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Spring 2020

**AAEP Convention
Wrap-Up Issue**

**Equine Health
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Veterinarian Wellness

**The Business
of Practice**

**Infectious Disease
Committee Report**

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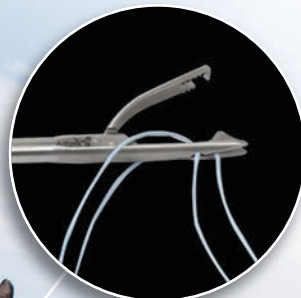


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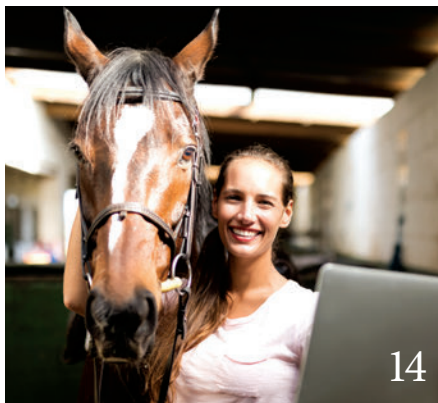
There were many outstanding business presentations at the 2019 AAEP Convention. Here are synopses of a few of those talks.

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Convention Highlights

We are excited to bring you information from the 2019 AAEP Convention and the NEAEP Symposium in this magazine. We wish we could bring you more content from these educational gatherings, because there truly was something for everyone.

The AAEP Convention is the largest educational gathering for equine veterinarians in the world. The 2019 AAEP Convention contained not only equine research and medical presentations, but discussions on business, veterinarian wellness, ethics and gender equality. There were wet labs (some presented by ISELP) and dry labs, round table discussions and committee meetings.

Every year, however, veterinarians tell me that one of the best things about the AAEP Convention is the "hallway meetings" that they have with friends, colleagues and presenters. Those one-on-one or small group discussions provide opportunities to clarify questions about tough cases, learn about a fellow practitioner's techniques and simply commune with those who understand the life of an equine veterinarian.

In this issue, you will find four different sections of AAEP Convention coverage: equine medical/research, veterinarian wellness, the business of equine veterinary practice and a report from the AAEP Infectious Diseases Committee.

NEAEP

EquiManagement has also partnered with Soft-Ride to bring you information from the 2019 NEAEP Symposium, held in Saratoga Springs, New York. The NEAEP is unique in that it caters to an audience of equine veterinarians and farriers, striving to enhance that relationship in order to better serve the horse.

The full day of various hands-on wet labs at NEAEP is one of the highlights of the Symposium. You could learn from some of the country's finest veterinarians and farriers in a small-class setting.

Also, the NEAEP is our newest official Media Partner. Welcome to all NEAEP members!

Disease Du Jour

We are happy to announce that Merck Animal Health is the 2020 sponsor of the EquiManagement Disease Du Jour bi-monthly podcast. We launched Disease Du Jour in late April 2019. The audience has grown steadily and has very high retention rates (meaning that folks listen to the whole podcast).



We hope you have been enjoying past Disease Du Jour podcasts and will join us for future podcasts every other Thursday! You can find information on past Disease Du Jour podcasts on EquiManagement.com. In addition, you can listen to or download episodes of Disease Du Jour on iTunes, SoundCloud, Stitcher or your favorite podcast platform.

EPM Society Partnership

We also welcome the EPM Society as an official Media Partner of EquiManagement! We have worked with this organization of veterinarians and researchers for a long time, and we applaud all that they do in this important area of horse health.

Welcome New Editorial Advisory Board Members

EquiManagement uses many veterinarians and researchers to help us bring great information to our readers. We welcome new editorial advisory board members Drs. Katie Flynn and Rick Mitchell. **EM**



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***Rhodococcus* Vaccine**

Rhodococcus equi (*R. equi*) granulomatous pneumonia in foals is a difficult disease to manage or prevent. Recently, Alopexx announced a licensing agreement with Merck Animal Health to develop and commercialize a vaccine for *R. equi*. It is referred to as a poly-N-acetyl glucosamine (PNAG) vaccine, which might have additional applications for equine (and human) disease.

The target of PNAG is a surface capsule polysaccharide that bacteria, fungi and protozoa produce, making this a potential broad-spectrum, antibody-mediated approach to infectious disease.

A recent study involved a collaboration of Noah Cohen, VMD, MPH, PhD, DACVIM, at the Equine Infectious Disease Laboratory at the College of Veterinary Medicine & Biomedical Sciences at Texas A&M University, with Colette Cywes-Bentley, PhD, and Gerald Pier, PhD, in conjunction with

Brigham and Women's Hospital and Harvard Medical School [Cywes-Bentley, C.; Rocha, J.N.; Bordin, A.I., et al. Antibody to Poly-N-acetyl glucosamine provides protection against intracellular pathogens: Mechanism of action and validation in horse foals challenged with *Rhodococcus equi*. *PLOS Pathogen*, July 19, 2018. <https://doi.org/10.1371/journal.ppat.1007160>].

Mares were vaccinated with the PNAG *R. equi* vaccine six weeks and three weeks prior to expected parturition. Antibody to *R. equi* was expected to pass to the foal via the colostrum. The PNAG *R. equi* vaccine has so far demonstrated 91% protective efficacy against *R. equi* in 11 of 12 foals born to immunized mares. In contrast, 86% (6 of 7) foals born to unvaccinated mares developed pneumonia.

Another study examined the efficacy of providing PNAG-hyperimmune plasma for passive immunization. 100%

of five foals given this plasma did not develop disease, whereas all four foals receiving normal plasma did.

The study noted: "Killing of intracellular organisms depends on antibody recognition of surface expression of PNAG on infected cells, along with complement deposition and neutrophil-assisted lysis of infected macrophages."

Future development of this vaccine holds promise for a number of intracellular bacterial pathogens.

Colic Following Gastroscopy

It is common practice to fast a horse overnight, then evaluate it for stomach ulcers using a gastroscope. A United Kingdom study examined post-gastroscopy complications, including the incidence of colic [Spanton, J.A.; Smith, L.; Mair, T.S. A clinical audit of the prevalence of colic in the 48 hours following gastroscopy in 436 horses.



ISTOCK/LISA DUKA

***R. equi* granulomatous pneumonia in foals is a difficult disease to manage or prevent. Research on a PNAG vaccine and a PNAG-hyperimmune plasma for passive immunization is ongoing.**

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Equine Veterinary Education 2019, doi: 10.1111/eve.13144].

Over five years at two equine clinics, there was a total of 573 gastroscopic exams in 436 horses. The exams lasted five to 30 minutes with most horses under sedation. The stomach was insufflated for best visualization in all but four cases. In the following 48 hours, nearly 3% of horses (17/573) experienced colic. All but one of the 17 colic incidents were mild and responded to analgesia and/or walking. The single serious colic incident (in a horse with a history of recurrent colic) required exploratory laparotomy. Of the 17 post-gastroscopic colic incidents, 12 were investigated with gastroscopy for unexplained colic—these were diagnosed with gastric impaction.

The study reconsidered colic post-gastroscopy by eliminating the 12 cases of gastric impaction. That resulted in 5/561 horses (0.9%) having complications in the 48 hours following gastroscopy. The five horses were examined due to colic, recurrent colic or exercise intolerance. The authors reported that two of five horses might have developed colic post-procedure due to incomplete deflation of the stomach. However, of

569 exams accompanied by insufflation, 180 were not deflated yet did not colic.

There was no relationship between grade of equine gastric ulcer syndrome (EGUS) and post-gastroscopy colic. In fact, 14 of the 17 post-exam colic cases did not have evidence of EGUS. Medication—omeprazole, sucralfate, flunixin meglumine—given on the day of gastroscopy also had no bearing on post-gastroscopy colic.

The study concluded that colic following gastroscopy is infrequent, at a rate of about 3%. Horses with gastric impactions seemed more likely to develop colic following the procedure. Colic that does occur following gastroscopy tends to be mild and easily resolved with conservative treatment.

DMSO Effects on Gastric Emptying

Horses affected by a variety of systemic inflammatory diseases—intestinal strangulation, colitis, metritis, pleuritis—develop endotoxemia, which adversely delays gastric emptying. It is thought that oxidative damage might be one consequence of endotoxin effects.

A study looked at the use of an antioxidant—dimethyl sulfoxide (DMSO)—



ARND BRONKHORST PHOTOGRAPHY

About 3% of horses that underwent gastroscopy then experienced colic. This colic tends to be mild and easily resolved with conservative treatments.

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Many diseases delay gastric emptying, so researchers looked at DMSO to see if it could protect against oxidative damage and improve gastric emptying.

to see if it could protect against oxidative damage and improve gastric emptying in the face of endotoxemia [Kelmer, G.; Doherty, T.J.; Elliott, S., et al. Evaluation of Dimethyl Sulfoxide Effects on Endotoxin-Induced Delayed

Gastric Emptying in Horses. *Israel Journal of Veterinary Medicine* Sept 2019, vol. 74, no. 3].

Three groups of six horses each were administered five liters of different solutions intravenously over an hour, then

given intravenous lipopolysaccharide (LPS, 0.2 ug/kg bwt) diluted in 1 liter of sodium chloride over 30 minutes:

1. Normosol + LPS
2. High-dose (1 g/kg bwt) DMSO + LPS
3. Low-dose (20 mg/kg bwt) DMSO + LPS
4. DMSO + saline

Horses in the DMSO-saline group were given a two-week washout period, then were randomly assigned to an LPS group. All of the horses also received acetaminophen (20 mg/kg) in 1 liter of tap water via nasogastric tube to enable measurement of gastric emptying. Acetaminophen is unaltered in the stomach and passes to the small intestine, where it is absorbed. Blood measurement of acetaminophen then indicates the rate of absorption based on gastric emptying.

The results were informative. All horses given LPS experienced delayed

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gastric emptying. DMSO did not minimize LPS adverse effects on gastric emptying, but it also did not further delay it. Interestingly, low-dose DMSO exacerbated LPS-induced delay in gastric emptying.

The researchers conclude that while DMSO exerts intestinal anti-ischemic intestinal effects and minimizes small intestinal adhesions, DMSO has no protective effect against LPS-induced delayed gastric emptying in horses.

Owner-Observed Clinical Signs Associated with Intestinal Sand

In many cases of sand colic, it is not until a horse demonstrates overt clinical signs that an owner is made aware of this problem. Clinical signs are often vague and intermittent—poor performance, diarrhea, loose feces, mild colic, weight loss or sensitivity to touch of

the abdominal wall. Radiographs of the cranio-ventral abdomen can give a visual diagnosis of the presence and amount of sand accumulation in the intestinal tract.

A Finnish study sought to correlate owner-reported clinical signs with the presence and size of intestinal sand accumulations [Niinisto, K.E.; Maatta, M.A., et al. Owner-Reported Clinical Signs and Management-Related Factors in Horses Radiographed for Intestinal Sand Accumulation. *Journal of Equine Veterinary Science* 2019, vol 80; pp. 10-15].

The survey was available to horse owners from September 2015 to November 2016. The questionnaire asked 447 respondents to recall the horse's clinical signs and management before and at the time of radiographic confirmation of sand accumulation.

Owners witnessed 69 horses eating

sand. Of those, 14 (20%) had no sand, 16 (23%) had small amounts, 21 (30%) had moderate amounts, and 18 (26%) had large accumulations.

More than half (66%) demonstrated more than one clinical sign. Those with colic signs and/or poor performance had significantly larger sand accumulations than those not displaying colic or poor performance. The greatest odds ratio of being afflicted with sand irritation correlated to a combination of colic and poor performance, with the next highest odds ration correlated to colic combined with diarrhea or hyperesthesia to touch of the abdominal wall.

Weight loss was an uncommon finding in this study, whereas poor hair coat, mild abdominal pain or abdominal sensitivity to touch were more common.

Other signs that horse owners noted included irritated or angry behavior, stretching stance or difficulty urinating, bloated abdomen, poor hair coat, girthing sensitivity, weight loss, hind limb kicking, bucking, swelling, teeth grinding, increased intestinal sounds, skittishness and reluctance to move.

Some owners did not identify any clinical signs despite the horses having large sand accumulations.

Of note, there were no significant differences between size of sand accumulation and housing or feeding practices, season or stereotypic behaviors. Instead, the size of sand accumulation correlated with how much roughage the horses consumed. Those individuals with a greedy appetite consumed more sand. Hierarchical position in the herd had an effect in that dominant horses had less sand, possibly because they access the better parts of the feed that are not directly on the ground. The method of feeding did not correlate directly with sand accumulation.

Another point made in the study is that some horses might accumulate sand due to an initial decline in intestinal motility that enables accumulation and lessens its rate of removal. **EM**

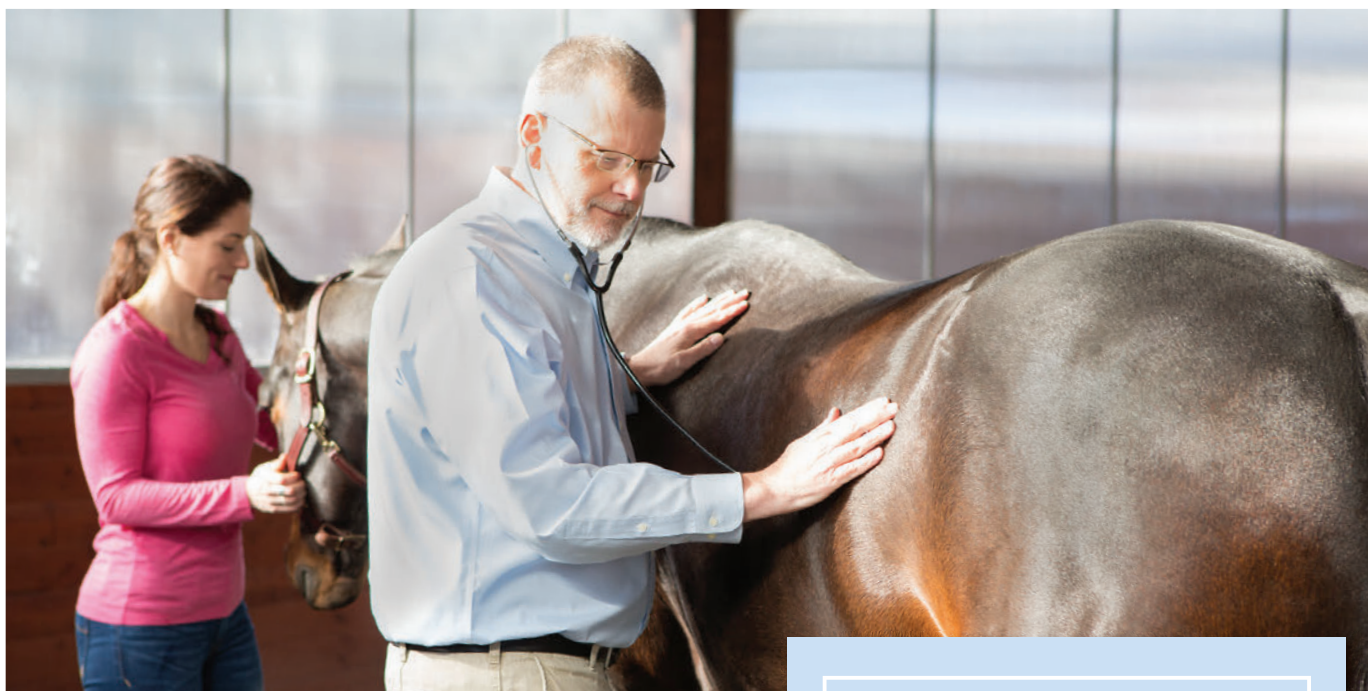
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Social Media Marketing

Social media is a powerful tool that your veterinary practice can utilize to strengthen and grow relationships with clients in the equine world. It allows you a simple and inexpensive opportunity to connect with horse owners and earn their business and loyalty, as well as a providing a platform for education. Clients love to feel connected to their veterinarians, and social media gives you an opportunity to start or join the conversation.

60 million of them using the platform. Instagram ranks second with about 45 million. In fact, research findings in 2019 indicated that Facebook is the most widely used social network among all age groups except teenagers. Although the growth of users slowed, there were 169.5 million Facebook users in the United States last year. And don't think your older clients don't participate—68% of Baby Boomers use Facebook.

If you're ready to get your clinic on social media or recognize that you need to do a better job promoting your practice, there are several important strategies that will make it more successful.

Choose a team member you trust to manage your social media profiles if you don't wish to perform this task yourself. Millennial staff members and associates are natural choices. You should expect

this employee to dedicate about two hours every week to posting, responding and managing the social media accounts. With the team member's input, choose which platform(s) you are most comfortable with to start—one or two is a good number initially. Platforms include Facebook, Google+, Twitter, LinkedIn, YouTube, Pinterest and Instagram. The key is using a platform that your clients and potential clients already use.

Next, determine a schedule for the postings. Because it is important to have consistent postings to maintain interest,

scheduling your posts in advance can minimize the hassle. With platforms that are used mostly with shorter posts or pictures (Facebook, Twitter, Instagram), posting once a day to several times a day is fine. On other platforms that lend themselves to more lengthy content (Google+, LinkedIn, YouTube), you don't have to post more than twice a week. Creating days of the week for certain types of content (e.g. "Mini Monday" or "Case of the Week Wednesday") can build followers and stimulate engagement with your posts. The more people respond to what you offer, the more likely they are to remember your brand. Showcasing your staff, patient success stories (with client permission, of course) and explaining disease outbreaks that have horse owners' attention are all winning ways to please your audience.

Visual content is significantly more engaging than plain text, so use images whenever you can. Obey copyright laws when posting any images. You can determine what type of content gains the most responses by utilizing each platform's analytical reporting. Because you're trying to open a dialogue with your clients, it is important to respond to their comments, whether they are positive or negative. While you don't need to respond to *every* comment, it will demonstrate that you are listening if your practice responds promptly to comments.

Because managing social media accounts is a fairly simple endeavor, it is not necessary to outsource this task, but if you prefer to do so, there are plenty of options for companies to help you. What is important is that you embrace the concept of marketing on a platform that is widely viewed by the clients you want and serve. **EM**



ISTOCK

Are your clients on social media? Millennials (those born between 1981 and 1996) are increasingly your clients, and they closely follow Baby Boomers as the largest segment in the U.S. population. Millennials readily adopt the latest technology, spend more on their pets (including veterinary care and pet services), and regularly use social media to connect with brands and services, as well as read online reviews before making purchase decisions.

Facebook is the most-used social network among U.S. millennials, with about



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Research Coverage from the AAEP Convention

Read synopses from selected presentations and table topics.

By Nancy S. Loving, DVM

The vast number of presentations at the 2019 AAEP Convention in Denver, Colorado, meant that there was something to interest everyone. In fact, practitioners often found they had more than one presentation they wanted to attend that were scheduled at the same time!

In this article we bring you summaries of a variety of presentations from the three days of the 65th AAEP Convention.

Table Topics

At the AAEP Convention each year,

table topics are well attended by members enthusiastic about discussions on a specific area of focus. Questions are submitted to the moderators, and each point is touched upon. Audience members actively participate in the discussions. It is a great give-and-take grounded in evidence-based science and practice experience.

PPID Cases

The table topic of endocrine disease discoveries was moderated by Nick Frank, DVM, PhD, and Hal Schott II, DVM, PhD, DACVIM, to a packed room. Equine practitioners first wanted

to talk about refractory cases of pituitary pars intermedia dysfunction (PPID) and how to handle these difficult cases. It was suggested that it is important to see improvements in clinical signs, although there might not be any appreciable change in ACTH values.

For situations where clinical improvement lags behind ACTH levels remaining above normal values, the suggestion is to progressively increase pergolide by about 1 mg, then re-evaluate in 30-60 days. A daily dose as high as 3-5 mg can be administered to a 500 kg horse.

Equine metabolic syndrome (EMS) horses that develop PPID are also at



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A slightly higher ACTH cutoff might be used when testing for PPID in gray horses, based on research done by Professor Andy Durham.

increased risk of developing laminitis due to increased insulin concentrations. If higher pergolide doses don't achieve results, it is possible to add cyproheptadine, which is less expensive. The risk of laminitis is a predominant concern in managing these horses.

For horses with ACTH results that don't match the horse's clinical appearance, the best surveillance of beginning stages of PPID relies on the thyrotropin-releasing (TRH) hormone test. Other hormones are likely present, yet assays aren't currently available for these. In some cases, a therapeutic trial of pergolide might be appropriate.

Horses afflicted with equine metabolic syndrome also might have the genetics to develop hyperinsulinemia and PPID. They should be closely monitored for early signs of PPID—lethargy, decreased performance, decreased activity, decreased muscle mass on the topline, an easy keeper who starts having trouble maintaining condition, and any changes in haircoat (such as slower shedding or winter hairs retained behind the elbows and on the backs of legs).

Original Prascend Trial: In the initial trials of pergolide (Prascend), 30 horses were monitored for 10½ years. Most required an increased dosage after five to six years of treatment. Of the 30 in the initial study, 26 died or were euthanized. Four of these had chronic laminitis; the others were euthanized due to osteoarthritis or strangulating lipoma, or were lost to natural death.

Monitoring and Testing During Pergolide Treatment: Frank and Schott

noted that usually horses with moderate or severe PPID can be diagnosed with a resting ACTH. Daily treatment can begin with 1 mg pergolide and ACTH retested in 30 days. It is desirable to see some response—a significant decrease or return to normal of resting ACTH values.

The TRH stimulation test is useful for suspected PPID cases that are mildly affected. If the suspicion of a mild problem falls within July through November, Frank advised that it is acceptable to wait until after November to do the testing. Horses diagnosed with PPID using the TRH stimulation test can be put on 1 mg pergolide, monitored and rechecked in six months with resting ACTH. It might be difficult to interpret a repeat TRH stimulation test, and there is not always a decline in ACTH levels. Therefore, Frank and Schott recommend to retest using resting ACTH.

TRH Stimulation Test: Vets wanted to know whether a horse should be fasted prior to administering the TRH stimulation test. Studies that have combined oral sugar test with the TRH stimulation test found that corn syrup and grain interfere with the TRH stimulation test. The recommendation is to refrain from feeding grain the night before or the morning of a TRH stimulation test.

Best practice is to perform the TRH stimulation test first, which only takes 10 minutes; then follow up with the oral sugar test, which takes 1½ hours.

Due to seasonal ACTH changes that lead to elevated ACTH levels in autumn months, the TRH stimulation test

shouldn't be used from July to November due to the difficulty in interpretation of values. However, if this test is done in the fall months and comes back negative, then it is definitely negative. It was also noted that there are breed variabilities, so it is important to correlate the TRH stimulation test with clinical signs. Any ACTH value of 200 pg/ml is considered positive for PPID; 110-200 pg/ml ACTH is equivocal for the TRH stimulation test.

Leptin as an Aid to Diagnosis: Leptin is secreted from fat and signals the hypothalamus about level of satiety. More adiposity means a horse will have higher leptin concentrations. Some individuals have internal adiposity that is not easily recognized, particularly when they lay down—fat in the subcutaneous tissues, as many warmbloods have. If leptin is high, a practitioner can use this lab value to demonstrate to a client how a horse's adiposity is affecting its insulin state.

Horses That Don't Tolerate Prascend: About 5% of horses treated with pergolide might experience appetite suppression from the medication. Sometimes it helps to lower the dose or start over at the low dose of half a tab (1/2 mg) every other day. Another suggested technique is to give less feed the night before, so the horse is hungry in the morning; or to try novel feed types and tastes. Another suggestion is to try compounded formulations of pergolide.

Magnesium, Thyro-L, Metformin: Magnesium is an important cofactor for insulin signaling. There might be low

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pyrexia in horses



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**When administered according to label directions.*

Zimeta is indicated for the control of pyrexia in horses

Important Safety Information

Zimeta™ (dipyrone injection) should not be used more frequently than every 12 hours. For use in horses only. Do not use in horses with a hypersensitivity to dipyrone, horses intended for human consumption or any food producing animals, including lactating dairy animals. Not for use in humans, avoid contact with skin and keep out of reach of children. Take care to avoid accidental self-injection and use routine precautions when handling and using loaded syringes. Prior to use, horses should undergo a thorough history and physical examination. Monitor for clinical signs of coagulopathy and use caution in horses at risk for hemorrhage. Concomitant use with other NSAIDs, corticosteroids and nephrotoxic drugs, should be avoided. As a class, NSAIDs may be associated with gastrointestinal, renal, and hepatic toxicity. The most common adverse reactions observed during clinical trials were Elevated Serum Sorbitol Dehydrogenase (SDH), Hypoalbuminemia and Gastric Ulcers. **For additional information, see brief summary of prescribing information on the following page.**

References: 1. Zimeta™ (dipyrone injection). [Full Prescribing Information], Kindred Biosciences, Inc. (Burlingame, CA). Revised: 03/2019. 2. Morressey PR, et al. Randomized blinded controlled trial of dipyrone as a treatment for pyrexia in horses. *Am J Vet Res.* 2019;80(3):294-299.

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**Zimeta™
(dipyrone injection)**

500mg/mL injection

For intravenous use in horses
Non-steroidal anti-inflammatory drug (NSAID)

CAUTION: Federal law (U.S.A.) restricts this drug to use by or on the order of a licensed veterinarian.

Before using this product, please consult the product insert, a summary of which follows:

Indication: Zimeta™ (dipyrone injection) is indicated for the control of pyrexia in horses.

Dosage and Administration: Always provide the Client Information Sheet with the prescription. Administer Zimeta by intravenous injection, once or twice daily, at 12 hour intervals, for up to three days, at a dosage of 30 mg/kg (13.6 mg/lb). **See product insert for complete dosing and administration information.**

Contraindications: Horses with hypersensitivity to dipyrone should not receive Zimeta. Due to the prolongation of prothrombin time (PT) and associated clinical signs of coagulopathy, dipyrone should not be given more frequently than every 12 hours.

Warnings: For use in horses only. Do not use in horses intended for human consumption. Do not use in any food producing animals, including lactating dairy animals.

Human Warnings: Care should be taken to ensure that dipyrone is not accidentally injected into humans as studies have indicated that dipyrone can cause agranulocytosis in humans.

Not for use in humans. Keep this and all drugs out of reach of children. In case of accidental exposure, contact a physician immediately. Direct contact with the skin should be avoided. If contact occurs, the skin should be washed immediately with soap and water. As with all injectable drugs causing profound physiological effects, routine precautions should be employed by practitioners when handling and using loaded syringes to prevent accidental self-injection.

Precautions: Horses should undergo a thorough history and physical examination before initiation of any NSAID therapy.

As a class, NSAIDs may be associated with platelet dysfunction and coagulopathy. Zimeta has been shown to cause prolongation of coagulation parameters in horses. Therefore, horses on Zimeta should be monitored for clinical signs of coagulopathy. Caution should be used in horses at risk for hemorrhage.

As a class, NSAIDs may be associated with gastrointestinal, renal, and hepatic toxicity. Sensitivity to drug-associated adverse events varies with the individual patient. Consider stopping therapy if adverse reactions, such as prolonged inappetence or abnormal feces, could be attributed to gastrointestinal toxicity. Patients at greatest risk for adverse events are those that are dehydrated, on diuretic therapy, or those with existing renal, cardiovascular, and/or hepatic dysfunction. Concurrent administration of potentially nephrotoxic drugs should be carefully approached or avoided. Since many NSAIDs possess the potential to produce gastrointestinal ulcerations and/or gastrointestinal perforation, concomitant use of Zimeta with other anti-inflammatory drugs, such as NSAIDs or corticosteroids, should be avoided. The influence of concomitant drugs that may inhibit the metabolism of Zimeta has not been evaluated. Drug compatibility should be monitored in patients requiring adjunctive therapy.

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

Adverse Reactions: Adverse reactions reported in a controlled field study of 138 horses of various breeds, ranging in age from 1 to 32 years of age, treated with Zimeta (n=107) or control product (n=31) are summarized in Table 1. The control product was a vehicle control (solution minus

dipyrone) with additional ingredients added to maintain masking during administration.

Table 1: Adverse Reactions Reported During the Field Study with Zimeta

Adverse Reaction	Zimeta™ (dipyrone injection) (N=107)	Control Product (N=31)
Elevated Serum Sorbitol Dehydro- genase (SDH)	5 (5%)	5 (16%)
Hypalbuminemia	3 (3%)	1 (3%)
Gastric Ulcers	2 (2%)	0 (0%)
Hyperemic Mucosa Right Dorsal Colon	1 (1%)	0 (0%)
Prolonged Activated Partial Thromboplastin Time (APTT)	1 (1%)	0 (0%)
Elevated Creatinine	1 (1%)	0 (0%)
Injection Site Reaction	1 (1%)	0 (0%)
Anorexia	1 (1%)	1 (3%)

**See Product Insert for complete
Adverse Reaction information.**

Information for Owners or Person Treating Horse: A Client Information Sheet should be provided to the person treating the horse. Treatment administrators and caretakers should be aware of the potential for adverse reactions and the clinical signs associated with NSAID intolerance. Adverse reactions may include colic, diarrhea, and decreased appetite. Serious adverse reactions can occur without warning and, in some situations, result in death. Clients should be advised to discontinue NSAID therapy and contact their veterinarian immediately if any signs of intolerance are observed.

Effectiveness: The effectiveness phase was a randomized, masked, controlled, multicenter, field study conducted to evaluate the effectiveness of Zimeta™ (dipyrone injection) administered intravenously at 30 mg/kg bodyweight in horses over one year of age with naturally occurring fevers. Enrolled horses had a rectal temperature $\geq 102.0^{\circ}\text{F}$. A horse was considered a treatment success if 6 hours following a single dose of study drug administration the rectal temperature decreased $\geq 2.0^{\circ}\text{F}$ from hour 0, or the temperature decreased to normal ($\leq 101.0^{\circ}\text{F}$).

One hundred and thirty-eight horses received treatment (104 Zimeta and 34 control product) and 137 horses (103 Zimeta and 34 control product) were included in the statistical analysis for effectiveness. At 6 hours post-treatment, the success rate was 74.8% (77/103) of Zimeta treated horses and 20.6% (7/34) of control horses. The results of the field study demonstrate that Zimeta administered at 30 mg/kg intravenously was effective for the control of pyrexia 6 hours following treatment administration.

**Refer to the Product Insert for
complete Effectiveness information.**

Storage Information: Store at Controlled Room Temperature 20°C and 25°C (68°F and 77°F); with excursions permitted between 15°C and 30°C (59°F and 86°F). Protect from light. Multi-dose vial. Use within 30 days of first puncture.

How Supplied: Zimeta is available as a 500mg/mL solution in a 100mL, multi-dose vial.

**Approved by FDA under NADA #
141-513 NDC 86078-245-01**

Manufactured for:
Kindred Biosciences, Inc.
1555 Bayshore Hwy, Suite 200,
Burlingame, CA 94010

To report adverse reactions call
Kindred Biosciences, Inc. at
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Rev. 11-2019
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magnesium serum levels in insulin dysfunctional (ID) horses, so magnesium supplementation might be necessary. That said, magnesium is not useful therapeutically in magnesium-normal individuals.

Thyro-L is used to manage equine metabolic syndrome by increasing the loss of body fat for horses with increased adiposity. Diet and exercise are preliminary strategies, yet if the fat horse is still refractory to weight loss, then it might be appropriate to try levothyroxine at a high dose—500 kg horses get 72 mg/day (4 tsp). This induces a mild hyperthyroid state to burn more calories. Weight loss results should be appreciated over three to six months.

Often results with metformin are disappointing in horses because of its poor bioavailability. It is given 30 minutes prior to feeding to blunt the insulin response to a meal. It was mentioned that it could be tried for 14 days, then

retest; or use it until the laminitis is under control.

No drug allows elimination of diet modifications and regular exercise to help control EMS or PPID. Hay should be tested for horses with high insulin and/or those that are sore footed. Ideally, non-structural carbohydrates (NSC) levels should be less than 10. An alternative is to use a complete feed that is pretested for desirable NSC levels.

Stop-and-Start Pergolide Treatment: There are no studies yet as to the efficacy of pergolide when owners stop and start treatment. The objective of medication use is to mitigate clinical

signs and minimize the risk of laminitis and PPID-associated immunosuppression. While pergolide doesn't shrink the size of the affected areas of the pituitary gland, it is meant to replace lost dopaminergic effects. The consequences of not giving pergolide during certain periods must factor into an owner's treatment plan.

SLG2 Inhibitors: Work is currently being done on drugs (velagliflozin, for example) that inhibit transport proteins in the proximal tubule in the kidneys, so more glucose is wasted through the urine to decrease a horse's glucose load. This has the potential to decrease circulating insulin.

There is currently no generic drug available—off-label treatment even of a miniature horse costs \$10/day. In addition, this drug causes lipid mobilization, so triglycerides and GGT increase.

Gray Horses:

Some initial work has been done in the UK (by Professor

Andy Durham) looking at tens of thousands of cases of ACTH levels in gray horses. There might be a difference in their levels compared to non-gray horses. Consequently, a slightly higher ACTH cutoff might be used for diagnosis of PPID in gray horses.

Control of Estrus Behavior

Controlling behavior and synchronizing breeding timing for shipped semen or embryo transfer are central issues important to many mare owners. Besides daily oral progesterone treatment to suppress estrus and related behavior, other techniques have been tried, including placing marbles in a mare's



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**Gray horses might have different
ACTH levels than non-gray horses.**



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uterus. These have not worked effectively, and there have been some health concerns including inflammation and infection.

A drug-free method for horses was described during the Kester News Hour at the 2019 AAEP Convention [Gradil, C.M.; Uricchio, C.K.; Schwarz, A. Self-Assembling Intrauterine Device (Upod) Modulation of the Reproductive Cycle in Mares. *Journal of Equine Veterinary Science*, Dec 2019, vol. 83; doi: 10.1015/j.jevs_2019.02.009].

A triplet of egg-shaped, shatter-proof magnetic beads (12mm x 26mm) are inserted singly into the uterus through a specialized pipette. Once in the uterus, the magnets assemble into a triangular configuration and are referred to as a Upod (which is a self-assembling intrauterine device). The Upod is easy to insert and has 100% retention. It is also easy to retrieve and remove. It is visible on ultrasound and with an external metal detector.

In recent studies, diestrus lasted 17 days in control mares but was prolonged up to two months with the Upod inserted. The Upod can be put into the uterus at any time in the estrus cycle.

When inserted post-ovulation, diestrus was maintained for 73 days (+/- 36 days). When inserted at any stage of the estrus cycle, duration of diestrus was 51 days (+/- 23 days).

The study further revealed that there is no change in biopsy scores once the Upod is removed and no impact on fertility. Pregnancy occurred in 100% of mares following Upod removal.

Based on subjective reports, this technique subdues estrus-related behavior and improves the rideability of the horses. The Upod will be available on a limited scale in 2020. There is also the potential to use this device to control feral horse populations.

Mitigation of 100-Mile Ride Fatalities

Of great concern to horse welfare, particularly in light of recent breakdown fatalities at Thoroughbred racetracks, is concern for similar fates in endurance horses.

Olin Balch, DVM, presented an overview of 17 years of data on fatalities from the American Endurance Ride Conference (AERC).

The report reviewed 127 investigated fatalities out of 335,456 starts between 2002-2018.

Three different groups of horse fatalities were considered:

- Group 1 = 82 competing horses with

- 50-mile competitions incurred 0.34 fatalities;
- 100-mile events incurred 1.48 fatalities.

Statistics from a 2007 USDA equine mortality review of all horses between 1998-2005 identified 0.14 fatalities per 1,000 horses. The Jockey Club reported 1.8 fatalities per 1,000 starts (as opposed to horses) in that same time period.

Analysis of Group 1, i.e., 82 endurance horses that developed and succumbed to metabolic disease, showed that 46 horses (56%) were eliminated while competing on trail during the event; nine horses (11%) finished the ride but were eliminated at the finish



KIMBERLY S. BROWN

Endurance horses competing at 50 miles had three times as many fatalities as the limited distance group, but still had significantly fewer fatalities than the 100-mile competitors.

metabolic disease;

- Group 2 = 24 competing horses with non-metabolic disease, such as falling off a cliff or the trail;
- Group 3 = horses present at the ride site, but not necessarily competing.

Of note is that there was no significant effect by year or by region.

Looking specifically at metabolic fatalities that occurred within three days of a race, the most significant effect on incidence related to distance, with 100-mile competitors suffering the most fatalities.

For every 1,000 starts:

- All starts incurred 0.28 fatalities;
- Limited distance (<30 miles) incurred 0.12 fatalities;

line and did not receive completion; and 27 (33%) horses were awarded completion and deemed fit to continue.

Besides the sobering fact that 33% of horses were awarded completion, yet died, what is also significant is that although only 4% of starters competed in 100-mile events, this group comprised 24% of the fatalities.

Limited distance competitors had very few fatalities with incidence in keeping with the USDA report.

Fifty-mile endurance horses had three times as many fatalities as the limited distance group, but still had significantly fewer fatalities than the 100-mile competitors.

The conclusion stated is that risk



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Research noted that there is likely a narrow window of time for interpretation and diagnosis of a stifle lesion after anesthesia.

increases with ride distance, and 77% of the fatalities were associated with metabolic demands. Of these, 85% were attributable to gastrointestinal abnormalities, including ileus.

With these findings in mind, veterinary officials at AERC recommended changes that were implemented in 2015:

- Horses are required to meet recovery pulse within 30 minutes of crossing the finish line instead of the previously allowed 60 minutes to reach pulse criteria, usually a heart rate of 60 or 64 beats per minute.
- At least two control veterinary judges must be present at an AERC-sanctioned ride.
- A triage/treatment veterinarian must be present at all AERC-sanctioned rides.

AERC veterinarians feel that the changes listed above that were implemented in 2015 have made a positive impact on 100-mile competitors:

- In 2002-2015, 1.74 fatalities occurred per 1,000 starts;
- In 2015-2018, 1.16 fatalities occurred per 1,000 starts.

The Tevis Cup Ride also implemented new requirements to help reduce the number of metabolic disorders. This his-

toric race outside of Auburn, California, represents 23% of all 100-mile starts, with an average of 184 horses qualified to start each year. The horses must be at least six years old, and both horse and rider must have completed a minimum of 300 miles of competition.

There are now cut-off times for arrival and departure from each veterinary check point; failure to meet these specified times results in elimination.

An additional safety veterinary exam is performed one to two hours following completion—this exam does not impact the completion status of the horse, it is simply to ensure health and safety of each horse after this degree of arduous exertion on 100 miles of mountain trail in the heat of summer.

In 2012, the AERC initiated recognition of “decade teams,” which are horses and riders who compete together in a 50 mile or longer competition at least once a year for 10 years. These do not have to be consecutive years, and the rider must be an AERC member during those years.

Recognition of this accolade has gone to 605 teams, and it promotes value and appreciation for athletic longevity of horses in the sport of endurance.

Intra-Articular Anesthesia of the Stifle

Another Kester News Hour presentation discussed interpretation of intra-articular anesthesia of the stifle [Radtke, A.; Fortier, L.A.; Regan, S., et al. Intra-articular anesthesia of the equine stifle improves foot lameness. *Equine Veterinary Journal*, May 2019, <https://doi.org/10.1111/evj.13135>].

In a crossover study design using an objective gait analysis inertial sensor (Equinosis Q with Lameness Locator), reversible foot lameness was induced with a circumferential hoof clamp to create lameness of Grade 3 (out of 5) in nine mature horses. Anesthesia was administered into three compartments of the stifle joints.

The peroneal nerve runs in close proximity to the lateral femorotibial joint capsule, and it also innervates portions of the distal limb, specifically the dorsal aspect of the laminar corium. This area of the foot is under particular strain during the push-off phase of the stride, and in this study the horses demonstrated push-off lameness with the hoof clamp in place.

Intra-articular anesthesia did not affect landing lameness in this study. Push-off lameness was evaluated with the inertial sensor system every 10 minutes for 90 minutes. Following that assessment, an abaxial nerve block was administered to identify whether or not residual pain was coming from the foot. Each horse's gait was analyzed 15 minutes following the distal limb block.

The report stated that there is likely a narrow window of time for interpretation and diagnosis of a stifle lesion. If lameness improves more than 50% within 30 minutes of blocking the stifle, it is more likely that the stifle is the source of the horse's injury. If more than 30 minutes elapses with less dramatic and/or slower improvement, the stifle is not necessarily the primary source of pain, and further diagnostic nerve blocks of the distal limb should be pursued.

The study demonstrated that stifle an-



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In Western performance horses, older age, a high degree of lameness and long duration of injury were issues identified in a study that affected a horse's return to function.

esthesia has the potential to reduce foot pain. Therefore, their recommendation is that in combination with a thorough lameness exam, it is important to block the distal limb before administering stifle anesthesia. If that isn't possible, veterinarians should pursue that block on a different day than performing stifle anesthesia.

Toxic Effects of Amikacin on Joints

Despite a low incidence (<0.1%) of septic arthritis following joint injections, surveys indicate that 78.6% of equine practitioners inject antibiotics prophylactically into joints. One common antibiotic used is amikacin, an aminoglycoside.

Lynn Pezzanite, DVM, MS, DACVSLA, reviewed a study that looked at the *in vitro* response of joint cells to amikacin.

While the study was performed on harvested cells in the lab, the research findings are sobering:

- Amikacin induced equine joint cell death rapidly in a dose-dependent manner.
- Amikacin decreased cell viability at one-hour exposure.
- Amikacin toxicity was not mitigated

by the addition or presence of synovial fluid.

- Amikacin is toxic to mesenchymal stromal cells.
- Amikacin inhibits mitochondrial metabolism at clinical doses.
- Amikacin induces cell death through induction of apoptosis.
- Amikacin induces cell death in cartilage and synovial explants at low, clinically relevant doses.
- Amikacin-induced cell death was not due to decreased pH.
- Amikacin concentrations greater than the MIC for common equine isolates persist for more than 24 hours even at low doses.
- A dose-dependent increase in inflammatory markers and collagen degradation products in synovium expresses inherent amikacin toxicity.

Pezzanite suggested that there are alternative antibiotics—ampicillin sulbactam or tobramycin—that are less toxic than amikacin. She also suggested that simultaneous administration of anti-inflammatory medications might mitigate some of the aminoglycoside's toxic effects.

Following this preliminary investigation, more studies are needed to assess the effects of amikacin on joints *in vivo*.

Stifle Arthroscopy in Western Performance Horses

It has been commonly accepted that Western performance horses have a worse prognosis following stifle arthroscopy than horses in other athletic pursuits. Researchers at Colorado State University wanted to address those theories.

Reining and cutting horses work off of their hindlimbs while executing sudden turns, stops, crouches and sprint propulsion. A previous study (Cohen, J., *Veterinary Surgery* 2009) indicated that 37% of horses in various athletic disciplines were able to return to their previous level of function following stifle arthroscopy.

Laurie Goodrich, DVM, PhD, DACVS, presented a Colorado State University study about the efficacy of stifle arthroscopy in 87 Western performance horses. The horses were followed for at least two years subsequent to stifle arthroscopy to determine return to performance.

Most of the horses in the study had stifle joint osteophytes, subchondral bone cysts and narrowed joint spaces identified during arthroscopy.

Older age, a high degree of lameness and long duration of injury were issues identified in the study that impacted a Western performance horse's return to function. Partial thickness cartilage lesions also decreased the odds of return to function. Prognosis worsened with increasing amounts of soft tissue abnormalities in the stifle.

The Colorado State University study found that 40% (32/82) of study horses returned to their intended use following stifle arthroscopy.

Post-operative administration of triamcinolone, IRAP, stem cells, systemic Adequan or NSAIDs affected the prognosis for return to function.

In conclusion, the outcome for Western performance horses' return to performance following stifle arthroscopy did not differ from results in other breeds and athletic disciplines. **EM**

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Please see Brief Summary of Full Prescribing Information on the following page.



INDICATION: BetaVet® is indicated for the control of pain and inflammation associated with osteoarthritis in horses.

IMPORTANT SAFETY INFORMATION

For Intra-Articular (I.A.) Use in Horses.

CONTRAINDICATIONS: BetaVet® is contraindicated in horses with hypersensitivity to betamethasone. Intra-articular injection of corticosteroids for local effect is contraindicated in the presence of septic arthritis.

WARNINGS: Do not use in horses intended for human consumption. Clinical and experimental data have demonstrated that corticosteroids administered orally or parenterally to animals may induce the first stage of parturition when administered during the last trimester of pregnancy and may precipitate premature parturition followed by dystocia, fetal death, retained placenta, and metritis. Additionally, corticosteroids administered to dogs, rabbits and rodents during pregnancy have resulted in cleft palate in offspring and in other congenital anomalies including deformed forelegs, phocomelia and anasarca. Therefore, before use of corticosteroids in pregnant animals, the possible benefits to the pregnant animal should be weighed against potential hazards to its developing embryo or fetus. Human Warnings: Not for use in humans. For use in animals only. Keep this and all medications out of the reach of children. Consult a physician in the case of accidental human exposure.

PRECAUTIONS: Corticosteroids, including BetaVet®, administered intra-articularly are systemically absorbed. Do not use in horses with acute infections. Acute moderate to severe exacerbation of pain, further loss of joint motion, fever, or malaise within several days following intra-articular injection may indicate a septic process. Because of the anti-inflammatory action of corticosteroids, signs of infection in the treated joint may be masked. Due to the potential for exacerbation of clinical signs of laminitis,

glucocorticoids should be used with caution in horses with a history of laminitis, or horses otherwise at a higher risk for laminitis. Use with caution in horses with chronic nephritis, equine pituitary pars intermedia dysfunction (PPID), and congestive heart failure. Concurrent use of other anti-inflammatory drugs, such as NSAIDs or other corticosteroids, should be approached with caution. Due to the potential for systemic exposure, concomitant use of NSAIDs and corticosteroids may increase the risk of gastrointestinal, renal, and other toxicity. Consider appropriate wash out times prior to administering additional NSAIDs or corticosteroids.

ADVERSE REACTIONS: Adverse reactions reported during a field study of 239 horses of various breeds which had been administered either BetaVet® (n=119) or a saline control (n=120) at five percent (5%) and above were: acute joint effusion and/or local injection site swelling (within 2 days of injection), 15% BetaVet® and 13% saline control; increased lameness (within the first 5 days), 6.7% BetaVet® and 8.3% saline control; loose stool, 5.9% BetaVet® and 8.3% saline control; increased heat in joint, 2.5% BetaVet® and 5% saline control; and depression, 5.9% BetaVet® and 1.6% saline control.

DOSAGE AND ADMINISTRATION: Shake well immediately before use. Use immediately after opening, then discard any remaining contents.

RX ONLY

References: 1. Trotter GW. Intra-articular corticosteroids. In: McIlwraith CW, Trotter GW, eds. *Joint Disease in the Horse*. Philadelphia: W.B. Saunders; 1996; 237-256.

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BetaVet®
betamethasone sodium phosphate &
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INJECTABLE SUSPENSION

BRIEF SUMMARY OF PRESCRIBING INFORMATION

[Betamethasone Sodium Phosphate and Betamethasone Acetate Injectable Suspension] 6 mg betamethasone per mL
For Intra-Articular (I.A.) Use in Horses

CAUTION: Federal law restricts this drug to use by or on the order of a licensed veterinarian.

INDICATION: BetaVet[®] is indicated for the control of pain and inflammation associated with osteoarthritis in horses.

DOSAGE AND ADMINISTRATION: Shake well immediately before use.

CONTRAINDICATIONS: BetaVet[®] is contraindicated in horses with hypersensitivity to betamethasone. Intra-articular injection of corticosteroids for local effect is contraindicated in the presence of septic arthritis.

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Clinical and experimental data have demonstrated that corticosteroids administered orally or parenterally to animals may induce the first stage of parturition when administered during the last trimester of pregnancy and may precipitate premature parturition followed by dystocia, fetal death, retained placenta, and metritis. Additionally, corticosteroids administered to dogs, rabbits and rodents during pregnancy have resulted in cleft palate in offspring. Corticosteroids administered to dogs during pregnancy have also resulted in other congenital anomalies including deformed forelegs, phocomelia and anasarca. Therefore, before use of corticosteroids in pregnant animals, the possible benefits to the pregnant animal should be weighed against potential hazards to its developing embryo or fetus. **Human Warnings:** Not for use in humans. For use in animals only. Keep this and all medications out of the reach of children. Consult a physician in the case of accidental human exposure.

PRECAUTIONS: Corticosteroids, including BetaVet[®], administered intra-articularly are systemically absorbed. Do not use in horses with acute infections. Acute moderate to severe exacerbation of pain, further loss of joint motion, fever, or malaise within several days following intra-articular injection may indicate a septic process. Because of the anti-inflammatory action of corticosteroids, signs of infection in the treated joint may be masked. Appropriate examination of joint fluid is necessary to exclude a septic process. If a bacterial infection is present, appropriate antibacterial therapy should be instituted immediately. Additional doses of corticosteroids should not be administered until joint sepsis has been definitively ruled out. Due to the potential for exacerbation of clinical signs of laminitis, glucocorticoids should be used with caution in horses with a history of laminitis, or horses otherwise at a higher risk for laminitis. Use with caution in horses with chronic nephritis, equine pituitary pars intermedia dysfunction (PPID), and congestive heart failure. Concurrent use of other anti-inflammatory drugs, such as NSAIDs or other corticosteroids, should be approached with caution. Due to the potential for systemic exposure, concomitant use of NSAIDs and corticosteroids may increase the risk of gastrointestinal, renal, and other toxicity. Consider appropriate wash out times prior to administering additional NSAIDs or corticosteroids.

ADVERSE REACTIONS: Adverse reactions reported during a field study of 239 horses of various breeds which had been administered either BetaVet[®] (n=119) or a saline control (n=120) were: acute joint effusion and/or local injection site swelling (within 2 days of injection), 15% BetaVet[®] and 13% saline control; increased lameness (within the first 5 days), 6.7% BetaVet[®] and 8.3% saline control; loose stool, 5.9% BetaVet[®] and 8.3% saline control; increased heat in joint, 2.5% BetaVet[®] and 5% saline control; depression, 5.9% BetaVet[®] and 1.6% saline control; agitation/anxiety, 4.2% BetaVet[®] and 2.5% saline control; delayed swelling of treated joint (5 or more days after injection), 2.5% BetaVet[®] and 3.3% saline control; inappetance, 3.4% BetaVet[®] and 2.5% saline control; dry stool, 1.7% BetaVet[®] and 0% saline control; excessive sweating, 0.8% BetaVet[®] and 0% saline control; acute non-weight bearing lameness, 0.8% BetaVet[®] and 0% saline control; and laminitis, 0.8% BetaVet[®] and 0% saline control.

CLINICAL PHARMACOLOGY: Betamethasone is a potent glucocorticoid steroid with anti-inflammatory and immunosuppressive properties. Depending upon their physico-chemical properties, drugs administered intra-articularly may enter the general circulation because the synovial joint cavity is in direct equilibrium with the surrounding blood supply. After the intra-articular administration of 9 mg BetaVet[®] in horses, there were quantifiable concentrations of betamethasone (above 1.0 ng/mL) in the plasma.

EFFECTIVENESS: A negative control, randomized, masked field study provided data to evaluate the effectiveness of BetaVet[®] administered at 1.5 mL [9 mg betamethasone] once intra-articularly for the control of pain and inflammation associated with osteoarthritis in horses. Clinical success was defined as improvement in one lameness grade according to the AAEP lameness scoring system on Day 5 following treatment. The success rate for horses in the BetaVet[®] group was statistically significantly different (p=0.0061) than that in the saline group, with success rates of 75.73% and 52.52%, respectively (back-transformed from the logistic regression).

ANIMAL SAFETY: A 3-week target animal safety (TAS) study was conducted to evaluate the safety of BetaVet[®] in mature, healthy horses. Treatment groups included a control (isotonic saline at a volume equivalent to the 4x group); 1X (0.0225 mg betamethasone per pound bodyweight; BetaVet[®]); 2X (0.045 mg betamethasone per pound bodyweight; BetaVet[®]) and 4X (0.09 mg betamethasone per pound bodyweight; BetaVet[®]). Treatments were administered by intra-articular injection into the left middle carpal joint once every 5-days for 3 treatments. Injection site reactions were the most common observations in all treatment groups. Injection site reactions were observed within 1 hour of dosing and included swelling at the injection site, lameness/stiffness of the left front limb, and flexing the left front knee at rest. The injection site reactions ranged from slight swelling (in many horses on multiple days in all treatment groups) to excessive fluid with swelling, pain, and lameness (4x group only). Injection site reactions were observed most commonly on treatment days, and generally decreased in number and severity over subsequent days. The incidence of injection site reactions increased after the second and third injection (number of abnormalities noted on day 10 > day 5 > day 0). In the BetaVet[®] treated groups the number and severity of the injection site reactions were dose dependent. The 4X BetaVet[®] group had the highest overall incidence of and severity of injection site reactions, which included heat, swelling, pain, bleeding, and holding the limb up at rest. The control group and 4X group (which received similar injection volumes) had a similar incidence of injection site reactions; however, the severity of reactions was greater in the 4X group. Absolute neutrophils were statistically significantly higher in the BetaVet[®] treated groups as compared to the control group. Trends toward a decrease in lymphocytes and eosinophils, and an increase in monocytes were identified in the BetaVet[®] treated groups after the initial dose of BetaVet[®]. Individual animal values for white blood cells generally remained within the reference range. BetaVet[®] treated horses also had a trend toward increased blood glucose after the initial dose. Some individual animals showed mild increases in blood glucose above the reference range.

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AAEP Infectious Disease Committee Report

The AAEP Infectious Disease Committee was busy in 2019 addressing concerns in the industry.

By Kimberly S. Brown

The AAEP Infectious Disease Committee held an informative meeting at the 2019 AAEP Convention in Denver, Colorado. This active committee worked even harder in 2019 to create guidelines for veterinarians while addressing serious infectious

disease concerns in the industry.

Katie Flynn, BVMS, chair of the committee, is an equine staff veterinarian with the California Department of Food and Agriculture, Animal Health Branch. She said that among the many accomplishments of the large Infectious Disease Committee in 2019 were 48

articles on the AAEP website which were reviewed for content. Nine of the articles were removed, 24 documents were deemed to need minor revisions, and nine were deemed to need major revisions. The documents needing revisions will be updated by subject matter experts in the coming year.

The committee also worked with the USEF on biosecurity communications and reporting criteria for infectious diseases to the Equine Disease Communication Center (EDCC).

Equine Influenza

Tom Chambers, PhD, is a professor at the University of Kentucky's Gluck Equine Research Center who focuses on the study of infectious disease, especially equine influenza and equine herpesvirus. He gave the update on equine influenza to the group. Chambers discussed the international significance of equine influenza, and he reviewed the Ohio outbreak where vaccinated horses became ill with influenza. After looking at virus isolates and the strains in current equine vaccines, Chambers said that no vaccine update is recommended at this time.

"This might be an unsatisfactory story, but it is where we are today," he noted.

Flynn noted that equine influenza is not reportable in most states even though it is an infectious disease. However, she said it is monitored in many states. "It is can be hard to get testing lab results from private laboratories for diseases which are not reportable," she said.

Vesicular Stomatitis

Angela Pelzel-McCluskey, DVM, MS, who is a national equine epidemiologist for the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Veterinary Services, attended the committee meeting as an AAEP member rather than as a representative of USDA, as her trip was not approved by the department. She reminded those in attendance that all of the 2019 vesicular stomatitis situation reports were posted and available. The same was true for EEE cases.

Flynn added that EEE was in the forefront in 2019 because of human cases and clusters of cases in various parts of the country. She said there had been some confusion about transmission of

EEE to humans as it can't be transmitted directly from the horse. "We will review materials on the AAEP website and address that confusion," she said.

Blood Products

Amy Gill, DVM, PhD, a veterinary medical officer with the USDA APHIS, Center for Veterinary Biologics, discussed the issue of equine parvovirus hepatitis, which can be spread through plasma products. "According to Center for Veterinary Biologics Notice No. 19-03, horses that test positive for infectious disease cannot be used as (blood product) donor horses," she said.

She added that labels on blood products will soon bear a product statement on equine serum hepatitis.

In 2018, an equine parvovirus-hepatitis (EqPV-H) was identified in association with equine serum hepatitis, also known as Theiler's disease. Arnold Theiler first described this disease in 1918, and it is sometimes seen after use of blood products in horses.

(Editor's note: There is an open access article available from the FDA's Emerging Infectious Diseases from February 2019 that described this from Dr. Tom Divers of Cornell University, et al., at https://wwwnc.cdc.gov/eid/article/24/2/17-1031_article.)

Gill said that blood product donor horses are required to be tested at least once a year. She said they will review those testing results in a future phase of testing.

Flynn said that equine parvovirus guidelines should be out in 2020.

Infectious Disease Reporting Rules

A discussion of the committee audience members next focused on why states have different reporting rules for equine infectious diseases. The consensus was that uniform rules would never happen because of limited funding/resources in different states and reporting disease priorities of the equine industry within each state.

Equine Import Centers

Another discussion focused on federal and private import centers based on the closure of the Florida center in January 2019. Rachel Lacey, DVM, of the Florida Department of Agriculture and Consumer Services, discussed equine health at international import facilities. She had presented on the topic of "Abnormal Equine Health Events at International Import Quarantine Facilities" to the USAHA Committee on Equine Working Group in October of 2019. *(Editor's note: You can find that presentation here: https://www.usaha.org/upload/Committee/InfectiousHorses/Lacey_Working_Group_International.pdf.)*

She said in the AAEP Infectious Disease Committee meeting that the USDA sick horse data from November of 2018 through June of 2019 showed that 200 sick horses were imported from Europe. Most had upper respiratory infections or fevers.

Lacey said there does not seem to be a "standardization" of import facilities in the United States for handling sick horses and reporting such cases. She is heading a working group of about 20 persons actively participating in state, federal and private import/export facilities to urge the USDA to standardize processes.

The recommendation from the USAHA group cited above was that:

"The United States Animal Health Association urges the United States Department of Agriculture (USDA), Animal and Plant Health Inspection Service (APHIS), Veterinary Services (VS), to take the following actions at all International Animal Import Quarantine Facilities:

1. to develop standard operating procedures for (import) quarantine facility staff and veterinarians to identify, investigate, document, report and track cases of abnormal equine health events;

2. to develop a standardized electronic system to consistently and uniformly record details of each abnormal health event, which should minimally include vital signs, physical exam findings, date

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and time of examination;

3. to identify abnormal health events/parameters in equines, and conduct further assessment to classify such as contagious, non-contagious or other;

4. to adopt a proven system to accurately evaluate each equine displaying clinical signs of disease, to clinically evaluate each case of a potentially infectious disease, to identify the infectious agent and determine the possible risk of exposure to other imported horses (protocols should include diagnostic testing at owner/agent's expense based on the syndromic clinical presentation);

5. to notify state animal health officials in both the state of destination and the state in which the horse is currently located of any abnormal horse health events identified and classified as possibly infectious (the notification should include any potential exposed cohorts with report prior to release

from quarantine);

6. to modify VS 17-30 such that it documents the potential risk of exposure to infectious disease for any equids associated with the abnormal health event;

7. to develop and implement a compliance agreement between owners/agents and the USDA that includes recommended biosecurity measures for destination premises;

8. to track all Abnormal Health Events for equids being imported into the United States and report such events to equine stakeholders if requested or applicable."

Flynn said, "We need more private veterinary facilities which meet federal requirements that can treat sick, imported horses."

EDCC

The Equine Disease Communication Center (EDCC) is the industry-funded hub for efficient communication of information about equine infectious diseases and disease outbreaks.

Katie McDaniel of the EDCC said the group launched a mobile app in 2019. Through December 2, 2019, the EDCC has reported more than 4,000 diseases. There are about 8,000 people on the email list and 12,000 that follow EDCC on Facebook.

In 2019 alone, the EDCC reported 400 alerts concerning 951 horses/premises.

Currently the EDCC is funded by the horse industry, but the group would like to get the USDA involved again, as they were involved in creating the reporting system.

Nat White, DVM, MS, DACVS, Professor Emeritus of Equine Surgery at the Marion duPont Scott Equine Medical Center, serves as director and administrative consultant with the EDCC. He said that once a disease or outbreak gets reported and there is a quarantine, that "everyone relaxes." He added that he doesn't think the industry understands how much disease is out there.



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White encouraged all of the veterinarians and officials in the room to report infectious diseases and disease outbreaks to the EDCC by using EDCC@AAEP.org. He said they carefully screen the reports and inquire of reporting practitioners whether the state veterinarian has been informed of the report.

Flynn reminded the audience that certain diseases—namely foreign animal diseases, such as piroplasmiasis—are not posted from individual practitioners. Those must come through official channels.

She said that if EDCC has a reportable disease, that the state can ask that information not be posted until regulatory authority can do their work; then the EDCC can post.

Hot Topic: Private Labs and EDCC

An audience member asked whether private labs are reporting diseases to EDCC. White said that the private labs should notify the state for reportable diseases, and they should report to EDCC on non-reportable diseases.

“We want to get all the important disease reported” to the state vet or EDCC, said White.

Al Kane, DVM, said from the audience that he would recommend case definitions. White said they try to get confirmed tests, but if the disease is obvious, then they will post. “We don’t have many that aren’t confirmed.”

An audience member asked whether equine parvovirus would be reported on EDCC. Flynn said that once guidance docs are completed on equine parvovirus, “we will give it to the practitioners.”

David Wilson, BVMS, MS, retired from UC Davis, noted that case definition is well described for most diseases, and there are levels of evidence. But compiling all of that could take a long time.

White said there are places on the reporting form for veterinarians to report all of that information.

Dipyrrone Launched

Under new business, an audience member brought up the launch of Zimeta, the new FDA-approved dipyrrone equine fever control medication.

The audience member said that understanding the incidence of fever in the horse is needed: “We need real-world data.”

Flynn said the definition of a fever at USDA import facilities is 101.5 degrees Fahrenheit. She noted that there can be a difference in temperature reported via biothermal chip versus rectal temperature.

Serology Guidelines

Flynn noted that the Infectious Diseases Committee was finalizing serology guidelines following the committee meeting. She said that the AAEP Board would have them to discuss during the convention. **EM**



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Polyacrylamide Hydrogel for Intercarpal Osteoarthritis

This AAEP presentation looked at a new management tool.

By Nancy S. Loving, DVM

New treatments for osteoarthritis are always welcomed, and many times a cutting-edge product's research is presented at AAEP to advise practitioners of possibilities to manage the equine athlete. It is thought that up to 60% of all lameness is attributable to osteoarthritis. One topic of discussion at the 2019 AAEP Convention focused on intra-articular administration of 2.5% polyacrylamide (PAAG) hydrogel (Arthramid).

The hydrogel material is hydrophilic, homogenous, biocompatible and viscoelastic. Following injection, cells are integrated into the synovium through blood vessel ingrowth, collagen deposition and water exchange. Integration of the hydrogel within the tissues serves to stabilize the joint capsule and synovium while increasing joint capsule elasticity.

A study evaluated use of this product in 33 flat-racing Thoroughbreds with lamenesses of Grade 1, 2 or 3 (on the AAEP scale of 0-5) that were in full training. Using radiology and intra-articular anesthesia, lameness pain was localized to the intercarpal joint. No horse was enrolled in the study if Grade 4 or 5, or if it had experienced a previous joint infection, arthroscopy within the preceding 12 weeks, or had intra-articular medications administered within the preceding four weeks.

The double-blinded, randomized, prospective study evaluated treatment of the

intercarpal joint with one of three medications: a) 2 ml of 2.5% PAAG; b) 12 mg triamcinolone; or c) 20 mg hyaluronic acid followed by two intravenous weekly doses of 40 mg HA. After 48 hours of rest post treatment, the horses returned to full gallop training. Mild effusion seen in some PAAG-treated horses for five to seven days improved with rest.

All horses were checked by a "blinded" veterinarian at two, four and six weeks, and at 12 weeks for the 2.5% PAAG-treated individuals. Although no differences were seen by week two, at weeks four and six, significant differences were seen in the 2.5% PAAG group. A successful outcome (resolution of lameness) occurred in 83% for 2.5% PAAG-treated horses, and 22-40% in the TA- and HA-treated horses.

The 2.5% PAAG-treated horses that were free of lameness at week six remained so at 12 weeks, and they demonstrated superior results in lameness resolution, lessened joint effusion and less reaction to flexion compared to the TA and HA groups. Intra-articular administration of 2.5% PAAG takes four to six weeks following treatment to elicit improvements in lameness scores.

Tissue engineer Greg McGarrell, BSc, MBA, CEO of Nupsala Veterinary Services, described two possible mechanisms of actions of PAAG. As a scaffold, it is incorporated into the synovial lining to substitute for missing/degraded tissue. With chronic synovitis, synovial fluid

within the degraded synovial membrane recesses inhibits tissue growth and interferes with disease modification. Injected hydrogel lays across the synovial membrane and its absorption enables proliferation and differentiation of intimal cells and fibroblasts to thicken the membrane and produce normal synovial fluid within the joint to counteract inflammatory mediators such as cytokines.

Another mechanism of PAAG hydrogel is under investigation. McGarrell explained that joint capsule fibrosis in advanced osteoarthritis restricts movement, which wreaks havoc with footfall. Proprioceptive deficits cause distal limb pain nociceptors to fire constantly to amplify pain while healthy, non-fibrotic joint capsule tissue works harder to move the limb, thereby stimulating pain from joint nociceptors. Increases in elasticity and flexion of a diseased joint following PAAG treatment help dampen nociceptor firing.

Rather than osteoarthritis pathology stemming from bone-on-bone, it might be a consequence of a fibrotic joint capsule—and relief comes from improved flexibility.

Arthritic disease is still present in treated horses, and osteoarthritic changes are influenced by exercise-induced trauma. To maximize beneficial effects of treatment, husbandry changes—such as shoeing, training surfaces or other predispositions to exercise-induced trauma—must be managed. **EM**

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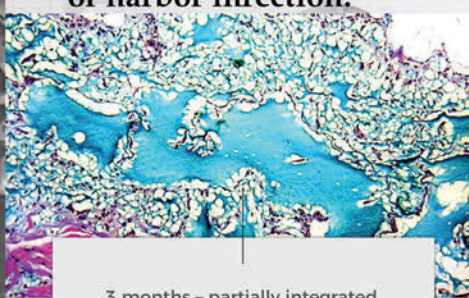
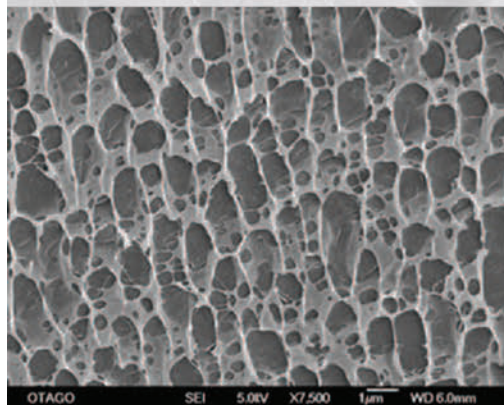
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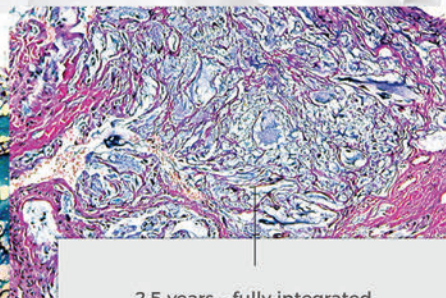
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NEAEP Coverage

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Lameness and podiatry information for vets and farriers
from the 2019 NEAEP Convention, brought to you by Soft-Ride

By Kimberly S. Brown

The Northeast Association of Equine Practitioners (NEAEP) is a unique organization in that it strives to build bridges between the professions of equine veterinary medicine and equine farriery. According to 2019 NEAEP President Raul Bras, DVM, certified journeyman farrier, the organization exists to encourage farriers and vets to work together for the well-being of the horse through communication and continuing education. (*Editor's note: Visit EquiManagement.com or your favorite podcast provider for the Disease*

Northeast Association of Equine Practitioners



Du Jour podcast episode 15 with Dr. Bras on Vet-Farrier Relationships.)

The NEAEP holds an annual symposium each year, and in 2019 it was held in Saratoga Springs, New York. *EquiManagement* is proud to partner with Soft-Ride to bring you highlights from the lameness and podiatry sections of the program.

Shoeing for Sporthorse Injuries: My Point of View

Professor Roger K. W. Smith, MA, VetMB, PhD, DipECVSMR, DipECVS, FRCVS, is professor of Equine Ortho-

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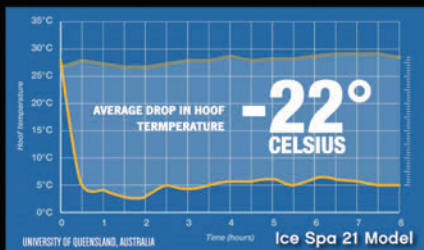
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paedics at the Royal Veterinary College (RVC) in the UK. He divides his time between running a specialist orthopedic service within the RVC and directing research into equine tendon disease.

Smith noted that in general, shoeing is rarely 100% effective without other concurrent treatment(s) related to the specific disease that caused the problem. He noted that horses frequently have an individual way of responding to therapeutic shoeing, and general rules are difficult to formulate.

“Any given shoe works best for the person that first invented it,” he noted, drawing a laugh from the crowd of vets and farriers. He added that shoeing is frequently governed by the “fashion of the day.”

Smith emphasized the need for a two-way trust between veterinarians and farriers for successful treatment. He encouraged regular, repeat radiography. He said getting the farrier on board with this is important since in general it takes two or three shoeings before a beneficial effect can be observed when trying to change foot balance.

“It’s difficult to determine what the orientation of the distal phalanx within the hoof is by looking at the outside of the foot,” Smith noted.

He said all types of corrective shoeing should be done based on sound biomechanical principles. He reminded the audience that the mechanics of the fore limb are not the same as the hind limb.

He stressed that vets and farriers need to differentiate between cause and effect. Loading patterns that cause disease is one problem, but sometimes disease results in conformational abnormality.

Smith said the key roles for therapeutic shoeing include managing foot problems (in particular navicular disease by

the correction of the dorsopalmar foot balance and protecting thin soles bruising); protecting tendons and ligaments; and managing fractures.

He said managing foot problems requires an accurate diagnosis and requires assessment of foot balance, both visually and radiographically.

Smith noted that navicular disease is “believed to be the consequence of aberrant bony remodeling associated with mechanical overload, which is exacerbated by the positive feedback loop that occurs when the horse has pain in the heels that induces increased tension in the DDFT in the first half of the stance phase. The most important parameter



Dr. Kent Allen was a lecturer and provided hands-on training during the full-day NEAEP wet labs.

for unloading the DDFT and navicular bone is the solar angle of the distal phalanx—for every one degree increase in the downward angulation of the distal phalanx there is a 4% reduction in the peak force exerted by the DDFT on the navicular bone.”

While we can’t delve into the specifics Smith discussed for every condition, he said the most important for navicular disease and DDFT pathology are trimming and shoeing to correct dorsopalmar foot balance with the aim of:

- reducing the load on the DDFT and navicular bone;
- facilitating the rolling of the toe; and
- avoiding coffin joint hyperextension.

“This (balance) is achieved by preserving the heels while trimming the sole at the toe to improve the downward angulation of the distal phalanx within the hoof capsule,” noted Smith. “This is only possible when there is a thick enough sole with which to achieve this alteration in angle. If the case of thin soles, artificial elevation of the heels is achieved with wedges or a graduated shoe. This has the same effect in unloading the DDFT but tends to unload the heels, which can encourage heel collapse, and so should only be used temporarily.

“The branches of the shoe should be extended as far caudally as possible (to center the center of rotation of the distal interphalangeal joint), the toe shortened (dumped), and a shoe with a rolled toe fitted to ease break-over,” he said.

“A number of shoe types can be used to achieve these goals, including wide-webbed seated out shoes, natural balanced shoes or egg-bar shoes,” he added.

Hind Limb Proximal Suspensory Desmitis

Kent Allen, DVM, ISELP certified, is the owner of Virginia Equine Imaging in Middleburg, Virginia, and is the ISELP vice president and executive director. Allen discussed hind limb proximal suspensory desmitis: predisposing factors, diagnosis, treatment and rehabilitation.

He said predisposing factors include:

- anatomy/conformation
 - straight hocks
 - fetlock joint hyperextension, although Allen said that might be a consequence of suspensory desmitis instead of a pre-existing fault
- degenerative change within the PSL, which can lead to further change and deterioration and stretching
- genetic collagen disorders (Peruvian Paso, Arab, Saddlebred, Quarter Horse, Thoroughbred, etc.)
- biomechanical stress

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- hoof conformation

Allen cautioned the vets and farriers in attendance to look beyond conformation, because hind limb proximal suspensory desmitis occurs in horses with correct conformation; horses that have no supporting biomechanical data; and young and old horses. In addition, it can be acute or chronic and insidious in onset.

“You should evaluate horses with changing conformation, fetlock drop and long pasterns critically,” noted Allen, “because once the proximal suspensory is lengthened, they don’t come back from it. Horses, whether chronic or injured or genetically inclined toward suspensory breakdown, they are not coming back as athletes.”

Allen said that genetics is involved in degenerative suspensory ligament desmitis in the breeds mentioned above. “This is progressive desmitis without an instigating injury,” said Allen. “It has characteristic ultrasonographic and histological features. These horses poorly regenerate collagen. There is research being conducted on specific genetic markers. I think this is a breakdown syndrome.”

Allen said the driving, propulsive action of the hind limb places a high amount of stress in the proximal suspensory ligament (PSL) region, according to research by Dr. Jean-Marie Denoix.

Allen also noted that if there is a change in conditioning, there can be a change in injuries. “I saw a three-day trainer change how he conditioned horses to train on steep, uphill conditioning and not low, rolling hills. We started seeing proximal suspensories and stifles and backs being affected.”

Allen walked the audience through diagnosis, which included a CURO de-

vice that his group published about and presented at the 2018 AAEP Convention. “It is very useful in diagnosing PSL injury and tracking PSL recovery,” said Allen. “Think of the tendon as guitar string, either ‘in tune’ and vibrating normally or loose and out of tune. When it gets oscillation (‘out of tune’), it vibrates poorly.”

In response to a question from the audience about reduction of swelling in the tendon as an indication of healing, Allen said, “That’s a great question. Proximal suspensories will reduce in swelling, but never look normal again. If you are waiting for ultrasound to tell you it is normal, then you will be disappointed. That’s why we like CURO. We can look at it from a functionality standpoint.”

Allen discussed research on treating these injuries with shock wave versus surgery. “Bottom line is there is not a huge difference in outcome between surgery and shockwave, and shockwave had lower recovery time,” said Allen.

However, he said surgical treatments might provide the best prognosis, with about 70% returning to their normal athletic function.

“Case selection for surgery is very important, and often non-surgical treatments are attempted first as surgery is not appropriate in all cases,” said Allen.

He said that about 60% treated with shock wave return to athletic function. The 40% who don’t respond usually go on to surgery.

Laminitis

Andrew van Eps, BVSc PhD DACVIM, of the University of Pennsylvania’s New Bolton Center, discussed “New Developments in Our Understanding of What Causes Different Forms of Laminitis.”

In his introduction, van Eps explained that the term “laminitis” is used to describe “the clinical and pathological consequences of disturbances in the attachment between inner hoof wall and distal phalanx that is normally provided by the digital lamellae.”



ARND BRONKHORST PHOTOGRAPHY

Supporting limb laminitis is an unpredictable and serious complication of a painful limb condition.

He said the lamellae suspend the bone within the hoof capsule, “and it is the largely unrecoverable loss of this suspensory function that leads to the lameness, dysfunction and morphological derangements characteristic of chronic laminitis.”

The three main clinical forms of laminitis are sepsis-related, insulin-mediated endocrinopathic and supporting-limb laminitis.

He explained that not all laminitis occurs the same way. He said that “pathologic alterations in the lamellae can be mild and insidious, with slow and progressive lengthening of lamellae due to stretch and cellular proliferation (as in many cases of endocrine-associated laminitis).” He said there also can be “rapid loss of tissue mechanical integrity due to widespread cellular adhesion and cytoskeletal failure (more common in sepsis-associated and supporting limb laminitis).”

The one thing van Eps emphasized was that once the suspensory function of the lamellae is lost, “the pain, morphological derangement and progression of digital pathology are largely consequences of novel mechanical forces now acting between the distal phalanx, sole and ground surface, together with the proliferative and dysplastic response of the lamellar epidermis to injury. These chronic processes are common

regardless of the inciting cause.”

He said that over the last decade, researchers have found that there are similarities and differences in the initial events that lead to laminitis, depending on the inciting cause. “A focus on these early events is leading to a better understanding of why laminitis occurs in different clinical situations and is helping to identify therapeutic targets,” said van Eps.

One point the presenter made was that while this tissue can heal, the reorganization of the tissues happens in a “disorganized” way. The architectural change is irreversible,” he said.

Supporting limb laminitis is an “unpredictable and serious complication of painful limb condition,” said van Eps. “Clinical recognition may be difficult—often you only see it happening when the horse becomes more lame on the supporting limb than on injured limb.”

He said the incidence has been estimated at “approximately 10-15% of horses that present for painful limb problems (or require limb casts) in North American studies, with body-weight and duration of casting identified as risk factors.”

Once supporting limb laminitis is clinically apparent, van Eps said it often progresses rapidly, with a mortality rate of at least 50%.

“The threat of supporting limb laminitis remains a major reason why treatment is never attempted in many cases, e.g. complicated limb fractures,” he said.

Supporting limb laminitis can be subclinical, noted van Eps. “Look at feet histologically if the horse is put down for other reasons, and often you will see it has laminitis in one or several limbs.”

He said supporting limb laminitis “is probably more common than we think.”

The researcher is looking at digital artery flow using a weighted surcingle. His team has found that locations of arterial blood flow are cut off under varying loads.

Using techniques in the live horse as

well as a cadaver limb model to study capillary fill in the lamellar tissue itself, they found that when the limb is loaded to the equivalent of standing on one leg, there pretty much is no capillary fill.

“The only thing that improves perfusion in a live horse is walking,” said van Eps.

In the Proceedings for the program, van Eps wrote: “Recent research is helping to clarify the relationship between limb loading patterns, lamellar perfusion/energy balance and signaling events at the level of the lamellar epithelial cell that lead to laminitis. Simple monitoring techniques focused on tracking limb load cycling in patients with painful limb conditions, coupled with powerful new methods of monitoring perfusion and metabolic function within the foot (microdialysis, PET scanning) will guide interventions in horses at risk of supporting limb laminitis. These interventions may be simple physical therapy strategies such as controlled walking/static limb load cycling, or may be focused on partial and intermittent limb load relief.”

In discussing **sepsis-associated laminitis**, van Eps said, “Laminitis occurs as a consequence of a range of conditions in horses where systemic inflammation is a feature, particularly when this inflammation is driven by bacteria or bacterial products liberated into the bloodstream (sepsis).”

He stated that “the presence of clinical signs of endotoxemia/sepsis is an established risk factor for the development of laminitis in hospitalized horses.”

In his presentation van Eps said that “Experimentally and in the clinic, colitis cases are 10 times less likely to develop laminitis if you cool their feet.”

Why does cooling work?

“Cooling controls inflammation, amongst other things,” he stated, adding that in unpublished data they have found it prevents energy dysregulation. He also said that cooling the feet controls “the growth factor signaling we see in laminitis—but we’re not sure how important that is yet.”

Cooling to Prevent Laminitis

Van Eps and associates published the paper “Continuous digital hypothermia prevents lamellar failure in the euglycaemic hyperinsulinaemic clamp model of equine laminitis” in the September 2019 issue of the *Equine Veterinary Journal*.

The paper noted that “continuous digital hypothermia can prevent the development and progression of laminitis associated with sepsis but its effects on laminitis due to hyperinsulinaemia are unknown.”

The conclusion of the paper stated, “Continuous digital hypothermia reduced the severity of laminitis in the EHC model and prevented histological lesions compatible with lamellar structural failure.”

The authors of the paper noted that the main limitations of the study were that “continuous digital hypothermia was initiated before recognition of laminitis and therefore the clinical applicability requires further investigation.

“The paper is an initial step in understanding how cooling can prevent this form of laminitis, which may help us to understand why insulin causes laminitis and identify targets for drug therapy,” they continued. “The results also support the use of foot cooling as a first aid measure for an acute bout of this ‘endocrinopathic’ form of laminitis.”

Take-Home Message

These were just a few of the many presentations covered in the three days of lectures and one full day of wet labs during the 2019 NEAEP Symposium. This educational joining of equine veterinarians and farriers is unique in the industry, and the information provided will benefit both groups to better serve their clients and their horses. **EM**

Editor’s note: Digital Proceedings from the NEAEP 2019 Symposium (plus NEAEP Proceedings back to 2014) are available to NEAEP members through the organization’s website.



Quality of Life and Career Satisfaction

Following are vet wellness highlights from the AAEP Convention.

By Amy L. Grice, VMD, MBA

On Tuesday afternoon at the 2019 AAEP Convention, a series of presentations addressed boundaries and burnout in the veterinary industry. Betsy Charles, DVM, led off the afternoon with a talk on boundary setting. She described why boundaries are essential for a fulfilling career. Charles stated that failure to set clear boundaries is one of the largest contributors to stress and unhappiness in the profession. She said boundaries are “a property line that defines what we are responsible for or not responsible for.”

Because it is impossible to set boundaries without understanding our values,

first we must determine what matters to us the most, Charles stated. She recommended reviewing the work of Brené Brown online to assist in identifying values and setting boundaries.

After identifying values, the next step is to “operationalize” them through identifying the specific behaviors that will satisfy those values. For example, if a core value is your family, then “operationalizing” that value would include setting boundaries so you can be home three nights of five in time to spend meaningful time with your family.

The next step is to communicate your boundary lines so that others have proper expectations and are not surprised.

Learning to say “no” and considering it a complete sentence is difficult, said Charles. She recommended the book “Boundaries: When to Say Yes, How to Say No to Take Control of Your Life” written by Drs. Henry Cloud and John Townsend.

Charles emphasized that respecting others’ boundaries is critical in reducing workplace stress. She concluded that only through meeting this challenge will future equine practitioners thrive.

Personal Wellness

Shannon Reed, DVM, MS, DACVS-LA, is a surgeon at The Ohio State University. She, like all veterinarians, experiences



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frequent stress. By approaching wellness as a daily personal priority, she seeks to mitigate its negative effects. In her presentation, Reed defined wellness as the combination of physical, mental and emotional health and well-being.

She said the first step in creating a personal wellness plan is to determine what constitutes well-being for you; each person has different needs. It is also necessary to figure out the barriers that might prevent you from achieving your goals. Many times, a veterinarian's strong work ethic prevents him or her from pursuing wellness goals that might conflict with the work of continually fulfilling client or patient demands. However, research with physicians has shown that attention to well-being will significantly increase performance. Stress, burnout, fatigue and depression negatively and markedly affect patient care.

Seeing personal wellness as a path to better patient care rather than a selfish act can allow some practitioners to practice self-care, she stated.

A holistic approach is necessary to integrate a personal wellness plan into the successful management of a veterinary practice, said Reed. Each step of the plan must be considered with the practice in mind. By asking certain questions of yourself, well-being can increase for all in the practice.

Reed said that the first questions involve whether you approach your colleagues at work with a mindset of collaboration or with a defensive, competitive stance. Creating room for personal wellness requires working with others as a team and relying on each other.

The next questions identify whether you feel ethically challenged by the services your clients ask of you, and whether you feel failure when a case does poorly or feel personally responsible for the outcome. These answers will help you know whether you can easily let go of your cases to colleagues in order to create space for self-care.

A big part of personal wellness is car-

ing for your health, the speaker stated. Do you consistently take the time for necessary health appointments at your personal physician, dentist, therapist, etc.? Do you make thoughtful dietary choices and exercise regularly?

Getting adequate sleep is also important, along with periods of quiet contemplation, such as meditation, yoga or prayer.

Unfortunately, equine practice workloads mean veterinarians often can't control overtime. Boundaries can help in this regard, she said.

Veterinarians should also think about their own efficiency and resiliency. The speaker suggested forming a list of personal goals and standards to create a more controlled work setting where



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time away is more easily achieved. To-do lists and time schedules can help you accomplish that, Reed said. It is important to reassess your priorities on the to-do list regularly and act proactively. With these steps, occupational stress can be a manageable risk rather than an intrinsic condition of the profession.

Avoiding Burnout

Ashleigh Olds-Sanchez, DVM, DAB-VP-Equine Practice, an ambulatory practitioner with many years of experience, discussed avoiding burnout as a solo practitioner. She began by acknowledging the current reality that many equine-oriented veterinarians either leave the equine profession within a few

years for companion animal medicine or decide to simply begin their careers there. Although she directed her talk to solo practitioners, she stated that her ideas for preventing burnout could be helpful for all equine practitioners, regardless of the size of their practices.

Olds-Sanchez defined burnout as a state of physical and mental exhaustion that culminates in a loss of identity or sense of purpose. Important causes of burnout include lack of social support, imbalance in work and life outside of work, lack of control over schedules and workload, and dysfunctional work cultures, she said.

Burnout is common among all kinds of healthcare workers, she said. Equine and large animal veterinarians are often affected.

Many practices struggle to attract and retain associate veterinarians, primarily due to low salaries and the lifestyle, she said. Equine practitioners experienced a decline in average income of 6.7% between 2006 and 2012. That was compared to an increase of 22.7% for companion animal veterinarians during the same time period. So it is not surprising that many vets have made the choice to leave equine, especially in light of the increasing educational debt that many young veterinarians carry.

Emergency duty on weekends and nights, along with the long daily hours that often accompany equine practice, are also reasons for the exodus, Olds-Sanchez said. Being available for emergencies is unavoidable for large animal veterinarians. Most of the time these services must be provided in the ambulatory setting. For solo practitioners, the obligation to be "on call" all of the time is a major cause of burnout.

Many new graduates are unwilling to undertake large animal practice if the job requires much on-call service.

Minimizing the impact of emergency duty can be challenging, but there are several ways to approach this problem, the speaker shared.

First, forming a local emergency

cooperative can help in reducing this burden.

Second, consider sharing emergency duty with a part-time employee veterinarian, possibly sharing the expense of that vet with another practice. Although traditionally practices are leery about not being available because their clients might not accept an outsider, Olds-Sanchez emphasized that by building a strong brand, this concern can be minimized. If you are lucky enough to be near a large referral hospital or university, she suggested forming a relationship that allows you to use those facilities for your clients' emergency needs when you need a break.

Another important aspect of preventing burnout includes formally scheduling personal time into each day or week, the speaker said. She suggested scheduling these times in the morning to ensure that they are not overwhelmed by the day. Other recommendations included attending focused continuing education to learn new skills that you can be excited about adding to your repertoire, networking with regional veterinarians at social events to build community and practicing mindfulness with intention. The latter can be done by appreciating simple moments of beautiful scenery or warm sunshine on a cold day, she said. This appreciation can build joy and gratitude into every day.

Lastly, the speaker counseled that strategies to provide financial outcomes more comparable with companion animal practice involve raising fees for services, being better at collecting payment, and being more savvy in practice management.

Take-Home Message

In closing, Olds-Sanchez suggested that although many equine veterinarians struggle with their quality of life and career satisfaction, utilizing steps outlined in this article can make a marked difference. **EM**



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The Business of Practice

There were many outstanding business presentations at the 2019 AAEP Convention. Here are synopses of a few of those talks.

By Amy L. Grice, VMD, MBA

The annual AAEP Convention is not only the world's largest educational gathering of equine veterinarians, it also provides some of the best equine business presentations. The 2019 AAEP Convention offered many pertinent and applicable business topics. In this article we summarize some of the presentations from the Convention.

Genderspeak: Working Together Successfully

In response to the changing demographics of gender among veterinarians, the keynote speaker of the AAEP convention was Tammy Hughes, a nationally renowned speaker on communication. For

the last 20 years, Hughes has explored the research on how women and men relate and how they evaluate situations differently. Her presentation was geared toward helping the audience understand what is typical in both gender cultures, allowing listeners to read people more accurately and evaluate their conduct more fairly. Hughes addressed the issue of communication differences with humor and sensitivity.

Hughes explained that "People do things for reasons that make sense to them. They learn appropriate adult behavior through their childhood experiences. It's not about good or bad, right or wrong—it is about differences!"

She stated that diversity is about much

more than gender; it includes race, generation, sexual orientation, ethnicity, physical qualities, nationality and culture. While there are some differences due to biology ("nature"), she said, many of the observable differences in communication come from nurture. In addition, she said it is important to recognize that all populations have a bell curve, so in each cohort there will be some who behave differently than the "norm." By becoming aware of these behaviors, we can become more agile in understanding each other as human beings, she said.

Much research has been conducted about innate gender differences, Hughes said. Some of this research is performed with infants in their first 24 hours of



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Ethics Session Proves Popular

At the 2019 AAEP Convention, an early-morning session was set aside to discuss ethical issues in equine practice. Emma Adam, BVetMed, PhD, DACVIM, DACVS, from the Gluck Equine Research Center, moderated an ethics case-based panel discussion. She noted that veterinarians often serve as ethical gatekeepers.

The overriding premise that dictates ethical guidelines is referred to as the “social license to operate (SLO).” This means that society and communities have given their approval for certain activities. Because of that overriding premise, the session began with a presentation on “Social License to Operate” by Camie Heleski, PhD, of the University of Kentucky.

Legitimacy, consent and trust are prerequisites for an effective social license to operate, along with transparency, accountability, honesty and credibility. While an SLO is difficult to quantify, it must be earned rather than granted, and if lost, it is tricky to regain. Questions that were asked:

- Do veterinarians have an automatic social license to operate?
- Have public attitudes toward veterinarians changed over the years?

Many horse owners see a value in veterinarians, but clients also have tremendous access to information, media and “Dr. Google.” Because of this, an automatic social license to operate for vets is not implicit, as it used to be.

Veterinarians usually lose public trust through objectionable actions. One audience member suggested that when posting on social media, it is smarter to offer evidence-based information rather than opinions and feelings, which can be damaging. It is also always appropriate to say, “I don’t know.”

As public trust of veterinarians is chipped away, this might be a wake-up call for practitioners to become more proactive. One person asked, “If we don’t speak up, should we expect the public to trust us?”

As pertains to private equine practice, when a practitioner feels that there is an ethical “red flag,” it is important to discuss those concerns with the client. One hypothetical example provided in the seminar depicted a client asking her veterinarian to inject a horse’s coffin joints for a horse show that is going on for the next few days. Just flatly saying, “No, you need a four-day withdrawal period prior to showing, so I won’t do that” leaves a bad taste in the client’s mouth and makes the veterinarian uncomfortable.

Rather than leaving it at that, it could work better for both client and vet if there is a discussion about other possible solutions. Clients don’t always know about the array of options for managing a horse’s chronic lameness conditions. Another proactive step to consider is to be involved with clients’ needs before an event is upon them. This could be accomplished using a computer-driven reminder to have the client contact you well in advance of an event.

Poor ethical standards and bad press have caused many industries to lose this social license to operate privilege—the mining industry, sows in gestational crates, greyhound racing, elephants in circuses and bullfighting in Spain, to name a few.

Heleski related that videos of negative things often go viral in a matter of hours, citing the video of a barrel horse being trained with a shocking device, which was shared 6,900 times in 90 minutes.

Although social license to operate is difficult to measure and quantify, she said that often “public emotion may not be recoverable.”

The intense scrutiny on 37 deaths in 2019 from catastrophic breakdowns of racehorses at Santa Anita is one of the situations that might put the sport of racing at risk of losing its social license to operate. There are practices deemed acceptable at U.S. racetracks that are not acceptable elsewhere, including the use of whips and race-day medication. It was suggested that the best way to handle the greater scrutiny of the racehorse industry is by responding to public opinion.

Attempts to keep things secret puts the industry on rocky ground, said Adam. In the case of racehorses, without intentional effort to educate the public, emotion will carry the day and racing will lose its social license to operate.

Following this talk, a series of short scripts were presented illustrating real ethical dilemmas that had been submitted. The panel and the audience engaged in spirited discussion about the issues that were raised, and offered possible solutions to the difficult positions that veterinarians can find themselves in.

The bottom line is that equine veterinarians will present a more trustworthy face to society by tackling problems head on. A willingness to discuss with horse owners and the public about why certain practices are done, and to explain potential remedies for situations, are important means for veterinarians to maintain and retain our social license to operate.—*Drs. Amy Grice and Nancy S. Loving*

life. Interestingly, male babies choose to focus visually on blinking lights and machinery, while female babies focus on faces primarily. Toy companies have done a great deal of research on children's preferences for toys over the last 50 years. By watching children play in rooms filled with all different types of toys, they have repeatedly observed that boys' play generally revolves around power, speed and noise, while girls' play involves caring and relationships. Although boys might interact with dolls, they create very different scenarios than girls in their play.

The speaker mentioned the differences in acceptable behavior that exist for each gender in different times of life. In the early years, the acceptable range of behavior for females is much wider than for males, she said, but this flips in adulthood. While girls are readily accepted in childhood as "tomboys," boys with softness are labelled "sissy"

or "pansy" and receive strong negative messages. As adults, society has much stronger limits on acceptable behavior for women, often narrowly defining what is feminine, while giving men a broad range of allowable conduct.

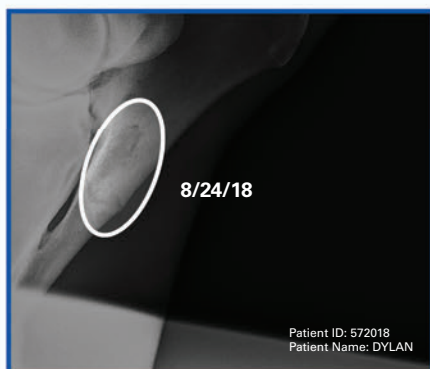
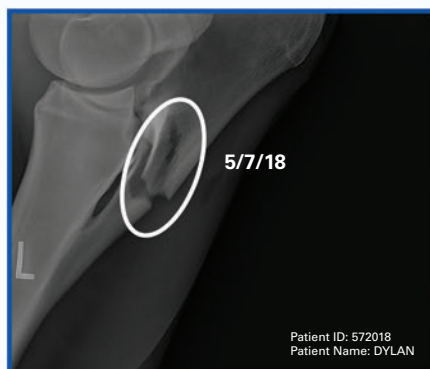
In defining the differences between males' and females' views of the work world, Hughes shared that men see power as hierarchical, while women are more comfortable with a flat structure. She described a meeting where older male physicians were to answer questions at a conference for younger doctors. They set up the room with a table on the stage that visually demonstrated their superiority. When young female doctors were added to the group answering questions, they wanted to set up the room with chairs in a circle on the same level. Neither understood the choices of the other. In the female culture, a flat structure minimizes individual power and increases cooperation. In

the male culture, scuffling for position and power is a way of life.

When a woman is the boss, she needs to do "relationship work" in order to maximize her team's performance. Because power is not seen as acceptable in females, she cannot toss a folder on a subordinate's desk and say, "I need this done by 3 p.m." as a man could do, said Hughes. Instead, she must have a conversation that strengthens the relationship and ask nicely for performance of the task.

When a team has a success, crowing loudly will be seen as arrogant and distasteful from a woman, but will be expected or at least accepted from a man.

Hughes shared that men and women focus on different things in their communication—goals versus process. Often women want to talk a situation or problem out with a colleague to process the circumstances and brainstorm possible solutions. By contrast, she said, men are



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goal oriented in their communication—they will want to suggest a solution because they process internally, while most women process externally. This leads to frustration where a man thinks, “Why did you ask me in the first place if you weren’t going to take my advice!” However, by giving prior notice that she is just looking to brainstorm, a woman can still have those conversations with a male colleague, the speaker added.

Another difference the speaker outlined between the genders is with having

instance, comfort with risk-taking allows males to typically “say they can do it (whatever it is), then figure it out,” while females are honest and say what they think could work after confessing their lack of experience with the issue. In keeping with this difference, a study showed that men will apply for a promotion or job if they have six of 10 “required” qualities, while women will only apply if they possess all 10 qualities, she said. Because of this, females can fail to advance in the workplace.



Males tend to work in single "boxes" at a time, while women multi-task in multiple, simultaneous "boxes." This can lead to misunderstandings in the workplace.

a linear focus versus multiple foci. Males tend to work in single “boxes” at a time, while women multi-task in multiple, simultaneous “boxes.” This gender difference is brain based, with females excelling at rapid task switching compared with males. When this disparity is not recognized, a boss will feel the employee of the opposite sex is under-performing and might deny them promotions, raises or good reviews, she said.

In describing different “rules of talk,” Hughes relayed that there are distinct gender differences in risk-taking versus honesty, use of linguistic devices, attribution of success versus failure, and non-verbal communication. For

Regarding the disparity in use of linguistic devices between the sexes, the speaker reported that women frequently use hedges, disclaimers and tag phrases to flatten out the power structure, a method that is very successful in female culture, but falls flat in the male power hierarchy. In contrast, males jockey for position and build relationships with each other through rough verbal bantering that can sound aggressive to females. These differences can be hard to overcome in the workplace, Hughes said.

Hughes explained that results of studies on attribution theory show clear gender differences. When study subjects took a test and were then given fake test

results and asked why they performed in such a manner, there was marked variation between the sexes. When the results indicated the test went well, females attributed their success to luck, effort or task ease, while males chalked their success up to their superior talents. When the fake results indicated poor performance, the females said they tried hard but couldn’t succeed, while the males blamed an external factor. In a humorous example, the speaker suggested that when a woman’s pants are too tight, she will say “I need a diet” and the man will say “There’s something wrong with these pants!”

Non-verbal communication is powerful, and women are subject to unwittingly miscommunicating with men in this manner. Of particular trouble is nodding. According to the speaker, women nod frequently to indicate “Yes, I am listening; I am paying attention to what you are saying,” but men translate these nods as agreement with their ideas. As a result, men often feel blindsided when the women later disagree or offer amendments to the proposal.

In summary, Hughes suggested that research overwhelmingly shows that mixed-gender teams always outperform homogeneous, single-gender work groups. However, the ability to interpret others’ communications through multiple lenses will elevate results even further and help create a more harmonious and level playing field at work.

Business New Hour

Mary Beth Whitcomb, DVM, MBA, ECVDI (Large Animal Associate), and Ernie Martinez, DVM, MBA, headed up this popular kick-off to the Business Education sessions at the AAEP Convention on Sunday afternoon.

A recent study performed in the U.K. and published in the *Veterinary Record* revealed that although women are increasingly the dominant gender by numbers in the veterinary profession, gender discrimination remains a serious issue. Researchers found that many

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female veterinarians deal with blatantly sexist clients who insist that males treat their animals. Even worse, practices are failing to address these gender discrimination issues, and practices promote female veterinarians at much lower rates than males. Women respondents, especially recent graduates, reported that they were assumed to have limited competence and high potential for careers cut short by maternity. Female veterinarians with children (but not males) were considered to have lower commitment to the profession.

The study also suggested that those who don't think women face discrimination are often the ones who discriminate the most.

ACVS Study: Next reported was a study published in *JAVMA* titled "Demographics, measures of professional achievement, and gender differences for diplomates of the American College of Veterinary Surgeons in 2015."

Results showed that hours per week worked and full-time versus part-time status did not differ by gender. Respondents in equine or large animal private practice worked the most hours (50-59 hours/week) and had the most emergency on-call responsibility. Women were more likely than men to be employed in academia. In both private practice and academia, respondents in small animal practice earned substantially more (\$228,000) than did those in equine or large animal practice (\$130,000), and men earned 18% more than women, even after relevant adjustment.

Females were less likely than males to be practice owners or to hold a presti-

gious academic title or rank. Results also showed that perceptions about the effect of gender in the workplace differed between men and women.

A partner study titled "The intersection of personal and professional lives for male and female diplomates of the American College of Veterinary Surgeons in 2015" was also reviewed. This paper revealed that men were more likely than women to be married or in a domestic partnership (88% vs 68%, respectively) and to have children (77% vs 47%).

Among women, but not men, respon-

of equine veterinarians in their first five years of practice was discussed. Survey results indicated that the primary driving forces behind this exodus are the lifestyle, long work hours, emergency duty and low compensation. The presenters said that recent numbers of jobs on the AAEP Job Site numbered 359.

Veterinarian Health and Welfare:

Wellness is a topic currently at the forefront of veterinary medicine, Whitcomb shared. National Public Radio (NPR) recently had a program on the Facebook group Not One More Veterinarian (NOMV), which is a non-profit

organization with 21,400 members. Moderators of the site are trained in suicide prevention, and a "Bad Day" phone list has NOMV members ready to talk to any veterinarian who need someone to listen. By partnering with BetterHelp, NOMV now also offers one month of free online counseling. Whitcomb added that the AAEP Healthy Practice program has a plethora of

wellness resources available and suggested that afsp.org is also a good site for more information.

Cyber Security: Rounding out the hour-long session, Martinez reported on the growing threat of cyber attacks in veterinary hospitals, with 19 of 400 NVA hospitals affected in 2019.

Measures to increase cybersecurity include having your Windows operating system on auto-update, utilizing anti-virus software, being careful not to open e-mails from addresses that are unfamiliar, and having a back-up system that you use daily. **EM**

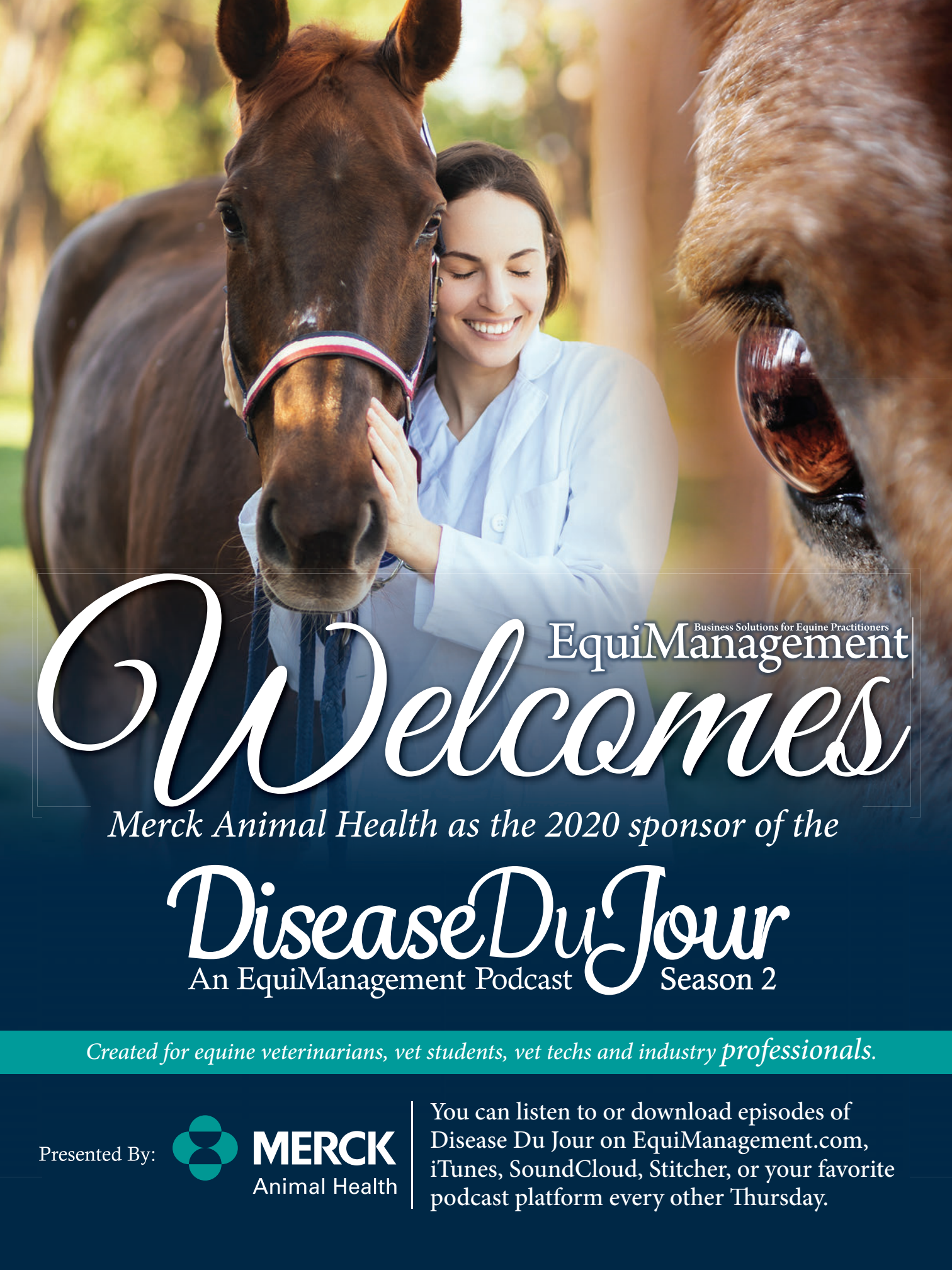


Respondents in small animal practice earned significantly more than did those in equine or large animal practice, and men earned 18% more than women.

dents in large animal practice were less likely than were those in small animal practice to be married or have children.

Respondents with children worked significantly fewer hours (6.0 less for women vs 3.1 hours less for men) than did those without children. Females were more likely than males to report that having children had negatively impacted their professional lives.

EquiManagement Article: The winter 2019 *EquiManagement* cover story "Leaving Equine Practice" was highlighted during the Business News Hour. In the article, the recent attrition



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Novel Management for Headshaking

Dr. John Madigan discussed a novel way to manage trigeminal nerve-mediated headshaking (TMH) at a special meeting hosted by Platinum Performance.

Platinum Performance hosted an invitation-only, full-day seminar just prior to the 2019 AAEP Convention in Denver, Colorado. At this seminar, John Madigan, DVM, MS, DACVIM, of the University of California, Davis, discussed a novel way to manage trigeminal nerve-mediated headshaking (TMH).

This syndrome is related to neuropathic pain that causes a horse to feel itching, tingling or electrical-like sensations that elicit head jerks, snorting, face rubbing and even instances of horses striking their faces. Madigan reported that as many as 4.6% of horses are affected, with 75% geldings; there is also a seasonal component.

Studies at the Neuromuscular Disease Laboratory (NDL) at the University of California, Davis, have identified an abnormality in the threshold of firing of the trigeminal nerve in affected horses. Stimulation to the gums at only 1/10 of normal is able to elicit a “headshaking” reaction from a TMH horse. On histopathology, there is no inflammation in the trigeminal nerve or ganglion.

Madigan proposed that this syndrome is then likely a functional problem related to ion channels that control thresholds for nerve firing—normal nerve responses depend on diffusion of sodium ions in and outward diffusion of



ARNOLD BRONKHORST PHOTOGRAPHY

UC Davis researchers have identified an abnormality in the threshold of firing of the trigeminal nerve in affected horses.

calcium ions. (Lidocaine, for example, decreases pain by acting as a sodium channel blocker.)

A study using six horses and six controls observed two possibilities for understanding the pathophysiology and potential management of TMH:

1. concentrations of ionized magnesium
2. dietary changes, and in particular DCAD (dietary cation anion differences)

DCAD Strategies

Bovine practitioners have long been aware of the importance of DCAD strategies to manage milk fever. Strong cation differences are determined by $[(\text{sodium} + \text{potassium} + \text{calcium} + \text{magnesium}) \text{ minus } (\text{chloride} + \text{sulfate} + \text{lactate})]$. Diets high in strong cations, especially potassium and sodium, are known to induce milk fever compared to diets high in anions such as chloride and sulfur.

High anion diets help reduce milk fever in cattle with no change in calcium nutrition. Two parathyroid hormone-dependent functions of bone resorption of calcium and renal production of vitamin D are enhanced in cows fed diets with added anions. Based on these findings, small fluctuations in pH within physiological range affect receptors in calcium mobilization, which controls ion channel opening.

With this in mind, the UC Davis researchers wondered whether changes in DCAD and blood pH in horses could have an effect on ion channels (sodium or potassium) that would in turn have an effect on trigeminal nerve pain? Could this strategy even beneficially affect modulation of musculoskeletal pain that influences equine performance?

Ion channels responsible for pain sensation are usually located at the peripheral terminals of nociceptors that relay



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information from end organs to the brain via dorsal root ganglia. Madigan explained that the nervous system goes through a wind-up process that regulates a persistent state of high reactivity—this is referred to as pain central sensitization. The wind-up process increases perceived pain to the same amount of stimulus experienced prior to the wind-up. The pain “feels worse than it actually is,” explained Madigan.

The UC Davis neurology lab researchers evaluated treatment of six TMH horses with intravenous hypertonic bicarbonate to mimic a DCAD diet to modulate this wind-up process and affect reactivity of the trigeminal nerve. The resultant mild alkalosis coincided with reduction of trigeminal pain to decrease headshaking by 50%.

Further studies at the lab will look at DCAD diets to see whether a difference

in perceived pain can be elicited in horses performing athletic exertions.

Magnesium and Boron Supplementation

Another experiment by the researchers focused on magnesium, which is a co-factor in more than 300 biochemical enzyme systems. While magnesium has no direct analgesic effect, its effect on inhibiting calcium from entering cells lessens or prevents central sensitization. In TMH horses, the trigeminal nerve misfires at a low threshold, but supplemental dietary magnesium modulates this hypersensitivity.

Madigan said that total blood magnesium is not reflective of the important ionized magnesium levels that are relevant for their effect on central sensitization. Specialized assays are necessary to measure ionized magnesium levels.

An additional 12-horse study analyzed the effect of magnesium with or without boron supplementation. Three treatments were provided in addition to grass and alfalfa hay: a) $\frac{3}{4}$ cup Equine Senior + $\frac{1}{4}$ cup canola oil + 2 tb apple sauce; b) the preceding diet plus 24.2 mg/kg magnesium citrate; and c) the preceding diet and magnesium supplement plus 40 mg/kg boron.

Horses receiving only the pelleted diet experienced a 44% reduction in headshaking.

The magnesium supplemented to the pelleted diet provided 52% resolution while magnesium and boron supplementation reduced headshaking by 64%.

By altering the DCAD in equine diets, it might be possible to provide therapy and improve the comfort of headshaking horses. **EM**

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