2011's Top Equine Studies

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Each year, researchers publish hundreds of horse health studies. And each year at the convention, three practitioners have the unique (and behemoth) task of deciding which to feature during the Kester News Hour.

This time Patrick M. McCue, DVM, PhD, Dipl. ACT, associate professor of equine science at Colorado State University in Fort Collins; Scott E. Palmer, VMD, Dipl. ABVP (Equine Practice), hospital director and staff surgeon at New Jersey Equine Clinic in Clarksburg, N.J.; and Steve Reed, DVM, Dipl. ACVIM, associate at Rood & Riddle Equine Hospital in Lexington, Ky., presented the top studies in equine reproduction, surgery, and medicine, respectively.

The hosts of the news report-themed presentation described the studies they found most important, interesting, or applicable during the session that is a perennial favorite among veterinarians. Here is a sampling of the research they covered. Journal references for these studies and summaries of additional studies can be found online (see links on page 15).

COURTESY AAEP/CHARLES PAZIO

From left to right: Drs. Patrick M. McCue, Scott E. Palmer, and Steve Reed presented the top studies in equine reproduction, surgery, and medicine, respectively.

Metabolic & Endocrine Disorders

Reed began by describing a handful of studies on diagnosing the single most commonly detected endocrine disorder in aging horses—***pituitary pars intermedia dysfunction*** (PPID, or equine Cushing's disease), which is characterized by enlargement of the pars intermedia region of the pituitary gland. Diagnosing PPID, he noted, has been a challenge in the past, and usually affected horses are identified through a combination of age and clinical signs.

In one study Reed referenced, researchers evaluated which breeds are most prone to PPID diagnosis and what—if any—effect geographic location had on PPID diagnosis. About 36% of all horses are diagnosed with PPID, Reed noted, but the disease is most commonly found in pony breeds and Morgan horses.

Further, the researchers found that levels of two hormones released by the pars intermedia—adrenocorticotropic hormone (ACTH) and α-melanocyte-stimulating hormone (α–MSH)—increase in all horses in the fall. And while fall begins earlier in the North then in the South, horses in the South display a greater pars intermedia response to the change in season.

The study is a step toward fulfilling certain diagnostic needs, he noted: "Seasonal and photoperiod (daylight's effect on plants and animals) reference ranges are needed when interpreting pars intermedia hormones in horses and may be helpful for early recognition of PPID in horses."

Additionally, Reed discussed a study in which a research team evaluated ***ACTH levels*** in more than 900 horses with PPID and another 900 without PPID. They found that during the fall (August to October) horses with PPID had an average ACTH concentration of 120 pg/mL compared to November to July when the levels were only 60 pg/mL. While levels fluctuated throughout the year in the non-PPID horses as well, the average ACTH thresholds were significantly lower year round in normal horses.

Reed concluded that because of the variation in hormone concentrations year-round, the fall could be the best time to test as a result of the observed spike in ACTH levels in PPID horses.

Respiratory & Cardiovascular Topics

Reed changed gears, describing a study in which scientists evaluated ***the effect of furosemide*** (commonly known as Salix) on treating exercise-induced pulmonary hemorrhage ("bleeders"). They found that administering 250 mg of Salix four hours prior to exercise (they tested the horses at 80% of maximum energy output) did not alter the horses' exercise performance, and it did not impact the way capillaries in the lungs regulated red blood cell volume, despite the fact it decreased cardiac output. Reed noted researchers are still working to understand exactly where in the lungs the bleeding originates and that it's possible a higher dose of Salix could have yielded different results.

Veterinarians often treat another respiratory disorder, ***recurrent airway obstruction*** (RAO, heaves), with systemic corticosteroids. This treatment method is often effective, but prolonged use can have adverse effects (including a suppressed immune system and an increased risk of founder) in some horses. Reed discussed a study in which researchers examined the effects of using an inhaled corticosteroid to treat RAO as opposed to traditional administration methods. The team assessed effects on the two arms of the immune systems, cell-mediated (protecting against intracellular organisms) and humoral immunity (via antibodies in the serum that protect the horse from infection), and noted no adverse reactions. Further, the team found that prolonged administration yielded no undesirable results.

Diagnostic Techniques

Reed then delved into a few studies regarding new or updated diagnostics. He first discussed a study in which investigators determined that ***dehydration in horses*** led to abnormalities evident on echocardiographic examination (an ultrasound of the heart). The most significant changes were observed in the left ventricle (the lower chamber of the heart that pumps oxygenated blood throughout the body) and left atrium (the upper chamber that transports the oxygenated blood from the pulmonary veins into the left ventricle) of dehydrated horses, both of which appeared decreased in size. The thickness of some wall structures within the heart also increased.

"The researchers warned (dehydration) could result in alteration of variables often applied to predict athletic potential in a horse," Reed said.

Clinicians are diagnosing ***cervical (neck vertebrae) problems in horses*** more frequently. While clinical assessment and cervical vertebral radiographs are the usual diagnostic tools veterinarians use, Reed discussed a study in which researchers examined the use of electromyography (which measures electrical activity of muscles) for diagnosis. Often used in human medicine for diagnosing movement disorders, the team tested the technique in horses and found it useful for evaluating suspected cervical lesions.

"(The researchers) seek to establish normal values to use for the diagnosis of horses with neurological problems involving the cervical vertebrae," he said, which will help vets recognize what is abnormal.

Drugs and Side Effects

Reed relayed the results of a recent study in which a research team reviewed ***non-steroidal anti-inflammatory drugs' (NSAIDs) effects on equine intestines***; he noted veterinarians have observed side effects including gastric ulceration and right dorsal colitis, especially when using these drugs to treat endotoxemia. Through their research, the team confirmed that extended NSAID use damages the intestinal mucosal barrier, which leads to a loss of normal barrier function (against some common antigens and pathogens).

Ocular Health

Reed closed his segment by discussing a study in which researchers evaluated the presence of ***ophthalmic lesions in neonatal foals*** admitted to a referral hospital for unrelated reasons. Fifty-six percent of foals had at least one potentially vision-limiting ophthalmic disease (possibly acquired as a result of another health problem).

He said, "Don't forget to look at the entire foal. If you treat them early, you might find things that could save their vision."

EVA Vaccines

McCue described equine viral arteritis (EVA) as a highly contagious disease that can cause weakness or sickness in foals and abortion in broodmares. The virus can be transmitted via respiratory secretions or breeding (natural cover or artificial insemination). The AAEP's vaccination guidelines state, "The manufacturer does not recommend use of (the EVA) vaccine in pregnant mares, especially in the last two months of pregnancy." However, a team of researchers revisited ***the safety of vaccinating pregnant mares against EVA***. McCue summarized, "It appears … safe to vaccinate healthy pregnant mares against equine arteritis virus up to three months before foaling and during the immediate postpartum period. Vaccination during the last two months of pregnancy was associated with a risk of abortion."

Veterinarians also recommend ***EVA vaccination for stallions*** (an initial vaccine, then annual boosters), but researchers on a recent study found a temporary low level of viral activity in semen shortly after initial vaccination.

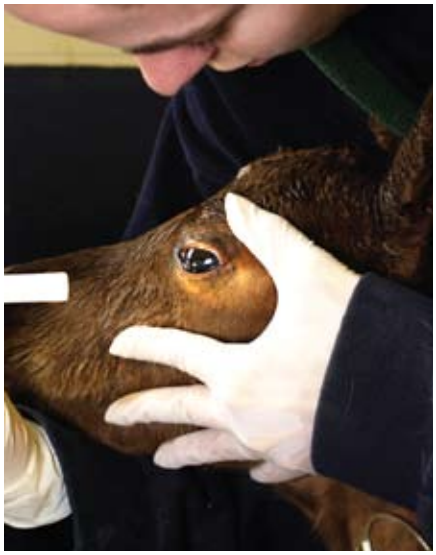
"Withhold use of semen for 14 days after first-time vaccination to minimize risk of transmission of vaccine virus and eliminate potential for vaccine virus in frozen semen," advised McCue. After the initial low level viral activity, there was no evidence of persistent vaccine virus in first-time vaccinated stallions' reproductive tracts, and there was no transmission of vaccine virus to in-contact horses.

Sperm Morphology and Quality

"Assessment of sperm morphology (physical characteristics) is a key component of semen analysis," noted McCue as he described a study in which researchers compared ***semen evaluation staining procedures*** for use in horses.

The scientists found wet mount preparations to be more sensitive for detecting abnormal sperm than stained smears, while smear preparations increased the proportion of detached heads. The Papanicolaou stain (a multichromatic staining that allows scientists to differentiate cells in smear preparations; it's well-known for its use cervical cancer screening in women) was unsuitable for stallions.

"A significant difference was noted among clinicians, suggesting that consistent training is important," he explained.



ANNE EBERHARDT

Reed said veterinarians should be sure to examine sick foals' eyes to detect possible associated eye illness.

In another ***semen quality and fertility study*** scientists looked at seasonal pregnancy rate, percentage of mares pregnant per cycle, and percentage pregnant on the first cycle. They found that a number of sperm abnormalities (such as coiled tails or abnormal/detached heads) depressed fertility, and more fertile stallions had better sperm motility and a higher percentage of morphologically normal sperm.

"The percentage of mares pregnant on their first cycle was the only fertility measurable to discriminate among high, average, and low fertility groups (among stallions)," McCue noted.

Embryo Transfer

McCue described one report of a successful embryo transfer program as "a valuable contribution to the world of embryo transfer with mind-boggling numbers—a great data set." Investigators presented the techniques and lessons learned from nearly 15,000 embryo flush procedures (up to 2,300 per year), nearly 8,000 established pregnancies, and 1,900 embryos transferred over a 13-year period.

"The take-home message is that a ***breeding soundness evaluation*** should be performed on each donor and recipient mare," summarized McCue. "Also, recipient mare selection and management is critical to success. Recipient mares can ovulate anywhere from the day before the donor mare ovulates until four days after the donor mare ovulates.

"Freezing small embryos is easy, but large ones are problematic and historical failures," said McCue as he introduced a study of ***a new technique for optimizing freezing of large embryos by the process of vitrification***. This technique involves removing fluid from the initially hollow early-stage embryo (termed a blastocyst) to collapse it prior to vitrification. Large embryos that were intentionally collapsed prior to freezing yielded good pregnancy rates after transfer (there was a 71% pregnancy rate in this study).

"This technique appears to be a significant step forward for equine embryo transfer and (embryo) cryopreservation," McCue commented.

Veterinarians might biopsy embryos for genetic evaluation for several reasons, from determining sex to identifying inherited diseases. He discussed a study in which scientists defined proper embryo biopsy techniques and ways to evaluate results.

"***Biopsy of large blastocyst stage embryos*** was possible and did not compromise embryo viability," he reported. "Genetic analysis was accurate for sex determination and is a 'work in progress' for diagnosing HERDA (hereditary regional dermal asthenia, also called hyperelastosis cutis, a skin condition) and HYPP (hyperkalemic periodic paralysis, a metabolic/muscle condition). Pre-implantation genetic diagnosis may soon become a viable clinical procedure in the horse."

Respiratory Problems: Surgical Approach

"Coughing is a common complaint in mature nonracehorses with epiglottic abnormalities," began Palmer as he described a retrospective study of mature horses (mean age of 16, with a range from 9 to 30) with ***abnormalities of the epiglottis*** (a flap of cartilage that moves to cover a horse's

windpipe when he swallows to prevent inhaling fluid or food). In the 23 horses studied, the primary complaint for 70% was chronic cough and the most common epiglottic abnormality was epiglottic entrapment, which results in hampered epiglottal movement (followed by subepiglottic granuloma and subepiglottic cyst). All horses were treated surgically and 74% required no further treatment, while a few required additional treatment for inflammation, RAO, and dorsal displacement of the soft palate.

"Upper airway endoscopy is recommended in the evaluation of older horses with a cough," summarized Palmer. "Surgical treatment can be beneficial in most horses, with some requiring further postoperative medical treatment."

In the years that have passed since the release of a practical backpack-based endoscopic system for examining the horse's airway during normal exercise, researchers have been reevaluating accepted knowledge about equine respiratory problems and working to develop optimal workouts for revealing abnormalities.

Another group of researchers recently published their investigation of ***dynamic endoscopy exams*** and the workouts used during those exams. Notably, airway noise was the easiest condition to reproduce on examination, and poor performance without noise was most difficult.

"A principal advantage of dynamic videoendoscopy is the ability to evaluate the horse in its natural surroundings and under race conditions," Palmer said. "However, it may be difficult to standardize exercise tests in the field under widely varying conditions. It is best to replicate race conditions as closely as possible with peers (working alongside); no single protocol is likely to be appropriate for all exams."

Laryngoplasty, also called tieback surgery, is a relatively common treatment for horses that make significant airway noise during exercise (roaring). The surgery—which involves placing one or two sutures in the left arytenoid cartilage to hold it out of the airway—is usually effective, but as with most treatments its success rate isn't 100%. A research team examined records of 45 horses that had had left laryngoplasty surgery over a 15-year period to see if collapse of the cartilage after surgery could be predicted from post-procedure resting endoscopy, and to explain why some horses perform poorly after surgery.

Palmer reported that horses with no post-surgical abduction (opening) tended to have left arytenoid collapse, but horses with moderate or good degree of abduction showed no predisposition to collapse.

"Complex obstructions causing respiratory noise were observed in most examinations, but they were not specific for arytenoid collapse," Palmer added. "These data underscore the value of performing a dynamic examination prior to surgery in order to identify conditions that may compromise the outcome of laryngoplasty."

Sinus infections in horses can be just as tough to get rid of as those in humans. Palmer reviewed one study in which veterinarians documented long-term health of horses following conservative treatment (such as standing procedures to drain or remove pus from and rinse the sinuses) for various types of sinus disease.

Long-term results were mostly positive, with 91% of horses cured and usually after only one treatment. The exception was sinus neoplasia (tumors), in which just 22% were cured.

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>
> DR. PATRICK M. MCCUE

"More conservative treatments, including removal of intrasinus inspissated (thickened) pus by sinoscopy, pre-existing sinonasal fistula, or sinusotomy, (three procedures) which avoid the risk and expense of general anesthesia are effective in managing chronic primary sinus disease in many cases," reported Palmer.

Colic

"***Recurrent colic*** is often discussed but not well-documented," noted Palmer, as he described a study on the condition and risk factors for it. In this study nearly 37% of horses with medically treated colic had another colic episode within the next year.

"Recurrence of colic was higher than previously reported," he commented. "Horses with a known dental problem or cribbing/windsucking were at increased risk of recurrence. This confirms long-held beliefs and gives us a baseline number to share with clients when treating medical colics in the field."

Diagnosing strangulating bowel lesions associated with colic isn't always easy; the horse's torso is quite large and capable of "hiding" some deep lesions such as bowel twists severe enough to cut off blood flow. However, a recent study provided insight on a simple test that can help identify strangulating bowel lesions requiring immediate surgical intervention.

In the study of 94 horses with colic, researchers found rising concentrations of lactate in peritoneal (abdominal cavity) fluid sampled via a "belly tap" over a 30-minute period to be a "good indicator of strangulating lesions, easily performed, sensitive (79%), specific (88%), and a good indicator of the need for surgery," said Palmer. "Unrelenting pain will always be a primary factor, but this test can help in more ambiguous cases."

Stem Cells

An increasing number of veterinarians are using stem cell therapy, and rising with this trend is the need for a ***safe, efficient bone marrow-derived stem cell harvesting technique***. In a recent study authors described such a technique that involves placing a Jamshidi needle (a cylindrical needle with a tapered cutting tip) into the fifth sternebra (a segment of the sternum) with ultrasound guidance. Palmer noted that this procedure "enables aspiration of bone marrow reliably with minimal damage to the sternum and risk to the horse."

"Long-term follow-up (after stem cell usage) is hard to find," said Palmer. He discussed a study of stem cell usage in which the researchers observed 141 racing Thoroughbreds (flat and steeplechase) for at least two years after returning to full work following stem cell treatment of superficial digital flexor tendon injuries.

"Tendon lesions filled in quickly, histological (tissue architecture) appearance showed well-aligned fibrils, and there was an absence of scar tissue," he described. "Ninety-eight percent returned to racing with a 26% re-injury rate in hunt horses and 50% in flat horses. There was no correlation between outcome and age, discipline, number of stem cells injected, or injury-to-implantation interval.

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"This study shows that marrow-derived mesenchymal stem cell implantation is safe and appears to reduce re-injury rate after superficial digital flexor injury, especially in (steeplechase horses)," he concluded. "It is the first report that provides evidence for long-term efficacy of mesenchymal stem cell treatment for tendinopathy (tendon disease) in racehorses. However, the long-term success in the Thoroughbred flat horse remains a challenge."

To successfully treat lesions stem cells need to reach and stay in the lesion, and the administration route (intravenous, intralesional, or regional perfusion) has a lot to do with that. Researchers recently compared the ***three methods of administering stem cells*** and found that intralesional injection of stem cells (directly into the lesion) was the most effective for keeping stem cells within the lesion after 24 hours (the lesion retained 10% of cells), while regional perfusion came in a close second with cells remaining in the lesions of 11 of 12 horses. In contrast, stem cells injected intravenously did not "home" on the lesions at all, instead scattering mostly around the lungs.

COURTESY DR. GAL KELMER

Regional limb perfusion was one of the methods scientists examined for administering stem cells. It came in second place to intralesional injection.

"Regional perfusion is a viable alternative if no core lesion (single obvious injury) is present," commented Palmer.

When injecting stem cells it might seem logical to also inject a little antibiotic to prevent infection from developing due to any pathogens introduced during the process. However, the clear message from a recent study is that this can be a very bad idea: ***Don't mix stem cells with gentocin or amikacin antibiotic***, as they kill the stem cells. In this study researchers found that those two antibiotics killed more than 95% of the injected stem cells after 45 minutes and two hours, respectively.

However, incubating stem cells with hyaluronic acid and penicillin/streptomycin resulted in acceptable viability of 80%.

Treated Infected Joints

"Septic arthritis is commonly treated with intravenous (IV) and regional perfusion in conjunction with joint lavage (flushing)," began Palmer as he discussed a study of tourniquet types. For regional limb perfusion, a veterinarian places a tourniquet on the leg for a short time to stop blood from flowing back up the limb before injecting antibiotic below the tourniquet. This allows the antibiotic to concentrate at high levels in the bloodstream below the touriquet, perfusing the tissues.

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>
> DR. SCOTT PALMER

Theoretically, he noted, ***performing a joint lavage simultaneously with regional limb perfusion*** could cause antibiotic loss in the joint and compromise treatment.

"In standing horses, IV regional limb perfusion performed simultaneously with joint lavage resulted in negligible loss of amikacin in the egress lavage fluids (the less antibiotic lost, the better),"

Palmer reported, "This study validated the positive effect of the simultaneous use of these two treatments for joint infection. Additionally, the Esmarch tourniquet was more effective in preventing loss of amikacin from the distal portion of the limb, easier to use, and less expensive than the pneumatic tourniquet."

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