diffuses and moves around, so you can block less or more structures than you intended. Take nerve blocks at face value if all of your diagnostics are falling into place. If

not, you've got more to look at."

Dyson described a similarly confusing case, with the following conclusions: "Consider the spectrum of pathology and the relationships between the cartilages of the foot and collateral ligaments of the coffin joint; they're connected, and if one is damaged, the other is likely to be as well. Learn the anatomy; you're not going to know all of it all the time because you forget things. You need to go back to the anatomy textbooks and don't be afraid to get bone specimens, preferably with ligaments attached, so you can remind yourself of the attachments of these structures to reach an accurate diagnosis."

**“Nuclear scintigraphy can be useful to highlight the potential presence of a fracture and prompt acquisition of different radiographic views to identify a fracture.”**

DR. SUE DYSON

**Sidebone** The collateral cartilages of the foot serve to dissipate shock when the foot lands, explained Dyson. At ground contact, they move abaxially (away from the centerline). Ossification, or hardening, of the foot's cartilages into bone (sidebone), affects this function and is easily detected on most radiograph systems.

Several Animal Health Trust studies investigated the prevalence and severity of sidebone. One study of 268 horses graded ossification on a scale of 0 to 5, with 5 as the most severe grade. Twenty-eight horses had sidebone of some grade.

Breed, body weight, and height to body weight ratio were all significantly associated with sidebone grade. Large native ponies such as Dales, Highland, Fell, and Connemaras, along with heavier individuals, were more likely to have more severe sidebone. Height to body weight ratio was negatively associated with sidebone grade; in other words, short, heavy horses had a higher occurrence of severe sidebone.

Lateral and medial cartilages had significantly different sidebone grades, and

usually the lateral cartilage grade was more severe.

"Large medial cartilages, asymmetry between feet, and a marked lack of correlation in size between the cartilages within a foot may be more indicative of an abnormality," Dyson noted.

#### **Nuclear scintigraphy (on 186 horses)**

This imaging modality was useful to see the level of remodeling in the cartilages of horses with sidebone; moderate to severe ossification as seen on radiographs was often associated with IRU.

All fractures of ossified cartilages also had IRU, indicating that moderate to severe ossification is a risk factor for fractures. Dyson reported that there was "good correlation and excellent agreement between radiographic and scintigraphic grades."

She also noted that ossification of only one cartilage of the foot might result in unbalanced stresses on that cartilage and associated ligaments, possibly contributing to a greater risk of injury to that cartilage than in a foot with symmetrically ossified cartilages on both sides.

"Some fractures were not easy to define radiographically, and scintigraphy confirmed them or sent us back to investigate further and find them," she commented.

"Scintigraphy may give information about the potential clinical significance of ossification of the cartilages of the foot and associated lesions, thus, prompting further study," she summarized. "This study also verified the observation that marked asymmetry of the cartilages of the foot within a foot may be a risk factor for injury."

"I think we're getting to some clarity about sidebone," commented Allen. "For years we were told it was due to medio-lateral (side-to-side) hoof imbalance, but there's more to it than that. I think it really does point out that we need to look at that sidebone in detail and make sure we're not just blasting past that lesion."

**Fracture of sidebones** Ten horses with 12 total fractures of the collateral cartilages were studied, and it was found that all of them had at least moderate ossification of the cartilages. Most (92%) of the fractures were at the base of the cartilage, and the medial cartilage was slightly more likely to be fractured (58% of fractures).

"Lameness tended to be most severe on a 10- to 15-meter circle on a hard surface with the lame limb on the inside of the circle," reported Dyson. "Lameness was

abolished by palmar (abaxial) sesamoid nerve blocks.

"In some horses it was difficult to make a definitive diagnosis based solely on radiographic findings, and comparison with nuclear scintigraphic images was invaluable," she said. "Comparison of solar, lateral, and dorsal scintigraphic images was invaluable to precisely locate the site of IRU."

Associated trauma to the coffin bone Four horses with severe sidebone were found to have associated trauma to the coffin bone, based on scintigraphy and MRI imaging, reported Dyson.

#### **Scintigraphy for Navicular Disease and Soft Tissue Injuries**

Out of 264 horses with front foot pain, scintigraphic images of 36.6% of their limbs showed IRU on a bone scan in the navicular bone, Dyson noted. Scintigraphy and MRI grades were highly correlated.

"It was concluded that positive nuclear scintigraphic results are good predictors of injury or disease of the navicular bone; however, a negative scintigraphic result does not preclude significant disease of the navicular bone," she said. "It appears that if bone necrosis is the predominant pathological process, IRU may be normal. End-stage sclerosis (bone hardening) is also not associated with IRU."

The same 264 horses' scintigraphic images were also evaluated to see any IRU

associated with soft tissue injuries. The most common soft tissue injuries with IRU were in the deep digital flexor tendon (13% of limbs) and in the insertion of that tendon on the coffin bone (14.3% of limbs).

"Positive nuclear scintigraphic results are good predictors of injury or disease of the deep digital flexor tendon and collateral ligaments of the distal interphalangeal joint (coffin joint), irrespective of the anatomical location of the lesion in the tendon or ligament," Dyson concluded. "But a negative scintigraphic result does not preclude significant injuries; however, in combination with MRI it can tell us something about the disease process. Nuclear scintigraphy was not useful for detecting lesions of the distal sesamoidean impar ligament."

**MRI Investigation** In those 264 horses with foot pain, MRI showed that 82.6% of limbs had deep digital flexor tendon lesions, most often near the collateral sesamoidean ligament (59.4%) and navicular bone (59%). Many of these lesions were small and not clinically significant, she noted.

Lesions at the level of the first phalanx or long pastern bone (just below the fetlock) tended to be core lesions (90.3%), while the aforementioned lower lesions tended to be sagittal (front to back) splits and dorsal (upper surface) abrasions. Lesions of the deep digital flexor tendon and

pathology in the navicular bone were associated.

Lesions of the distal sesamoidean impar ligament and collateral sesamoidean ligament were less common (38.2% and 10.5%), but both were also associated with navicular bone abnormalities.

"There are close interactions between injuries of the components of the podotrochlear apparatus, the deep digital flexor tendon, the navicular bursa, and the distal interphalangeal joint," Dyson concluded. "The navicular bone can't be considered in isolation. Core lesions of the deep digital flexor tendon at the level of the proximal phalanx may have a different etiology (cause) than lesions occurring further distally."

**Cannon Bone Stress Fracture** Dyson described a case of cannon bone stress fracture, which was a subtle fracture in the upper rear aspect of the bone in a forelimb (just below the back of the knee). The lameness worsened with more trotting and when the horse slowed down, which she noted is a hallmark of this injury. A few of these cases have pre-existing sclerotic changes, she noted.

The prognosis is generally a complete recovery with three months of stall rest and ascending walking exercise, she said.

**Proximal Suspensory Desmitis** A 4-year-old Warmblood was presented to Dyson because he'd lost quality of movement. "In

# Show stronger.

Two exclusive ingredients in STEADFAST™ EQUINE — **NEM** and **TelaFIRM** — work together to build soundness from the inside out in as little as seven days. STEADFAST EQUINE also provides ascorbic acid for healthy joints; calcium, phosphorous and vitamin D for healthy bones and biotin for healthy skin and hooves. [Learn more at arenusperformance.com.](http://arenusperformance.com)

a young horse with loss of action, proximal suspensory desmitis is always in the forefront of my mind," she said.

In this horse, no abnormalities were detectable with ultrasound, scintigraphy, or radiographs. However, MRI located the suspensory lesion in the lateral lobe. "MRI has the potential to diagnose proximal suspensory desmitis in horses where we don't see any ultrasonographic abnormalities," she noted.

#### **Coffin joint collateral ligament desmitis**

Dyson's last report described a study of coffin joint collateral ligament (CL) desmitis in which horses were divided into three groups:

**Group 1** 109 horses with primary CL injury.

**Group 2** 113 horses with CL injury along with other injuries.

**Group 3** 11 horses with primary CL injury, but no MRI examination.

Group 1 included 45 horses with lameness in one forelimb (unilateral), 59 with lameness in both forelimbs (bilateral), and five with hindlimb injury (one bilaterally).

Dyson reported that no localizing clinical signs were present in most horses, and pain was not apparent when palpating or manipulating the lower limb joints in any horse. However, lameness was considerably worse when the horses were worked in circles, especially on hard ground. She commented that horses with medial collateral ligament desmitis were sometimes more lame when the affected limb was to the outside of the circle. Abaxial sesamoid nerve blocks were the only ones that made all horses go sound.

The medial collateral ligament was injured in 73.4% of horses, and the lateral collateral ligament was also injured in 14.5% of horses. The remainder had injuries to only the lateral ligament. Horses that jump (including show jumpers and eventers) were overrepresented in the study, comprising 50 of the 109 horses.

Ultrasound found collateral ligament problems in only 44% of horses, and only six horses had abnormalities detectable with radiographs. But MRI found problems in all 109 horses.

**Group 2** Eighty-five of the 113 horses (75.2%) had multiple concurrent injuries involving the coffin joint, deep digital flexor tendon, distal sesamoidean impar ligament, navicular bursa, or collateral sesamoidean ligament (often on the same side of the foot with collateral ligament

injury). Medial injuries were more common, affecting 105 horses (93%). Ultrasound found collateral ligament abnormalities in only 13 horses (11.5%), and radiographs found no ligament problems, although they did find coffin bone fractures in three horses.

**Group 3** All 11 of these horses had ultrasonographic abnormalities of the collateral ligament, and eight of nine evaluated with scintigraphy had positive findings.

Bony cystlike lesions at the attachments of the collateral ligament worsened the response to treatment in groups 1 and 3.

"Correlation between clinical findings and imaging modalities is enabling us to slowly unravel the complexity of the causes of foot pain and to begin to understand some of the risk factors for injury, different pathological mechanisms, and factors influencing prognosis," Dyson concluded. "It is important to emphasize that, although scintigraphy and MRI are hugely valuable tools, in a significant proportion of horses, a conclusive diagnosis can be reached with a thorough clinical examination, combined with radiography and ultrasonography. Clinical investigation should follow a logical, stepwise progression."

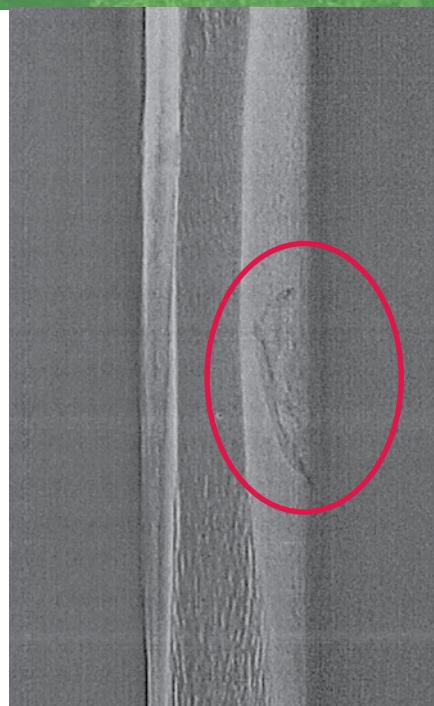
Allen added, "We (imaging referral practices) can't promise a full lameness work-up will be cheap, but we'll stay on it until we have a diagnosis. There's a real need for this in this country; too often a case doesn't get a good work-up and there's real value to doing this."

#### **The State of Stem Cell Therapy**

Stem cell therapy has received a good deal of attention in both human and veterinary medicine in recent years. It holds theoretical promise for treating conditions ranging from traumatic tendon and cartilage injury to liver failure, Parkinson's disease, and nerve/spinal cord damage, but it is still in its infancy.

Lisa Fortier, DVM, PhD, Dipl. ACVS, associate professor of clinical sciences at Cornell University, said, "Stem cells are not yet living up to the hype. We've got a long way to go before we really know what we're doing and can fine-tune these therapies."

Fortier and Roger Smith, MA, VetMB, DEO, MRCVS, PhD, Dipl. ECVS, professor of equine orthopedics at the Royal Veterinary College in Herts, in the United Kingdom, presented an in-depth session on the current state of stem cell research



DR. DAVID NUNAMAKER

Horses with cannon bone stress fractures generally complete recovery with three months of stall rest and ascending walking exercise.

for horses. Their presentations described the specifics and challenges of stem cell work along with the evidence that supports its use for equine tendon and cartilage defects.

**Stem cell background** First, what is a stem cell? Even this seemingly basic answer is unclear, said Fortier. "The definition and identification of stem cells is constantly evolving," she noted. "There is no current consensus on a gold standard assay to isolate or identify stem cells."

Part of the challenge is that once stem cells differentiate into specific cell types (such as tendon or ligament cells), classifying them can be ambiguous. (Is that a stem cell, a tendon cell, or a stem cell that became a tendon cell?) Also, no single cell surface marker can differentiate stem cells from other cells. Instead, one must identify them by seeing what markers are present and absent, much like a combination lock (i.e., only a very specific combination of markers defines a stem cell).

Researchers are working to develop an assay combining many different markers to identify stem cells so they can determine absolute numbers of stem cells harvested and used in therapies. This will help clarify research on their use.

"To date, equine studies that have investigated the use of 'stem cells' contain no information regarding characterization of the cells before implantation or data

concerning survival or function of the transplanted/grafted cells," noted Fortier.

While researchers aren't yet in agreement on the methods and criteria for identifying stem cells, some are working on more functional testing to find out what stem cells can do. To discuss this testing, we need to know a few additional "background basics" of stem cell therapy. These include whether they are embryonic stem cells (ES, cells derived from embryos or generated using genetic means) or adult-derived mesenchymal stem cells (MSCs). The latter are further broken down into the type of tissue from which they were harvested—whether they came from bone marrow or fat (adipose) tissue (BM-MSCs and A-MSCs, respectively). Each type and location of stem cells carries specific nuances; they can't all be lumped together.

**Embryonic stem cells** carry a few challenges. There has been a lot of political/ethical debate about the generation and destruction of embryos to generate stem cells, and there has been a concern about immune rejection of the cells, since they would contain the genetic material of an individual different from the recipient. Very current breakthroughs, however, suggest that embryonic stem cells can be made from adult somatic cells such as skin cells. This methodology involves the introduction of four genes that "re-program" a cell to become an embryonic stem cell. This

**“Bone marrow-derived stem cells have received the most attention scientifically and, hence, are the best characterized.”**

DR. LISA FORTIER

methodology obviates the need for generation or destruction of embryos and it allows the establishment of patient-specific stem cells that would not be rejected by the immune system.

**Bone marrow-derived stem cells** can be harvested from the sternum (breastbone) or iliac crest (part of the hip). These stem cells only comprise one in 10,000-100,000 of nucleated cells in bone marrow, said Fortier, but they "have received the most attention scientifically and, hence, are the best characterized." They are harvested with the horse standing and sedated, then they are cultured for about three weeks to increase their number to 10 million or so. They are then implanted into a lesion along with bone marrow supernatant (liquid), which contains growth factors to help heal the lesion. Since the cells come from the patient, there's no risk of rejection.

**Adipose-derived stem cells** have not done as well in some cell differentiation studies

(which evaluate how well stem cells can be induced to grow into different tissue types, such as bone, muscle, or liver). Harvesting them results in more donor site morbidity (damage) than harvesting of BM-MSCs. However, they do have their advantages; they don't have to be cultured for three weeks, so treatment of a lesion can occur quickly—within a couple of days. Fat tissue is harvested from the tailhead, then the fat cells are removed and what's left (about 50 million nucleated cells, about 2% of which are A-MSCs) is injected into the lesion. This approach also carries no risk of rejection.

Several questions about stem cell therapy apply to all types of cells, said Fortier. They include the following:

- What's the best approach to using stem cells?
- How many stem cells do you need?
- Do we expect the stem cells to take environmental cues from surrounding tissues and just turn into what's needed, or do they need some guidance?
- How important are growth factors?
- What's the best way to grow stem cells in culture to gain maximum effect?

"There is a lot to learn, so we need to pick specific areas to focus on in order to optimize clinical implementation of stem cells," she commented. "The future of stem cell therapy is limitless for healing tendon, cartilage, laminitis, bones, nerves, etc."

# Feel better.

Rest assured, you're doing what's right for your horse with STEADFAST™ EQUINE from Arenus. There is no better, safer, faster and more convenient way to build soundness from the inside out. And by providing your horse with a long, healthy and active life, you'll feel better, too — about your performance and the animals for which you care. [Learn more at arenusperformance.com](http://arenusperformance.com).

**Stem cells for tendon lesions** "The horse is a professional athlete, and tendon injuries are extremely common," noted Smith; one study found that they affect 23% of National Hunt horses in training and 46% of limb injuries at racecourses.

He focused on the superficial digital flexor tendon in particular, noting that a large part of its function is to store energy via its elasticity and return that energy to the horse for the next stride. "That's what makes the horse an efficient runner," he explained. "The horse is estimated to be 120% energy efficient at the gallop." The downside, of course, is injury when the tendons and ligaments are overstretched.

When a tendon is injured and subsequently healed, the scarred tendon is less elastic than normal tissue, putting it at risk of re-injury; one study of National Hunt horses found that 56% of those with superficial digital flexor tendon injuries suffered re-injury. "This is the rationale behind use of stem cells to treat tendon overstrain injuries—we need regeneration (of normal tissue) rather than repair (scarred tissue)," Smith explained.

Equine MSCs cultured in the laboratory create a matrix of tendon tissue that is "remarkably ordered," he observed. This is one of the keys to healing tendons—the cells must be organized linearly so they can handle the linear stress placed on them, rather than being disorganized so they can't stretch effectively.

One good thing about tendon lesions is that they generally form a closed cavity within the tendon. This helps hold stem cells in place and provides a vascularized scaffold (granulation tissue bed with blood vessels) to help organize healed tissue and provide blood supply, growth factors in the fluids present to help heal the lesion, and a mechanically appropriate environment.

Smith reported that lab animal studies have found that treatment of surgically created tendon and ligament lesions with MSCs results in better tissue organization, composition, and mechanics, compared to controls. In addition, an equine study in the United Kingdom using BM-MSCs found that in 82 of 168 treated racehorses that were available for follow-up after one year, there was a 78% success rate (no re-injury) compared to 43% of horses conservatively treated in another study—a 35% improvement in success rate. More specifically, the success rate in National Hunt horses (in

training and racing) was 82% of 71 horses, and the success rate in 11 flat racing horses was 50%. Twenty-four sport horses in other disciplines had an 87% success rate, compared to a 57-77% success rate with conservative treatment in another study.

He noted that horses that were re-injured had a significantly longer interval between injury and treatment (83 vs. 44 days), suggesting that delayed treatment resulted in more fibrosis of the lesion. He now recommends earlier harvesting of bone marrow (within one month of injury) and treatment. Pre-injury harvesting and storage of cells might also prove beneficial, as might storage of stem cells recovered from that horse's umbilical cord at birth.

**“Stem cells won’t remove fibrous tissue once it’s there, so treatment will be less effective on chronic cases.”**

DR. ROGER SMITH

"Stem cells won't remove fibrous tissue once it's there, so treatment will be less effective on chronic cases," he advised. "I recommend it for first-time injury, but sometimes it's also been tried on horses with more chronic presentation or those that have had poor success with other treatments."

Less evidence is available regarding the value of A-MSCs in tendon injuries; Smith reported that a pilot study using the collagenase model of tendon injury found improved tissue organization and increased specific gene expression compared to controls. Although this approach has been used in many U.S. horses, clinical results have yet to be published.

Both treatments are followed by a 48-week protocol of rest and controlled exercise designed to provide appropriate mechanical stimulus to the healing cells without causing further damage. The protocol is adapted based on the individual horse's progress.

"There are some encouraging aspects to this technology, although definitive proof of efficacy is still lacking," Smith said. "Furthermore, there have been no direct comparisons between the two techniques (BM-MSCs and A-MSC). Combining stem

cell therapies with other more established methods to prevent re-injury, such as desmotomy (division) of the accessory ligament of the superficial digital flexor tendon (superior check ligament desmotomy), makes a lot of sense and might have value. But it must be remembered that there are still considerable gaps in our knowledge, although the technology is developing rapidly."

He explained the harvesting and treatment procedures in detail for the audience.

**Stem cells for cartilage lesions** One advantage of using stem cells to treat cartilage lesions is that the cells are harvested and inserted during a single arthroscopic surgery; no laboratory culture time is required. The technique involves removing any calcified cartilage, using a micropick to perforate cartilage and thus get growth factors from the bone beneath, and filling the defect with a stem cell mixture harvested from bone marrow. The mix includes thrombin to break fibrinogen down into a fibrin scaffold, which holds the stem cells and growth factors in place.

"First you dry the area with helium, then put in tricalcium phosphate (if there is a bone void underneath the cartilage), then put in the graft (stem cell mixture)," Fortier explained. "It clots immediately and sets in 30-45 seconds, and you can sculpt it so it fits in perfectly."

She discussed one ongoing study, funded by the Grayson Jockey-Club Research Foundation, of young (2- to 5-year-old) horses using this technique and BM-MSC in 15-mm full-thickness surgically created defects.

Eight months post-surgery, treated sites had significantly more fill of the lesions (more than 75% fill vs. less than 25% fill in control sites on the same horse) and improved texture of the repair. Glycosaminoglycan (GAG) content (which helps hydrate and lubricate the joint) was not normal in treated lesions, but it was better than in control sites.

"Stem cell therapy is an exciting technology, but it's still developing," summarized Smith. "We must have sensible expectations for the therapy; this field is high on emotion and low on science. We're trying to readjust that balance, but certainly for your clients they'll always be attracted to stem cells and you have to temper that enthusiasm with explanation of where the technology currently is." ♦



( your way )



( our way )

Are you *still* using multiple supplements  
to keep your horse sound?



## Introducing STEADFAST™ EQUINE — the better way to build soundness from the inside out.

More than a joint health product, better than a typical hoof health product, and different than a vitamin/mineral product, STEADFAST™ EQUINE is the only product designed by veterinarians and nutritionists specifically to support your horse's entire structural system. With its exclusive ingredients NEM® and TélaFirm™, STEADFAST EQUINE is "the one and only one" supplement that provides noticeable results for all your structural health concerns, including relief from joint discomfort in as little as 7 days! [Learn more at arenusperformance.com.](http://arenusperformance.com)



Ask your veterinarian about STEADFAST™ EQUINE or order online  
at [www.smartpakequine.com](http://www.smartpakequine.com) and [www.arenusperformance.com](http://www.arenusperformance.com).

**Steadfast**  
EQUINE™

*The One and Only One.™*

STEADFAST™ EQUINE is a product of Arenus, a division of Novus Nutrition Brands, LLC., St. Louis, Missouri | [www.arenusperformance.com](http://www.arenusperformance.com)  
STEADFAST™ and TélaFirm™ are trademarks of Novus Nutrition Brands, LLC. | NEM® is a registered trademark of ESM Technologies, LLC.  
The SmartPak™ logo is a trademark of SmartPak Equine, LLC. | Patent pending | © Copyright Novus Nutrition Brands, LLC., 2008.

# Arthritis

BY CHRISTY WEST

## Doxycycline Antibiotic For Arthritis?

Osteoarthritis is the most common human joint disorder in the world, and in the equine industry it's the most economically important disease," said Ashlee Watts, DVM, a graduate student at Cornell University, during the 2007 American Association of Equine Practitioners Convention, held Dec. 1-5 in Orlando, Fla. "It's the primary cause of decreased athletic function and wastage in racehorses."

Many medications have been tried to treat this common condition, and Watts discussed the relatively new option of doxycycline for arthritis. Doxycycline is a semisynthetic antibiotic that's related to tetracycline and has been used in horses since the 1990s. It's also used to treat Lyme disease, and one study on that disease noted that horses given the medication along with other antibiotics "never went better," despite being negative for Lyme disease, suggesting a possible anti-inflammatory effect. Therefore, researchers decided to investigate its possible use against osteoarthritis.

Doxycycline might indeed be therapeutic for osteoarthritis, laminitis, and neuropathy (nerve dysfunction), and it might be useful for prophylaxis in high-risk cases.

Previous laboratory research found that at concentrations as low as 0.0462 microliters ( $\mu\text{g/mL}$ ) in synovial (joint) fluid and plasma, doxycycline could inhibit the expression of matrix metalloproteinases 3 and 13 (MMP 3 and 13). Various MMP enzymes have been implicated in osteoarthritic and laminitic disease processes, so inhibiting them might help slow these disease processes. However, antibiotics shouldn't be used at antimicrobial levels (which are substantially higher than 0.0462 microliters ( $\mu\text{g/mL}$ ) without good reason, because this might promote antibiotic-resistant bacteria strains.

To determine if oral dosing could deliver enough doxycycline (0.0462  $\mu\text{g/mL}$ )

to joints without having antimicrobial effects, researchers fed six healthy horses 5 mg/kg (half the recommended antimicrobial dose) every 12 hours via nasogastric tube for two days. This dosing strategy was, indeed, effective at achieving therapeutic concentrations in the joints, Watts reported; levels reached 0.1943  $\mu\text{g/mL}$  by one hour after administration and increased thereafter.

Thus, doxycycline might indeed be therapeutic for osteoarthritis, laminitis, and neuropathy (nerve dysfunction), and it might be useful for prophylaxis in high-risk cases. Possible concerns with doxycycline use include photosensitization (horse becomes overly sensitive to light) and whether it can be performance-enhancing in addition to disease-modifying.

"Further *in vivo* studies are warranted to determine if MMP activity is inhibited *in vivo* and to fully elucidate a medication protocol," she concluded.

(Lisa Fortier, DVM, PhD, Dipl. ACVS, associate professor of veterinary clinical sciences at Cornell University, was the principal investigator on the study.)

## Treatments for Osteoarthritis

Osteoarthritis has a major impact on pain and athleticism of horses, and many medications are used to combat it. At the 2007 American Association of Equine Practitioners Convention, held Dec. 1-5 in Orlando, Fla., an *in vitro* study comparing commercial preparations of hyaluronic acid (HA, Hylartin V) and the corticosteroid



Swelling in the fetlock joint due to osteoarthritis.

DR. NANCY S. LOVING

triamcinolone acetate (TA, Vetalog), in terms of two measures of joint health, were presented. Elysia Schaefer, DVM, a graduate student and second-year equine surgery resident at the University of Illinois, presented the study results.

"Hyaluronic acid is an important component of cartilage that helps maintain hydrostatic pressures to resist weight-bearing forces," she explained. "Corticosteroids inhibit the production of inflammatory mediators (some of which can break down cartilage) and leukotrienes (which sustain inflammatory reactions), which are in part responsible for pain. They also block production of pro-inflammatory cytokines."

The study was carried out on normal chondrocyte (cartilage cell) pellets from six horses that were stimulated to break down the cartilage matrices by using interleukin-1 (a degradation protein). Researchers found that only the HA product significantly increased proteoglycan synthesis (proteoglycan is a necessary

component of cartilage), while both products significantly increased glycosaminoglycan content of cartilage (which works to protect against the progression of arthritis).

"In this study, there was no significant interaction when combining HA and TA," noted Schaefer. "Both a high dose of HA (2 mg/mL) and of TA (0.6 mg/mL) had a protective effect on interleukin-1-stimulated chondrocytes."

### Myristol's Effects on Clinical Joint Disease

The results of a blinded, controlled study on the effects of the neutraceutical Myristol on lameness caused by osteoarthritis (OA) were discussed by Kevin Keegan, DVM, MS, Dipl. ACVS, associate professor of equine surgery at the University of Missouri.

The product contains cetyl myristoleate, glucosamine hydrochloride, methylsulfonylmethane, and hydrolyzed collagen. "Each individual ingredient has shown some positive effect in either human clinical trials or *in vitro* (in the lab) in horses," said Keegan.

For the study, 39 horses in Missouri and Florida were selected for naturally occurring osteoarthritis that caused Grade 2-4 lameness on a scale of 0-4. Horses were either in the control group (no Myristol) or the treated group, which received 4

ounces of Myristol daily for 14 days, then 2.67 oz daily for 28 days (42 total days of supplementation). Lameness exams at Days 1, 14, 28, and 42 were used to assess the efficacy of the supplement.

Researchers found that treatment with Myristol significantly improved lameness score, lameness at the walk, response to joint flexion, lameness after flexion, and quality of life compared to controls.

"We conclude that oral administration of Myristol had beneficial clinical effects on horses with naturally occurring OA," said Keegan. "The most apparent beneficial effects were in parameters related to joint flexion. For many of these horses, this was a significant improvement in their quality of life."

### Surpass vs. Bute for Arthritis

David Frisbie, DVM, PhD, Dipl. ACVS, associate professor of veterinary clinical sciences at Colorado State University (CSU), discussed a study comparing clinical efficacy and joint health parameters of Surpass (topical liposomal diclofenac cream) to those of the commonly used oral non-steroidal anti-inflammatory medication phenylbutazone (Bute).

In 24 horses, carpal (knee) osteoarthritis was induced in one knee, and the horses were split into one control and two treatment groups. One treatment group got 7.2 g of Surpass on the affected joint

every 12 hours for five days, while the other received 2 g of Bute orally once a day for five days. Horses were exercised on a high-speed treadmill daily, and lameness, tissue scores, biochemical scores, and biomarker scores were used to evaluate the efficacy of treatment.

Frisbie reported that the Bute- and Surpass-treated limbs got significantly better in terms of lameness scores. The cartilage glycosaminoglycan content in the Surpass-treated limbs was better than with Bute (meaning the cartilage was better hydrated and lubricated). There were also improvements in bone sclerosis (hardening) of the radial carpal bone and total erosion scores in the Surpass-treated joints.



"Both Surpass and Bute had symptom-modifying effects, but Surpass alone had disease-modifying (curing) effects," Frisbie summarized. "Diclofenac liposomal cream (Surpass) applied to a joint with experimental osteoarthritis provides a significantly better outcome than a similar joint treated with systemic phenylbutazone." ♣

# Jump higher.

Different than a vitamin/mineral product. More than a joint health product. Better than a typical hoof health product. STEADFAST™ EQUINE is "the one and only one" dietary supplement that's better at building soundness from the inside out, providing your horse with a long, healthy and active life.

Learn more at [arenusperformance.com](http://arenusperformance.com).

# Digestive Health

BY CHRISTY WEST

## Clearing Sand From the Gut

Sand colic due to an accumulation of sand in the intestines accounts for up to 30% of all colics, often causing weight loss and chronic diarrhea. Psyllium has often been recommended as a laxative for clearing sand out of the intestines, although previous research results have been mixed as to its effectiveness. Allen Landes, DVM, of Equine Medical Service in Fort Collins, Colo., discussed the efficacy of a commercial psyllium/probiotic/prebiotic product (Assure and Assure Plus) on fecal sand clearance.

"There are three risk factors leading to sand accumulation: Soil type, pasture quality, and feeding practice," Landes noted. "As clinicians, we can only modify one of these (feeding practice). Our sand content at this study location was about 28%, but many nearby areas are more than 60% sand. Owners can visit <http://websoilsurvey.nrcs.usda.gov/app> to get more information on the sand content of their local soils and see if they have a sand problem."

Eight clinically healthy horses were kept on pasture and/or in stalls during the study, and they were supplemented with hay to maintain body weight. Their feces were screened for sand for seven days before any treatment. For 35 days they received 30 g of Assure (probiotic/prebiotic mix intended to improve the health of gut microflora) followed by 226 g of Assure Plus (probiotic/prebiotic with psyllium) per 454 kg (1,000 pounds) of body weight 12-15 hours later, according to the manufacturer's directions. No horses developed colic during the study.

Fecal sand output significantly increased (nearly doubling) by Day 4 of treatment and remained elevated through Day 31, reported Landes.

"These results suggest that this product may be an effective prophylactic treatment for sand enteropathy (intestinal disease) and sand colic when management alone is



JENNIFER THILTGEN

A study found ulcer scores were significantly lower with an alfalfa diet than with a coastal Bermuda grass hay diet. Ulcers tended to be worse at the end of the Bermuda hay diet study period.

not sufficient to prevent intestinal sand accumulation," he concluded.

## Stapling the Gut

These days, in many species incisions are often closed with staples rather than stitches—and they're not just for external use any more. Christina Ellis, DVM, a veterinarian with Peterson & Smith Equine Hospital in Ocala, Fla., described the use of a TA-90 stapling device to close the large colon following a pelvic flexure enterotomy (opening and removal of large intestinal contents to treat colic).

At Peterson & Smith, at least 200 horses have undergone this procedure since 1983 with no known complications, reported Ellis. The advantages are simplicity and shorter surgical times—the process is approximately 12 minutes faster with the TA-90 device—compared to a hand-sewn, double-layer closure. Disadvantages include only the cost of the equipment (hospital costs are \$65 for staple cartridges spanning 9 cm) and the need to learn how to use the device. Multiple staple cartridges

can be used to close incisions longer than 9 cm, although this is rarely needed.

The stainless steel staples are left in the colon, becoming part of the healed gut wall, Ellis reported. No known complications or tissue reactions have occurred from this.

"Staple closure is as effective as hand sewing for this procedure, and faster," concluded Ellis.

## Reducing Hindgut Acidosis

Acidosis (abnormally high acidity) in the hindgut (the large intestine and colon) can cause a number of problems in horses, including anorexia, colic, laminitis, and stereotypic (continuous, repetitive, and serving no purpose) behaviors such as wood chewing and weaving. Unfortunately, this is often a risk when feeding today's rich concentrate feeds, and it all goes back to the evolution of the horse's digestive system. That system was designed to process large amounts of high-fiber, poor-quality forage, rather than today's richer diets.

Joe Pagan, PhD, president of Kentucky Equine Research in Versailles, Ky.,

presented the results of a study evaluating the efficacy of a protected sodium bicarbonate product in fighting hindgut acidosis. This problem is common in dairy cattle on high-grain diets, he noted, and sodium bicarbonate is often fed to combat the resultant drop in feed intake and milk production.

"Unfortunately, in horses raw sodium bicarbonate never makes it to the hindgut; it just buffers the stomach," he noted. However, Kentucky Equine Research, along with Balchem Corporation, has developed a protected form of sodium bicarbonate (PSB, product name EquiShure) that was the focus of the current study.

Six 5-year-old Thoroughbreds in training on a high-speed treadmill were split into control and treatment groups and studied. One group was fed 168 g of EquiShure (100 g of sodium bicarbonate; the rest is the encapsulation agent) daily for a four-week period, then the other group received the same treatment (the treatment and control groups were swapped for the second study period). All horses received a diet of unfortified sweet feed, timothy hay, and 50 g of loose salt. Blood and fecal samples were collected every two hours for eight hours on Day 15 of each period, and during week four, all horses wore a complete collection harness for five days so fecal and urine contents could be analyzed.

**Results** Fecal acidity increased in controls by six hours after feeding. In contrast, the horses receiving PSB had no significant changes in fecal acidity during the sampling period. Horses on PSB also had significantly higher absorption of fat and sodium. There was a trend toward increased digestibility of neutral detergent fiber (fiber content), hemicellulose (a plant cell wall polysaccharide), and fat, but these differences were not statistically significant.

"The PSB used in this study was effective in attenuating the hindgut acidosis that resulted from high-grain intakes in exercised Thoroughbreds," concluded Pagan. "More research is needed to evaluate how PSB supplementation affects intestinal epithelial health and integrity."

### Risk Factors for Gastric Ulcers in Thoroughbreds

Up to 86% of Australian Thoroughbred racehorses have been reported to have gastric ulcers. Research on which factors most significantly contribute to ulcers was presented by Guy Lester, BVMS, PhD, associate professor of large animal medicine at Murdoch University. This extensive study evaluated 191 variables affecting 402 horses with 37 trainers in several locations across western Australia. Thirty-three percent of the horses were found to

have moderate or severe gastric ulceration (defined as a score of 2-3 on an ulcer severity scale of 0-3). Here are some of the factors that increased ulcer risk:

**The horse's digestive system was designed to process large amounts of high-fiber, poor-quality forage, rather than today's richer diets**

DR. JOE PAGAN

**Cribbing/windsucking** This was the most significant risk factor at 7.6 times higher risk. Whether cribbing might be a cause or an effect of ulcers is unclear. Other stereotypic (continuous, repetitive, and serving no purpose) behaviors were also correlated with higher ulcer risk.

**Location of training** Training in an urban environment conferred a greater risk of ulceration (3.9 times higher risk), but it was not retained in the final model. This indicated that it was factors common to this training environment rather than simply training in the city.

**Time in training** Ulcer risk increased by

# Ride farther.

Your horse's joints, bones, hooves, and other connective tissues may be impacted over time due to athletic performance and aging. While many equine health products may address one component of your horse's framework, STEADFAST™ EQUINE supports your horse's entire structural system.

Learn more at [arenusperformance.com](http://arenusperformance.com).

a factor of 1.1 for every week in work, independent of the total time a horse spent on the property.

**Body condition maintenance** Horses that had trouble maintaining weight were 3.4 times more likely to have ulcers. This factor was also correlated to weeks in work.

**Having a radio on in the barn** Talk radio was correlated with a 3.6-fold increase in ulcer risk, while music radio increased risk 2.8-fold (this statistic brought chuckles from the audience).

Lester noted that radio could be a surrogate factor for a more urban setting (known to increase ulcer risk), and that race radio with constant yelling of race status might, indeed, be more stressful to horses stalled nearby.

**Factors decreasing ulcer risk:** Training on the property where the horse was housed—3.3 times lower risk.

Turnout with other horses—3.3 times lower risk.

**Additional observations:** Ulcer prevalence varied widely by region, but management within those regions likely had more of an impact.

Some trainers had no horses with ulcers, while others had ulcers in nearly every horse in the barn.

Horses that were aggressive toward

people seemed less likely to have ulcers. “Maybe they know how to manage their stress—they just let it fly,” said Lester with a smile.

Failing to race to expectation was highly significant, but was not used in the final model. “Trainers are quite perceptive in identifying clinically affected horses and not racing them,” he noted.

Diet did not have much of an impact, but feeding practices didn’t vary much.

Gastric ulceration “is a multifactorial disease, and elimination of a single factor may fail to impact disease prevalence,” Lester concluded. “Don’t just go turn the radio off; it’s more complex than that. Variations in the way individuals handle stress and ulceration make it tough to make consistent recommendations.”

## Alfalfa Hay Reduces Ulcer Severity

Noah Cohen, VMD, PhD, Dipl. ACVIM, professor of equine medicine at Texas A&M University, discussed a study that found alfalfa hay reduced the severity of ulcers in young, exercising horses.

In this study, 24 Quarter Horse yearlings were kept in small dry lots and fed two different diets for 28 days each, with a 21-day pasture washout period between. The first diet included coastal Bermuda grass hay and a 15% pelleted concentrate, while

the other diet included the same amount of alfalfa hay and the same concentrate. All horses were exercised three times per week using a horse exerciser.

Ulcer scores were significantly lower for the alfalfa diet than for the Bermuda hay diet, and the 11 horses in the alfalfa group with ulcers at the beginning of the study all improved their ulcer score by at least two grades. However, one horse went the other direction, developing ulcers while on the alfalfa diet. Only five of the 12 horses starting the Bermuda diet with ulcers had ulcer score improvement, and only two of those improved by the two grades or more. Ulcers tended to be worse at the end of the Bermuda diet period.

Another notable finding was that while ulcer scores didn’t change significantly from the end of the Bermuda diet to the end of the pastured washout period, they increased significantly from the end of the alfalfa diet to the end of the washout period.

“So only one of 23 horses fed alfalfa worsened vs. 16 of 24 on coastal Bermuda,” Cohen summarized. “Eleven of 12 horses on alfalfa remained ulcer-free compared to only three of 12 on Bermuda.”

He cautioned that not all alfalfa is created equal, and it’s not yet known whether older horses or those exercising more intensely would see the same benefits. ♣

# Show stronger.

Two exclusive ingredients in STEADFAST™ EQUINE — **NEM** and **TelaFIRM™** — work together to build soundness from the inside out in as little as seven days. STEADFAST EQUINE also provides ascorbic acid for healthy joints; calcium, phosphorous and vitamin D for healthy bones and biotin for healthy skin and hooves. [Learn more at arenusperformance.com](http://arenusperformance.com).

# Medicine/Surgery

BY CHRISTY WEST

## Surgery for Triple-Level Spinal Cord Compression

Spinal cord compression in the neck, more technically known as cervical vertebral stenotic myelopathy or CVSM, can cause notable incoordination and affects about 2% of racing Thoroughbreds. Probably the most well-known horse affected by CVSM was Thoroughbred champion racehorse and sire Seattle Slew, whose successful surgeries were well-publicized. But Slew had only two affected joints in his neck, and some horses have three joints compromised by CVSM. Only four reports of successful outcomes of surgery on such cases had been published as of November 2007, but a report of 12 cases was presented at the convention.

"Affected cases have a narrowing of the vertebral spinal canal (stenosis), which causes incoordination, inappropriate rigidity, paresis (impaired movement), and weakness," explained Nicholas Huggons, DVM, a veterinarian with the San Luis Rey Equine Hospital in Bonsall, Calif. "It's most frequently seen in young, rapidly growing, well-fed horses. Surgical management aims to stop repetitive trauma to the spinal cord. Horses that don't receive therapy have a poor prognosis because of the continuous damage done to the cervical spinal cord."

The surgery usually consists of inserting metal cylinders through the adjacent bones on one side of the joint, effectively immobilizing the joint. Huggons conservatively estimated that more than 1,000

horses have undergone this procedure for one or more joints since the surgery was developed in 1979 for horses.

In this 12-case series, the average age of onset was two years, and all cases were males (eight of 12 were geldings). Five were Thoroughbreds, with the rest being of various breeds. Surgery was done to stabilize three joints on each horse, primarily between cervical vertebrae C3-4, C4-5, and C5-6 (see image below), although two horses had C6-7 fused. Five horses had the original stainless-steel baskets placed, five

have been used thusly, and two are entering training. The implant type used made no difference in outcomes.

"Triple level fusions have similar success rates to single and double fusions," he said. "Affected patients can live productive and/or competitive lives with no danger to themselves or their handlers, and they do not require daily medications."

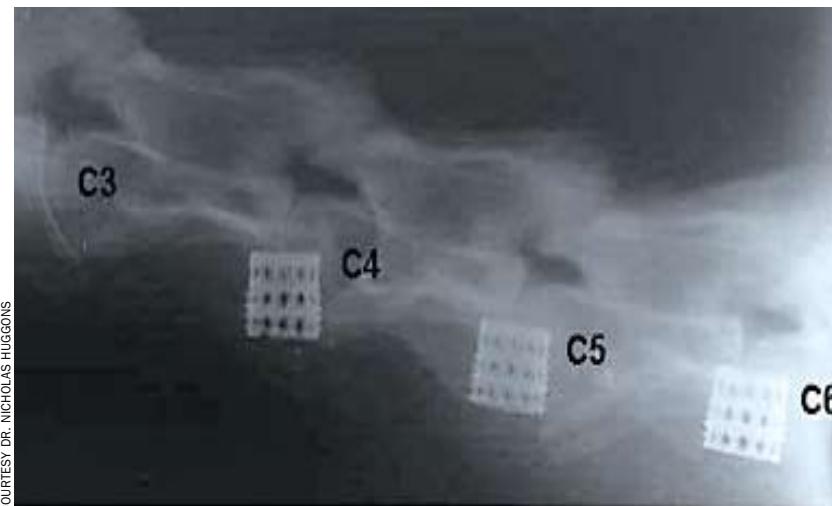
## Bioabsorbable Cisplatin Beads For Skin Cancers

Skin cancers are seen in horses, and

many methods and technologies have been used to treat them. One of the more recent strategies is intralesional chemotherapy, or placing a chemotherapeutic agent directly in the tumor to kill the abnormal cells. Christina Hewes, DVM, MS, Dipl. ACVS, a practitioner in Alamo, Calif., discussed the newest twist on this approach—placing bioabsorbable beads of the chemotherapeutic agent cisplatin in a tumor for a slow release of chemotherapy.

The advantages, she noted, include greater safety for the practitioner than reconstituting and injecting a liquid solution into the tumor (cisplatin plus sesame oil emulsion) and the possibility that fewer treatments are required (two compared to four treatments recommended for the liquid approach).

Horses are treated every 30 days until the tumor does not regrow; most horses in this study received two treatments. Any wound drainage is cleaned by a veterinarian wearing chemotherapy gloves to minimize exposure to cisplatin, and materials



Surgery was done to stabilize three joints on each horse, primarily between cervical vertebrae C3-4, C4-5, and C5-6 (shown here).

had Kerf Cleaning Cylinders (also known as Seattle Slew implants), and two had bone grafts.

All but one horse recovered; that horse was euthanized due to incisional complications. One later died in a paddock accident, but the rest improved at least one neurological grade and 75% had improved by two grades at one year after surgery. Overall, 67% of horses returned to their intended athletic function. Four horses were intended to race, and two did (one won a stakes race). Three of the six other horses intended for pleasure riding or showing

are disposed of in biohazard containers.

At the Marion Du Pont Scott Equine Medical Center in Leesburg, Va., 40 of 48 horses (83%) treated with this approach were relapse-free two years later. Hewes reported the following success rates from an article published in the Nov. 15, 2006, issue of the *Journal of the American Veterinary Medical Association*:

- 91% (20/22) of cases with spindle cell tumors (sarcomas and fibrosarcomas) were relapse-free after two years. Three cases with regrowth at one, two, and three years resolved after one additional treatment.
- Squamous cell carcinomas had the greatest tendency to recur (60% success rate), likely due to the duration of these cases and the increased metastatic (spreading) potential of this tumor type.
- 93% (13/14) of melanoma cases were relapse-free after two years, including all affected gray horses. The one failure was a bay horse with malignant melanoma.
- The sole cases of basal cell sarcoma and adenocarcinoma were relapse-free after two years.
- One horse with lymphosarcoma showed metastasis after nine months.
- Flat sarcoids don't respond well to this treatment; growth stops, but the tumor doesn't regress.

Complications included swelling, erythema (capillary congestion), wound drainage, subtle scarring, and a corneal ulcer requiring eye removal in one horse (following treatment of an upper eyelid tumor).

## High-Tech Fetlock Joint Fragment Removal

Joint chips plague many high-performance horses—up to 29% of Standardbred yearlings and 2% of Thoroughbred yearlings. Often the chips must be removed, usually with arthroscopic surgery, before the horse can return to full soundness. Alastair Kay, BVSc, MRCVS, a surgery resident at The Ohio State University Veterinary Teaching Hospital, representing Hagyard Equine Medical Institute in Lexington, Ky., described a high-tech method for removing chips from the rearward portion of the fetlock joint.

"Radiofrequency devices continue to be used extensively in human medicine for both intra-articular (within a joint) and extra-articular (outside the joint)

procedures," he noted. The role of the bipolar radiofrequency device is to use high voltage to dissect away any soft tissue holding the fragments so they can be easily removed. The device has a ground electrode within the probe, so there is little risk of inadvertent tissue damage and no need for a grounding pad.

## Joint chips plague many high-performance horses—up to 29% of Standardbred yearlings and 2% of Thoroughbred yearlings

For this study, 33 cases with axial (near centerline) fragments from the upper first phalanx bone were randomly selected from one year. Forty-one fragments were removed from 36 joints in the study horses, and these were primarily in the hind limbs. Treatment consisted of arthroscopic surgery, including use of the radiofrequency device. Once the fragment was visualized, the device's curved Coblation hook probe was used to release soft tissue holding the fragment. Once released, fragments were physically removed with a rongeur instrument before curetting (smoothing) the fragment bed, if required.

"This is a very targeted approach that causes minimal intra-articular bleeding, provides excellent visualization, minimizes the risk of iatrogenic (physician-caused) injury, reduces surgery time, and minimizes complications," Kay summarized. "This instrument has become an important accessory for intra-articular soft-tissue dissection in this referral center (Hagyard)."

## First Aid for Limb Fractures

When a horse's leg is fractured, the primary treatment goal is to stabilize the fracture site so the broken bone ends don't further separate and do more damage. The outcomes of these cases often have a great deal to do with how well the broken leg was stabilized in the field before a surgeon ever saw the horse. John Janicek, DVM, MS, Dipl. ACVS, of Weems and Stephens Equine Hospital in Aubrey, Texas, presented a review of field stabilization techniques for limb fractures in various parts of the leg.

Following patient evaluation and stabilization, fracture stabilization generally consists of a splint applied over a uniformly layered bandage; the splint could be made of PVC pipe, wood boards or tool handles, metal rods, or casting material—anything lightweight and rigid.

"The general rule of thumb is to immobilize the joint above and below the fracture," explained Janicek. "Avoid splinting up to the same level of the fracture, because that will create a fulcrum action that can result in further displacement. Most of these materials are lying around the clinic already, so bring them to ambulatory calls with possible fractures."

He divides forelimbs and hind limbs into four sections when describing how to stabilize them:

- Section 1 (forelimbs and hind limbs): Fractures of the fetlock or lower regions. Splints run up to just below the knee or hock.
  - Section 2 (forelimb): Fractures from the top of the knee to just above the fetlock. Caudal and lateral splints (on the rear and outside of the leg) run up to the elbow.
  - Section 2 (hind limb): Fractures of the hind cannon bone. A caudal splint runs up to the point of the hock, while a lateral splint runs up to the level of the stifle.
  - Section 3 (forelimb): Fractures between the knee and elbow. A caudal splint runs up to the elbow, while a lateral splint lying against the shoulder helps prevent abduction of the limb (pulling it away from the body's midline).
  - Section 3 (hind limb): Fractures from just below the stifle joint to the bottom of the hock. A lateral splint running up past the pelvis helps prevent abduction.
  - Section 4 (forelimb): Fractures from the elbow upward. A caudal splint helps lock the knee in extension, which is often tough for these cases to do. The injury is not splinted as it has extensive muscle coverage that provides stabilization.
  - Section 4 (hind limb): Fractures from the stifle joint upward. These injuries are not splinted as they have extensive muscle coverage that provides stabilization.
- "In most cases, patient and limb stabilization followed by consultation with the nearest surgical facility provides the best service to the horse and the client," noted Janicek. When transporting the horse for surgery, he recommended the following:
- The trailer should be brought as close to

the horse as possible to minimize movement.

- Chest and butt bars should be used in the trailer to stabilize the horse.
- The horse's head should be left untied to improve balance.
- Provide hay to keep him busy.
- Haul horses with forelimb fractures facing backward, and hindlimb cases facing forward as it's harder for horses to balance during braking than during acceleration.

### Traumatic Brain Injury in Horses

"Head trauma is common in horses, and a number of these cases will present with neurologic signs consistent with brain injury," said Darien Feary, BVSc, MS, Dipl. ACVIM, ACVECC, a lecturer in equine medicine with the University of Sydney, Australia, in discussing management of these injuries. Due to limited research on equine brain injury, most equine recommendations come from human research, she reported.

The two most common types of equine head trauma resulting in neurologic dysfunction are injury to the frontal/parietal brain from kicks or head-on collisions and poll trauma from flipping over backward, she said. These injuries are not always associated with fractures.

Frontal trauma can result in lacerations

or contusions of the cerebral cortex. Neurologic signs can include contralateral (in the opposite eye) blindness, depressed mentation (mentality), compulsive wandering, and generalized seizures.

Poll trauma tends to result in the most severe brain injuries. "Young horses are particularly susceptible to this because they tend to flip over on their heads when they don't want to do something, and the skull bones in this area don't fuse until they're three to four years old," Feary noted. Brainstem and blood vessel damage with this injury can cause head-tilt, nystagmus (involuntary, rapid, rhythmic movement of the eyeball), depressed mentation, tetraparesis (weakness of the extremities), facial nerve paralysis, and bleeding into the guttural pouches.

Brain injury takes two forms—primary and secondary. Primary injury is immediate, direct, mechanical, or structural injury occurring at impact, such as concussions, lacerations, edema (fluid swelling), or hemorrhage. Secondary injury encompasses "the cascade of local, then global, cellular and neurochemical alterations that occur in minutes to days after the initial injury and lead to progressive axonal (nerve body) degeneration and cell death," Feary explained. "In contrast to primary injury, which the clinician has no or minimal control over, the deleterious effects of

secondary injury may be attenuated with prompt and appropriate therapeutic intervention."

### Management

"The management of recumbent, neurologic equine patients is particularly challenging and labor-intensive, often limiting treatment options and duration," she said. "As a result, the management of severe brain injury in horses is anecdotally reputed to be intensive, expensive, and associated with a guarded to grave prognosis." However, advanced monitoring tools and treatment options available today might improve the success rates with these cases, she noted.

The main goals of therapy are to control intracranial (inside the skull) pressure, keeping it below 20 mm Hg; support cerebral perfusion (blood vessel pressure) at more than 60 mm Hg; minimize secondary injury; and treat any concurrent injuries or diseases.

Additional management measures might include inhaled oxygen therapy, non-steroidal anti-inflammatory medication, antioxidant therapy, anti-seizure medication in seizing horses, thiamine (vitamin B1) supplementation, maintenance of normal body temperature (i.e., cooling horses with fevers), and elevation of the head by 10-30°.

# Feel better.

Rest assured, you're doing what's right for your horse with STEADFAST™ EQUINE from Arenus. There is no better, safer, faster and more convenient way to build soundness from the inside out. And by providing your horse with a long, healthy and active life, you'll feel better, too — about your performance and the animals for which you care. [Learn more at arenusperformance.com](http://arenusperformance.com).

## Brain Injury Study

Feeary described a retrospective study of 34 horses treated for primary brain injury at the University of California, Davis, between 1994 and 2004. Poll injury was the most common, and 62% of the horses survived. Factors decreasing survival rates included higher packed cell volume (the portion of blood occupied by red blood cells, 40% vs. 33%), recumbency for more than four hours (18 times less likely to survive), and skull base fractures (7.5 times less likely to survive).

"Survival rate in this study was higher than other previously reported studies in horses and widespread anecdotal belief; perhaps this is a reflection of the significant advances made in the equine veterinary profession through all levels," she concluded.

## How to Apply a Half-Limb Cast and Elevated Support Limb Shoe

There are many situations when casting a horse's lower limb can be beneficial, such as when he has a fracture of a pastern bone, a tendon or ligament injury, or a wound that won't heal because of excess movement. During the convention a discussion on how to apply a half-limb cast and elevated supporting limb shoe was presented by Ryan Carpenter, DVM, a resident in veterinary clinical sciences at Colorado State University.

Compared to a bandage, Carpenter said, the half-limb cast offers better immobilization, better durability, and less expense (the latter because it's cheaper than multiple bandage changes). However, pressure sores are a risk if the fetlock joint is improperly angled within the cast.

Carpenter described a technique in which the lower limb cast is applied to the standing horse, avoiding the risks and expense of general anesthesia.

Key to this approach is placing the foot to be casted on a narrow wooden block (2 inches by 2 inches) so the heels and toe hang off the block. This allows most of the cast to be applied with the horse standing in a normal, full weight-bearing position; this helps reduce poor fit and pressure sores.

Another important part of this procedure is the application of a pad and frog support material, possibly along with a shaped wooden block, to the opposite front or hind (contralateral) limb if the

casting material is thick enough on the bottom of the foot to effectively lengthen that leg. This promotes even weight bearing on both limbs and aims to minimize muscle soreness and the risk of contralateral limb laminitis.

The study authors have applied more than 30 of these casts, with about two-thirds on hind limbs and one-third on forelimbs, and they report minimal complications.

## Repairing Hernias with Subcutaneous Mesh

Incisional hernias (protrusion of abdominal contents through a gap in an incision beneath the skin) occur in up to 17% of horses receiving abdominal surgery, reported Gal Kelmer, DVM, MS, clinical assistant professor at the University of Tennessee's College of Veterinary Medicine. These hernias are often repaired with stitches alone or with mesh implanted beneath the musculature, but Kelmer reported excellent success and a lower risk of complications by placing mesh just beneath the skin, over primary suture closure of the hernia defect.

**Incisional hernias  
occur in up to 17% of  
horses receiving  
abdominal surgery**

He was quick to note that not all hernias need repair; horses with light work schedules might not require surgery. However, harder-working horses, such as jumpers or racehorses, might need this procedure. Abdominal bandages to support the incision are used after surgery for a variable time period, and patients are rested from heavy exercise for three months.

"The advantages of this procedure include secured closure with two closures in one procedure—the primary closure with sutures is backed up with mesh placement," Kelmer said. "The cosmetic appearance is good. Sutures alone often end up with several small defects, which are not a problem, but they're cosmetically not good. We've repaired hernias on more than 50 horses with this technique and have had a very low complication rate."

## Correcting Large Colon Displacement

Left dorsal displacement of the large colon isn't the most common cause of colic—only about 6-8% of colics are caused by this. However, up to 21% of affected horses tend to displace again, even after surgical correction. These horses often have a deep nephrosplenic space, which describes the area bounded by the left kidney, spleen, nephrosplenic ligament (supporting the spleen and kidney), and the body wall. Since the large colon is not attached to the body wall, it can move around in the abdomen quite a bit and part of it can become trapped in this deep space, resulting in left dorsal displacement of the large colon (also called nephrosplenic entrapment).

Closing/ablating (removing) the nephrosplenic space with sutures can prevent recurrence of this problem. Megan Parker, DVM, of Hagyard Equine Medical Institute in Lexington, Ky., described a hand-assisted laparoscopic technique for ablation of the nephrosplenic space in the standing horse (the technique was developed by Dwayne Rodgerson, DVM, Dipl. ACVS, also of Hagyard).

Other approaches to correction are more technically challenging and carry greater risks of organ damage, adhesions, and infection, she noted. In contrast, hand-assisted laparoscopic surgery on a standing, sedated horse offers a less invasive procedure with better visualization of the surgical field, a shorter convalescent period, shorter surgery time, no general anesthesia, and a rapid return to full function. The same surgical concept is used for removal of kidneys, ovaries, and abdominal tumors, she added.

Five cases were treated with this approach in the past two years, with a success rate of 100% and minimal discomfort, Parker reported. None have had recurrence of left dorsal displacement of the large colon since then, and two patients went back to race training, with one doing quite well in races.

"The hand-assisted laparoscopic technique is very easy to perform and is associated with low morbidity (subsequent illness)," she concluded. "Practitioners should be aware that this technique provides a safe, easy, and efficient way to prevent recurrence of left dorsal displacement of the large colon." ♀

# Horse Management

BY CHRISTY WEST AND LES SELLNOW

## How to Airlift a Horse

John Madigan, DVM, MS, Dipl. ACVIM, director of the large animal hospital at the University of California, Davis, explained how to safely airlift a horse.

"Most horses we lift are healthy, they are just trapped somewhere they can't get out of," he noted. "We do all airlifts on standing horses."

The first thing to do, he reported, is to look into all other available options of moving the horse, as they're usually a lot easier and less dangerous. Or, moving the horse might not be time-critical; for example, a horse in a flooded area could move to high ground and be cared for there until floodwaters recede.

If it's decided that an airlift might be necessary, the horse's owner makes direct contact with the helicopter operator, approves the costs, and places the helicopter on standby, pending scheduling and future determinations.

"Live cargo transport presents numerous problems for helicopter safety," Madigan cautioned. "Horses with uncontrolled movements in the air or on the ground during liftoff and landing can produce significant aircraft instability." To limit this risk, he uses sedation and the UC Davis Anderson sling, which controls and supports the head and body of the horse. His team has used this sling in 28 successful airlifts, and they have also used a sling termed the UC Davis Large Animal Lift to move one recumbent (down) horse.

The helicopter needs to be able to lift at least 1,200-1,500 pounds at sea level, and the pilot needs to have longline experience (using long cables below the helicopter). The horse is lifted on a 150-foot cable, preferably one made of Kevlar rather than steel to reduce static electricity buildup. "If someone's misbehaving, ask him to go ground the sling frame," Madigan said with a grin, knowing a static shock would be the result.

"Ideally, rescue groups should have a

prior arrangement and training session with the pilot who is on call," he noted. He described several training sessions at the school with multiple military branches that might have occasion to airlift horses and mules into and out of remote areas.

charge of physical and chemical restraint, as well as precautions for personnel;

7. Apply and detach Anderson sling;
8. Use personnel safety equipment, including ear and eye protection;
9. Plan for implementation of helicopter

**“ Horses with uncontrolled movements in the air or on the ground during liftoff and landing can produce significant aircraft instability. ”**

DR. JOHN MADIGAN

Madigan described the procedures, training, communication, and chain of command for airlifts in detail. Consultation with the on-site veterinarian before getting involved is essential, and the overall theme was that prior training and careful, specific planning of procedures and responsibilities is critical to success. Two complete teams are required—one to send the horse, and one to receive it at a safe location.

Once everything is in place and well-understood, the airlift itself doesn't take long if no snags are encountered; he reported on some airlifts that took only about an hour from start to finish.

Madigan offered the following checklist of information to be covered in a pre-rescue orientation.

1. Know who is in charge of the rescue;
2. Know who will perform a brief physical examination of the animal prior to sedation or transport;
3. Orient and inspect the sling equipment and overhead support device;
4. Organize ground-to-air radio communications and hand signals from ground to air;
5. Know helicopter safety orientation and grounding methods of the sling overhead frame prior to human or animal contact;
6. Animal restraint—know who is in

hovering, animal positioning, lift protocol (including inspection at 10-foot hover), and landing and detachment methods;

10. Assign lift and receiving teams;
11. Know who will perform cable attachment to the helicopter and overhead frame; and

12. Establish the timetable of events.

He described several airlifts with photos and videos to illustrate his points, including one rescue that didn't even result in an airlift because a nearby band of inmates helped dig a cast horse out of a ditch.

"You never know where help is going to come from," Madigan commented.

"The process of airlifting a horse still carries inherent dangers for the horse and rescue personnel," he concluded. "Risks may be lessened by a program that involves regular training, including a helicopter lift when possible, to increase the team's familiarity and comfort level with the UC Davis Anderson sling or Large Animal Lift and airlift protocols."

## Reducing Back Sensitivity

Back pain is often suspected in horses, but most treatments haven't been researched much or at all. Results of a study designed to measure the effects of massage, chiropractic, and phenylbutazone (Bute) on back sensitivity were presented by Kevin Haussler, DVM, DC, PhD,

assistant professor within the Department of Clinical Sciences at Colorado State University.

Researchers used pressure algometry (a spring-loaded device with a rubber-tipped plunger that measures applied pressure on a gauge readout) to measure mechanical nociceptive threshold (MNT)—the pressure at which a horse reacts painfully—at several locations along the spine. This method of objective pain assessment is also used in humans to evaluate pain. A higher MNT means more pressure is required to elicit a response, so the horse is less sensitive (less painful).



COURTESY DR. KEVIN HAUSSLER

Pressure algometry can help researchers measure pain.

Researchers theorized that subclinical back pain is present in all ridden horses, so therapy should lessen that pain and raise MNTs. Thirty-eight healthy adult horses with no history of back pain from four farms were used for this study, which aimed to see which treatment modality raised MNTs the most over the course of a week. The horses were treated as follows:

- Seven horses received Bute (1 g/500 pounds orally every 12 hours) for a week.
- Eight received one chiropractic treatment using a spring-loaded mechanical force instrument at localized regions of joint stiffness, abnormally high muscle tension, or pain (this mechanism ensured a consistent force/velocity of the treatment).
- Eight received one directed massage by a certified massage therapist.
- Seven received no treatment, but continued to be ridden (active controls).
- Eight received no treatment, but were turned out and rested (inactive controls).

■ All horses' MNTs were evaluated on Day 0 (before treatment) and at Days 1, 3, and 7 post-treatment.

■ The results of MNT evaluation on different sites on each horse were pooled for evaluation, and the numbers were somewhat surprising, said Haussler.

■ The Bute group actually had a negative response, with 9% and 8% lower MNTs on Days 1 and 3 compared to Day 0. On Day 7, this group had an 8% higher MNT. Bute is much more effective if given when active inflammation is present, noted Haussler.

■ Massage was beneficial throughout the study period, with an 8% higher MNT on Day 1, 9% higher on Day 3, and 12% on Day 7.

■ Chiropractic resulted in a slight (1%) decrease in MNT on Day 1, an 11% increase on Day 3, and a 27% increase on Day 7 on average.

■ Both active and inactive controls' MNTs fluctuated by about 1% across all days.

"We hypothesized that low-grade back pain or inflammation was present in ridden horses, and we found this to be true; otherwise the MNTs would not have increased in all three treatment groups relative to the two control groups," said Haussler. "Massage was beneficial throughout the study; Bute had negative effects for 3 days, then it had a positive effect; and chiropractic had a negative effect on the first day, but then it had the most positive effects."

"Pressure algometry provides an objective tool to evaluate commonly used, but unproven, treatment modalities for the treatment of back pain," he concluded. "Future studies need to evaluate combined treatment effects and long-term MNT changes in horses with documented back pain."

## Investigating Horse Poisoning

When an owner suspects that a horse might have eaten something poisonous, the veterinarian is generally the first person he or she calls. In addition to treating any health problems, that veterinarian is uniquely suited to investigate the cause of the problem as well, said Bob Wright, BSc (Agr), DVM, of the Ontario Ministry of Agriculture, Food and Rural Affairs.

"Private practitioners often lack confidence in their abilities to investigate these cases, but we're ideally suited because we're on farms all the time, we have extensive knowledge of equine behavior,

agricultural practices, what's normal in the horse world, feeding practices, etc.," he explained. "Often the primary problem is a change in husbandry that has encouraged horses to seek anything edible."

"Most horses won't touch poisonous plants unless they're forced to," he stated. "Thin pasture sets them up for that. Even poor-quality hay might cause a horse to look for other things to eat. And limited feeding because of weight or insulin resistance worries can make the horse go looking for more to eat."

Pasture plants aren't the only culprit, of course; toxicity from stored feed or supplements, or a combination thereof, can also cause clinical signs.

What signs suggest poisoning? Wright noted that clinical signs are often vague and varied, and they can include laminitis, colic, hair loss, skin lesions, photosensitivity (a skin reaction that can look like sunburn), or, at worst, death.

In an investigation, "I start with body condition scoring and determine whether the horse might be looking for something else to eat, or if there might be a point source of toxin," he said. "And I'll record feeds and feeding practices, including the presence or absence of pasture, supplemental feeding, every scoop and pinch of anything, and the feeding schedule. Management is also important; horses housed individually or limit fed are often at greater risk. Bedding should be evaluated, too."

Feeds are sampled and pastures are carefully walked, but Wright warns that pasture walks can turn up a lot more than you might think. "Most pastures and fence-rows contain numerous poisonous plants," he noted. "You need to be able to recognize the most common toxic plants and trees in your area, and know under what circumstances they are toxic (i.e., when they are fresh or frozen). Sometimes horses can eat certain weeds and be okay, and other times it will really hurt them."

"Don't jump to a conclusion about the first toxic plant you find," he advised. "Often the primary cause of the problem is poor-quality feed or underfeeding. Look at those things first, because the toxic weeds will often be there, but the horse might not be eating them. In my experience, improper or poor husbandry practices were a primary contributing factor to the disease problem in more than 50% of recent poison investigations. Too commonly, a single plant in the pasture is blamed when an

underlying problem, such as insufficient high-quality feed, is the primary cause."

### Feed and Weed Sampling

Wright tests all feeds, bedding, hay, vitamins, minerals, whole grains, nutraceuticals, pasture, water—anything the horse might consume. Visual examination is the start, identifying things such as whether there are a lot of noncultivated plants (weeds) in hay and what species of grasses/legumes are in the hay. Then he sends carefully collected samples to laboratories for further investigation.

When walking the pasture, he prefers to work alone—without owners or assistants asking questions—so he doesn't miss anything. He'll look for places where trees can be reached by horses near fences and see if any toxic plants appear to have been equine snacks, especially along fencelines.



COURTESY DR. BOB WRIGHT

Photosensitization-type lesions with damage and peeling of the skin are sometimes a clinical sign of poisoning.

"All plant material is suspect," he said. "Look for potential contamination from roadways or neighbors' lawn clippings."

He noted the following common toxin sources:

- Botulism, which often occurs from haylage contamination;
- Clippings from ornamental yew shrubs;
- Poison hemlock, which is common in swampy areas;
- Blister beetles in alfalfa hay, which can cause severe toxicity;
- Oleander leaves;
- Red maple leaves

Public health units can help test the water for contamination, he said. Streams and ponds carry a higher risk of contamination

and blue-green algae poisoning than deep wells or city water sources.

"The take-home message is that you've got to know the common acute toxins in your area," he said. "Take charge of the situation and don't rely on the lab to give you a diagnosis. Complete a thorough farm investigation, keep an open mind, and use a common-sense approach to find the inciting cause."

### Healthy Horses Workshop

It started as Horseman's Day back in 2000 when the American Association of Equine Practitioners (AAEP) convention was held in San Antonio, Texas. Today it is known as the Healthy Horses Workshop, but the basic concept remains unaltered. During the convention for veterinarians, researchers, and veterinary technicians, one day is set aside for horse owners in the area to listen to experts in the field lecture and demonstrate on specific aspects involved in the overall wellness, training, and care of the horse.

The presenters and their topics, were: Rob Arnott, DVM, a practitioner in Palm City, Fla., dentistry; Heather Heiderich, DVM, associate veterinarian with Florida Equine in Clermont, Fla., acupuncture and chiropractic; Jennifer MacLeay, DVM, PhD, Dipl. ACVIM, assistant professor of large animal medicine at Colorado State University, Understanding the Science of Natural Horsemanship; David Hayes, DVM, owner of The Pet Hospital in Meridian, Idaho, One Step Horsemanship; and Olympic gold medalist David O'Connor giving demonstrations and discussing horsemanship. Following are some comments from some presenters.

### Dentistry

Arnott told his listeners that the equine tooth has evolved over million of years to allow the horse to become a grazing animal. The horse, he said, has hypsodont teeth, which means they erupt throughout the horse's lifetime—at the rate of three to four millimeters per year—to compensate for the wear from the daily grinding action when eating.

The hypsodont tooth eventually will be used up, but it can last for 25 to 30 years with proper care. Proper dental care is important, he said, because horses are living longer today than ever as the result of good nutrition and medical care.

Dental care should begin in conjunction

with the first "wellness" examination for a newborn foal. A brief visual examination might reveal problems that can be successfully treated early in the animal's life, but they might not be as treatable later on.

Arnott said as the horse grows and matures, regular dental exams should be conducted. "The frequency with which your horse should receive a comprehensive dental exam and dental work is dependent on many factors," he told the group. "As a general rule of thumb, many equine veterinarians recommend at least a brief dental exam biannually until the horse reaches five years of age. During this time there is a tremendous amount of activity going on in your horse's mouth; 24 deciduous teeth erupt and are shed and 36 to 44 permanent teeth erupt. Early identification of any potential problems allows for a faster intervention, which will hopefully minimize the impact of the problem over the lifetime of your companion."

After age five many veterinarians will recommend that a dental exam be performed on an annual basis through age 15. From that point on, he suggested, it would be a good idea to revert to biannual evaluations.

### Acupuncture and Chiropractic

Acupuncture can be effective in treating chronic pain and musculoskeletal disorders such as lameness, Heiderich told her listeners. She said it also can be beneficial for eye problems, mild colic, respiratory disorders, anhidrosis (the inability to sweat), behavior problems, anxiety, neurological issues, and immune-related conditions.

Acupuncture, she told the group, is an ancient technique that originated from traditional Chinese medicine and involves putting needles in specific points on the body to treat disease or relieve pain. Those specific places, she said, are known as acupuncture points and can be used to diagnose and treat certain conditions.

These points, she further explained, are specific locations on the surface of the skin where pressure is applied in order to affect the channels through which Qi, defined as life force and energy, flows through the body. "By stimulating these acupuncture points, even those located far from the site of the symptoms, the veterinary acupuncturist can help the animal's body to heal itself by balancing its own vital energies," said Heiderich.

Chiropractic, she said, "is a type of

holistic health care that promotes natural health through adjustments of the joints of the body in an attempt to remove interference from an individual's nervous system," she explained.

The chiropractic approach, she told the group, has been around for 100 years and involves the specific portion of the nervous system housed within the skull and the spinal column. It was discovered, she said, that a malalignment of joints (known as subluxation), especially the vertebrae, adversely alters nerve function in those areas. The goal of the chiropractor is to put the joints back into proper alignment.

Heiderich emphasized that chiropractic care does not replace traditional veterinary medicine, but it works very well in conjunction with it. "The chiropractic adjustment," she said, "is designed to restore correct alignment and full working order, thus, restoring the proper function of the nervous system."

## The Language of Gold

O'Connor put on a three-hour clinic at the end of the day, complete with dressage and jumping demonstrations and coupled with advice on how to be successful with your horse. He stayed to autograph copies of the book *Life in the Galloping Lane* that he and his wife, Karen, authored.

Helping him during his presentation was

one of the event horses from the O'Connor Event Team, Tigger Too. The horse had a portion of his colon removed in the third of three colic surgeries to solve a medical problem, but he is still competing at a high level with a young rider, although he must be kept on a special diet.

O'Connor's theme for the day was set forth early when he said: "It is our job, outright, to understand the horse's language, not for them to understand ours."

Horses are very social animals, he said, and if we take them out of an environment where they can socialize with other horses, such as in preparation for a major event where they spend much of their time isolated in a protective box stall, the normal environment must be replaced and "you are it." You should spend time with the horse in a relaxed setting, such as grooming, rather than just in training sessions.

When horses are in a group setting, he said, there is always one that is the "bucket" horse. He described that horse as being the one that, if you were to set out a bucket of grain, would always be the horse that took possession of the bucket because it was number one in that group's pecking order.

O'Connor said in learning to communicate with—and relate to—horses, "you have to be the bucket horse, the leader."

However, he pointed out, this position isn't established through force, but rather by establishing a line of communication with the horse that leads to respect.

Using his horse as a prop, O'Connor demonstrated how a horse can be taught what he described as "the four basics" on a longe line. The four basics are moving the forehand, moving the backhand, lowering the head, and backing. "The round pen can be a valuable tool," he said.

O'Connor also told the group that various disciplines in equine competition should keep open minds about what others are doing, rather than ignoring everything but that in which they are involved. He said dressage riders, for example, could learn from cutting horses. He explained that many dressage horses are keyed up and on edge much of the time. The cutting horse, he said, moves in quiet, slow motion when going into the herd and bringing out a cow, but when it starts cutting, it is an exploding dynamo of energy and action. The moment the horse is signaled to cease work, it reverts immediately to a calm state.

O'Connor said he learned much about communicating with an equine companion when he was 11 years of age. He, his mother, and his 13-year-old brother set out on horseback from their home in Maryland and rode on a cross-country odyssey to Oregon. ♦

# Jump higher.

Different than a vitamin/mineral product. More than a joint health product. Better than a typical hoof health product. STEADFAST™ EQUINE is "the one and only one" dietary supplement that's better at building soundness from the inside out, providing your horse with a long, healthy and active life.

[Learn more at arenusperformance.com.](http://arenusperformance.com)

# Infectious Diseases

BY LES SELLNOW

## Measuring Titers

Ashley Boyle, DVM, Dipl. ACVIM, assistant professor in equine field science at the University of Pennsylvania's School of Veterinary Medicine, discussed SeM-specific antibody titer levels as a possible indicator for deciding whether to vaccinate horses against *Streptococcus equi* infection (strangles). (SeM-specific antibody titers refer to the concentration of antibodies in the sera that recognizes one of the surface proteins—called an M protein—of *S. equi*.)

Some horses suffer an adverse reaction when vaccinated against *S. equi*, she said, in the form of purpura hemorrhagica. This is an overzealous immune response to *S. equi* by the horse's body that results in pinpoint hemorrhages along the mucous membranes, as well as areas of firm, pitting edema on the lower abdomen and lower limbs.

Purpura hemorrhagica appears more frequently in horses with high titers of *S. equi* antibodies. Boyle said a horse's age and breed can have an effect on titer levels. Warmbloods and Thoroughbreds generally have higher titers than other breeds. She also pointed out that the likelihood of having a high titer—1:1600—increased with each year of age. "Both age and breed should be considered when determining whether or not an ELISA test to measure SeM-specific antibody levels or titer should be conducted before vaccination."

## Azithromycin

M. Keith Chaffin, DVM, MS, Dipl. ACVIM, professor of medicine in the College of Veterinary Medicine at Texas A&M University, reported on a study involving the use of azithromycin (a lipid-soluble antimicrobial), marketed as Zithromax by Pfizer Laboratories as a preventive treatment for *Rhodococcus equi* infection in foals on endemic farms. (*R. equi* can cause deadly pneumonia in foals.)

The study involved 10 breeding farms

with a history of endemic *R. equi* infections. There were 338 foals involved in the study. Chaffin said the number of *R. equi*-affected foals was significantly higher in the group that was not administered Zithromax, compared to the treated group—21% of the nontreated foals were affected, compared to 5% of those treated. No adverse effects from the drug were detected in the treated foals. Use of the drug did not eliminate *R. equi* on the endemic farms studied, he said, but it did curtail the incidence.

He also said that more research will be necessary before this approach can be recommended for widespread application in the field.

## Enrofloxacin

Thomas J. Divers, DVM, Dipl. ACVIM, of Cornell University told the group that persistent *Leptospira* spp infection of the eye has been confirmed in some horses with recurrent uveitis (moon blindness). He reported on a study aimed at determining whether the intravenous (IV) administration of enrofloxacin, an antibiotic marketed as Baytril 100 by Bayer, would provide high enough levels of the antibiotic in the aqueous humor inside the eye to help clear up the infection.

In the study, six affected adult horses received 7.5 mg/kg IV every 24 hours for a total of four treatments. The conclusion, he said, was the levels of enrofloxacin in the eye were high enough to suggest that this therapy may be a useful adjunct treatment for recurrent uveitis associated with persistent *Leptospira* spp infections.



PAULA DA SILVA

While equine influenza is usually not fatal, it can spread quickly and cause long periods of down time.

## Flu Vaccination

Paul Lunn, BVSc, MS, PhD, of Colorado State University (CSU) reported on a study involving Recombitek equine influenza vaccine marketed by Merial. Twenty-three unvaccinated ponies were involved in the study. Eleven were placed in a control group and 12 were vaccinated twice at 35-day intervals. Six months after the second vaccination, ponies in both groups were challenged with (were exposed to) a flu virus. Lunn said ponies in the vaccinated group demonstrated "significant protection from challenge infection as determined by duration and extent of pyrexia (high fever), clinical score (of signs of disease), and body weight. Viral shedding occurred in both groups, but shedding occurred at a significantly lower level in the vaccinated group." He said the unvaccinated ponies demonstrated severe clinical signs, and seven of the 11



( your way )



( our way )

Are you *still* using multiple supplements  
to keep your horse sound?



## Introducing STEADFAST™ EQUINE — the better way to build soundness from the inside out.

More than a joint health product, better than a typical hoof health product, and different than a vitamin/mineral product, STEADFAST™ EQUINE is the only product designed by veterinarians and nutritionists specifically to support your horse's entire structural system. With its exclusive ingredients NEM® and TelaFirm™, STEADFAST EQUINE is "the one and only one" supplement that provides noticeable results for all your structural health concerns, including relief from joint discomfort in as little as 7 days! [Learn more at arenusperformance.com.](http://arenusperformance.com)



Ask your veterinarian about STEADFAST™ EQUINE or order online  
at [www.smartpakequine.com](http://www.smartpakequine.com) and [www.arenusperformance.com](http://www.arenusperformance.com).

**Steadfast™**  
EQUINE

*The One and Only One.™*

STEADFAST™ EQUINE is a product of Arenus, a division of Novus Nutrition Brands, LLC., St. Louis, Missouri | [www.arenusperformance.com](http://www.arenusperformance.com)  
STEADFAST™ and TelaFirm™ are trademarks of Novus Nutrition Brands, LLC. | NEM® is a registered trademark of ESM Technologies, LLC.  
The SmartPak™ logo is a trademark of SmartPak Equine, LLC. | Patent pending | © Copyright Novus Nutrition Brands, LLC., 2008.

required therapy with non-steroidal anti-inflammatory drugs and antibiotics.

### West Nile Virus Vaccine

Leonardo Singer, DVM, MS, of Merial Ltd. reported on a recombinant canarypox-vectored equine West Nile virus (WNV) vaccine, marketed by Merial under the trade name Recombitek Equine West Nile Vaccine. Involved in the study were 20 mixed-breed horses, ranging in age from 18 months to 14 years. Horses were housed in a single pasture at a research facility in Montana until Day 42 after an initial vaccination. They were then transferred to CSU. There, the test horses received a single dose (1 mL) of the vaccine on Days 0 and 35. On Day 49, all of the horses in the study were challenged with WNV by direct intrathecal injection (into the space in which cerebrospinal fluid circulates around the brain and spinal cord). The results of the test indicated the vaccine did, indeed, protect the horses from WNV and led the researchers to this conclusion, as stated by Singer: "The result of this study and previous studies show significant protection data from a single dose of vaccine and protective immunity lasting for one year after a course of two injections."

### Lawsonia Infections

Michele Frazer, DVM, Dipl. ACVIM, of Hagyard Equine Medical Institute in Lexington, Ky., discussed ways to diagnose and treat infection with the bacterium *Lawsonia intracellularis*, a disease that, in the past, has been much more common in pigs than in horses. The disease most commonly manifests in equine weanlings 6 to 7 months of age. Clinical signs range from mild to severe and include weight loss, rough hair coat, diarrhea, ventral edema, a pot-belly appearance, and poor body condition. The goals of treatment are elimination of the bacteria and supportive care. Recent clinical experiences, she said, have indicated that good results can be obtained by administering the antiprotozoal metronidazole combined with either of the antibiotics oxytetracycline or chloramphenicol. Alternate choices include doxycycline, erythromycin, clarithromycin, or azithromycin. Frazer said although the disease has shown up in horses during the past 10 years and has become increasingly common, the source of infection is not yet known. ♣

# How To: Dentistry

BY LES SELLNOW

### Bitting

Dwight Bennett, DVM, PhD, a retired professor from Colorado State University and a longtime student of bits and their effects on horses, opened the How To session on dentistry. He focused on bits used in driving horses.

"Familiarity with the unique bitting requirements for draft horses, light horses shown in harness, horses driven in multiple hitches, and harness racing horses is important to the equine veterinarian dentist," he declared. "The diagnosis, treatment, and prevention of many dental problems require a basic knowledge of the use of driving bits, overchecks, and side checks. The type of driving and the biting system used are important parts of a driving horse's dental history."

Bennett then proceeded to describe various bits and the effects they have on the horse's mouth, including overcheck and side check reins. A careful examination of the lips and mouth can reveal a horse's biting history and the reason for biting problems, he said. "For example, chafing at the corners of the lips may indicate that bridle checks need to be loosened or that a team is improperly aligned. Tenderness in the lower interdental space (between the incisors and the molars of the lower jaw) may be a sign of mandibular perostitis (inflammation of the periosteum, the connective tissue that sheathes the bones), which indicates that either the bit or the driver's hand is excessively harsh. Sores on the upper interdental space or on the hard palate may indicate that the cheek-rein is set too high or that the overcheck bit is too severe."

### Sinus Problems

Palle Brink, DVM, Dipl. ECVS, of Sweden, discussed the formation of an oromaxillary sinus fistula. It is a complication that can occur in 7-33% of horses after loss or removal of the caudal (rearward) four maxillary (upper) teeth in horses, in which an abnormal passageway from the oral cavity to the paranasal sinuses

is formed. It occurs more often in older horses. He then went into detail on a surgical approach to remedy the problem.

### Maleruptions of Premolars in Miniatures

Edward Earley, DVM, of Laurel Highland Farm and Equine Services in Williamsport, Pa., told the group that some Miniature Horses are prone to maleruption of the upper fourth premolars, which are the last cheek teeth to erupt into the arcade. Horses at risk should be monitored with regular oral examinations, he said, along with radiographs. Maleruption can be the cause of periodontal disease. Earley also described steps that the equine dentist can take to solve the problem.

### Dental Malocclusions

Bayard Rucker, DVM, of Lebanon, Va., discussed "How to Detect Reoccurring Dental Malocclusions Caused by Enamel Insufficiency." He said abnormalities of wear, such as ramps, hooks, and a wave or step mouth, might be caused by a number of problems, including enamel hypoplasia (lack of enamel). Simply correcting the malocclusion doesn't necessarily solve the problem, Rucker said, as the lack of enamel will result in overworn areas in the future.

"Maintenance shortening of the opposing teeth will be needed annually or bimannually," he said.

### Chewing Motion

Hilary Clayton, BVMS, PhD, MRCVS, of Michigan State University, is better known for discussing gait analysis than chewing motion. However, using some of the same technology used for gait analysis, she described how a series of cameras was utilized to record the motions of a horse's mouth when chewing hay and when chewing pelleted feed. The results of the study proved that when a horse chews hay, the mandibular motion is much greater than when chewing pelleted feed. The greater range of motion helps reduce the threat of dental overgrowth. ♣

# Nutrition

BY NANCY S. LOVING, DVM

## Endocrine Disorder Feeding Tips

Nicholas Frank, DVM, PhD, Dipl. ACVIM, associate professor of large animal clinical sciences at the University of Tennessee, spoke about equine endocrine disorders that are the most manageable by dietary control: equine metabolic syndrome (EMS) and equine Cushing's disease (ECD or pituitary pars intermedia dysfunction, PPID).

An EMS horse tends to be fairly young, might have some genetic predisposition, and has pronounced fat deposits, especially on the neck, shoulders, and buttocks. These horses are considered "easy keepers." Some breeds are more likely to develop EMS than others, such as Paso

Finos and Arabians. Generally, these horses have a higher-than-normal blood insulin concentration. An ECD horse is typically an older or aged horse with pituitary dysfunction that results in excess secretion of ACTH (adrenocorticotropic hormone), alpha-MSH (alpha-melanocyte stimulating hormone), and other hormones. These horses have delayed or patchy hair coat shedding, and there is noticeable muscle loss. Often there is excess drinking and urination, which might go undetected.

Frank said insulin resistance can develop in either EMS or ECD individuals. Insulin resistance results from impaired tissue responses to insulin due to problems with insulin receptors, insulin-signaling

pathways, or glucose transport systems. To compensate, many horses will secrete additional insulin, thereby worsening the problem. An obese horse has lipid accumulation within adipose (fat tissue) and skeletal muscle tissue that interferes with insulin signaling, leading to insulin resistance. Frank described some basic concepts that are important for a horse owner and veterinarian to consider:

- Obesity predisposes to insulin resistance;
- Insulin resistance is a diabeteslike state;
- Sugars exacerbate insulin resistance;
- Insulin resistance makes horses more prone to laminitis;



An insulin-resistant horse in good body condition should be fed to improve insulin sensitivity.

SUSAN KORDISH

■ It is important to avoid laminitis triggers such as intestinal abnormalities, seasonal variations, and dietary changes.

A goal for managing an obese horse is to induce weight loss. In a horse that is in good body condition, yet has insulin resistance, you should aim to maintain its current weight with the objective of improving insulin sensitivity. A thin Cushing's horse with insulin resistance should gain weight and improve its insulin sensitivity.

Of three possible diets to manage insulin resistance, the first Frank described is a **weight loss diet** in which all grain is eliminated and access to pasture is eliminated or restricted to less than two hours per day or to a small area of strip grazing. A grazing muzzle is useful to control consumption of grass. Dynamic phases of grass growth (i.e., following drought conditions) should be avoided. Soaking hay for 30 minutes before feeding lowers its sugar content. Hay should be analyzed for its nonstructural carbohydrate (NSC) content, and hay should be selected that is low (less than 10-12%) in NSC. Frank notes that it is impossible to identify NSC content (simple sugars and starches) from appearance, and content varies by grass type, rainfall, soil type, season, cutting, and time of day. (As a comparison to forage, oats have a value of 50% NSC.)

Initially, the fat horse should be fed 2% of its current body weight in hay along

with elimination of grain and pasture grass from the diet. Then, hay is lowered to 1.5% of current body weight, then offered at 1.5% of ideal body weight. For example, you'd give 15 pounds of forage to a 1,000-pound horse. The horse is fed at this level until an ideal body condition score is achieved. In some cases, a hay-only diet might provide insufficient protein; a diet of 8% protein is acceptable. If more protein is needed, a small amount of alfalfa

The second diet Frank considered is a **weight maintenance diet** that is predominantly forage-based (hay) with less than 12% NSC. Hay is fed at a rate of roughly 2% of body weight to maintain weight. Vitamins, minerals, and protein are provided as needed. High-glycemic feeds should be completely avoided, such as sweet feed with molasses, as this challenges glucose and insulin metabolism and exacerbates insulin resistance. A horse experiences a higher glycemic response (blood sugar) if carbohydrates are digested in the small intestine, so it is best to feed small amounts of food more frequently, (so lesser amounts of carbs ferment in the small intestine at one time) and to feed hay before concentrates. Always avoid sudden changes in feed so the bacterial flora in the bowel can adjust gradually to various feed materials.

Frank stressed that "a safer feed is not necessarily a safe feed." General recommendations apply to most, but not all, insulin-resistant horses since insulin resistance varies in severity and there are individual variations in responses to feed. Body condition should be assessed every two to four weeks, and blood insulin should be monitored.

The **weight gain diet** relies on low-NSC (less than 12%) hay fed free-choice along with molasses-free beet pulp and rice bran or corn oil. Soaked molasses-free beet pulp is mostly digested in the large intestine.

## **A horse needs nutrients for healing and immune function, but loading the bowels with feed might increase the chance for intestinal shut- down and colic relapse or for breakdown of the abdominal incision**

DR. RAY GEOR

hay or soybean meal can be substituted for a portion of the diet.

Exercise is important for weight loss, provided laminitis or lameness does not preclude physical activity.

# Ride farther.

Your horse's joints, bones, hooves, and other connective tissues may be impacted over time due to athletic performance and aging. While many equine health products may address one component of your horse's framework, STEADFAST™ EQUINE supports your horse's entire structural system.

Learn more at [arenusperformance.com](http://arenusperformance.com).

Presoaked, one cup is equivalent to one-quarter pound. Start with one-quarter to one-half pound of pre-soaked beet pulp and feed this twice a day, increasing gradually to 1 pound daily. Beet pulp should be rinsed twice in warm water to remove simple sugars, then soaked for 10 to 30 minutes in warm water before feeding.

Commercial low-NSC pelleted feeds are also recommended for weight maintenance or gain. Advantages of these products include the ease of feeding, regular testing of ingredients to ensure a lower sugar content, and addition of ingredients that affect absorption and palatability.

### **Feeding After Colic**

Nutritional support of horses following a bout of colic is important, especially for hospitalized horses following colic surgery, noted Ray Geor, BVSc, MVSc, PhD, Dipl. ACVIM, professor, Paul Mellon Distinguished Chair, and director of Virginia Tech's Middleburg Agricultural Research and Extension Center in Middleburg, Va.

There are arguments as to how much to feed following a colic attack or colic surgery. A horse needs nutrients for healing and immune function, but loading the bowels with feed (and the weight of the feed) might increase the chance for intestinal shutdown and colic relapse or for breakdown of the abdominal incision.

### **Pelleted mashes and slurries combined with high-fat supplements can be offered to geriatric horses with poor dentition or missing teeth**

DR. DAVID PUGH

It has been common practice to withhold feed initially and provide only water and possibly intravenous fluids and electrolytes to a horse that suffered from colic or colic surgery, then slowly re-introduce feed at a rate that allows the GI system to accommodate forage.

Geor advocated feeding a stall-maintenance ration (approximately 70% of maintenance needs; a maintenance diet accommodates basic physiologic functions without the added demands of exercise, etc.) for two to four days after horses have colic surgery, increasing the ration continually until reaching a maintenance intake of digestible energy.

Three avenues of nutritional support are available: 1) voluntary feeding, 2) assisted feeding, and 3) parenteral nutrition. Geor

stressed that how a horse should be fed depends on the underlying cause of the colic incident, as well as the horse's appetite and extenuating complications that might arise in the recuperative phase. A horse with a simple colic might have feed and water withheld during the episode, but as soon as the colic has resolved, the horse can return to a normal diet. Many practitioners advocate elimination of the grain portion of the diet for a few days to allow restoration of hindgut microbial function.

In contrast, following intestinal surgery feed should not be introduced until there is evidence that intestinal motility has been restored, and, even then, only small amounts (1 pound) of forage are offered at frequent intervals (four to six times a day). Increase the amount gradually and steadily based on the horse's response.

Another tactic is to offer pasture grazing for 20-40 minutes intermittently throughout the day or to offer pelleted senior feed, which is digestible and low-bulk. For the two weeks following surgery, it is best not to offer grain so as not to further disrupt hindgut (large intestine) microbial activity. Reinstatement of grain begins with small amounts (2 pounds or less per day) and is increased gradually.

By the second or third day following surgery a horse should voluntarily consume at least 75% of stall-maintenance

# Show stronger.

Two exclusive ingredients in STEADFAST™ EQUINE — **NEM** and **TelaFIRM™** — work together to build soundness from the inside out in as little as seven days. STEADFAST EQUINE also provides ascorbic acid for healthy joints; calcium, phosphorous and vitamin D for healthy bones and biotin for healthy skin and hooves. [Learn more at arenusperformance.com.](http://arenusperformance.com)

requirements in forage, i.e., 8 pounds of hay for a 1,000-pound horse. A horse that won't eat this amount of hay will need appetite stimulation with grass or other palatable, but highly digestible, feed, particularly if the horse is in poor body condition. If this fails to induce an appetite, then assisted feeding is necessary. This relies on administration by stomach tube of energy-dense pelleted feed, slurried and supplemented with fats. The volume given by stomach tube four to six times per day is slowly increased over several days to a target amount. Careful clinical monitoring is important to avoid stomach distention, intestinal shutdown, or laminitis.

The third strategy for nutritional support is that of parenteral nutrition that is given intravenously through a catheter dedicated only to this purpose. This form of nutrition is particularly valuable for horses recovering from enteritis (intestinal inflammation) or from small intestinal surgery, particularly if a portion of small intestine has been removed.

Once intestinal motility is restored with no gastric reflux, it is recommended to feed a highly digestible diet using fresh green grass or soft first-cutting hay and/or pelleted feed mashes, offering only very small meals every three to four hours.

Regarding large intestinal disorders, such as an impaction, feed should be withheld until the impaction has cleared. Grain should not be fed until it is evident that manure is passing regularly and in appropriate quantity and consistency. If large intestinal surgery was performed, it is important to monitor for diarrhea, as Geor reported the risk of diarrhea is increased twofold in horses with large intestinal disorders as compared to other intestinal problems. This risk increases if the large colon has undergone direct surgical invasion. There appears to be some mitigating effect on diarrhea when grass hay is fed. Hay can be offered starting 12 hours post-surgery, with small amounts of soft first-cutting grass hay given every two to three hours. Grain should be withheld for 10-14 days, but pelleted feed can be fed due to its low bulk.

Following extensive large colon resection (removal of a section), Geor noted that transit time of nutrients is altered so low-bulk feeds, such as pelleted feed, can be offered initially, followed by legume forage or a grass-legume hay mix. Additional

calories can be obtained through high-fat concentrates (oil, rice bran, or supplements especially high in fat) with avoidance of grains and sweet feed.

### Feeding the Geriatric Horse

A horse kept healthy and disease-free in its younger years has the potential to live well into its 20s and 30s, stated David Pugh, DVM, MS, Dipl. ACT, ACVN, of Fort

## Maintaining stability of the hindgut microbial community is of paramount importance to GI health

DR. RAY GEOR

Dodge Animal Health. In the senior horse, routine medical management should be implemented, including parasite control, dentistry, and dietary modifications to accommodate existing problems.

Dental disease is a common problem in aged horses, so the teeth should be checked at least twice yearly to minimize the risk of choke and to avoid weight loss. Pelleted mashes and slurries combined with high-fat supplements can be offered to geriatric horses with poor dentition or missing teeth. If an older horse is able to maintain good body condition on a regular maintenance diet, then no extra supplementation should be necessary. Some aged horses require "safe" feeding areas to avoid herd competition, especially if afflicted with arthritis or failing eyesight.

Pugh noted that nutrition for aging horses and young, growing horses is similar in the protein and energy needed to support their metabolism. An old horse might not digest dietary fiber efficiently, and he also might need a higher (12-14%) protein intake because he can't digest protein as well. It is important to ensure adequate intake of specific amino acids, such as lysine and threonine. In many cases including alfalfa in the diet helps to limit loss of muscle mass and weight. A high-fat supplement (vegetable oil and/or rice bran) is useful to provide calories, as are beet pulp mashes or pelleted feeds. Pugh recommends that concentrates be restricted to no more than 0.5% of body weight per feeding, as, for

example, a 1,000-pound horse should not receive more than 5 pounds of concentrate at a meal.

Body condition might be difficult to maintain in some older horses due to inadequate intake of feed, poor digestive capacity, dental disease, metabolic disease, endocrine disease, or infection. A complete physical exam and blood work should be performed on a geriatric horse to rule out existing problems.

Before protein is increased, it is important to examine liver and kidney function. In general, dietary calcium should be kept below 1% due to the potential for kidney stones in aged horses. Thus, the use of alfalfa must be considered carefully. In these cases increased protein needs might be provided with soybean meal.

A horse with kidney disease should receive less than 8% protein and will do best on grass hay supplemented with fat and/or corn oil if more calories are needed. Digestion of phosphorus seems to decline with age, and it is valuable to monitor the calcium to phosphorus ratios. A horse with liver disease should not be fed a high-fat or high-protein diet, and that horse might benefit from vitamin B supplementation.

Support of a geriatric horse's immune system could be helped by supplemental vitamin C and vitamin E, along with maintaining a good body condition score. Pituitary adenomas (benign tumors in glandular tissue) and/or obesity elicit glucose intolerance and insulin resistance, making feeding of such individuals a real challenge. If a horse requires additional calories and does not have a liver problem, these are best offered as high-fat supplement.

### Managing Carbs in Horses

How is feeding carbohydrates related to gastrointestinal (GI) disease? Geor discussed the conflict between GI physiology and the way horse owners tend to feed modern horses, especially those with high athletic demands. The propensity to feed high-grain and high-concentrate diets instead of relying on high-fiber diets has increased the incidence of colic.

One study from 1997 indicated that on 31 farms, the risk of colic increased 4½ times when horses were fed moderate to large amounts of grain (5-10 pounds).

An increased risk of colic also is related to a change in diet; particularly in the first week after a diet change, there is a chance

of simple colonic obstruction or distension, but risk diminishes 15-28 days following dietary changes.

Geor stressed that other contributing factors should be considered, such as level of physical activity, breed, age, season, and the area's weather; but, in general, there is an increased risk of colic with high-grain concentrate diets and with recent dietary changes. So, the question is, "Why?"

Geor said there is a disturbance of the hindgut ecosystem related to delivery of undigested starch and other rapidly fermentable carbohydrates to the hindgut. A limited capacity for starch digestion in the small intestine contributes to overflow of starch to the hindgut. There is also a lag or transition time in the speed of microbial adaptation to dietary changes. He pointed out that maintaining stability of the hindgut microbial community is of paramount importance to GI health.

There are three types of carbohydrates:  
**Hydrolyzable** Starches and sugars are digested in the small intestine to generate glucose, but these ferment rapidly in the stomach or the large intestine.

**Rapidly fermentable** Fructans and oligosaccharides (saccharides of a small number of component sugars) that rely on *Lactobacillus*, *Streptococcus*, and *Clostridium* spp, with lactate production as a byproduct.

**Slowly fermentable** Cellulose that relies on *Fibrobacter* and *Eubacterium* spp that consume lactate.

If a large load of rapidly fermentable carbohydrates enters the hindgut, overgrowth of lactate-producing bacteria leads to increased lactate and gas production, acidity of the hindgut, a die-off of Gram-negative bacteria, and the release of endotoxin and other substances. The result is disruption of the mucosal layer of the intestinal lining, absorption of endotoxin, more gas distention, and altered gut motility with the potential for an intestinal volvulus (twist). This sequence of events results in an acute and severe colic.

A more chronic and less severe intestinal disruption develops from a decrease in fiber-fermenting, acid-utilizing microbes. This leads to chronic acidosis, digestive inefficiency, weight loss, altered fecal consistency, and the development of stereotypic behaviors such as cribbing.

Hindgut acidosis develops subsequent to sudden introduction of grain feeding or an abrupt increase in amount of grain fed.

Acidosis also results from large grain concentrate meals, lush spring pasture grazing, or from forage that is high in nonfiber carbohydrates, such as what occurs with rich legume hay.

Studies indicate there is a stepwise decrease in cecal pH relative to increasing amounts of grain and the size of a starch meal. Larger grain meals increase risk of starch bypass of the small intestine with rapid fermentation in the large intestine. The effects of this depend on the horse's adaptation to the types of starch and size of meal.

### One study from 1997 indicated that on 31 farms, the risk of colic increased 4½ times when horses were fed moderate to large amounts of grain (5-10 pounds).

Cecal acidity is associated with feeding grain starch of low digestibility, such as is seen with corn. The higher digestibility of oats mitigates this effect, whereas barley and corn starch are more resistant to digestion and lead to acidosis.

Oats are about 84% digested before reaching the cecum as opposed to corn at 45% or less digestion. Heat treatment or reduction in particle size (micronization or extrusion) is needed for improved pre-cecal digestibility and retention of normal cecal pH.

As for probiotics (dietary supplements containing potentially beneficial bacteria or yeasts), Geor pointed out that data is lacking due to the absence of well-designed scientific studies. In addition, there are issues regarding product quality, and some studies show adverse effects in foals receiving probiotics containing *Lactobacillus pentosus*.

Another new supplement (made by Kentucky Equine Research) that is advertised as a hindgut buffer is purported to mitigate moderate decreases in cecal pH following a grain meal or when grazing lush pasture.

Geor summarized his recommendations to reduce colic risk:

- Minimize the flow of rapidly fermentable carbs to the cecum and large colon;
- Limit amount of grain, sweet feed, or pelleted feed per meal to no more than 4½ pounds of starch for a 1,100-pound horse;
- Increase the number, not the size, of meals to at least three feedings per day and provide free-choice hay when possible;
- Feed starch sources high in pre-cecal digestibility, such as oats. If using corn or barley, these need heat treatment, such as extrusion, popping, or micronization;
- Slowly introduce changes in cereal or sweet feed to increments of less than 1 pound per day over seven to 10 days;
- Use alternative concentrated energy sources, such as oils, or rice bran, or highly digestible super fibers, i.e., beet pulp or soya hulls;
- Encourage long-stem forage intake to at least 1-1½% of body weight, i.e., 12-17 pounds per day for a 1,000-pound horse; and
- When switching hay batches, blend over seven to 10 days.

Geor also mentioned how diet affects equine gastric ulcer syndrome (EGUS), which is reported to have an incidence of 60% in pleasure and show horses, and 85-90% in racehorses.

The "trickle" feeding pattern of pastured horses (small intake of feed over a long period of time) might have a protective effect that is coupled with the high-fiber diet of pasture grass. Saliva production doubles when eating hay and is continuous when grazing; saliva has a powerful buffering effect on stomach acid.

Alfalfa has an additional buffering effect on stomach acid, whereas recent findings do not support any benefits from corn or rice oil in preventing development of EGUS. Overall, it is important to remember that a horse has a small stomach and large hindgut and a limited capacity for starch digestion in the small intestine. In general, the best strategies rely on feeding smaller and more frequent meals with less reliance on cereal or sweet feeds.

Other supplements were discussed, such as "stabilizing" products for the hindgut ecosystem. A live yeast preparation or prebiotic (a food substance intended to promote the growth of certain bacteria in the intestines; 10 grams per day of *Saccharomyces*) mitigates the decrease in pH that occurs with high-starch meals, but of greater importance is the feeding of high dietary fiber, i.e., forage. ♣

# Ophthalmology

BY NANCY S. LOVING, DVM

## Eye Examination

Dennis Brooks, DVM, PhD, Dipl. ACVO, of the University of Florida veterinary school, led the panel at the in-depth session on ophthalmology. He was excited to share many developments from the last six months that allow veterinarians to save eyes and sight. He stressed that in most cases an eye exam does not require special equipment, but it does require a "lack of fear" in addition to a bright light, a direct ophthalmoscope or otoscope (an instrument for examining ears), and skills to perform a thorough exam.

Brooks pointed out that a veterinarian is limited by the nature of the beast in examining eyes. Assessment of a menace reflex from hand motion is a crude measure, making it hard to determine if the horse is reacting to the feel of air or to hand motion. The best equine test for vision is the "dazzle reflex," a sensitive test for retinal function.

An observer determines if the horse squints in response a bright light shined into the injured eye. Although there might be a variable pupillary response to the light, squinting denotes the perception of light. If the horse's cornea is opaque, yet he squints, then the retina is still working.

Another useful test is the "flashlight test" or indirect papillary reflex that stimulates the bad eye with light while observing for pupillary reaction in the other eye. Often inflammation is confined to the front of an eye, and a positive indirect pupillary reflex indicates that there is a chance to save sight and the damaged eye.

Brooks also pointed out that, in general, the upper eyelashes of a painful eye tend to point down. This droopiness of the lashes is one of the last things to return to a normal position as an injury heals. It might be necessary to view the eyes from a distance, even with binoculars, for a horse that is protective of examination of the eye and tends to close when a person approaches. Brooks described helpful regional nerve



Veterinarians are limited by the nature of the beast in examining eyes.

blocks to anesthetize branches of cranial nerves to curtail blinking or sensation of pain and to facilitate careful examination of eye structures.

With wry humor, he noted there "are really only two eye diseases: corneal ulcers, and everything else." Staining the eye with fluorescein dye identifies defects in the corneal epithelium (the outer layer of the cornea) and the extent of an ulcer. The corneal epithelium is eight layers thick, but the dye will be picked up with loss of only one to two layers. The Seidel's test detects a corneal perforation when the fluorescein changes color as it leaks into a hole. Normal passage of fluorescein

through the nasolacrimal duct (the duct that connects the eye to the nasal passages) can take up to 10-15 minutes.

Use of Rose Bengal stain evaluates stability and integrity of the tear film. Normally, the tear film takes 10-15 seconds to break up, but rapid dissipation indicates roughening on the corneal surface that won't allow the tear film to hold together. Dry eye is one cause of a roughened corneal surface, and this can occur with viral or fungal diseases.

An observant veterinarian can tell a lot from color changes within the cornea: white might indicate an abscess, blue discoloration is consistent with edema

expected with an ulcer; red indicates blood vessel entry for healing, while a dark color is of concern for imminent rupture. A pigmented iris will change color, becoming dark with inflammation from uveitis, melanoma, or hemorrhage. The size of the pupil also gives specific information—a large pupil might indicate glaucoma or retinal or optic nerve disease; small pupil size is symptomatic of uveitis. Aqueous flare is visible as little white spots seen with a slit lamp; this results from protein leaking from blood vessels of the iris and is another sign of uveitis.

For a corneal ulcer, Brooks recommends obtaining a bacterial culture first, then evaluating cells with cytology. Once he removes superficial debris, he gathers a deep scraping at the edge and base of an ulcer, using the handle end of a metal scalpel blade.

Brooks stressed that even after treatment kills bacteria, white blood cells (neutrophils) die and dump enzymes (proteases) into the tear film that continue to worsen an ulcer. One objective in treatment is to return the tear film proteases back to normal. Blood vessels grow from the periphery at 1 mm/day, while white blood cells move in at a rate of 8 mm/day.

The horse has the highest intraocular pressure (IOP) of any land mammal, and the horse's head must be up when measur-

ing it; IOP increases 87% with the head in the down position. Looking at the drainage angle (the gray band on the lateral, or outer, portion of the eye), one should see minute holes. If these holes collapse and close and appear solid, there is an increased risk of glaucoma.

## Treatment of Uveitis

Mary Utter, DVM, PhD, Dipl. ACVO, of the University of Pennsylvania veterinary school, stressed that equine recurrent uveitis (ERU) is the leading cause of blindness in horses. The prevalence of uveitis in the United States horse population is about 8% based on a 2005 study—this means there could be 736,000 horses with moon blindness in the United States!

Utter pointed out that this is a syndrome of many subsets rather than being a single disease. She compared it to laminitis in that both are inflammatory processes involving multiple tissues in key functional areas, and both occur due to a variety of triggers. She noted, "Both of these diseases are poorly understood, both have a variable response to therapy, and both are bad for the horse."

A horse can have a genetic predisposition to develop uveitis, but in most cases the disease process begins as some compromise to the blood-ocular barrier in which the blood vessels of the iris and

ciliary body become leaky. White blood cells enter the eye along with their inflammatory cytokines and enzymes. She explained that molecular mimicry could play a role—an antigen might trigger the immune system, then similar antigens of the horse can subsequently trigger the immune system, which causes the clinical signs of ERU.

ERU is like an autoimmune response, tending to be a dynamic process with shifts in immune-reactivity that cause a waxing and waning of uveitis episodes.

Suspected stimuli that might incite an attack of ERU are bacterial, viral, and parasitic diseases, including leptospirosis, onchocerciasis, strangles, brucellosis, toxoplasmosis, equine herpesvirus, and Lyme disease. Some breeds have a predilection for developing ERU, including Appaloosas and Warmbloods.

While leptospirosis is the most significant cause of uveitis in all species worldwide, Utter feels there also might be a "lepto link" in horses. Leptospirosis is a bacteria that penetrates mucous membranes in the mouth and settles in the kidneys, causing an animal to shed the organism in urine for 2-3 months. Although the serum titer elevates within 4-8 days following infection (antibodies are made by the horse), the virus persists for the animal's life.

# Feel better.

Rest assured, you're doing what's right for your horse with STEADFAST™ EQUINE from Arenus. There is no better, safer, faster and more convenient way to build soundness from the inside out. And by providing your horse with a long, healthy and active life, you'll feel better, too — about your performance and the animals for which you care. [Learn more at arenusperformance.com](http://arenusperformance.com).

Initially, the illness is mild and clinical signs might be missed; months later the eye disease begins, with increasing damage with each flare-up. Horses with the highest risk are those with access to carrier species, such as cattle, deer, rats, or raccoons, and especially in close proximity to water sources since this organism can live for months in ground water. A leptospirosis vaccine is approved for cattle, but its use in horses is considered off label. The vaccine should only be used on "at risk" farms and only on horses with normal eye exams and negative serum titers.

Utter reported on breed predilection for ERU, saying 80% of uveitis cases occur in Appaloosas, and generally both eyes are affected. The individuals most at risk are those with coat patterns with overall roan or light coat color, little pigment around the eyelids, and sparse manes and tails. In Germany, some lines of Warmbloods are at risk.

In an Appaloosa with a positive lepto titer, 100% will lose sight in one eye and 50% go completely blind. If an Appaloosa has had no exposure to leptospirosis, there is a 70% of losing sight in one eye and a 29% chance of total blindness. In non-Appaloosa breeds, a horse with a positive lepto titer has a 50% chance of losing sight in one eye and 17% risk of complete blindness, while if the horse has no previous exposure to lepto, the non-Appaloosa has a 34% chance of loss of vision in one eye and only 6% chance of going blind.

Utter described how a horse with ERU will have an acute attack alternating with periods of quiescence, yet damage is ongoing despite a lack of outward clinical signs. Each episode results in more permanent damage. During a flare-up, there is tearing, pupillary constriction (miosis), conjunctivitis and redness, decreased intraocular pressure, and other signs of inflammation. Chronic cases can have evidence of "footprints" of previous episodes, such as iris adhesions, increased pigmentation of the iris, and scarring on the optic disc.

Cataracts are a common sequela, with the potential to lead to glaucoma. Other indications of chronic inflammation and damage might be present, including band keratopathy (deposition of calcium just beneath the epithelium), phthisis bulbi (degeneration and atrophy of the globe), or retinal detachment.

Utter stressed the importance of client



Eye injuries can be very serious and warrant an immediate call to your veterinarian for possible treatment, such as this horse above who scratched his cornea.

education so subtle clinical signs can be recognized early to enable timely implementation of treatment. Treatment goals focus on preserving vision, controlling active inflammation, and minimizing discomfort and permanent damage.

### Corneal Ulcers

Caryn Plummer, DVM, Dipl. ACVO, assistant professor at the University of Florida veterinary school, described the outer corneal layer (epithelium) as the windshield of the eye, and explained that it is protective and supportive to underlying corneal tissues. Beneath the epithelium is the stroma, the thickest layer of the cornea, comprised of collagen and fibroblasts. Beneath that is the thin basement membrane (Descemet's membrane), and at the bottom of the cornea is the single-cell endothelial layer that serves as a pump to move accumulated fluid from the interior of the cornea.

Plummer noted that ulcers are classified according to their depth, cause (etiology), and response to treatment. She noted that following an injury, mitosis (cell division) stops, and the cells at the edge of the wound enlarge and lose their attachment, allowing them to slide over the

defect. Initially, this forms a single layer of cells, but eventually a multilayered sheet of cells will cover the corneal wound. The epithelial cells migrate at a rate of 0.6 mm/day if there is no concurrent infection; it takes at least six weeks for the epithelium to securely attach once it has crossed the defect. An indolent ulcer is one that won't heal either due to an abnormality of the basement membrane or a problem of adherence.

A defect in the stroma requires a balance of resorption and remodeling, which takes longer than healing of more superficial ulcers. Any imbalance in this restorative process can lead to "melting" of the cornea.

This can occur due to upregulation of enzymes of bacteria or white blood cells that cause "housekeeping cleanup" to exceed the rate of repair. Normal tear fluid contains soluble proteases essential to corneal health. Disproportionate amounts of these, as produced by inflammatory cells, lead to pathologic degradation. Normal repair also requires corneal blood vessels, which move at the rate of 1 mm/day, yet they are slowed by therapy with non-steroidal anti-inflammatory medications (NSAIDs).

White blood cells invade the cornea at 8.6 mm/day, so they are the first to respond to injury. Epithelial cells move at 0.6-1.2 mm/day.

A melting ulcer is not always due to bacterial influences, and this is a true emergency due to the possibility of prolapse of internal eye tissues within hours or days. It is always prudent to do a bacterial culture and sensitivity and cell cytology, in addition to implementing aggressive treatment with topical antibiotics and possibly antifungal agents. Removal

of necrotic debris surrounding the margins of an ulcer allows epithelium to cover the defect. Plummer said it is important to keep in mind that "sterility does not equate with healing." Dilation of the pupil deters internal damage, and NSAIDs quiet the uveitis and lessen pain.

Enzymes are responsible for collagen destruction, so medications that inhibit destructive enzymes are critical for success. Equine serum reduces enzymes by 90%, while 0.2% EDTA (ethylene diamine tetra acetate, a chemical used as an

anticoagulant and as a chelator) slows proteolytic activity (cleavage of proteins by proteases) by 99.4%. Plummer noted there might be advantages in obtaining serum from another horse on the property. Other enzyme-inhibiting products are available with similar effects. The objective is to stop corneal melting, restore drainage, sterilize the wound, provide structural support for ulcer repair, decrease pain and inflammation, and prevent secondary damage to the interior of the eye. Treatment might be required every two to six hours. Surgery and placement of a subpalpebral (beneath the eyelid) lavage tube might be necessary to facilitate healing.

## Contributing Authors

Contributors to the AAEP Wrap-Up are:

**Christy West**, TheHorse.com Web Master and freelance writer.

**Nancy Loving, DVM**, owns Loving Equine Clinic in Boulder, Colo., and has a special interest in managing the care of sport horses. Her newest book, *All Horse Systems Go*, is a comprehensive veterinary care and conditioning resource in full color that covers all facets of horse care. She has also authored the books *Go the Distance* as a resource for endurance horse owners and *Conformation and Performance* (both available at [www.ExclusivelyEquine.com](http://www.ExclusivelyEquine.com) or by calling 800/582-5604), as well as many veterinary articles for both horse owner and professional audiences. Her next book, *First Aid for Horse and Rider*, is due out soon.

**Les Sellnow**, is a freelance writer based near Riverton, Wyo. He specializes in articles on equine research, and he operates a ranch where he raises horses and livestock. He has authored several fiction and nonfiction books, including *Understanding Equine Lameness*, *Understanding The Young Horse*, *The Journey of the Western Horse*, and *Happy Trails*, published by Eclipse Press and available at [www.ExclusivelyEquine.com](http://www.ExclusivelyEquine.com).

## Special Thanks

Many professional writers and veterinarians contribute to making this Wrap-Up possible. All articles are reviewed by the presenter or moderator of a session without compensation. We are grateful to these dedicated veterinarians, researchers, and other professionals for their assistance. ♣

## Required Reading for Responsible Horse Owners.



For over 10 years *The Horse: Your Guide to Equine Health Care* has been essential reading by responsible horse owners.

Subscribe today, and along with your full access to TheHorse.com, you'll receive 12 issues of *The Horse* filled with essential information you need to know to keep your horses healthy and strong. Order now and **SAVE OVER 72%** off the cover price. Plus, you'll get the next edition of *The Horse Source* FREE.

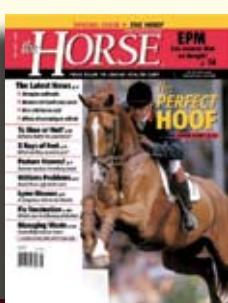


### NO RISK. NO OBLIGATION.

Your satisfaction is absolutely guaranteed. If you're not completely satisfied, we'll send you a refund for all unmailed issues!

# SUBSCRIBE NOW!

[CLICK HERE](#) or  
call 1-800-582-5604



**the**  
**HORSE**  
YOUR GUIDE TO EQUINE HEALTH CARE

CQ06Z236TH



( your way )



( our way )

Are you *still* using multiple supplements  
to keep your horse sound?



## Introducing STEADFAST™ EQUINE — the better way to build soundness from the inside out.

More than a joint health product, better than a typical hoof health product, and different than a vitamin/mineral product, STEADFAST™ EQUINE is the only product designed by veterinarians and nutritionists specifically to support your horse's entire structural system. With its exclusive ingredients NEM® and TélaFirm™, STEADFAST EQUINE is "the one and only one" supplement that provides noticeable results for all your structural health concerns, including relief from joint discomfort in as little as 7 days! [Learn more at arenusperformance.com.](http://arenusperformance.com)



Ask your veterinarian about STEADFAST™ EQUINE or order online  
at [www.smartpakequine.com](http://www.smartpakequine.com) and [www.arenusperformance.com](http://www.arenusperformance.com).

**Steadfast™**  
EQUINE

*The One and Only One.™*

STEADFAST™ EQUINE is a product of Arenus, a division of Novus Nutrition Brands, LLC., St. Louis, Missouri | [www.arenusperformance.com](http://www.arenusperformance.com)  
STEADFAST™ and TélaFirm™ are trademarks of Novus Nutrition Brands, LLC. | NEM® is a registered trademark of ESM Technologies, LLC.  
The SmartPak™ logo is a trademark of SmartPak Equine, LLC. | Patent pending | © Copyright Novus Nutrition Brands, LLC., 2008.