Farriers and veterinarians gathered to discuss their research, advancements, and understanding of this often deadly disease.

Researchers reported that feral horses grazing in lush forage areas are prone to developing pasture-induced laminitis.

Grasping Laminitis

Alexandra Beckstett

Farriers, veterinarians, and horse owners convened at the 6th International Equine Conference on Laminitis and Diseases of the Foot, held Oct. 28-31, 2011, in West Palm Beach, Fla., to discuss ways to combat laminitis. This devastating hoof disease is caused by inflammation of the horse’s laminae—interlocking leaflike tissues attaching the hoof to the coffin bone. Through a series of scientific, practical, and owner-oriented programs, presenters covered issues such as lameness detection, pain management, shoeing, and treatment methods.
Following are synopses of some of the conference presentations.

**Foot Type and Laminitis Incidence in Feral Horses**

Horses that roam free in the wild, whether American mustangs, Australian brumbies, or horses from other feral herds, differ from their domestic counterparts in that they receive no food, water, veterinary care, or hoof care from humans. To determine what effect feral horses’ natural environments have on hoof type and predisposition toward developing laminitis, Brian Hampson, PhD, of the Australian Brumby Research Unit (www.wildhorsesresearch.com) at the University of Queensland’s School of Veterinary Science, tracked brumbies and evaluated their feet visually and radiographically (via X-ray). He presented his findings at the conference.

Hampson and colleagues caught and placed GPS tracking devices on 35 brumbies from six Australian study areas characterized by different environmental conditions (e.g., water sources, food, footing). After tracking the horses’ travel patterns for periods of six weeks to six months, the team caught the animals again and downloaded GPS data that revealed how far horses traveled in each environment. With this information Hampson determined that environment has a huge impact on the horses’ feet. Additionally, he photographed and radiographed the feet of 100 horses euthanized during routine culling operations and established 40 foot shape and structure parameters for study. Looking at two different foot types in particular—those of horses from rocky desert areas versus soft, sandy terrain—he determined Australian brumbies have no “natural” foot type, but rather the environment dictates their hoof characteristics.

As expected, the feet of horses in the rocky environment had worn down, but not necessarily for the better. Radiographs revealed these horses’ hoof walls were 19-30 mm thick (domestic horses’ thickness is typically 14-18 mm), indicating a stiff hoof type that could lead to foot pathologies; their “sinker” distance was twice that of domestic horses, meaning that the bony skeleton had sunk over time deeper into the outer hoof; and their soles were excessively thick, creating tight, boxy, and heavy feet. The laminae were attenuated, or stretched, and ultimately, coffin bone “sinking” with signs of concussive laminitis was the norm in these animals.

The feet of the brumbies residing and traveling on soft, sandy terrain wore more slowly than those of the rocky environment horses, and their hoof walls were not excessively thick. Instead, they had long toes that broke away naturally. These horses’ feet showed no signs of laminitis or other serious foot pathology.

After recording the characteristics of these horses’ feet, Hampson then aimed to determine if their foot types could change. He caught 12 horses (six from rocky terrain and six from sandy), radiographed and photographed their feet, and then swapped their environments. He tracked the rocky environment horses via GPS for six months (800 km traveled) in a sandy environment and the sandy environment horses for four months (1,016 km traveled) in the rocky environment. What he discovered was that foot type does depend on environment (e.g., substrate hardness and distance traveled), as both groups of horses’ feet changed completely during this time period to match the new host environments.

Hampson also discovered a high incidence of laminitis in four study areas around Australia. Of the euthanized horses he radiographed:

- 67% of 15 rocky terrain horses were laminitic;
- 40% of 15 sandy desert horses were laminitic;
- 93% of 15 “prime grazing terrain” horses were laminitic;
- 40% of 56 Kaimanawa region (New Zealand) horses were laminitic.

In the sandy desert and prime grazing areas where lush forage is prevalent after floods and fires, Hampson was not surprised to discover more laminitis cases that likely were pasture-induced. In the rocky area, where horses had more stable diets and traveled far distances, the high laminitis rates were unexpected but were likely due to the horses’ concussive environment, increased sole loading, and difficult lifestyle from birth. He added that these horses did not appear “overly lame” and still traveled high distances. “It may be that the robust foot structure and the unique foot morphology of these horses is protective against mechanical trauma and the pain often associated with chronic laminitis in domesticated horses,” he hypothesized.

Hampson ultimately concluded there is no one natural foot type in horses and, contrary to popular belief, feral horses are not exempt from developing laminitis. Also, “There is currently no clear evidence to support the use of the extreme feral horse foot as a model for equine foot care,” he cautioned. Keeping in mind all horses are likely vulnerable to laminitis, Hampson proposed the following suggestions for horse owners:

- Maintain appropriate diets;
- Don’t overtrim horses’ feet;
- Try to avoid excessive time spent on hard surfaces; and
- Encourage animals to exercise more, such as by using feeding practices that require horses to move around or by housing horses in large paddocks.

**Laminitis Prevention and Early Intervention in Hospitalized Horses**

Horses hospitalized for serious surgical or medical conditions are at an increased risk for developing laminitis as...
a complication of their injury or illness. Thus, preventing laminitis or intervening early in these animals is key, according to James Orsini, DVM, Dipl. ACVS, associate professor of surgery and director of the Laminitis Institute at the University of Pennsylvania’s New Bolton Center.

First, said Orsini, veterinarians must identify at-risk patients, such as those with a non-weight-bearing lameness or a systemic inflammatory response syndrome (SIRS, such as pleuropneumonia). "Treating the primary problem is an absolute imperative in laminitis prevention and early intervention," he explained.

Take a performance horse with a non-weight-bearing lameness, for instance: He might have suffered a fracture or a catastrophic breakdown of the suspensory apparatus and is stressed, exhausted, and painful. Compound that condition with the likelihood that he’s on a high-carbohydrate diet, and you have a recipe for laminitis development.

"The first order of business is to stabilize the patient medically and mechanically (i.e., using a bandage, splint, or cast to help him avoid developing a contralateral limb lameness) and provide pain relief while the injury is fully evaluated and the patient prepared for surgery," Orsini relayed.

If the injury cannot be stabilized, or if an instability develops (such as an infection or implant failure, implants being hardware such as screws/plates/wires used in surgical repair), the horse’s risk for developing supporting limb laminitis increases. Orsini recommended veterinarians monitor these animals closely for at least four to six weeks post-surgery to ensure no complications occur.

The next step in laminitis prevention in the stabilized patient is pain management to encourage even loading on all legs. Non-steroidal anti-inflammatoryatories (NSAIDs) are the first-line therapy, but opiates and other medications such as local anesthetics (lidocaine) or α-2 agonists (e.g., sedatives such as xylazine) might also be useful. Potential side effects of opiates, however, include anxiety, restlessness, and ileus (a lack of progressive motility in the gastrointestinal tract). Thus, other pain relief options might be needed and could include epidural analgesia, fentanyl (an opioid) transdermal patches, gabapentin (an anticonvulsant used to treat neuropathic pain in humans), and alternative therapies such as acupuncture or physical therapy.

"None of the currently available choices is the be-all and end-all of pain management in horses," Orsini added. "And rarely is just one drug or treatment modality adequate on its own in the severely painful patient."

The third laminitis prevention and/or intervention aspect is protecting the lamellar structures in the loaded limb. To achieve this, veterinarians should limit strain on the dermal-epidermal “bond” by applying hoof mechanics such as heel wedges or glue-on shoes. Veterinarians also need to protect and cushion the solar surface of the foot for comfort (if the laminitis cascade has begun, because of the increased pressure and weight-bearing or coffin bone sinking) as well as more evenly distributed weight-bearing. This can be achieved by avoiding hard surfaces, providing an optimal depth of stall bedding ("enough to cushion but not so much as to hamper movement," Orsini suggested), and applying a glue-on shoe packed with cushion material.

Orsini also suggested applying cryotherapy (cold therapy), employing multimodal anti-inflammatory therapy, monitoring SIRS-affected horses closely, and promoting good gastrointestinal health. No matter the approach, he concluded, "All hospitalized patients should be closely monitored until their condition is stable and they are well on the road to recovery."

**Recognizing Early Signs of Insulin Resistance before Laminitis Onset**

Early detection and intervention are key to managing any disease process. With laminitis, picking up on the subtle signs of hyperinsulinemia (high levels of insulin in the blood resulting from insulin resistance) before the horse suffers a serious laminitic event is one way caretakers and veterinarians can try to halt the hoof disease in its tracks. Donald Walsh, DVM, of the Animal Health Foundation, in Pacific, Mo., described easily detectable changes in hoof growth that might hint at the development of hyperinsulinemia and laminitis.

Laminitic changes associated with hyperinsulinemia start and progress slowly. Walsh believes abnormal division of insulin basal cells (the bottom cell layer of the epidermis) and stimulation of insulinlike growth factor receptors on laminar cells cause the laminae, which connect the horse's hoof to the coffin bone, to stretch and lengthen. "If hyperinsulinemia is not addressed and blood insulin levels normalized (through diet, exercise, and appropriate medication), then continued abnormal hoof growth may lead to further weakening of the laminae and the development of laminitis," he explained.

Early signs of hoof damage due to hyperinsulinemia can include abnormal growth rings in the external hoof wall and separation of the hoof wall from the white line when looking at the bottom of the horse’s foot, with “seedy” toe (increased width of the white line where the sole and the hoof wall meet) as the laminae weaken. Small areas of hemorrhage (caused by damage to the laminar vessels) in the seedy toe area might also be visible.

This process can be “somewhat reversible,” Walsh said, if caught early. Thus, “owners need to look for abnormal hoof growth, have their veterinarian check the horse’s insulin levels, and institute a low-carbohydrate diet and exercise program (even 10 minutes a day is beneficial) and medical treatments to restore (normal) insulin levels,” he concluded.

Regarding trimming and caring for these horses’ feet, Walsh suggested farriers
move the breakover back to reduce stress on the laminae; leave a little excess hoof wall on the sides of the foot to reduce sole pressure; and cauterize the seedy toe to prevent bacteria from entering.

The Toe Crena: A Laminitic Link?

Have you ever noticed that mysterious notch at mid-toe in the white line region of your horse’s foot and wondered what it is? This shallow notch comes in different shapes, sizes, and textures and might or might not extend to the outer hoof wall or up to the coffin bone. According to Lancaster, the purpose and relationship of the toe “crena” to toe wall health is relatively unknown, as no formal research has been conducted about it, but she presented her theories at the conference.

Not every horse has crenas on his feet (and in many horses they come, go, and evolve), so theories as to its existence include:
- The old belief that it’s a man-made injury, likely caused by unskilled farriers;
- It’s a coffin bone notch, or “toe stay,” for hoof stabilization that prevents twisting of the coffin bone; or
- It’s a vestigial remnant of a similar looking cleft found in the coffin bone of pre-horse species fossils.

In the limited crena research Lancaster has performed, she collected 18 feet from Quarter Horses euthanized for reasons unrelated to the feet and found that 15 had toe crenas on the sole surface. In five feet the crena extended up to the level of the coffin bone. Upon microscopic examination of the crena tissue at the coffin bone level, she determined it had “the histologic appearance of the laminar wedge (compromised tissue when the laminae separate) found in chronically laminitic feet.”

Lancaster noted that when the crena exists at both the sole surface and bone level the “laminar wedge-like” tissue appears to disrupt the normal laminar interface that should secure the coffin bone to the hoof wall. More research is needed, she said, to determine whether the crena is a marker of toe wall health or if this hoof characteristic could be used as a possible prognostic indicator in laminitic horses. As a precautionary method, she suggested owners, veterinarians, and farriers might want to monitor this region on the toe if a horse is undergoing laminitis treatment or other hoof rehabilitation.

Endocrinopathic Laminitis: An Incomplete Picture

Endocrinopathic laminitis—that which stems from hormonal conditions such as equine metabolic syndrome (EMS) or equine Cushing’s disease—is detected commonly in equine practice, but it continues to puzzle veterinarians and researchers alike. Ray Geor, BVSc, PhD, Dipl. ACVIM, professor and chair of large animal clinical sciences at Michigan State University’s College of Veterinary Medicine, spoke about “metabolic foot” topics he believes require more research.

It’s known that horses with endocrine disorders have an increased susceptibility for developing laminitis, and the whys and hows of this susceptibility are the subject of current research efforts by several groups around the world. Take EMS, for example: Over the past six or seven years researchers have made several breakthroughs in determining criteria related to this disease that are associated with laminitis risk, such as higher body condition score, higher serum triglyceride levels (fats), greater insulin response, and lower insulin sensitivity. However, Geor noted some significant knowledge gaps, including needs for:
- Better-defined characteristics (e.g., breed, age, activity level, diet) linked to endocrine-metabolic phenotypes (physical traits) associated with laminitis;
- Improved diagnostic approaches for identifying animals at risk for developing laminitis;
- An understanding of the mechanisms of laminar damage in these animals (i.e., why does laminitis occur?).

Geor noted that the importance of obesity and regional fat accumulation in laminitis development in horses is hazy. After all, he pointed out, “Not all fat horses are insulin resistant and laminitis-prone, and some insulin-resistant, laminitis-prone animals are not fat.” One hypothesis is that obesity might be tied to a pro-inflammatory state that could lead to laminitis, although recent work in this area suggests that high blood insulin concentrations rather than inflammation are key to the development of laminitis in EMS-affected horses.

Identifying horses and ponies at risk for developing laminitis is a key area for research, said Geor, because “more sensitive and specific diagnostic methods would facilitate early implementation of preventive measures so that laminitis can be avoided.”

Ultimately, Geor said, researchers are making exciting progress in the endocrinopathic laminitis picture, but it is still incomplete. An ongoing study involving researchers from the University of Minnesota, Michigan State University, and Tufts University promises to yield important new findings regarding EMS (see www.cvm.umn.edu/equinegenetics/ems/home.html for more information or to participate in this research project). In the meantime owners of horses with any metabolic or endocrine disorders should work with their veterinarians to monitor their horses’ laminitis risk.

Assessing Lameness Severity in Horses with Chronic Laminitis

The pain and lameness chronically laminitic horses experience are what make this disease a top concern for veterinarians. Evaluating lameness severity, however, is largely subjective. David Hood, DVM,
Now you can reduce the signs of PPID and help your horse get back to normal.¹

An estimated 1 in 7 horses or ponies over 15 years of age has PPID,² a condition that can make them seem older and increase their risk for dangerous conditions like laminitis. PRASCEND is the first and only FDA-licensed product that controls clinical signs of PPID. Early diagnosis and treatment are important, so if you’ve spotted the signs, PRASCEND can help your horse look and feel healthy and happy again.¹

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PhD, discussed using force plate-based technology for quantifying lameness severity in these horses.

Hood, who investigated the technology with colleagues at his Hoof Diagnostic and Rehabilitation Clinic (HDRC), in Bryan, Texas, explained that veterinarians typically diagnose chronic laminitis based on a horse's display of lameness and the characteristic laminitic stance, with forelimbs placed out in front and hind limbs positioned under the body. Disease severity is proportional to lameness pain; a horse severe pain has a grave prognosis.

In his observational study Hood evaluated 30 horses admitted to the HDRC and diagnosed with laminitis. He assigned each horse an Obel grade (from I to IV, where IV is extremely lame and reluctant to walk), which among veterinarians is currently the accepted subjective method of evaluating lameness in chronically laminitic horses. He also took radiographs to define which of the horses' feet were affected.

Each horse then stood on a force plate for five minutes so veterinarians could record the ground force reaction data, or how the horse was loading each foot. Researchers also calculated each horse's center of load (COL) and how it differed from that of a normal, healthy horse. From this information—termed the mean load stance pattern—the researchers determined correlations between a horse's stance and lameness; the COL and lameness; and stance and the foot involved.

Overall, Hood observed that:
- A laminitic horse's COL points to the least lame foot;
- Twenty-two horses (73%) had greater than 5% load difference between their forefeet. All horses favored one forefoot over the other;
- In the horses that it was displaced to the hind, the COL was displaced more to the left hind (14 horses) than the right hind (5 horses); and
- The greater the caudal displacement (toward the hind end), the greater the lameness severity.

In conclusion, Hood noted that this method of determining lameness severity in laminitic horses is relatively safe, as compared to jogging a horse over a hard surface. He also believes this to be a more objective and accurate lameness severity index, with no outside interference. Furthermore, it enhances the veterinarian's diagnosis and "is critical to evaluating and comparing treatments used in rehabilitation of the horse with chronic laminitis," said Hood.

**Understanding Chronic Lameness and Low-Dose Bute Use**

To treat any lameness issue a veterinarian must first identify the origins of pain and etiologies responsible—something that can be particularly challenging in a horse with laminitis. Hood shared some effective methods to pinpoint laminitic pain and explored using the NSAID piroxicam (Bute) to control it.

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**The use of low-dose corticosteroids such as dexamethasone in the acutely laminitic horse would decrease inflammation in the laminae and hoof capsule.**

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**DR. ROBERT BOSWELL**

Veterinarians often use differential nerve blocks to pinpoint pain's region of origin (e.g., solar, heel, fetlock, metacarpal, etc.). In a series of experiments using nerve blocks on chronically laminitic horses coupled with force plate evaluation of lameness severity, Hood noted the following results:

- Not all lameness is a result of pain avoidance (Some "appear to be related to chronic elevation of the heels and/or contracture of the flexor tendons and suspensory apparatus," Hood explained.);
- Most lameness originates in the solar and heel regions, rather than the laminae interface;
- Nondigital lameness (such as due to degenerative joint disease higher up in the limb) frequently is superimposed on digital lameness; and
- There is a high incidence of hind limb lameness in horses with chronic laminitis, attributed to "repeated overloading of the rear limbs in attempts to rise without fully loading the forefoot," said Hood.

Hood also described an experimental study on Bute's pain-relieving effects in which he administered low-dose oral Bute to 20 laminitic horses 30 minutes before morning feeding and performed a force plate-based stance analysis in the afternoon.

Hood noted rapid response (lameness improvement) in 30-50% of the horses within the first 24 hours. Their pain levels plateaued (stopped improving), however, after four to 10 days on this regimen. When treatment was discontinued after 10 days the horses all returned to their original levels of lameness within three to eight days. Hood's conclusions:

- Don't expect a rapid response to Bute administration, and don't elevate a horse's dosage until his pain levels have plateaued.
- NSAIDs do not address pathologies associated with laminitis.
- Owners should be forewarned of a delayed return to lameness in horses after Bute use has been discontinued.

**Treatment Methods**

**Low-Dose Corticosteroids** Laminitis treatment recommendations and therapies come and go: Some once considered gold standards have been abandoned altogether; and others resurface over time (e.g., icing acutely laminitic feet). Corticosteroids, which veterinarians have historically advised against using to treat laminitic horses, might be one of those therapies warranting reconsideration. With this in mind, Robert Boswell, DVM, a private practitioner in Wellington, Fla., discussed why he believes these potent anti-inflammatories are an effective treatment method.

When approaching a laminitis case, Boswell's goals include identifying and treating the cause of disease (as opposed to addressing just the clinical signs); supporting the bony column of the distal limb and the sensitive soft tissues within the hoof capsule; and treating inflammation aggressively and rapidly with tools such as ice, rest, dimethylsulfoxide (DMSO), and NSAIDs. Veterinarians often shy away from administering corticosteroids (such as dexamethasone and prednisone), however, due to possible systemic effects associated with high doses—including triggering laminitic episodes.

According the Boswell, corticosteroids’ (when used appropriately, in low doses) benefits should outweigh the risks. For instance, these drugs inhibit inflammatory mediator expression and decrease prostaglandin production (a fatty acid-derived compound that triggers an inflammatory response). He emphasized that no causal relationship exists between corticosteroid use and laminitis development; cases associated with corticosteroid use occurred with unreasonably high drug doses for long periods of time.
"I propose that if we are indeed intending to aggressively decrease inflammation we are not maximizing our chances for success by excluding low doses of corticosteroids," he said. "I believe that the use of low-dose corticosteroids would dramatically improve the outcomes for many of our laminitis patients."

Boswell reminded veterinarians to consider each laminitic horse’s clinical picture before prescribing corticosteroids. An insulin-resistant horse or one at risk for SIRS, for instance, might not be an appropriate candidate because high doses of corticosteroids can raise blood insulin levels. He said more research is needed to determine appropriate doses, administration rates, and if low doses also raise insulin levels.

In conclusion Boswell suggested that “the use of low-dose corticosteroids such as dexamethasone in the acutely laminitic horse, either systemically or via regional limb perfusion, would decrease inflammation in the laminae and hoof capsule.”

By incorporating corticosteroids into acute laminitis treatment regimens, veterinarians might start seeing a better overall response to initial therapies.

**Stem Cell Therapy** This regenerative approach has gained much press recently as a potential method for treating equine injuries. While scientific studies on its efficacy are scarce, Scott Morrison, DVM, of Rood & Riddle Equine Hospital’s podiatry unit, in Lexington, Ky., and other practitioners are using various stem cell approaches in their practice and recording results. Morrison described his success with umbilical cord-derived stem cells in nonresponsive chronic laminitis cases.

Using traditional treatment methods such as foot casts, deep flexor tenotomy, hoof wall resection, anti-inflammatory therapy, etc., Morrison previously had an 18% success rate (e.g., a return to pasture soundness) treating chronic, uncompensated (unstable coffin bone, or "sinker") laminitis cases; 88% success treating horses suffering from severe coffin bone rotation with sole penetration; and 44% success treating severe coffin bone disease (bone loss) cases. With the hope that stem cells could help promote better-quality tissue growth in the diseased foot, Morrison recently examined whether adding stem cell therapy to routine laminitis treatment could improve success rates.

Morrison relayed that he has used allogenic (from umbilical cord blood) stem cell therapy in 31 cases—three with severe

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The prevalence rises to 30% with increasing age.\(^2\)

**PPID (equine Cushing’s disease) is not just found in older horses.**

- PPID has been seen in horses as young as 7 years of age\(^3\)
- All breeds can be affected and there is no gender difference\(^3\)
- Up to 70% of horses seen for laminitis have been found to have PPID\(^4\)

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rotation of the coffin bone within the hoof capsule and the rest “sinks.” He said he chose to use allogenic cells because it’s crucial to begin treatment on these cases as soon as possible—veterinarians typically don’t have time to collect and harvest the horse’s own cells (which takes four to six weeks).

In these cases Morrison delivered doses of 25 million cells directly to the affected foot via regional perfusion (placing a tourniquet on the limb and injecting cells into a vein below the tourniquet) for 20-30 minutes. The average case received three doses of 20-25 million cells, or treatment every three to four weeks as needed. As soon as a month after treatment began, Morrison reported seeing new sole growth soon as a month after treatment began, every three to four weeks as needed. As soon as a month after treatment began, Morrison reported seeing new sole growth and coronary band regeneration of healthy wall in several horses. Among the 31 cases, he had success (again, pasture soundness) treating 65% (13 of 20) of acute sinkers, 100% (3 of 3) of severe rotation cases, and 37.5% (3 of 8) of severe bone disease cases using stem cell therapy. However, Morrison noted the first successful case is only 14 months out from initial treatment, and he still needs to determine long-term success rates.

Morrison added that although stem cell therapy might be useful for rehabilitating severe laminitis cases, traditional treatment methods should also be in place for a successful outcome. As promising as it is, stem cell therapy is still an inexact science, and clinicians continue to examine its use for treating laminitis cases. “Timing of treatment, route of administration, and histological studies of the tissue type generated after stem cell therapy are areas that need further investigation,” he concluded.

**Acupuncture** Veterinarians and horse owners consider this relatively simple treatment option for a variety of equine ailments, but little scientific evidence of its efficacy exists—particularly in regards to treating laminitis. Lancaster explored how this complementary therapy can be used as part of a multimodal approach to treating laminitis.

When treating laminitis, veterinarians’ goals include reducing the horse’s pain and inflammation, unloading the most compromised structures in the foot, and treating the underlying cause of the disease. Acupuncture can be useful and help boost traditional treatments’ efficacy, according to Lancaster, with its pain-relieving and anti-inflammatory effects and with its homeostatic (regulating) influences. The biggest asset this therapy offers for laminitis patients, however, is pain modulation.

“The needles send a message to the nervous system that can interrupt or reduce pain,” Lancaster explained. Acupuncture research (performed largely on lab animals and humans) has shown that it does this by regulating the nervous system. Since the nervous system controls the entire body, she explained, acupuncture can have beneficial effects on the whole horse.

Acupuncture “dosing”—how many needles the practitioner uses, what size they are, how long they stay in, and where they are placed—is not an exact science. However, Lancaster noted that placing needles around the hoof and coronary band as well as at other points on the limbs might promote blood flow and pain relief in both acute and chronic laminitis cases.

In chronic cases where musculoskeletal damage has occurred, pain relief beyond the foot might be warranted, and needles could theoretically be placed in many locations on the horse’s body.

In Lancaster’s experience, clinicians or horse owners typically see a positive response after two to three acupuncture treatments; but as with any treatment method, it’s not going to work 100% of the time.

“Acupuncture can be used in conjunction with standard protocols, both medical and surgical,” she concluded. “The safety profile and lack of contraindications make acupuncture worth trying in all laminitis patients.”

**Cryotherapy Methods** Cryotherapy, or cold therapy, has been shown to prevent laminitis in the at-risk equine patient and is often recommended for relieving pain and inflammation in the acutely laminitic horse. In a workshop at the 6th International Equine Conference on Laminitis and Diseases of the Foot, held Oct. 28-31 in West Palm Beach, Fla., three laminitis researchers discussed cryotherapy benefits methods.

Presenters included Christopher Pollit, BVSc, PhD, director of the Australian Equine Laminitis Research Unit and honorary professor of equine medicine at the University of Queensland’s School of Veterinary Science; Andrew van Eps, BVSc, PhD, MACVSc, and Dipl. ACVIM, senior lecturer in equine medicine at the University of Queensland’s School of Veterinary Science; and Orsini, all of whom have studied and practiced cryotherapy.

Cryotherapy is known to have anti-inflammatory effects, along with analgesia (pain relief), vasoconstriction (blood vessel narrowing), and hypometabolism (this reduces the metabolic demands of the foot; or, as Orsini explained it, “puts the foot into a temporary state of hibernation”). The therapy’s key mechanism is that it reduces enzymatic activity in the lamellar tissue by about 50% for every 10˚C drop in tissue temperature. Benefits of this include:

- Decreased pain and muscle spasm (a local anesthetic effect);
- Reduced edema (fluid swelling) due to increased blood viscosity and enhanced coagulation; and
- Reduced metabolic needs of the lamellar tissue and enzymatic action.
Prascend® (pergolide mesylate) Tablets, 1 mg

Dopamine receptor agonist for oral use in horses only

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\[
\text{HO-CH}_2-C-N\left(\text{CH}_3\right)\text{-C6H}_4\text{-NH-C6H}_4\text{-OH} \quad \text{HO-CH}_2-C-N\left(\text{CH}_3\right)\text{-C6H}_4\text{-NH-C6H}_4\text{-OH}
\]

Table 1 Dosing Table

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<th>Body weight</th>
<th>2 mcg/kg</th>
<th>4 mcg/kg</th>
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<tr>
<td>136 - 340 kg</td>
<td>0.5 tablet</td>
<td>1 tablet</td>
</tr>
<tr>
<td>341 - 567 kg</td>
<td>1 tablet</td>
<td>2 tablets</td>
</tr>
<tr>
<td>568 - 795 kg</td>
<td>1.5 tablets</td>
<td>3 tablets</td>
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<tr>
<td>796 - 1,022 kg</td>
<td>2 tablets</td>
<td>4 tablets</td>
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Dosage and Administration: Administer orally at a starting dose of 2 mcg/kg once daily. Dose may be adjusted to effect, not to exceed 4 mcg/kg daily. It has been reported that pergolide tablets may cause eye irritation, an irritating smell, or headache when Prascend Tablets are split or crushed. Prascend Tablets should not be crushed due to the potential for increased human exposure and care should be taken to minimize exposure when splitting tablets. The tablets are scored and the calculated dosage should be provided to the nearest one-half tablet increment (see Table 1).

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Adverse Reactions: A total of 122 horses treated with Prascend Tablets for six months were included in a field study safety analysis.

Table 2 Summary of the most common adverse reactions (N=122)

<table>
<thead>
<tr>
<th>Clinical sign</th>
<th># Cases</th>
<th>Cases (%)</th>
</tr>
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<tbody>
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<td>Decreased appetite</td>
<td>40</td>
<td>32.8</td>
</tr>
<tr>
<td>Lameness</td>
<td>22</td>
<td>18.0</td>
</tr>
<tr>
<td>Diarrhea/Loose stool</td>
<td>12</td>
<td>9.8</td>
</tr>
<tr>
<td>Colic</td>
<td>12</td>
<td>9.8</td>
</tr>
<tr>
<td>Lethargy</td>
<td>Abnormal Weight Loss</td>
<td>11</td>
</tr>
<tr>
<td>Laminis</td>
<td>10</td>
<td>8.2</td>
</tr>
<tr>
<td>Heart murmur</td>
<td>10</td>
<td>8.2</td>
</tr>
<tr>
<td>Death</td>
<td>8</td>
<td>6.6</td>
</tr>
<tr>
<td>Tooth disorder</td>
<td>8</td>
<td>6.6</td>
</tr>
<tr>
<td>Skin abscess</td>
<td>7</td>
<td>5.7</td>
</tr>
<tr>
<td>Musculoskeletal pain</td>
<td>6</td>
<td>4.9</td>
</tr>
<tr>
<td>Behavior change</td>
<td>6</td>
<td>4.9</td>
</tr>
</tbody>
</table>

Three new cases and 7 pre-existing, recurring cases of inappetence or decreased appetite occurred at one or more meals in 40 of 122 horses treated with Prascend. At the baseline evaluation 1.5% of owners reported a history of inappetence or decreased appetite as compared to the 32.8% of horses that experienced inappetence or decreased appetite during the study. Most cases of inappetence were transient and occurred during the first month of treatment; however, some horses experienced sporadic inappetence throughout the study. Two horses required a temporary reduction dose due to inappetance during the first month of the study. Both horses returned to their original dose within 30 days. Weight loss occurred in more than half of the horses in this study; however, weight loss that was considered abnormal was only reported in 11 horses. Lethargy was reported in 9.8% of horses during the study, and was not reported in any horses at the baseline evaluation. Behavioral changes were noted in 6 horses including aggression, kicking, agitation, nervous behavior and increased activity. One horse required a temporary reduction in dose due to energetic behavior during the first month of the study. Eight horses died or were euthanized during the study due to worsening of pre-existing conditions (laminis, dental disease, septic tenosynovitis) or colic (strangulating lipomas, large colon volvulus).

One mare was inadvertently enrolled in the study while pregnant and experienced dystocia resulting in the death of the foal. To report suspected adverse reactions, to obtain a Material Safety Data Sheet (MSDS), or for technical assistance, call (800) 525-7029.

Clinical Pharmacology: Pergolide mesylate is a synthetic ergot derivative and is a potent dopamine receptor agonist. As with other dopamine agonists, pergolide inhibits the release of prolactin which suggests that it may interfere with lactation. In a study in normal mares, 8.9% of mares treated with pergolide had decreased by half for 3 to 5 days and then titrated back up in 2 mcg/kg increments every 2 weeks until the desired effect is achieved.

Contraindications: Prascend is contraindicated in horses with hypersensitivity to pergolide mesylate or other ergot derivatives.

Warnings: Do not use in horses intended for human consumption.

Human Warnings: Not for use in humans. Keep this and all medications out of the reach of children. Prascend should not be administered by persons who have had adverse reactions to ergotamine or other ergot derivatives. Pregnant or lactating women should wear gloves when administering this product. It has been reported that pergolide tablets may cause eye irritation, an irritating smell, or headache when Prascend Tablets are split or crushed. Prascend Tablets should not be crushed due to the potential for increased human exposure and care should be taken to minimize exposure when splitting tablets. Consult a physician in case of accidental ingestion by humans.

Precautions: Treatment with Prascend may cause inappetence.

The use of Prascend in breeding, pregnant, or lactating horses has not been evaluated. The effects of pergolide mesylate on breeding, pregnant, or lactating horses are not known; however, the pharmacologic action of pergolide suggests that it may interfere with reproductive functions such as lactation.

Prascend is approximately 90% associated with plasma proteins. Use caution if administering Prascend with other drugs that affect protein binding. Dopamine antagonists, such as neurepinephrine, dopamine, reserpine, or metoclopramide, ordinarily should not be administered concurrently with Prascend (a dopamine agonist) since these agents may diminish the effectiveness of Prascend. Adverse Reactions: A total of 122 horses treated with Prascend Tablets for six months were included in a field study safety analysis.

Table 3 Proportion of Treatment Successes on Day 180

<table>
<thead>
<tr>
<th>Test</th>
<th># Animals</th>
<th>Baseline</th>
<th>Day 90</th>
<th>Day 180</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACTH</td>
<td>20</td>
<td>73.53</td>
<td>51.12</td>
<td>45.08</td>
</tr>
<tr>
<td>DEX</td>
<td>93</td>
<td>3.12</td>
<td>1.39</td>
<td>1.47</td>
</tr>
</tbody>
</table>

* Dexamethasone suppression test; Post dexamethasone cortisol concentration

Animal Safety: In a six month target animal safety study, healthy adult horses received Prascend administered orally, once daily, at doses of either 0 mcg/kg, 4 mcg/kg, 6 mcg/kg, or 8 mcg/kg (0X, 1X, 1.5X, or 2X the maximum recommended dose). Eight were healthy horses (four males and four females) in each treatment group. Doses were prepared by dissolving tablets in approximately 10 mL of a 50% sugar water solution.

Prascend treated groups had lower mean heart rates and higher mean temperatures than the control group. Horses in all treatment groups had minimum heart rates within the normal range and maximum temperatures below 101.5°F. One 1.5X horse experienced a mild episode of episodic colic on Day 3 that resolved after treatment with flunixin meglumine. Mean red blood cell counts and hemoglobin values were lower in Prascend treated groups as compared to the control group. Other hematology parameters including hematocrit, white blood cells, absolute neutrophils, and absolute lymphocytes exhibited mild, transient decreases as compared to the control group. The hematology parameters generally decreased over the first 30 to 60 days after treatment initiation and then returned to values similar to pre-treatment levels. No treatment-related alterations were identified on histopathology evaluation of bone marrow.

Storage: Store at or below 25°C (77°F).

How Supplied: Prascend (pergolide mesylate) Tablets are available in 1 mg strength - packaged 10 tablets per blister and 60 or 160 tablets per carton.

References:

Manufactured for:
Boehringer Ingelheim Vetmedica, Inc.
St. Joseph, MO 64506 U.S.A.

Made in Japan and packaged in Germany.

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Enrolled horses were diagnosed with PPID based on the presence of hirsutism and an abnormal study endocrine test result. All horses were treated with 2 mcg/kg Prascend (to the nearest one-half tablet) orally once daily for the first three months. If the endocrine test result on Day 90 was normal or adequately improved, the horse continued on the same dose through Day 180. If the endocrine test result on Day 90 was abnormal, the dose increased to 4 mcg/kg given once daily through Day 180. Forty-seven (41.6%) of the 113 horses included in the effectiveness database required a dose increase at Day 90. Improvement was noted in scores for all clinical sign categories and in mean results for endocrine tests.
Some cryotherapy methods are more labor-intensive or cost-prohibitive than others. Basic methods include icing and bandaging; applying an ice sleeve, ice pack wrap, or ice boot; or even tethering a horse in a pool of cold water for an extended period of time. More elaborate approaches include the Game Ready cooling and compression system—which the presenters considered a superior method to standard icing and ice boots; the Australian ice tub, which circulates ice water around horses’ limbs; and the Equine Spa, which has a built-in refrigerator unit and pump for circulating chilled water. Ideally, van Eps said he would like to see product manufacturers develop a swivel apparatus attached to ice boots that allows a horse to move around his stall while undergoing therapy.

Van Eps also noted that he prefers most horses to remain with their legs immersed in ice water for five to seven days. Interestingly, none of the researchers had documented any negative effects to horses’ hoof integrity due to prolonged submersion in water. However, potential adverse effects of this approach include:

- Excessive coagulation (more prone to blood clotting with certain diseases);
- Enhanced edema, possibly due to standing in one place for days;
- Immunosuppression (reduced disease-fighting ability) believed to be associated with a decrease in white blood cells reaching the foot tissues; and
- Altered mechanical properties of the tissue thought to be due to the temperature changes (and, thus, reduced flexibility) of the tissues.

The researchers noted that the range of suitable cryotherapy methods is limited only by one’s imagination, but that veterinarians and owners should remember cryotherapy’s positive effects stemming from the circulating action of the ice water. Such benefits cannot be achieved by simply standing a horse in a cold environment or material such as snow.

**Shoeing Strategies**

**Healing the Hoof During Therapy or Layup**

Whether caused by injury or lameness, time off from competition affords an opportunity for a farrier to make shoeing and trimming changes to accommodate a performance horse’s needs. Aaron Gygax, CJF, a sport horse farrier from Brittnau, Switzerland, explained how—with a veterinarian’s advice—a farrier can devise a hoof care plan that helps a horse return to performing as soon as possible.

“Making the most of this time helps speed recovery and improves the overall health and condition of the feet before the horse starts back in work,” he explained.

Gygax emphasized that communication between veterinarian, horse owner, rider, and farrier during this period is key. The farrier, in particular, needs to know how much time off the horse requires; if his layup is injury-related and, if so, due to what type of injury; and how much exercise he will be getting and on what surface (A horse that needs to be hand-walked over hard ground for injury recovery, for instance, should not be barefoot).

"An effective support system for the compromised hoof involves identifying the areas of compromise and then designing a specific strategy that addresses all the needs of that foot," said Morrison.

To identify these areas of compromise, Morrison might perform a thorough physical exam—paying special attention to palpating the coronary band—and take venograms (a procedure for visualizing blood flow within the foot) and radiographs of the foot. He then designs a shoeing strategy to achieve the following:

- Alter the hoof angle appropriately;
- Recruit the frog, sole, and bars into greater weight bearing;
- Unload or reduce weight bearing in a particular region of the hoof (generally, that which is most painful or affected by structural damage);
- Ease resistance to movement;
- Aid shock absorption; and
- Increase hoof capsule rigidity.

Morrison bases his treatment approach on each case’s level of severity.

Low-grade chronic, compensated case feet “often have toe cracks, not much hoof to nail shoes to, and (the outer hoof walls) are dish-shaped,” Morrison explained. With these horses he applies glue-on or mild mechanical shoes (the more mechanical the shoe, the more it increases the palmar angle), typically with a small heel wedge and a breakover point straight down from the coronary band to reduce tension on the laminae. (The laminae connect the coffin bone to the hoof wall and are compromised in laminitis.) After just a few shoeings, Morrison noted that these horses’ soles start to thicken, which is important for protection as well as for a weight bearing and support. His aim for horses in light use, such as broodmares, is to get them barefoot as soon as possible and continue to trim accordingly.
Horses with metabolic syndrome commonly exhibit compensated chronic laminitis, Morrison said, noting that cases in these animals are characterized by more severe hoof capsule distortion. Thus, these horses’ feet require additional sole support and more mechanics (more of a heel wedge) in their shoes.

“I trim for balance and shoe for support to accommodate the deep digital flexor tendon (DDFT, which runs down the back of the horse’s leg and attaches to the back of the coffin bone),” he explained. “I try to get the bottom or solar surface of the coffin bone more parallel to the ground, trim the heel, and then use a wedge to decrease tension on the DDFT and establish a more even weight distribution over the solar surface of P3 (the distal phalanx or coffin bone).”

When hoof growth from heel to toe returns to normal, Morrison considers it balanced, and at this point the farrier can reduce the degree of heel wedge gradually, depending on hoof capsule growth and the horse’s comfort level.

Morrison said he considers uncompensated cases the “train wreck” cases. In these horses he might perform a deep digi-pensated cases the “train wreck” cases. In horse’s comfort level.

reduce the degree of heel wedge gradually, returns to normal, Morrison considers it coffin bone).”

a more even weight distribution over the crease tension on the DDFT and establish trim the heel, and then use a wedge to decrease tension on the DDFT and establish a more even weight distribution over the solar surface of P3 (the distal phalanx or coffin bone).

Regardless of a laminitis case’s severity, Morrison said rehabilitation is aimed at altering the sole and coronary band’s growth patterns. “The foot essentially re-balances itself with our mechanical help. It’s a process,” he explained. “Once the foot is balanced (even wall growth in the toe and heels, mentioned above, with good sole depth and normal coffin bone angle) the mechanics can be scaled down to various degrees depending on the integrity of the lamellar attachments. Since the coffin bone is the foundation upon which the hoof capsule is formed, a healthy bone is imperative for long-term success.”

Using Foot Casts to Manage Laminitis ‘Sinking’ Cases Mechanical collapse, or “sinking,” of the P3 is a devastating complication of laminitis. Prognoses for these cases are often poor; but foot casts might improve horses’ survival rates if applied early in the sinking process. Raul Bras, DVM, CJF, of Rood & Riddle Equine Hospital’s podiatry center, in Lexington, Ky., relayed his and colleagues’ experiences using foot casts on laminitic horses.

When treating a laminitic horse, Bras’ objectives for limiting coffin bone displacement include reducing the horse’s body weight to lessen the load on the foot; ensuring weight bearing is shared by the sole and frog; redistributing weight bearing from the most stressed portion of the wall to the least stressed; and decreasing mechanical forces around the coffin joint. He explained that the benefits of using a foot cast to achieve this include:

- Stabilizing the entire foot;
- Decreasing individual movement of the hoof capsule and bony column—essentially making these a single unit;
- Reducing shearing and twisting of the lamellar interface; and
- Providing axial (inner hoof wall) support and ease of breakover in all directions.

To determine how effective foot casts are in treating displacement cases, Bras reviewed Rood & Riddle records from 2005 to 11 of 43 horses with laminitis secondary to a systemic illness (e.g., colitis, pneumonia) that were treated with foot casts. The majority of horses were Thoroughbred broodmares, but a variety of other breeds also were represented.

The horses were monitored initially for early clinical signs of displacement such as coronary band ledging, in which a ledge or depression can be felt in the soft tissue nearest the hoof wall. The treating vet then performed subcoronary grooving in each animal’s hoof wall about a half inch below the hairline to try to relieve pressure prior to applying a cast. He or she applied a sole support material, a felt pad (to avoid cast sores), Stockinette cotton cast padding, and fiberglass casting tape to create a cast encasing the entire foot and pastern. Once the cast was set the vet applied a shallow dome made of acrylic material to the ground surface of the cast, allowing the foot to break over in any direction and focusing the load under the coffin joint.

Casts remained on the horses for about 30 days before removal and hoof reevaluation. The veterinarian reapplied each cast as many times as needed and removed it when displacement was no longer evident. Long-term follow-up on these horses continued for at least two years, and their outcomes were considered successful if they were pasture sound. Of these horses, 47% survived, which is a better-than-expected outcome, according to Bras.

Thus, “foot casts are an effective technique to manage (coffin bone) displacement of horses with acute or early chronic laminitis,” Bras concluded. “The whole idea is to prevent further damage.”

ABOUT THE AUTHOR
Alexandra Beckstett is the Features/Departments Editor for The Horse: Your Guide to Equine Health Care.