



# HEALTH ZONE

## Foal Health

### Young Horse Health Threats

DR. STACEY OKE

Foals can stand within a mere 120 minutes of birth. They're unsteady, ungraceful, and uncoordinated, getting their limbs in a tangle and tumbling every which way, yet they almost always achieve an upright stance. And while it might take a bit of trial and error, before long these sprightly youngsters are purposefully poking about, eager to nurse and, soon, bounding confidently around stall and pasture.

Equine veterinary research can follow a similar process—ups and downs, triumphant discoveries, and frustrating face-plants.

### Protect your foal from these three important causes of young horse illness

Scientists focusing on this age group tell us that three of the more important and prevalent conditions involve these youngsters' respiratory health, digestive performance, and overall immune system vigor. They interrupt healthy development, stopping progress before it barely begins, can be expensive to treat, and they can even be deadly.

For these reasons four leading researchers have narrowed their field of must-solve diseases and conditions to longtime offender *Rhodococcus equi* infection, the increasingly prevalent equine proliferative enteropathy (EPE), and the more recently recognized adrenal insufficiency.

They've given us the latest information on preventing or catching these early and hope it will help owners help foals stand on their own four feet.

#### A Respiratory Concern: *Rhodococcus equi*

This hardy bacterium continues to be a thorn in many breeders' sides. It can survive in the environment, where foals—which have immature immune systems—can become infected easily by inhaling or ingesting it. Many foals that acquire



ANNE M. EBERHARDT; INSET, COURTESY COCREGINA LINDER

Foals can inhale or ingest *R. equi* (seen here on a stain of a sample) in their environment; infection can lead to bronchopneumonia

*R. equi* never show signs of disease, but foals younger than five months can develop potentially life-threatening bronchopneumonia, so many veterinarians take a proactive approach to detecting infection with temperature checks, blood tests, and ultrasound and chest radiograph screening for lung lesions.

“Considering the costs associated with screening, diagnosis, and treating disease, *R. equi* has a major financial impact on the equine industry,” said Dr. David Horohov, professor at the University of Kentucky's Maxwell H. Gluck Equine Research Center, in Lexington.

#### What's New?

The 2013 American Association of Equine Practitioners' annual convention, held Dec. 7-11 in Nashville, Tenn., featured several presentations and discussions on *R. equi*. One of those revolved around recent data Horohov and his colleague Dr. Macarena Sanz have generated.

“One of the important features we've learned about *R. equi* is that in order to infect foals the bacterium must have a small section of DNA that expresses a protein called VapA,” Horohov explained. “In order for foals and horses to fight off the infection, antibodies need to be produced against that VapA protein.”

Most young horses produce antibodies naturally after birth, but newborn foals' immature immune systems cannot produce these important pathogen-fighting proteins as effectively as adult horses. Managers at some equine operations elect to administer hyperimmune plasma containing *R. equi* antibodies to foals shortly after birth, with the goal of providing passive immunity. Unfortunately, scientists haven't confirmed if this actually protects foals against *R. equi*.

In Horohov's study his team collected blood samples from foals on one farm that



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received hyperimmune plasma within 24 hours of birth as well as from a group of foals from another farm that did not use hyperimmune plasma. Then they collected samples once monthly for five to six months from the foals and also gathered samples from the foals' dams during that same time.

In total the researchers collected 161 samples from mare and foal pairs, including 121 pairs from the group with foals that received hyperimmune plasma. Horohov said the team found that:

- Despite an overall *R. equi* prevalence ranging from 0.1-50% on the farms, all mares had very low levels of VapA immunoglobulins that can bind to the VapA protein;
- Foals treated with hyperimmune plasma had significantly higher levels of VapA infection-fighting immunoglobulins than their dams; and
- All foals, regardless of whether they were treated with hyperimmune plasma, had increased VapA immunoglobulin levels over the course of the study period. That increase occurred later in life (starting at 1 month) in foals not treated with hyperimmune plasma.

"Even on farms that have a high incidence of clinical cases of *R. equi* pneumonia, mares did not have (high) levels of VapA immunoglobulins, which means they are unlikely to be able to protect their foals from *R. equi* infection," Horohov said. "One of the most interesting features of this study is the finding that foals naturally exposed to *R. equi* produce VapA antibodies starting at about 1 month. So despite the fact the youngest foals are highly susceptible to infection, they are capable of responding to the bacterium."

### On the Horizon

He added that most of the foals that develop initial signs of infection, as determined by ultrasound exam, recover without treatment.

Horohov's group is continuing to investigate the mechanism that causes this lesion regression. "Information gained from these studies could lead to better prevention and treatment of this important disease," he concluded.

## A Weanling Worry: Equine Proliferative Enteropathy

This intestinal disease caused by the bacterium *Lawsonia intracellularis* in-

vades cells called enterocytes that line the inner layer of the intestines, causing the affected regions to thicken. Researchers first recognized equine proliferative enteropathy (EPE) in horses in 1982, and it has since become progressively more common worldwide.

Weanling foals four to seven months old are most commonly infected, probably ingesting *L. intracellularis* shed in manure by other infected animals that appear normal (called subclinical carriers). Clinical signs of EPE include:

- Lethargy;
- Anorexia;
- Fever;
- Swelling (edema) of the limbs, ventral abdomen, sheath, and throatlatch;
- Colic; and
- Diarrhea.

### What's New?

"Since recognizing EPE as an important disease in foals and young horses and realizing that it is spreading and becoming more common, we have learned a great deal about this condition and the disease-causing organism," said Dr. Nicola Pusterla, professor in the Department of Medicine and Epidemiology at the University of California, Davis, School of Veterinary Medicine.

The July 2013 issue of *Equine Veterinary Journal* featured a comprehensive review article by Pusterla and Dr. Connie Gebhart from the University of Minnesota, St. Paul, describing how to monitor EPE on a farm. They suggest the following options for detecting EPE cases and for reducing and preventing its spread:

1. Test all infected horses' herdmates for antibodies against *L. intracellularis*;
2. Perform routine (bimonthly) testing of total protein or albumin in the blood (because one of the consistent hallmarks of EPE is low blood protein); and
3. Monitor all horses in a herd daily for early signs of disease by taking temperatures and measuring body weight.

In their article Pusterla and Gebhart suggest that using polymerase chain reaction testing—one of the currently available diagnostic tools—to identify bacterial DNA in a horse's fecal sample is not useful for monitoring disease in a herd because it is expensive and garners low rates of positives. They also advise against treating foals with antimicrobials based on clinical signs alone because of those

drugs' potential negative side effects.

Researchers say one of the more exciting advances in this field has been finding a way to prevent the disease.

"An intrarectal vaccine against *L. intracellularis* is commercially available," Pusterla said. "When given 30 days apart, two doses are safe and effective, meaning that vaccinated foals maintained higher body weights and higher total protein levels in their blood than nonvaccinated foals."

He recommends, however, that owners still monitor vaccinated foals as described above.

### On the Horizon

"Although we have learned a great deal about this disease, certain aspects... remain poorly understood," explained Pusterla. "For example, most of the information on how exactly the bacterium causes disease has been extrapolated from studies using experimentally infected hamsters, pigs, and rabbits."

In the "real life" setting, Pusterla said we still don't know how *L. intracellularis* triggers intestinal cells to multiply. In addition, scientists know little about the genetic virulence factors (such as VapA in *R. equi*) that make *L. intracellularis* problematic for horses, and they have not yet identified genetic "markers" in horses that could make them more susceptible to *L. intracellularis* infection.

"Research in this field is continuing and focusing on these topics to better understand EPE and better manage foals to either avoid or minimize the disease," said Pusterla.

## A Sick Foal Side Effect: Adrenal Insufficiency

During times of stress and disease, the horse's adrenal glands release a hormone called cortisol to help control inflammation throughout the body. But in critically ill patients, such as young foals with severe bacterial infections, the adrenal glands do not release enough cortisol. This means their delicate bodies are at the mercy of a large number of potent inflammatory mediators, or molecules that immune cells release when harmful agents invade the body. Veterinarians refer to this condition as relative adrenal insufficiency or, more commonly, critical illness-related corticosteroid insufficiency (CIRCI).

To help horse owners understand CIRCI better, Dr. Kelsey Hart, assistant

professor in the University of Georgia's Department of Large Animal Internal Medicine, in Athens, describes the condition as "an inadequate cortisol response for the existing degree of severe illness."

In people and animals, CIRCI most commonly develops secondary to sepsis.

"Multiple studies show that septic (human) patients with CIRCI are more likely to develop cardiovascular collapse and uncontrolled inflammatory responses, in addition to having significantly higher incidence of multiple organ failure and death than septic patients that don't develop CIRCI," said Hart.

At birth, the hypothalamic-pituitary-adrenal (HPA) axis—a complex set of interactions among these three glands that regulates cortisol secretion—in all foals is blunted and ill-equipped to regulate normal physiologic, metabolic, or inflammatory responses to stress and disease. Sick neonatal foals, especially those born premature, endure great physiological stress and are highly susceptible to infection, which means two important things:

1. They appear likely to develop CIRCI; and
2. Those with CIRCI suffer more severe clinical signs of disease and are less likely to survive hospitalization than foals with normal HPA axis function.

Hart and others have determined in studies that approximately 40% of hospitalized foals have CIRCI.

### What's New?

"Until recently, what wasn't known was exactly how the HPA axis functions in sick foals treated by veterinarians in a neonatal unit or whether there was any way to treat CIRCI in newborn foals," said Hart. "We recently performed a study that looked at whether administration of a low dose of synthetic cortisol (hydrocortisone) to replace missing cortisol could have beneficial anti-inflammatory effects that might help sick foals survive life-threatening bacterial infections."

In their study Hart and colleagues recruited 39 full-term healthy foals that were two to nine days old from the university's research herds to determine if they could safely administer a short low-dose hydrocortisone regimen in foals and whether it would decrease



ANNE M. EBERHARDT

Sick neonatal foals endure great physiological stress and are highly susceptible to infection

inflammation effectively.

The team found that administering a low dose of steroids "decreased the (foal's) expression of various mediators of inflammation," said Hart. "In addition, there were no adverse effects associated with this hydrocortisone regimen when given to these healthy foals."

These findings mean that, indeed, systemic steroid administration might help replace cortisol in septic foals with CIRCI.

### On the Horizon

"Our ultimate goal of our lab's work in this area is to try to improve treatment strategies and outcomes for premature and septic neonatal foals, which are some

of the most critically ill and fragile patients we encounter in equine medicine," Hart said.

She said the research her team is currently performing will help identify causative factors for CIRCI in patients with bacterial infections.

Hart says foal owners should become familiar with CIRCI because it can complicate a sick newborn foal's prognosis. It is important to remember, though, that not every sick foal develops CIRCI or requires hydrocortisone treatment, and steroids administered at the wrong time or dose can be harmful.

"We are actively working to determine the best method for (rapid) CIRCI diagnosis in foals and to determine the safest steroid supplementation regimen for use in foals," concluded Hart.

### Take-Home Message

Although not exhaustive, the information in this article can help horse owners better manage foals to maximize health and minimize expenses related to disease. *R. equi* continues to pose a threat to foals, EPE persists in young horse populations, and adrenal sufficiency can substantially impact sick/premature foals' ability to survive disease. Rapid identification of ill foals and the timely institution of appropriate veterinary-directed therapy are key factors in restoring a sick foal to health. **EH**

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