Foal Pneumonia

BY DR. STACEY OKE
ANNE M. EBERHARDT PHOTOS

Like soldiers guarding treasure, breeders go to great lengths to ensure their mares deliver healthy foals. So it can be disheartening when these youngsters suddenly develop a fever, runny nose, and cough in their first few months. One of the reasons foals might show these pneumonia-like signs is the way their fledgling immune systems work.

"A foal's immune system is different than an adult's, which partly explains why they are more prone to certain serious respiratory tract infections that don't generally affect adult horses," said Dr. Noah Cohen, professor of equine medicine at Texas A&M University.

The immune system has two major "branches:" one that fights microorganisms living inside foal's bodies but outside individual cells, and a second that fights microorganisms living inside specific cells. Ironically, the cells that some bacteria and viruses invade belong to the immune system itself.

While your foal's immune system is adept at protecting itself against many disease-causing organisms, two bacteria continue to present problems: *Rhodococcus equi* and *Streptococcus zooepidemicus*. We'll describe why these pathogens are dangerous and ways owners can protect their four-legged treasures. First, let's look at how a foal's immune system works and what makes him susceptible to pneumonia.

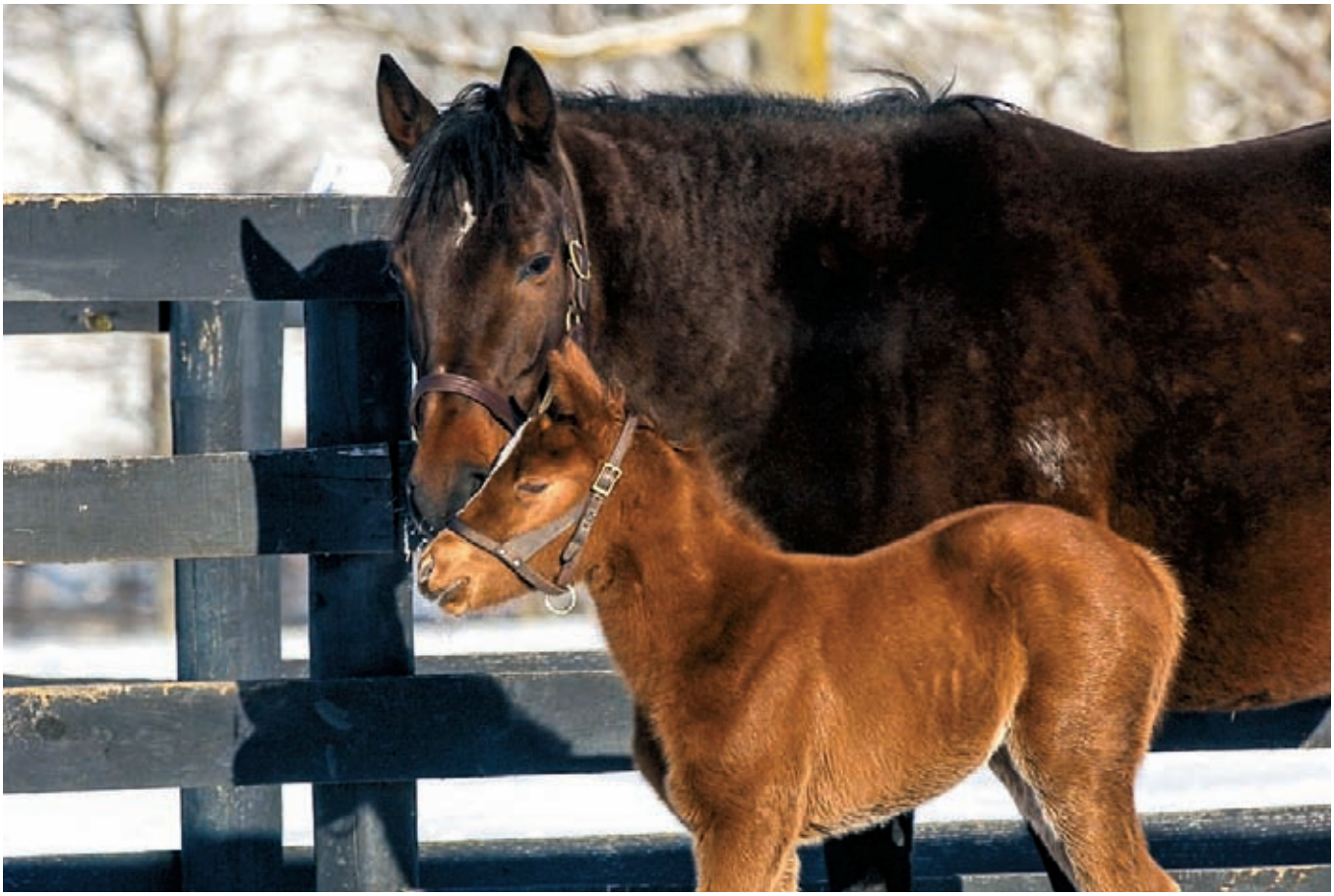
Two important bacteria cause lung infections in foals; here's how the body and your veterinarian battle these sometimes deadly pathogens

How Foals Fight Infection

All cells have microscopic molecules on their surfaces that essentially serve as flags of identity to the cells around them. In the case of viruses and bacteria, their flags are akin to the classic skull and crossbone flags on pirate ships. These symbols of danger signal the foal's immune system that an enemy is on board and needs to be dealt with swiftly.

Ideally, when a pathogen enters a horse's body, certain immune system cells quickly recognize the invader and surround and eliminate it. This works well for staving off bacteria and microorganisms that circulate in the bloodstream and live outside the horse's cells.

"Although there is some conflicting evidence, it appears that innate immune responses of neonates may be less effective



Because a foal's immune system is different than an adult's, it is more prone to serious respiratory tract infections

than older foals and horses," Cohen said. "This contributes to increased susceptibility to both intracellular and extracellular bacterial infections. For intracellular bacteria such as *R. equi*, adaptive immune responses involving T helper lymphocytes are critical."

Helper T-cells (specific white blood cell types that help produce antibodies against antigens) play an important role in clearing intracellular bacteria. These cells produce a specific inflammatory mediator called interferon-gamma (INF-γ) that is important for eliminating such bacteria. At the 9th International Conference on Equine Infectious Diseases, held October 2012, Dr. David Horohov, a professor and the William Robert Mills Chair in Equine Immunology in the Department of Veterinary Science at the University of Kentucky's Gluck Equine Research Center, reported that foals 3- to 42-days-old are far more susceptible to *R. equi* infections than older foals due to an apparent lack of INF-γ. Production of this mediator increases rapidly with age, which partly explains why older foals and adult horses can fight off *R. equi* infections better than younger foals.

Even if a foal appears healthy, an ultrasound exam can identify areas of diseased lung that aren't causing outward signs of pneumonia

If the foal doesn't have an adequate arsenal of IFN-γ, *R. equi* and even *S. zooepidemicus* can quickly commandeer certain types of cells in his body. Once the bacteria are inside those cells they reproduce rapidly, creating hundreds of new infection-causing bacteria that invade other nearby cells to continue the cycle.

Pirates of Respiration

R. equi and *S. zooepidemicus* are important causes of foal pneumonia. The signs of disease and treatment options have been well-described previously and are listed in the chart (see page 50). One of the more important issues researchers have discussed recently involves the benefits and drawbacks of early diagnosis via ultrasonography to initiate early mass treatment of foals.

"Ultrasound is widely used to examine foals' lungs for signs of pneumonia, particularly *R. equi*," Cohen said. "The theory is that even though the foals appear outwardly healthy, an ultrasound exam can identify small areas of diseased lung that aren't yet causing outward signs of pneumonia. Such foals with subclinical signs of infection can therefore be treated before they become ill."

Considering the mortality rate of *R. equi* can reach 40%, very early detection and treatment are clearly desirable. Other

Review of Two Common Causes of Pneumonia in Foals

Intracellular Pathogen	*Streptococcus zooepidemicus**	*Rhodococcus equi*
Description of disease each causes	Bacterial pneumonia that often occurs secondary to an earlier viral infection	Pyogranulomatous bronchopneumonia with abscesses scattered extensively through the lung
Age of onset	Foals >1 month old	Foals 1–6 months old
Signs of disease	■ Fever ■ Depression ■ Nasal discharge ■ Cough ■ Increased respiratory rate ■ Increased breathing effort	■ Sporadic, intermittent cough ■ Fever ■ Lethargy ■ Decreased appetite ■ Ill thrift ■ Respiratory distress
Source of bacteria	Normally *S. zooepidemicus* is found in the upper respiratory tract. Following viral infection or stress (e.g., transport, weaning), *S. zooepidemicus* invades the lower airways.	*R. equi* is found in the soil on farms around the world, but growth is optimized in warm and dry environments.
Treatment	*S. zooepidemicus* is usually sensitive to β-lactam antibiotics, rifampin, chloramphenicol, and erythromycin. Resistance to trimethoprim-sulfa has been reported. Foals are treated for a minimum of 10-14 days until all signs of pneumonia, have resolved.	Veterinarians prescribe a combination of rifampin and a macrolide antibiotic (e.g., erythromycin, clarithromycin, azithromycin). Foals are often treated for 30 days, but a course of treatment can last up to six to eight months (until all signs of pneumonia have completely resolved).
Prognosis	Prognosis is good for complete recovery if treated promptly and fully (until complete resolution of clinical signs).	Approximately 70–80% of foals recover fully, but mortality rates can reach as high as 40%.
Possible sequelae (secondary conditions)	Not reported	■ Ulcerative colitis (diarrhea) and typhlitis (cecum inflammation) ■ Septic arthritis ■ Osteomyelitis (bone infection) ■ Liver and kidney abscesses
Prevention	■ Reduce or eliminate environmental stressors and viral or parasitic infections. ■ Ensure mares are fully vaccinated prepartum.	■ Administer chemoprophylaxis (antibiotics in the first two weeks of life) and immunoprophylaxis/hyperimmune plasma (administered at birth and again at 21 days of age). ■ Use environmental management techniques to limit air and soil burdens of *R. equi*. ■ Practice responsible herd management (e.g., limit stocking densities and group foals together by age).

** Not to be confused with* Streptococcus equi, *the causative agent of strangles.*

benefits are that ultrasound screening is quick, the results are available immediately, and it appears to be a better screening test for *R. equi* than a variety of blood tests.

However, veterinarians have expressed concerns about routine ultrasound screening of apparently healthy foals. For instance, not all foals with ultrasound evidence of pneumonia will ultimately develop clinical signs of the disease. So although early diagnosis and mass treatment might seem great, it's not all sunny skies.

"It is currently not known exactly how many foals with evidence of abscesses on the ultrasound examination do eventually develop pneumonia," noted Cohen.

He estimates the proportion is around 15-30%.

Therefore, treating all foals with ultrasound evidence of pneumonia means veterinarians are treating many foals that might not need it. Treatment can be expensive because it's long-term (until clinical signs cease, which can take six-eight months), and foals can be at an increased risk for de-

veloping adverse reactions to the drugs.

"Another important concern associated with 'mass treating' is the potential for development of antibiotic resistance by bacteria," Cohen said. "Resistance to macrolides and rifampin (antibiotics commonly used to treat foal pneumonia) appears to be emerging."

In 2010 Dr. Steeve Giguère, professor of veterinary medicine and the Marguerite Thomas Hodgson chair in equine studies at the University of Georgia's Department of Large Animal Medicine, and colleagues used ultrasound to screen 138 foals for *R. equi*. Forty-five apparently healthy foals with evidence of subclinical disease on the ultrasound were treated. Researchers collected tracheal wash samples from 28 of the treated foals, and 41% of the samples contained *R. equi* strains resistant to macrolides and rifampin.

Basic preventive measures can minimize the risk of infection and minimize foal pneumonia's impact

"These results support the theory that mass-treating foals based on ultrasound screening may be contributing to resistance, and because we don't currently have other effective treatment options against *R. equi*, this is concerning," Cohen said.

Despite ultrasonography's drawbacks, Cohen still advocates some screening. "We don't yet have effective vaccines for *R. equi*, and the insidious progression of the disease means that foals may not show outward signs until the infection has progressed to advanced stages," he said. "Screening will allow us to identify cases earlier in order to achieve better outcomes. We just need to modify our screening program to find something that has the sensitivity of ultrasound without the large number of false-positive results. Ultrasonography can also be used to help diagnose *S. zooepidemicus*, but it doesn't tend to be used as a screening tool like in *R. equi*."

Don't Walk the Plank

When it comes to foals and pneumonia, don't live dangerously. Basic preventive measures, such as ensuring mares are healthy, dewormed, and vaccinated prepartum, and efforts to isolate mares and foals into groups based on age to minimize risk of infection can help minimize foal pneumonia's impact. But these methods aren't 100% foolproof, so researchers are continually trying to develop vaccines.

"Making a vaccine for intracellular bacteria such as *R. equi* and *S. zooepidemicus*

COLOSTRUM: THE GIVING LIFE FORCE

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That miracle is in the colostrum that will be supplied to that foal via the first milk it ingests from its dam's udders. It is one of nature's true miracles and is a complete package of nutrients, minerals, growth factors, appetite stimulants, and antibodies, which will initiate and establish a newborn's system and start the foal in the right directions, giving energy and calories to support itself, antibodies to fight infectious agents for the next few months, factors to combat both the causes of diseases throughout the body and the discomforts from fighting them off.

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All of this is available today without worry of contamination via mishandling or of keeping it frozen to protect it from adulteration. That's what's available to you with Re-Borne, the most advanced form of whole, concentrated colostrum made today. *—Dr. Steven C. Allday, DVM, developer of Re-Borne*

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is a mission for many veterinary researchers," said Dr. Nicola Pusterla, an associate professor in the Department of Medicine and Epidemiology at the University of California, Davis. "A candidate vaccine for *R. equi* is being tested in Germany with promising preliminary results."

The Calm Following the Storm

Each year a multitude of foals are diagnosed, treated, and eventually recover from respiratory tract infections. But what are the consequences of foal pneumonia later in life? Researchers have published two separate studies in the past two years attempting to answer this question.

In the first study, researchers looked retrospectively at 1,200 Thoroughbred foals destined for the racetrack and determined that 4.7% experienced pneumonia in the first six months of life. Of those foals, 64% raced at least once, which was statistically comparable to the 67% of foals that did not have pneumonia and eventually raced. The investigators also noted no difference in number of career starts, wins, places, and total earnings between the foals that did and did not have pneumonia.

In the second study, researchers from Australia found that 125 of 491 Thoroughbred foals (25%) diagnosed with *R. equi* went on to have significantly fewer starts and shorter careers than foals not diagnosed with *R. equi*.

"These results suggest that clinical *R. equi* pneumonia as a foal negatively impacts the career longevity and ultimate capacity to perform as an elite Thoroughbred," the authors concluded.

Interestingly, the authors of the latter study did concede that the reasons for retirement were not noted and the residual effects of *R. equi* pneumonia appeared to have "no impact on the ability for the horse to race, even as a 2-year-old."

Scientists stress the need for future studies to determine the true impact of both main types of foal pneumonia on future athletic performance.

Take-Home Message

Although there are a number of potential causes of pneumonia in foals, infections with the intracellular bacteria *R. equi* and *S. zooepidemicus* are the most common and important causes, as far as morbidity and expense of treatment. Until a vaccine is commercially available, the best way to minimize the chances of infection is prevention. BH

Excerpted from The Horse: Your Guide to Equine Health Care. Free weekly newsletters at *www.TheHorse.com*